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Human Technology: An Interdisciplinary Journal on Humans in ICT Environments

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From the Editor in Chief**INNOVATION, LEARNING, AND COMMUNITIES**

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Research in the interdisciplinary field of human–technology interaction takes many forms and perspectives. However, no matter which lens is used in evaluating the interrelationship between the human and the technology or which technology is being explored, issues of learning, context, use intention, and community form essential components of all research because they are components of all technology use. Of these four components, learning is affected by and affects the other three.

In recent decades, strong focus on shared expertise, participatory activities, and other forms of social collectives have moved to the forefront of attention in the fields of learning and work and everyday practices. Theories of learning have increasingly emphasized social forms of learning as opposed to focusing on individual minds (e.g., Greeno, 1998; Stahl, 2005). Socially oriented theories also have been reflected in the field of design, focusing on codesign of applications and environments for groups and communities. In light of these trends, various kinds of collectives, such as networks and communities, have been approached in the research of different disciplines, such as in sociology, educational science, anthropology, and in communication studies.

A variety of definitions have been provided for the concept of community (see, e.g., Bruhn, 2005). One of the typical features of traditional local communities is close ties with personal relationships (e.g., Mercer, 2000; Pöysä & Häkkinen, 2009). Today's communities can cross the borders between physical and virtual spaces—especially through the use of social media—as well as across multiple communities simultaneously (Pöysä & Häkkinen, 2009).

Moreover, the nature of partnership and sense of belonging to communities might vary. Sometimes the participants prefer looser ties with each other. In those cases, we often refer to these relationships as networks instead of communities. Alternatively, communities can refer to close relationships between participants or among the user practices or interests. Many of these issues are envisioned within the concept of a community of practice, although Li et al. (2009) demonstrated how the definition, goals, and practices of that term continue to evolve and are applied differently.

Thus, a relevant question for researchers, technology designers, and implementation advocates is when today's online networks can be called communities. The emphasis on participation, net-

working, and the shared creation of content and knowledge in Web 2.0 practices offers new kinds of possibilities for forming communities (Bonderup Dohn, 2009). In the global environment and immediacy of social media, the question arises whether communities always necessitate physical meetings or even an interpersonal relationship. So a tension remains regarding expectations of technology in regard to community building: Despite the rhetoric, can technology alone build community? In my view, technology certainly is a core enabling platform in the global environment. However, many other elements—both tangible and intangible—are equally contributory to the shared sense of community among members.

Another stream of research and discussion, especially in the field of educational science, is that of informal learning. While mainstream research on educational science has focused on formal learning and institutionalized schooling, discussion has recently moved to how students participate in complex social and cultural activities outside of formal educational settings (Barron, 2006; Bransford et al., 2006; Marsick & Watkins, 2001). This includes the personal practices and implications of tacit knowledge (Armstrong & Mahmud, 2008; Eraut, 2000) and self-directed (Boyer & Kelly, 2005; Brookfield, 1986) and self-regulated (Järvelä & Järvenoja, 2011; Loyens, Magda, & Rikers, 2008; Schunk, 2005) learning, even within a social learning context. The synergy and the learning potential at the intersection of informal and formal learning activities are expected to shape learners' experiences in significant ways, whether those learners are within an education institution, a work environment, or a social setting. Currently, personal engagement, typical of informal learning, is taken as an ideal model even within formal educational settings, but such an approach also can bring challenges and counterproductive effects, such as an increase in off-task activities or misconceptions in core areas. Furthermore, the challenge remains for institutionalized educational curricula, pedagogical practices, and leadership to acknowledge the importance and value of informal skills and competencies (Barron, 2006). The traditions, structures, and processes of formal education do not support the utilization of informal learning resources. For example, Korkeamäki and Dreher (2011) stated that Finnish first-grade classroom instruction does not take into account children's developing competencies with newer technologies, even though the national core curriculum strongly emphasizes the link between what is learned at home, including media literacy and ICT skills, and what is taught at school.

The challenges of integrating informal learning, peer (i.e., community of practice) learning, and social media as a support of learning and knowledge generation exist in non-educational organizations as well. These are particularly important in regard to the introduction of any innovation, such as ICT adoption in organizations. An innovation can refer to an idea, practice, or object that is perceived as new or significantly renewed by an individual or other unit of adoption. Rogers (2003) introduced the theory of diffusion of innovation, referring to the process by which innovation is communicated through certain channels over time among the members of a social system. And as in the introduction of new knowledge in any setting, multiple characteristics of an innovation, of the individual user, and the individual's specific perceptions of the two impact the learning about and adoption of the innovation.

Contemporary mobile tools for social interaction, for engagement in the economy and work, and for learning and personal research, are crucial for almost any everyday context. Therefore, in the process of introducing innovation to individuals, for example, in the field of e-commerce, the developer and introducers need to assist potential users in forming a positive attitude toward the innovation. This essential process involves not only the study on the

effects of consumers' personal traits on their perceptions of and attitudes toward using mobile devices for communications and commerce, but also which mental schemes and expectations undergird those perceptions and, ultimately, the potential user's learning about and application of the innovation. These also are crucial elements to be taken into account in design of new products.

This issue of *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments* presents research that explores some of these important issues in innovation adoption and learning to implement innovations. Each paper refers to an aspect of interaction design and adoption from the perspective of the user experience.

Our first paper is by **Korkeamäki, Dreher, and Pekkarinen**, who present a timely study reflecting the challenges of informal learning. They focus on young children's use of media at home and if and how it impacts their formal literacy learning. They base their work on a parent questionnaire, through which they investigated Finnish preschool and first-grade children's use of print and electronic media in the home and their literacy development. Their findings indicate that these children are frequent media users, including playing electronic games, but that the effect on literacy learning need not be negative. The results also indicate that preschool children play more games designed for learning while first graders play more entertainment games.

Kim and Hahn studied the effect of personal traits on consumer perceptions of young adults' mobile device use, as well as their attitudes toward mobile communication and commerce. This study shows that individuals' high-tech involvement and experiment proclivity were important factors influencing their perceived ease of use of mobile devices for communication. In addition, the study revealed that fashion/brand leadership had a positive effect on perceived enjoyment and perceived usefulness of mobile devices for communication. These findings suggest significant implications for a positive impact on young adults' attitudes toward using mobile devices for communication and commerce.

The article by **Lehane** is the second half of his study into intuitive design. Specifically, he discusses the Systems Acceptance Indicator, a validated survey instrument for assessing the user experience from a cognitive-ergonomic perspective. The action research discussed in this paper utilized grounded theory analysis to establish the data-driven emergent theoretical constructs that provided the system acceptance categories (criteria) for the survey. Lehane discusses the development of the theoretical rationale for classification criteria for the SAI survey, which came from applying concepts from a grounded theory analysis to users' responses to surveys and within focus group interviews. The users described the problems they encountered in the system requirements and implementation and, from those descriptions, the survey criteria surfaced classifications that grouped the issues and facilitated learning interventions.

The study by **Olatokun and Ntemana** investigated the influence of the five attributes of diffusion of innovation theory—relative advantage, complexity, compatibility, trialability, and observability—on university lecturers' use of information and communication technologies (ICTs). They used a structured questionnaire to collect data from 213 lecturers at the National University of Lesotho. The results of the study indicated that relative advantage, complexity, and observability had a positive effect on the lecturers' attitudes. The implications of this study offer insights into how university administrations, particularly in developing countries, can successfully support the adoption of ICTs within the higher education process.

We also include in this issue a book review: **Kai Tuuri** assesses Morana Alač's *Handling Digital Brains: A Laboratory Study of Multimodal Semiotic Interaction in the Age of Computers*. He acknowledges the book as an interesting contribution for human–technology studies. Alač offers insights for ethnographic research, science studies, interaction analysis or cognitive science, to name a few disciplines, by illustrating the issues related to the pervasively present embodiment in human meaning making and social interaction. The book also reveals how the bodily engagement is present in brain imaging data in an fMRI (functional magnetic resonance imaging) laboratory environment. However, Alač calls for social sciences to make its position clear within studies in the field of neuroscience.

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FINNISH PRESCHOOL AND FIRST-GRADE CHILDREN'S USE OF MEDIA AT HOME

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Abstract: *We investigated Finnish children's use of print and electronic media in the home and their literacy development. Questionnaire data from 857 parents of preschoolers (collected in 2006 and 2007) and first graders (2008) showed that homes were well equipped with electronic media including Internet access in almost every home, although only a third of the children used the Internet. Television, print media, and videos/DVDs were more commonly used than computers. Most first graders but few preschoolers had mobile phones. Most parents read bedtime stories, had a sizable number of children's books, and library visits were common. Boys' and girls' skills in reading did not differ at the beginning of their preschool year. But girls showed more interest in writing while boys played more console and computer-based games. Most first graders were reading early in the school year, suggesting that electronic media are not harmful but may even support literacy development.*

Keywords: *print literacy, media literacy, electronic media, family literacy practices, early literacy development, preschool, first grade.*

INTRODUCTION

Young children's use of print and electronic media can influence the way they come to understand literacy, which, in turn, can impact their future achievement as readers. Considerable research details how young children's literacy-related practices contribute to their literacy development, particularly in practices relevant to print media (Teale & Sulzby, 1989; Yaden, Rowe, & MacGillivray, 2000). But children are increasingly surrounded by and engaged with nonprint media such as television, computers, the Internet, and mobile phones. As documented in research in the USA and the UK, for example, children watch considerable

amounts of television (e.g., Marsh et al., 2005). Similarly, surveys evidence the increasing use of newer technologies, such as computer software and the Internet, by children of early school age and younger (Common Sense Media, 2011; Rathbun & West, 2003; Rideout & Hamel, 2006). In fact, commercial markets are targeting even very young children (Vandewater et al., 2007). Studies have found that children use a variety of technologies (e.g., Blanchard & Moore, 2010) and that family literacy practices have changed from the use of mostly print-based texts to techno-literacy practices involving multimodal texts using new technology such as computers, console games, and mobile phones (Marsh, 2004). Although the role of moving and still images is increasing, words and letters on the screen continue to be important (Marsh, 2009).

Considerable debate on the effects of technology on young children has taken place. With regard to electronic media, television has been the most widely researched, with evidence indicating that, depending on the amount and type, television viewing can have both positive and negative effects on literacy (e.g., Neuman, 1988; Schmidt et al., 2006). However, much less research is available on the effects of newer technologies (see Rideout, Foehr, & Roberts, 2010). Some view newer digital technologies as a threat to the use of books, newspapers, and magazines (Rideout et al., 2010). In contrast, others view new technologies as something to be valued, and advocate expanding the perspective on what counts as literacy in young children (e.g., Karchmer, Mallette, & Leu, 2002).

But what is the situation in Finland? Our purpose in this study was to examine young Finnish children's engagement with newer technologies, as well as more traditional media such as television, radio, and print-based material in the home. Because most research on young children's media use in Finland has addressed only some aspects of media use, we were interested in including all these media in the same study. Furthermore, we also investigated children's emerging literacy knowledge in order to learn how these media may contribute to that knowledge. As we detail below, Finland is characterized by a strong tradition of valuing reading, and, as research suggests, children's easy access to technologies. Thus, Finland is an interesting context in which to explore young children's media use, with an eye toward shedding light on the debate about the effects of technology on young children's literacy development. Possible outcomes of these trends could result in, for example, newer technologies displacing older media such as books, or literacy-related practices reflecting expanded media use, with older media being supplemented with rather than replaced by newer technologies.

Finland is a reading nation. Finns subscribe to and read newspapers at an exceptionally high level, when compared with international trends (Sauri, 2007). In addition, Spadaro (2002) reported that Finns use libraries more frequently than any other nation in the European Union.

Recently, however, some decline in book reading in Finland has been noticed. For example, Lappalainen (2008) found that seventh-grade students borrowed fewer library books in 2008 than their counterparts in 2002. Similarly, in a Gallup Finnish International poll (YIPPEE, 2008), 12% of 3- to 16-year-olds reported that they never read books although only 2% reported never watching television. In addition, the poll indicated that daily use of the Internet is more frequent among 3- to 16-year-olds than reading books (63% vs. 48%, respectively). Such data seem to suggest that newer technologies are rivaling the use of traditional media such as children's books. However, other studies suggest that reading is still a quite frequent activity in Finland. For example, Hirvonen (2012) found that 46% of first graders (7-year-olds) reported reading books daily. Thus, additional research is needed to address the interplay of Finnish children's reading habits and use of other media, especially for young children.

Many Finnish researchers have studied school-age children's media use (children start school at age 7 in Finland). For example, studies indicate that digital gaming is common among school-age children. Ermi, Mäyrä, and Heliö (2005) found that 98% of 10- to 12-year-olds reported playing digital games at least occasionally, with 75% doing so at least once a week. All the boys in that study played digital games at least to some extent, but a few girls reported they did not play such games at all. Typically, the playing took place with a home computer (88% of families had a computer). Moreover, 54% of children indicated they had other equipment for playing games, with only 4% reporting that they did not. Among 8- to 10-year-olds, Matikkala and Lahikainen (2005) found that 84% of boys reported playing computer games at least once a week, but only 54% of girls did so. These children also used media for communication: 58% used mobile phones, 39% sent text messages, 31% used e-mail, and 16% participated in group e-mails between several writers. Hirvonen's (2012) research indicated that 42% of 7- to 11-year old children played computer, console, or Internet games daily. In a study of 11-year-olds' Internet use, Oinas-Kukkonen and Kurki (2009) found that 90% reported regular use, but with different patterns by gender. While 60% of the boys reported playing Internet games daily, only 36% of the girls did so. Instead, the girls used the Internet primarily for social interaction. Suoninen (2011) found that 86% of 7- and 8-year-old boys and 65% of girls played digital games weekly, with 30% of boys and 15% of girls playing these games daily. Girls mainly played platform games and learning games; boys preferred platform games, as well as driving, sports, and adventure games.

Research on school-age Finnish children also indicates that watching television is common. For example, in Suoninen's (2011) study, parents reported that 66% of 7- and 8-year-olds watched television daily. Similarly, Uusitalo, Vehmas, and Kupiainen (2011) found that the small groups of 11-year-olds they interviewed reported watching 96 minutes of television a day, on average, whereas the 14-year-olds reported watching 88 minutes of television.

Similarly, television viewing has also been studied with below school-age children. Valkonen, Pennonen, and Lahikainen (2005) interviewed 5- and 6-year-old children and surveyed their parents in two large Finnish cities. On average, these children watched television 1.4 hours per day, but the time varied from 36 minutes to 4.2 hours. Generally, children watched only children's programs on their own, while other programs were watched with their parents. In such circumstances, parents were able to influence which programs were viewed as well as to share and reflect on what they and their children had seen. They also were able to restrict their children's television viewing. Similarly, Korhonen (2008) found that 5- and 6-year-old children typically watched 1 to 2 hours of television daily, and that 90% of the parents she surveyed reported controlling their children's television access. Although parents sometimes worry that watching television can be harmful to their children, some parents in Korhonen's study reported that their children benefited from watching television, by learning new vocabulary and ideas, as well as widening their worldview. And, of course, parents report that television entertains their children (Koivusalo-Kuusivaara, 2007).

Indeed, television viewing has been the focus of many studies. But in a recent survey, Suoninen (2011) investigated not only children's television viewing but also their use of media more widely. Her results confirmed widespread television use, with parents reporting that 34% of children under age 3 watched television daily, while 63% of 3- and 4-year-olds did so. In addition, her survey examined children's use of the Internet, mobile phones, radio, and CDs. Her results showed, for example, that parents indicated that about 38% of 5- and 6-year-olds

used the Internet 1–2 times a week, while 70% of 7- and 8-year-olds did so. Similarly, older children (7- and 8-year-olds) were more frequent players of digital games, with parents reporting that 75% of them played 1–2 times a week, whereas only 41% of the younger children (5- and 6-year-olds) did so. Interestingly, only 15% of those games were designed for learning. Parents reported a substantial increase in the opportunity to use cellular phones by age: Only 30% of 5- and 6-year-olds used mobile phones but 93% of 7- and 8-year-olds did so. Parents reported that 43% of these older children used mobile phones daily. But listening to recordings or the radio was more equal, with 86% of 5- and 6 year-olds and 80% of 7- and 8-year-olds listening to them 1–2 times a week. However, listening took place primarily in the car. In regard to reading, 58% of parents reported reading to their 5- and 6-year-old daily, with 91% reporting reading at least three times a week. Parent also indicated that their 5- or 6-year-old read on their own or browsed books frequently, with 79% doing so 6-7 times a week and 21% once or twice a week. Parents reported that 65% of 7- and 8-year-olds read books 6-7 times a week and 35% read 3–5 times a week. Reading magazines was slightly less frequent, with 26% of 7- and 8-year-olds reading 6-7 times a week, 42% reading 3-5 times a week, and 32% reading 1-2 times a week. Based on such findings, Suoninen (2011) concluded that although children regularly used several electronic media, they still read books and magazines.

Many studies reviewed above have focused on Finnish children's use of television and computers. Because family literacy practices may include a variety of print literacy and technoliteracy (Marsh, 2004), we investigated both print and electronic media. In addition, many studies on children have used a case study approach in which the number of children is small (e.g., Koivusalo-Kuusivaara, 2007; Korhonen, 2008). In contrast, we targeted a population large enough to generalize the results. Similar to the current study, Suoninen (2011) also used a larger population and queried parents about young children's print and electronic media use. However, our study differs from Suoninen's by including information on children's emergent literacy knowledge, such as their letter knowledge. Moreover, our populations are different. We surveyed Finnish parents about their preschool (6-year-old) and first-grade (7-year-old) children's home media use in a city that is well known for technology, as well as in the rural areas around the city. Thus, our results provide information on potential differences in the two contexts.

We were interested in learning whether children's practices at home are different among preschool and first-grade children since Finnish first graders are expected to be much more independent than the preschool children in all practical matters (e.g., Strandell & Forsberg, 2005). As a result, parents may think that they no longer need to read to first graders, letting them take care of their activities in print-literacy or the use of technology on their own. It is also likely that first-grade children have already learned to read, which, in turn, might result in more independent use of media. Therefore, we aimed to shed light on the issue of whether newer technologies are a threat to the use of traditional media.

METHOD

Participants

Parents of preschool (6-year-old) and first-grade (7-year-old) children participated in this study. Parents came from either a city or rural areas. The city is currently well known for its

technology (e.g., Nokia). Earlier, paper mills were big employers in the area. The city has both a multidisciplinary university and a university of applied sciences, as well as other research institutes. The rural areas consist of regions about hundred kilometers north and south of the city. These areas are midsize communities in which people make their living mainly by farming or employment at small enterprises.

Preschools are typically housed in Finnish kindergartens, which provide care for children aged 1 through 6, somewhat analogous to day-care centers in the USA. In this study, the city preschools were housed in kindergarten buildings, as is typical, but in two of the rural cases, the preschools and kindergartens were located within elementary schools. Regardless of their location, all preschools follow the same national curriculum framework.

In this study, the preschool students' parents came from both the city and rural areas. The first-grade students' parents were all from the city.

Questionnaire

Our questionnaire consisted of 40 questions (see the Appendix) in four categories: 10 items on the children's demographics and family background, 11 about the availability of home media, 11 on how often children used these media and with whom they used them, and 8 questions on children's literacy development.

Our questionnaire drew on the previous work of Marsh et al. (2005), who conducted research with parents of young British children, and who, in turn, drew on similar research in the USA (Rideout, Vandewater, & Wartella, 2003). However, our questionnaire included questions that dealt with children's literacy development (see the Children's Literacy Development section below), an area that Marsh et al. (2005) did not address. In addition, Marsh and her colleagues studied children aged from birth to 6 years, while we studied children aged 6 and 7. Studying older children allowed us to investigate how parents viewed their children's literacy development.

The survey instrument comprised primarily multiple-choice questions, each with two to 10 answer options. Of the five nonmultiple choice questions, two asked parents the year of their child's birth and the language used at home; the other three addressed the number of newspapers, magazines, and children's magazines subscribed to by the family. All questions resulted in data on a nominal or ordinal scale.

Data Collection

We surveyed parents in the autumn that their children started preschool (in 2006 or 2007) or first grade (in 2008). We sent the surveys to the home through kindergarten and first-grade teachers and they were returned via teachers in a sealed envelope. In the city, 496 questionnaires were sent to preschool parents and 55% (275) of them were returned; 564 questionnaires were sent to first-grade parents, with a return rate of 76% (427). We sent 250 questionnaires to rural parents of preschool children, with a return rate of 62% (155). The overall return rate was 65%. The preschool questionnaires were sent to city parents from randomly selected kindergartens in September 2006, and in October 2007 to parents in rural areas surfaced through a network of kindergarten teachers who had participated in an in-service training with the first author. The personal contact with teachers in the rural area may explain the difference in return rate between

the city (55%) and rural (62%) preschool parents. In both cases, however, these response rates are near the 60% response rate in Marsh et al.'s (2005) study. The questionnaires to first-grade parents were sent October 2008 via the teachers in randomly selected city schools. Because there were two years in between the city preschool and first grade data collection, none of the parents were surveyed twice for the same child. All parents had about 2 weeks to return the questionnaire.

Data Analyses

The data were analyzed using frequencies and cross tabulations, with chi square (χ^2) to test significance because the data were either on a nominal or ordinal scale. Because the sample size was large, small differences could have resulted in statistically significant differences that were unwarranted. Therefore, to address this issue and improve reliability, we tested statistical significance by sampling at random a smaller set of the data (see Lenth, 2001). Specifically, we first used the entire data set for cross tabulation and for statistical analysis, but we verified the results by randomly selecting a smaller sample (100 questionnaires from preschool data and 100 from first-grade data) for the same analyses. In our results, we report frequencies in the cross tabulations and statistical significance based on the entire data set, but we used the smaller random sample to verify that the significant effects were reliable.

RESULTS

Parents of first-grade and preschool children in the city did not differ in educational level (as noted, in the rural area, the survey was sent only to parents of preschoolers). However, there was a difference in educational level between parents in the city and rural areas ($\chi^2 = 23.08, p = .000$), with rural parents having a smaller percentage of advanced degrees (16%) than city parents (34%). Rural parents were more likely to have vocational education (37%) than city parents (22%). Nevertheless, many rural parents had college or polytechnic education (47%) at about the same rate as city parents (45%). The majority (89%) of parents who participated were female. Almost all families (98%) were native Finnish speakers. There were no statistically significant differences in families' level of income in our sample.

We report the results mainly in tables. There were a few statistically significant differences in results between city and rural children, boys and girls, and preschool children and first-graders. Whenever such a difference occurred, we report it in the text.

Home Equipment

Homes were well equipped, as shown in Table 1. Eighty-eight percent of homes had televisions. Overall, 97% of homes had a computer: This figure was 99% in first-graders' homes and 95% in preschoolers' homes. Internet access was available in 96% of homes. Console games were less common than televisions or computers, with more first graders (62%) than preschool children (45%) having console games at home ($\chi^2 = 22.57, p = .000$). In addition, more first graders' homes (87%) than preschool children's homes (77%) had a digital camera ($\chi^2 = 14.38, p = .000$).

Table 1. Types of Equipment Present in the Home.

Home equipment	Preschoolers	First graders	Average
TV	88%	88%	88%
Videos	94%	93%	94%
Phone/ mobile	100%	100%	100%
Radio	96%	93%	95%
Stereos	97%	95%	96%
Computer/ laptop	95%	99%	97%
Console game	45%	62%	53%
Video camera	41%	48%	44%
Digital camera	77%	87%	82%
Internet	94%	97%	96%

However, as shown in Table 2, it was unusual for children to have their own computers (5% for both preschool children and first graders). Similarly, only 21% of preschoolers and first graders had a television in their own room. In addition, the results suggest that most children may receive their own mobile phone when they start school, since 79% of first graders had one, while only 10% of preschoolers had a phone ($\chi^2 = 402.5$, $p = .000$).

Table 2. Types of Equipment in a Child's Own or Shared Room.

Equipment in own room	Preschoolers	First graders	Average
TV	21%	21%	21%
Videos	20%	17%	19%
Radio	24%	31%	28%
Stereos	41%	48%	44%
Computer/laptop	5%	5%	5%
Internet	8%	11%	9%
Console games	11%	17%	14%
Own mobile phone	10%	79%	45%

Television and Video/DVD Viewing and Listening to the Radio

Overall, as shown in Table 3, the time spent watching television each day ranged from a small minority (4%) of children who watched 3 hours or more to 12% who did not watch television at all. Most children were in the middle: 45% watched television 1–2 hours daily while 40% watched up to an hour daily.

There was a significant difference in preschool children's television watching in the city and rural areas ($\chi^2 = 20.27$, $p = .001$). Specifically, 53% of rural preschool children watched television one or more hours daily, compared to only 42% of city preschoolers doing so. Interestingly, more children in the rural area (19%) than in the city (10%) did not watch any television at all.

Table 3. Time Spent with Various Media.

Hours per day	> 3	1–2	< 1	None
TV	4%	45%	40%	12%
Videos/DVD	1%	22%	64%	13%
Stereos	1%	6%	69%	25%
Radio	1%	3%	54%	42%
Computer	1%	14%	67%	18%
Console game	1%	8%	39%	52%
Print media	3%	31%	65%	1%

Note. Because of rounding, percentages may not equal exactly 100%.

As shown in Table 4, watching videos and DVDs was more popular among the preschool children than first graders: 27% of preschool children watched videos or DVDs daily or almost daily, whereas 16% of first graders did so; 52% of first graders and 42% of preschool children watched them only once a week or less ($\chi^2 = 22.82, p = .000$).

Table 4. Frequency of Using Different Media Activities by Finnish Preschooler (pr) and First Grader (fg).

Frequency per Week	6-7 days		4-5 days		2-3 days		once		less than weekly		never	
	pr	fg	pr	fg	pr	fg	pr	fg	pr	fg	pr	fg
Watches TV	64%	64%	19%	17%	4%	6%	1%	1%	2%	5%	10%	7%
Watches videos/DVDs	8%	6%	19%	10%	31%	32%	20%	26%	19%	25%	3%	1%
Listens to the stereo/CDs	10%	6%	9%	9%	22%	25%	22%	15%	32%	35%	5%	10%
Listens to the radio	9%	3%	8%	8%	13%	16%	17%	13%	35%	38%	18%	22%
Uses computer	7%	13%	12%	16%	24%	31%	21%	16%	27%	22%	8%	2%
Plays console games	1%	4%	6%	10%	11%	16%	9%	13%	21%	23%	52%	34%
Reads or scans books, comics or magazines	65%	66%	20%	16%	10%	11%	3%	5%	2%	2%	0%	0%
Uses cell phone for playing or calling*	3%	32%	3%	15%	9%	20%	9%	8%	37%	15%	39%	10%

Note: The cell phone was not necessarily the child's own.

Because of rounding, percentages may not equal exactly 100%.

Listening to the radio was more popular among the preschool children than first graders ($\chi^2 = 18.79, p = .002$). For example, 17% of preschool children listened to the radio daily or almost daily, whereas 11% of first graders did so. Eighteen percent of preschool children and 22% of first graders did not listen to the radio at all.

The Use of Computers and Console Games

As shown in Tables 3 and 4, using the computer was more popular than playing console games. This finding makes sense, considering that 97% of families had a computer and only 53% had a

game console (see Table 1). Although a computer was available in almost every home, Table 3 indicates that only 15% of children used it one hour or more daily. In addition, 18% of children did not use computers at all. First graders used computers more often than preschool children: 29% of first graders used computers at least four times a week but only 20% of preschool children did so ($\chi^2 = 32.36, p = .000$).

First graders also spent more time daily with console games than preschool children. Thirty-one percent of first graders played console games more than half an hour daily, while 18% of preschoolers did so. For preschool children, 61% never played console games compared with 43% of first graders ($\chi^2 = 31.36, p = .000$). Girls played console games considerably less frequently than boys, with 67% of girls and 38% of boys not playing at all. The daily playing was moderate for most children (see Table 3). It is worth noting that only 1% of boys (and no girls) played 3 or more hours daily. Thirty-six percent of boys and 12% of girls played console games half an hour to 2 hours daily ($\chi^2 = 88.57, p = .000$).

Some children were also involved in other activities with computers. As shown in Table 5, 33% of children played computer games designed for learning very often or often, while 54% played other computer games very often or often. For preschool children, 39% (both in the city and rural areas) played games designed for learning very often compared to 27% of the first graders ($\chi^2 = 34.48, p = .000$). Parents also indicated that 17% of the children drew with graphic tools very often or often, 58% sometimes and 24% never, with girls using graphic tools more frequently than boys. Thirty-two percent of boys but only 17% of girls did not use graphic tools at all ($\chi^2 = 27.91, p = .000$).

Table 5. Use of Computers.

Working/playing with computer	Almost always	Often	Sometimes	Rarely	Never
Learning games	12%	21%	33%	20%	14%
Other computer games	11%	33%	25%	15%	17%
Music	0%	7%	17%	20%	57%
Movies	1%	5%	14%	16%	64%
Drawing	2%	15%	34%	24%	24%
Surfing the Internet	2%	5%	11%	15%	67%
Writing	1%	2%	9%	16%	72%
Chatting	0%	1%	2%	3%	95%
Email	0%	0%	2%	3%	95%

Note. Because of rounding, percentages may not equal exactly 100%.

Chatting via Messenger was even more rare than graphic tool use, with 95% of children never doing so while 1% of the children were frequent users. Similarly, 95% of children never read or wrote e-mails. Netsurfing was a bit more popular, with 7% of the children doing it very often or often, 26% sometimes or seldom, and 67% never.

Availability of Print Media

Despite the increase in electronic media in Finland, it remains customary to subscribe to newspapers. However, newspaper subscriptions differed between the families in the city and those in the rural areas. In the latter locations, 53% of families subscribed to two or more newspapers, as compared to 24% ($\chi^2 = 60.03, p = .000$) in the city.

Most homes (60%) have more than 40 children's books, 29% have 21–40 books, and 11% have fewer than 20 books. Parents reported the number of other books (not specifically for children) at home as follows: 20% had more than 200 books, 26% had 81–200, 41% had 21–80, and 13% fewer than 20 books. There were more books in city homes (48% reported more than 100 books) than in homes in the rural area (28% reported more than 100 books; $\chi^2 = 21.62, p = .001$). Forty-eight percent of parents in rural areas reported visiting libraries at least 2–3 times a month compared to 32% of city parents ($\chi^2 = 11.40, p = .022$). Similarly, preschool children (47%) in rural areas visited libraries more often than city preschool children (23%; $\chi^2 = 28.46, p = .000$).

Use of Print Media

As indicated in Table 3, more children (34%) spent at least 1 hour per day with print media—such as reading books or comics in children's magazines—than with either computers (15%) or playing console games (9%). Only television watching, with 49% viewing at least an hour daily, was more frequent than time spent with books and other print materials. Although taken together, nonprint media certainly compete with print media, nevertheless 85% of preschool children were engaged in reading books, magazines, or comic strips 4–7 days a week (see Table 4). Typically, this practice took place with their parents. In fact, as reported in Table 6, most parents of both preschoolers and first graders read bedtime stories to their children. However, there was a statistically significant difference between preschool and first grade bedtime reading, with 70% of preschool children's parents reading very often or often while 58% of first graders' parents did so ($\chi^2 = 15.93, p = .001$). It is important to note that, according to the parents, 21% of preschool children were able to read by themselves, while 77% of the first-grade children were able to read. Despite the fact that most first graders had learned to read, most parents reported still regularly reading bedtime stories to them.

Table 6. Parents Reading Bedtime Stories.

	Very often	Often	Sometimes	Never
Preschoolers	50%	20%	26%	4%
First graders	41%	17%	33%	9%
Average	45%	19%	30%	6%

According to the survey, 88% of the parents started reading to their children before the child was a year old. But there was a difference according to the level of the parents' education ($\chi^2 = 50.44, p = .000$). Parents with a higher level of education were more likely to start reading early. For example, while 45% of parents with vocational education or less began reading to their children before 6 months of age, 66% of those with advanced degrees did so.

Children's Literacy Development

We included questions about children's emerging literacy to investigate how actively children were involved in print media in their environment. For example, these questions addressed how actively children asked questions about print, whether they showed interest in print in various media contexts, to what extent they recognized letters and words, whether they attempted to write and were interested in writing, and whether they were able to read. We also examined whether there were differences between boys and girls. We focus here on preschool children because, as noted, parents reported that 77% of the first graders were already reading conventionally.

The results for preschool children indicated that only 7% had not demonstrated interest in print by asking questions about what is written (e.g., on television, shop windows, signs) whereas 37% asked questions and 56% of the children were actively trying to recognize letters and words. In fact, parents reported that 72% of the children were able to recognize all the letters at the beginning of their preschool year and only 2% did not recognize any. As shown in Table 7, parents indicated that the most interesting contexts for reading attempts were books, magazines, and comics, with 49% of the children very interested in recognizing words in them and only 1% not showing any interest. Logos, such as those in shops, appeared to be very interesting for 37% of the children. As might be expected, the majority of children showed at least some interest in these logos. Almost equally interesting contexts were texts in the children's home environment. Namely, 32% of the children attempted to read texts such as those on milk cartons while only 5% of children were not interested in reading them. Surprisingly, texts on television were a much less interesting context for the literacy activity, with only 11% of children very interested in recognizing these texts and 25% not interested at all.

Similarly, writing attempts were frequent, with 53% of parents reporting that their children were either writing or pretending to write daily. In addition, when asked if their child was interested in writing, parents noted that 49% of children were very interested in writing activities. However, there was a statistically significant gender difference in interests, with 66% of the girls interested in writing but only 34% of the boys demonstrating similar interest ($\chi^2 = 53.83$, $p = .000$). Moreover, a similar statistically significant difference was found between the frequencies of writing activities: 70% of the girls wrote daily but only 39% of the boys did so ($\chi^2 = 42.62$,

Table 7. Preschooler Interest in Finding Out About the Printed Text in Various Situations.

How interested the preschooler is in	Very interested	Quite interested	A bit interested	Not interested	Don't know
Text on television	11%	24%	32%	25%	8%
Texts of different magazines	24%	35%	32%	9%	0%
Ads	18%	30%	34%	17%	1%
Shop signs, road signs, etc.	37%	34%	26%	3%	0%
Other texts at home (e.g., on a milk carton)	32%	39%	24%	5%	0%
When reading a book, comic book or a magazine	49%	34%	16%	1%	0%

Note. Because of rounding, percentages may not equal exactly 100%.

$p = .000$). Despite these statistically significant differences in interests and the frequencies in their attempts, there was no difference between boys' and girls' literacy development, with 22% of the girls and 20% boys being able to read in preschool.

DISCUSSION

Our findings indicate that Finnish preschool and first-grade children are quite frequent media users, and homes provide them with an environment that includes traditional media as well as newer technologies. Interestingly, parents reported more computers than televisions in their homes. Additionally, our data indicate that young Finnish children have televisions in their own rooms less often than their British or American peers. Marsh et al. (2005) reported that 29% of the British children aged 0 to 6 years in their study had their own televisions and Common Sense Media (2011) reported that 42% of 0- to 8-year-old children in the USA had a television. In contrast, we found that only 21% of Finnish children have their own televisions, which differs from Suoninen (2011), who reported that only 10% of children had a television in their own room. Similar to results from case studies (e.g., Valkonen et al., 2005) and Suoninen's survey (2011), our results indicate that the time spent watching television varied. Parents reported that 40% of the children watched television less than an hour a day and 12% of the children did not watch at all. A very small minority of preschool-age children (0.4% in the city and none in the rural areas) watched television more than 4 hours daily. The finding that there are more computers than televisions in homes, as well as variation in time spent watching television, could possibly be explained by the fact that the area has a large population of a religious group that does not accept television but does allow videos/DVDs, computers and the Internet. However, this possibility needs to be explored.

Based on our findings as well as previous research, playing electronic games and computer-based games is a common activity in Finland. Interestingly, our results indicate that preschool children play more games designed for learning while first graders play more entertainment games. This finding corresponds to Suoninen's (2011) finding that learning games were not as popular as entertainment games with first graders. Our results indicate that boys were more frequent game players than girls, as is evident in other studies as well (Ermi et al., 2005; Matikkala & Lahikainen, 2005; Suoninen, 2011). Some parents think that computer gaming is beneficial for children's learning (see Suoninen, 2011). However, this view might reflect an overemphasis on the potential benefits: A child's technical skills do not necessarily translate into learning skills in information and communication technology (ICT) contexts.

Finnish parents have not been ambitious to teach literacy to their children before school (Karvonen, 2005). However, several games have been designed to help prepare children for school by teaching, for instance, letters and their sounds. Parents may think that these games are useful specifically before school, but presume the school will take responsibility for teaching once the child enters first grade.

Parents noted that a high percentage of children could read at the start of first grade, indicating that children have learned to read during their preschool year or before. Our findings suggest that many activities at home can spark children's curiosity about learning literacy, such as using environmental print as a context for learning letters and other concepts of print.

Furthermore, our findings indicate that Finnish homes still reflect a reading culture that values print media. Although watching television is a common and frequent activity, especially among preschoolers, children also engage in reading several days of a week. The use of libraries is also frequent, as is the practice of reading bedtime stories. However, parents do not read as frequently to their first graders as to their preschool children. This finding might reflect some parents' belief that children do not need to be read to once they learn to read themselves.

The decrease in frequency of reading to first graders may be related to notion of children being expected to be independent at a young age in Finland. This expectation has been addressed in the media with regard to children staying at home alone after school, beginning in the first grade (Strandell & Forsberg, 2005). Perhaps being home alone after school is the reason for our finding a dramatic increase in the number of children with their own mobile phones, as preschoolers move to first grade. A similar finding was also observed in Suoninen's (2011) study. First graders need mobile phones to call their parents while they are on their own at home or in the neighborhood after school before their parents come from work.

Importantly, our results support the claim that newer technologies have not harmed literacy development, as has been debated (Schmidt et al., 2006), but may even support it (e.g., Karchmer et al., 2002). Literacy skill was found to develop well, with 77% of parents reporting that their first-grade child was able to read before the start of school. Moreover, the parents' reports showed no difference in the percentage of boys and girls who could read at the beginning of their preschool year, even though girls showed more interest in writing and were more engaged in writing activities than boys, while boys played more console and computer-based games (which may have included learning games). This lack of gender distinction at the beginning of the preschool year may indicate that involvement in print literacy is not more powerful than other media environments in learning to read. In fact, electronic media may motivate some children even more than printed texts. Such motivation, in turn, affords opportunities for children to learn literacy, provided that electronic media include print in a meaningful way from a child's point of view. But to explore this issue more ethnographic research is needed to investigate processes occurring in children's activities with media in formal and informal environments.

Evidence indicates, however, that Finnish first-grade classroom instruction has not taken into account children's developing competencies with newer technologies (Korkeamäki & Dreher, 2011), even though the national core curriculum for first and second grade states that (a) instruction should continue the learning that has begun at home, and (b) children's reading and writing skills, including media literacy and skills in ICTs, should be developed (National Board of Education, 2004). Moreover, even the use of children's trade books is rare in first-grade classrooms (Korkeamäki & Dreher, 2011). Preschool classrooms are even less well equipped with technology, such as computers and access to the Internet, than the classrooms in schools. Therefore, children's home environments are the primary source for learning media literacy skills. However, new technologies offer abundant resources that could enrich the curriculum so that it better matches children's interests and lives (e.g., Marsh, 2008). Also, the use of media and popular culture affords opportunities for facilitating children's development as critical users of media. Indeed, some children are very competent producers of digital texts and have posted their texts on the Internet before they enter school.

Our findings and the findings of other Finnish studies about children as frequent users of new technologies correspond to similar results in other countries, such as Britain (Ofcom,

2010) and the USA (Blanchard & Moore, 2010; Common Sense Media, 2011). However, despite such findings, some have argued that teachers do not take advantage of the literacy and technological skills young children bring to school with them (see Knobel, 2006). Researchers have suggested that since print-based texts have changed to screen-based, instruction should also reflect this change (e.g., Kress, 2003; Marsh, 2009). Because they involve new technologies (e.g., computers, console games, and mobile phones), multimodal texts and techno-literacy practices (Marsh, 2004) challenge teachers, even though words and letters on screen continue to be important (Marsh, 2009). Teachers and teacher educators need to address this challenge with more classroom research that investigates the usefulness of techno-literacy and how it might support the development of print literacy.

We recognize the limitations of our research. First, studies that examine media use are subject to the rapidly changing technology environment, and this study is no exception. New forms of technology have already emerged since we collected our data. For example, this study could not have specifically addressed forms of media that have appeared or increased in popularity after the data were collected (e.g., tablet computers, increasingly smarter phones). Although newer technologies could affect the results, a survey of Finnish children conducted after ours showed similar results (Suoninen, 2011), thus supporting our findings. Furthermore, the findings of Common Sense Media (2011) show that the newer technologies are not yet very common with young US children and that the time they spend with these devices is still very small compared to other media.

Another possible limitation of this study is that city preschool parents had a lower response rate (55%) compared to rural preschool parents (62%). As noted earlier, however, response rates for both groups were similar to the response rate in Marsh et al.'s (2005) study. In addition, although differential response rates could have affected the results, the evidence indicates few differences between rural and city results, suggesting that media culture is similar in both the city and rural areas.

CONCLUSION

Our study confirms the findings of several earlier case studies. But more importantly, our findings from 2006–2008 data parallel those of Suoninen's (2011) study with 2010 data that used similar methods. Because many of the items in Suoninen's and our surveys were quite similar, these two large-scale studies confirm that young Finnish children's use of technology at home is very frequent. Similar results have been found in studies in several countries (e.g., Common Sense Media, 2011; Ofcom, 2010). This trend, thus, presents a challenge to preschools and schools: Evidence indicates that instructional practices typically do not take advantage of young children's developing knowledge of diverse technologies (e.g., Korkeamäki & Dreher, 2011).

In addition to providing converging evidence of children's media use at home, our study also addressed children's literacy learning, an area that was not part of Suoninen's study. Our findings suggest that technology does not harm literacy development. However, we need more studies in relation to learning literacy and the use of technologies, specifically focusing on learning literacy both in formal and informal settings. In particular, research is needed on how teachers can build on the knowledge that many of today's young children already possess when they enter school.

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Appendix

QUESTIONNAIRE ABOUT PRESCHOOL AGE CHILDREN'S USE OF MEDIA¹

Background questions

- 1. Your gender**
 1. male
 2. female
- 2. Gender of your preschool age child**
 1. boy
 2. girl
- 3. Birth year of your preschool age child** _____
- 4. Your preschool age child has**
 1. a younger sibling / younger siblings
 2. an older sibling / older siblings
 3. both a younger sibling / siblings and an older sibling / siblings
 4. preschooler is the only child
- 5. Your professional education (if you are a student, choose your education according to your upcoming degree)**
 1. no professional education
 2. professional course or courses
 3. vocational school
 4. institute level education
 5. polytechnic degree
 6. academic qualification
- 6. Professional education of your spouse or partner (if he/she is a student, choose his/her education according to the upcoming degree)**
 1. no professional education
 2. professional course or courses
 3. vocational school
 4. institute level education
 5. polytechnic degree
 6. academic qualification
- 7. Which of the following options describes your work situation best?**
 1. day job
 2. shift work
 3. part-time job
 4. not working
- 8. Which of the following options describes your spouse or partner's work situation best?**
 1. day job
 2. shift work
 3. part-time job
 4. not working

¹ The survey was conducted in Finnish, and translated here by the researchers. The questionnaire for first graders was identical except that *preschool* was replaced by *first grade*.

9. In your opinion, your economic situation is

1. very good
2. good
3. satisfactory
4. difficult
5. very difficult

10. What language is primarily spoken in your family? _____

The following questions are related to the media equipment in your home.

11. Which of the following equipment is found at your home? You may select as many choices as needed.

Take into account only the equipment that is working and is in use.

1. television
2. VCR / DVD
3. telephone (also cell phones)
4. radio
5. stereo / CD player or tape player
6. computer (also laptops)
7. game console (PlayStation, X-Box, etc.)
8. video camera / digital video camera meant for shooting videos
9. digital camera
10. none of the above

12. Do any of your home computers have Internet connection?

1. yes
2. no

13. Which of the following equipment does your preschool age child have in his/her own or a shared room? You may select as many choices as needed.

1. television
2. VCR / DVD
3. radio
4. stereo / CD player or tape player
5. computer without Internet connection
6. computer with Internet connection
7. game console (PlayStation, X-Box, etc.)
8. none of the above

14. Does your child have his/her own cell phone?

1. yes
2. no

15. How many of the following does your preschool age child own or share with siblings? Choose the best answer for each row.

	0	1-10	11-20	21-30	31-40	over 40
books (picture books, storybooks, nonfiction books, coloring books, etc.)	1	2	3	4	5	6
videos / DVDs computer or console games	1	2	3	4	5	6
music recordings	1	2	3	4	5	6
fairy tale recordings	1	2	3	4	5	6

16. How many other books altogether are there in your house? (children's books not included)

1. 0-20
2. 21-50
3. 51-80
4. 81-100
5. 101-150
6. 151-200
7. more than 200

17. How many newspaper subscriptions are delivered to your home at the moment? _____ pcs.
18. How many magazine subscriptions for adults are delivered to your home at the moment? _____ pcs.
19. Are there some magazine subscriptions for your child? (also magazine subscriptions for siblings to share?) How many? _____ pcs.
20. How often do you buy newspapers or magazines as newsstand copies?
1. almost every day
 2. 2-4 times a week
 3. about once a week
 4. less than once a week
 5. never
21. How many computer games designed to support learning do you have in your household?
1. 11 or more
 2. 5-10
 3. 2-4
 4. 1
 5. don't know
 6. none

The following questions are related to your preschool age child's use of media

22. How often does your child do the following activities? Choose one option for each row.

	6-7 days a week	4-5 days a week	2-3 days a week	once a week	less than once a week	never
watches TV	1	2	3	4	5	6
watches video / DVD	1	2	3	4	5	6
listens to the stereo	1	2	3	4	5	6
listens to the radio	1	2	3	4	5	6
uses the computer	1	2	3	4	5	6
plays with the game console	1	2	3	4	5	6
reads or scans books, comics or magazines	1	2	3	4	5	6
uses cell phone (e.g., for playing or calling; not necessarily his/her own)	1	2	3	4	5	6

23. How much time, on average, does your preschool age child use the following activities per day? Choose one option for each row.

	more than 4 hours	3-4 hours	1-2 hours	from half an hour to an hour	less than half an hour	never
watching TV	1	2	3	4	5	6
watching video / DVD	1	2	3	4	5	6
listening to the stereo	1	2	3	4	5	6
listening to the radio	1	2	3	4	5	6
using the computer	1	2	3	4	5	6
playing with a game console	1	2	3	4	5	6
scanning or reading books, comics or magazines	1	2	3	4	5	6

24. Books, magazines, comic books, etc., are read to the child ...

1. many times a day
2. at least once a day
3. many times a week
4. about once a week or less
5. hardly ever

25. How old was your child when you began to read to or look at picture books with him/her?

1. under 6 months old
2. 6 months – 1 year old
3. 1-2 years old
4. 2-3 years old
5. 3-4 years old
6. 5-6 years old
7. don't know
8. child is not being read to

26. Your child is read to ...

	almost always	often	sometimes	never
when going to bed	1	2	3	4
when he/she wants and some adult has time	1	2	3	4
in other situations, when?	1	2	3	4

27. How often do you go to the library?

	once or more a week	2-3 times a month	once a month	very rarely	never
father / mother	1	2	3	4	5
preschool age child	1	2	3	4	5

28. What do you borrow from the library for your preschool age child?

	almost always	often	sometimes	rarely	never
books	1	2	3	4	5
magazines	1	2	3	4	5
videos / DVDs	1	2	3	4	5
computer or console games	1	2	3	4	5
fairy tale recordings	1	2	3	4	5
music	1	2	3	4	5

29. How often does one of the parents do the following activities together with your preschool age child?

	every day	2-6 times a week	once a week	less than once a week	never
watches TV	1	2	3	4	5
watches video / DVD	1	2	3	4	5
uses the computer or game console	1	2	3	4	5
reads a book, comics or magazines	1	2	3	4	5
listens to music or fairy tale recordings	1	2	3	4	5
listens to the radio	1	2	3	4	5
participates in his / her games	1	2	3	4	5
participates in his /her hobby activities	1	2	3	4	5

30. With whom does your child usually

	with friends	with siblings	with parents	with someone else	alone	doesn't do this
watch TV	1	2	3	4	5	6
watch video / DVD	1	2	3	4	5	6
listen to music or fairy tale recordings	1	2	3	4	5	6
listen to the radio	1	2	3	4	5	6
play with game consoles	1	2	3	4	5	6
use the computer	1	2	3	4	5	6
surf online	1	2	3	4	5	6

31. What does your child do with the computer?

	almost always	often	sometimes	rarely	never
plays computer games designed to support learning	1	2	3	4	5
plays other computer games	1	2	3	4	5
listens to music	1	2	3	4	5
watches movies	1	2	3	4	5
draws with a drawing program	1	2	3	4	5
surfs on the Internet	1	2	3	4	5
uses a word processor	1	2	3	4	5
discusses with friends (e.g., in Messenger)	1	2	3	4	5
reads and writes emails	1	2	3	4	5
something else, what?	1	2	3	4	5

32. Think back; at what age did your child first do each of the following?

	less than 1 year	1-2 years	3-4 years	5-6 years	don't know	child doesn't do this
watched TV	1	2	3	4	5	6
watched videos / DVDs	1	2	3	4	5	6
listened to the radio	1	2	3	4	5	6
listened to the stereo	1	2	3	4	5	6
used the computer	1	2	3	4	5	6
played with a game console	1	2	3	4	5	6
used a telephone / cell phone	1	2	3	4	5	6

In the last section, the questions are related to your child's attitudes towards written language.

33. How many letters of the alphabet does your child know?

1. none
2. few
3. about a half
4. almost all
5. all

34. Can your child read?

1. yes
2. no
3. don't know

35. If your child can already read, at what age was he/she when he/she learned to read?

1. 2 years or less
2. 3 years
3. 4 years
4. 5 years
5. 6 years

36. Is your child interested in finding out what is written, for example, in the texts on television, in the ads coming home or in shop windows or signs? Choose one option that describes your child the best.

1. doesn't ask
2. asks what it says in them
3. tries to recognize or read letters from them by him/herself

37. How interested is the child to find out about the printed text in the following situations?

	very interested	quite interested	a bit interested	not interested	don't know
text on television	1	2	3	4	5
texts of different magazines	1	2	3	4	5
ads coming at home	1	2	3	4	5
shop signs, road signs, etc.	1	2	3	4	5
other texts at home (e.g., on a milk carton)	1	2	3	4	5
when reading a book, comic book or a magazine	1	2	3	4	5

38. How often does your child write or pretend to write text?

1. every day
2. 2-6 times a week
3. about once a week
4. rarely
5. never

39. Is your child interested in writing?

1. very interested
2. quite interested
3. a bit interested
4. not interested
5. don't know

40. Your child recognizes words ... (Choose all that apply.)

1. based on familiar letters
2. based on color or shape
3. child can already read
4. don't know

Thank you very much for your answers!

EFFECTS OF PERSONAL TRAITS ON GENERATION Y CONSUMERS' ATTITUDES TOWARD THE USE OF MOBILE DEVICES FOR COMMUNICATION AND COMMERCE

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Abstract: *The purpose of this study was to investigate the effects of young adult consumers' personal traits (high-tech involvement, experiment proclivity, and fashion/brand leadership) on their perceptions of and attitudes toward using mobile devices for communications and commerce. The integrated stimulus-organism-responses paradigm (Fiore & Kim, 2007) served as the overarching framework, combining the uses and gratifications theory (Blumler & Katz, 1974) and the extended technology acceptance model (Kim, Ma, & Park, 2009). A convenience sample of 504 college students in 2 U. S. universities provided usable responses to our survey. Causal modeling analysis results showed that personal trait variables had significant impacts on the perceived ease of use, usefulness, and enjoyment, and attitudes toward mobile communication and mobile commerce. Findings also suggested that three perception variables positively influenced attitudes toward using mobile devices for communication as well as for commerce. This study provides empirical evidence of the potential of mobile commerce among young adult consumers.*

Keywords: *mobile technology, personal traits, Generation Y, fashion industry.*

INTRODUCTION

Mobile technology has evolved into a new, fast-growing marketing communication tool. Via technology, consumers access the Internet wirelessly to search for and research information, products, and services from anywhere and at any time (Ktoridou, Epaminondas, & Kaufmann, 2008). Mobile commerce (hereafter m-commerce) is defined as next-generation e-commerce in which any monetary transactions, such as shopping, banking, purchasing mobile phone services, and investing, occur using mobile devices (Ko, Kim, & Lee, 2009). By the end of 2011, it was estimated that there were approximately 5.98 billion mobile subscriptions worldwide, which was

equivalent to 87% of the world's population. This was a substantial increase from 5.4 billion in 2010, and 4.7 billion subscriptions in 2009. Nearly a billion and a half mobile subscribers lived in the developed countries, which implied the fact that the mobile subscription industry in these countries was quite saturated. On the other hand, the 4.52 billion subscribers in the developing countries results in a 79% penetration rate, which signals potential growth in these regions. (International Telecommunication Union, 2011). Further, it was estimated that m-commerce revenues in the US alone were expected to hit US\$1 billion in 2012, and mobile advertising growing to US\$38 billion by 2015 (Favell, 2011). According to Oracle's (2011) mobile trends report, 48% of consumers across all age groups utilize mobile devices on a wireless Internet network to assist in activities ranging from researching or browsing products and/or services on retailers' Web sites to scanning barcodes of merchandise for prices.

Understanding the Gen Y consumer segment is crucial for mobile technology-related industries due to its spending power and heavy usage of mobile devices and services. The consumers of this segment were born between 1980 and 1994, and thus comprise the current young adult population. This segment exhibited an annual expenditure of US\$187 billion in 2010. Gen Y consumers are known to be early adopters of new technology and heavy users of the Internet (Cross-Bystrom, 2010). According to Adweek (2012), about 38% of the total U.S. adult population own smart phones, while more than half of Gen Y consumers own them (58%, about 40.6 million), followed by Gen X (49%)¹ and Gen Z (47%). In contrast, less than a third of young baby boomers (29%), a fifth of old baby boomers (19%), and only 9% of the GI generation own smart phones. Gen Y consumers outnumbered all other age groups regarding mobile (voice) minutes used, text messages sent/received, and wireless data transmitted (Lenhart, Ling, Campbell, & Purcell, 2010).

According to Totten, Lipscomb, Cook, and Lesch (2005), the younger generations, such as Gen Y consumers, often use mobile phones as a medium of self-expression and individuality by downloading unique ring tones, screensavers, and message tones onto their phones. For Gen Y consumers, mobile phones are also used as an important means to stay connected with peers and family through social media sites (Kolsaker & Drakatos, 2009), as well as to extend existing social relationships (Pertierra, 2005). Because Gen Y consumers appear to be in the mainstream of mobile data service users in the US, it is crucial to examine the relationships between their personal traits and beliefs about and attitudes toward communication and commerce using mobile devices.

A recent study revealed that Gen Y consumers who perceive mobile services as providing emotional value have more satisfaction with the service, which in turn leads to the loyalty intention regarding those mobile services (Kumar & Lim, 2008). Currently, m-commerce has much potential to grow in the US in many different industries, including the fashion industry. There are, however, only a few studies (e.g., Kim, Ma, & Park, 2009) regarding the young adult consumer's attitude toward m-commerce and their willingness to adopt m-commerce. Because mobile devices are becoming an important part of young adult consumers' lifestyles (McGuigan, 2005), the consumers' personal traits may influence their behavior regarding mobile devices.

Considering innovative and conspicuous nature of mobile devices in the mobile commerce setting (Kim et al., 2009), we chose three personal trait variables, high-tech involvement, experiment proclivity, and fashion/brand leadership. Thus, the purpose of this study was to examine the effects of these personal trait variables on Gen Y consumers'

attitudes toward using mobile devices for communication as well as for commerce purposes. The integrated stimulus-organism-responses paradigm (Fiore & Kim, 2007) served as the overarching framework for this study, combining the extended technology acceptance model (Kim et al., 2009) and the uses and gratifications theory (Blumler & Katz, 1974). The significance of this study lies in two areas. First, it attempts to offer an integrated theoretical framework to understand contemporary young adult consumers' perceptions of and attitudes toward using mobile devices by synthesizing three theories from various fields, specifically marketing, environmental psychology, and communication. Second, this study investigates how three different personal trait variables (high-tech involvement, experiment proclivity, and fashion/brand leadership) play roles in the consumers' perceptions of and attitude toward mobile communication and toward m-commerce.

THEORETICAL FRAMEWORKS

Because young adult consumers have adopted wireless Internet technology quickly, it has become urgent to better understand their shopping experiences in today's technologically advanced marketplace. Two theoretical perspectives, the technology acceptance model (TAM) and the uses and gratifications theory (UGT), have been applied extensively in the study of consumer behavior related to the adoption and use of technology (Chua, Goh, & Lee, 2012; Gao, Sultan, & Rohm, 2010; Stafford, Stafford, & Schkade, 2004). For instance, a recent study by Kim et al. (2009) provided empirical evidence supporting the integration of TAM (Davis, 1989) and the theory of reasoned action (Fishbein & Ajzen, 1975) in the mobile communication context. In this study, we adopt Fiore and Kim's (2007) integrated stimulus-organism-responses (S-O-R) model to serve as a grounding framework to combine and expand UGT and the extended TAM model by Kim et al. (2009). This is done by incorporating and examining the effects of high-tech involvement, experiment proclivity, and fashion/brand leadership as personal trait variables on young consumers' perceptions of and attitudes toward using mobile devices for communications and commerce.

Stimulus-Organism-Response (S-O-R) Model

Since the introduction of Holbrook and Hirschman's (1982) ground-breaking work on the nature and mechanism of experiential consumption—consumers' hedonic responses during shopping and usage experiences—researchers have studied extensively the effects of experiential consumption on consumer responses. Based on an in-depth literature review in environmental psychology, Fiore and Kim (2007) presented an integrated conceptual model that combines both the hedonic experience-related consciousness–emotion–value model and the utilitarian experience-related cognition–affect–behavior model under the paradigm of the S-O-R model. Stimulus is defined as an element in the shopping environment that potentially affects the consumers' cognitive/consciousness and affective/emotional processes (Fiore & Kim, 2007). According to Fiore and Kim, person–environment variables, such as personal traits, demographic characteristics, and market segments, serve as moderators influencing the strength and direction of the relationships between the stimulus (the shopping environment) and consumers' responses (attitudes and behaviors) to the shopping environment. They also

noted that the organism, which includes the individual's consciousness, emotion, and value variables along with the cognition and affect variables, mediates the processes between the stimulus and consumers' responses. In the present study, therefore, we examined various personal trait variables that pertain to mobile shopping environments that may affect consumers' responses toward mobile communication and/or toward m-commerce.

The personal trait variables studied in the current research are high-tech involvement, experiment proclivity, and fashion/brand leadership. Examining these personal traits is also theoretically grounded on UGT (Blumler & Katz, 1974), which has been used to explain the role of personal motive related to consumer choice of a new communication medium (Chua et al., 2012; Gao et al., 2010; Stafford et al., 2004).

Uses and Gratifications Theory (UGT)

The UGT stemmed from mass communications research as a paradigm to understand media users' motives to seek out a media source that fulfills specific gratifications (Blumler & Katz, 1974). The UGT is considered to be one of the most appropriate theoretical frameworks to predict factors related to consumer choice of media (Chua et al., 2012; Gao et al., 2010). The UGT has been used in the study of consumers' adoption of different media, including technologies, software services, and mobile services, and to explain how users proactively search for the optimum medium that will not only meet the given basic needs but also enhance knowledge and social and psychological needs (Chua et al., 2012; Gao et al., 2010; Leung, 2001; Leung & Wei, 2000; Katz & Blumler, 1974; Stafford et al., 2004). Previous studies have demonstrated that nonutilitarian gratifications, such as sociability, symbolizing one's status, and fashionability, are very prominent for mobile uses (Leung, 2001; Leung & Wei, 2000; Thorbjornsen, Pedersen, & Nysveen, 2007). For example, related to an individual's instant messaging service, Leung (2001) found that usage was defined by seven gratification factors: relaxation, entertainment, fashion, inclusion, affection, sociability, and escape. In a study of mobile phone use, Leung and Wei (2000) also identified several perceived gratification factors, including affection/sociability, entertainment, instrumentality, psychological reassurance, fashion/status mobility, and immediate access. In a study that examined users' motivation on Internet use, Stafford et al. (2004) identified three major gratifications: content, process, and the social. Content gratifications concern the information and technology application hosted by the mobile service, process gratifications concern the actual use of the mobile technology, which involves high-tech involvement and experiment proclivity, while social gratifications are related to the mobile use for interpersonal communication, status, and thus fashion in general, including fashion/brand leadership. Although Stafford et al.'s (2004) study was based on Internet use, we believe similar gratifications can be identified for mobile use. Therefore, we draw on Stafford et al.'s three gratification factors for investigating three personal trait variables: high-tech involvement, experiment proclivity, and fashion/brand leadership.

Extended Technology Acceptance Model (TAM)

TAM (Davis, 1989), which originated from the theory of reasoned action (TRA; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and was tailored for the field of information system management, presented perceived usefulness and perceived ease of use as attitudinal

determinants to explain relationships among attitudes, intention to use, and actual application usage of a specific technology application system. A number of studies support the relationships depicted by the TAM (e.g., Kwon & Chidambaram, 2000; Nysveen, Pedersen, & Thorbjornsen, 2005a, 2005b; Pagani, 2004; Venkatesh, Morris, Davis, & Davis, 2003). Integrating TAM, TRA, and the media dependency theory (Ball-Rokeach & DeFleur, 1976), Kim et al. (2009) proposed and empirically tested an extended TAM model in mobile communication and m-commerce settings. They found positive relationships among consumers' perceptions of the ease of mobile device use, usefulness of mobile devices, and enjoyment using mobile devices in predicting adoption of mobile communication and m-commerce for the fashion industry.

This current study extends the Kim et al. (2009) study by examining the effect of personal trait variables on consumers' attitudes toward the adoption of mobile technology for fashion goods. In this study, various personal traits (high-tech involvement, experiment proclivity, and fashion/brand leadership) were examined as predictors of perceived ease of use, perceived usefulness, and perceived enjoyment using mobile devices. Based on the synthesis of the adopted theoretical frameworks, we proposed the conceptual model (see Figure 1) to be empirically examined in the present study. Subsequent literature review for hypotheses development follows.

LITERATURE REVIEW

Consumer Behavior in M-commerce

The significant growth in mobile device usage has resulted in the increasing execution of mobile advertisements for products and services and, in turn, mobile networking has become an efficient and effective channel of marketing communication (Tsang, Ho, & Liang, 2004). However, the results of this effective channel cannot be successful without positive consumer attitudes toward the channel and/or advertisement itself. Consumers' attitudes toward m-commerce have been studied by comparing consumers in the US and other countries (e.g., Altuna & Konuk, 2009; Shen & Chen, 2008). Various antecedents affecting consumers' attitudes toward m-commerce were examined in previous studies. Jun and Lee (2007) found that characteristics of mobile technology, such as mobility, convenience, and multimedia service, were positively related to attitudes toward mobile advertising. Phau and Teah (2009) studied young consumers' motives for using short message services (SMS) and found that convenience and economical benefits significantly influenced SMS usage frequency. In addition, Nysveen et al. (2005a, 2005b) showed that perceived enjoyment, perceived usefulness, and perceived expressiveness had strong overall impacts on consumers' intentions to use mobile services. They also found that perceived usefulness was a general antecedent for consumers' intentions to use various kinds of mobile services, while perceived enjoyment was a particularly important driver for using experiential services such as communication and gaming services. Furthermore, other studies have examined how mobile marketing influences the consumer decision-making process and shopping experience. For example, Karaatli, Ma, and Suntornpithug (2010) studied mobile services' impact on the overall shopping experience of the consumer and at different stages of the consumer decision-making process. They found that most of the participants believed that mobile services can potentially improve the various

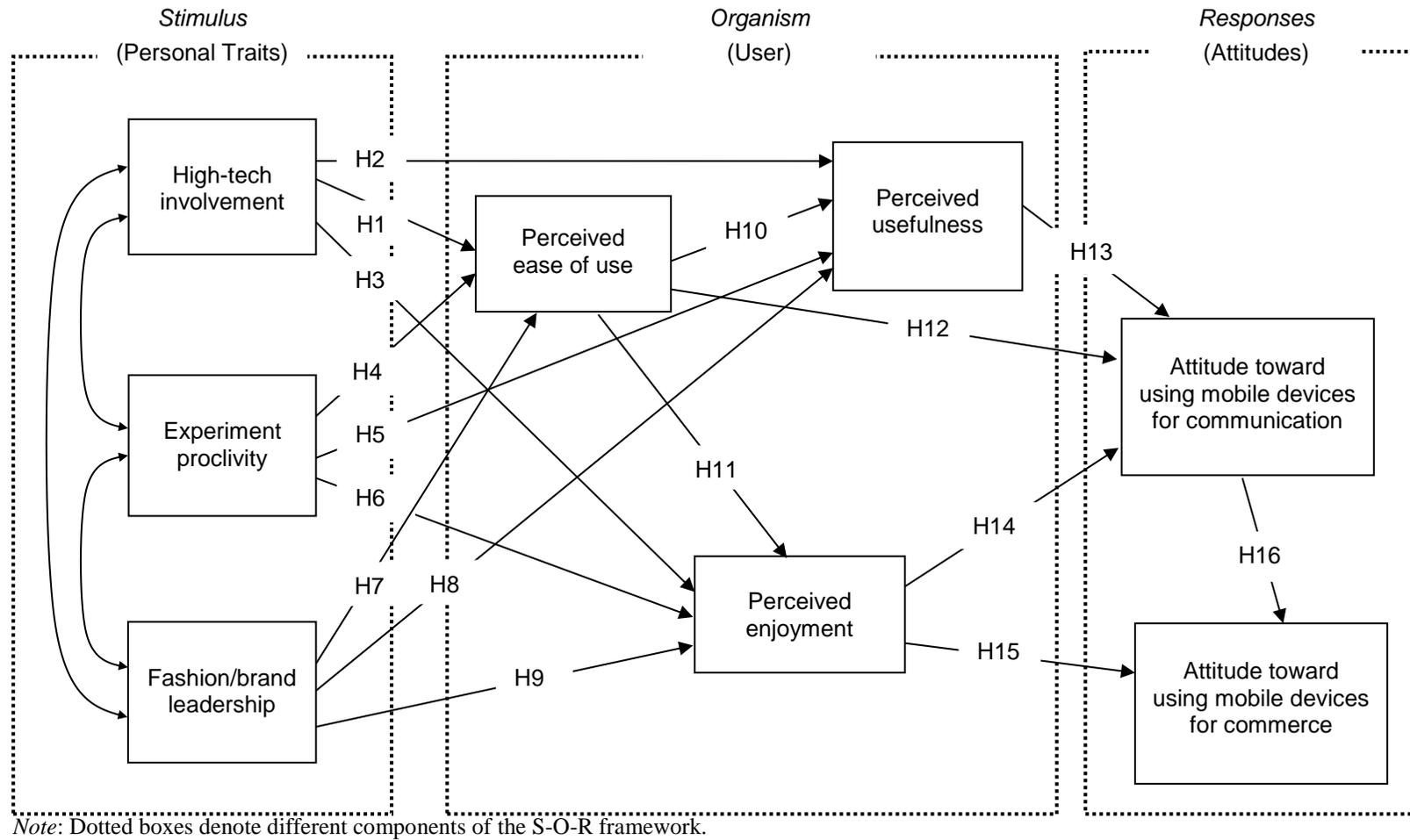


Figure 1. Proposed conceptual model exhibiting relationships among variables.

aspects of the shopping experience. On the contrary, Maity (2010) examined consumer decision-making experiences across three channels—m-commerce, e-commerce, and in-store—and found negative responses to consumer decision-making in the m-commerce setting. This finding was explained by the cognitive cost/sacrifice associated with undertaking decision-making in an m-commerce setting: Most participants complained of experiencing physical and emotional stress when using m-commerce as a new retail channel.

High-Tech Involvement and Experiment Proclivity

A few studies have explored the antecedents of TAM's perception variables, particularly regarding the adoption of m-commerce. One stream examined the relationships between consumers' involvement with advanced technology, such as mobile technology, and their attitudes toward and/or adoption of m-commerce (e.g., Altuna & Konuk, 2009; Jayasingh & Eze, 2009). In this paper, we focus on individuals' high-tech involvement as an explanatory and predictive variable for consumers' attitudes toward using mobile devices for communication as well as for commerce. Goldsmith and Hofacker (1992) argued that domain-specific innovation provides a deeper explanation of an individual's innovativeness and is highly associated with one's adoption of new products. In the literature, domain-specific innovativeness has been studied as a significant predictor of consumers' adoption of innovations (e.g., Goldsmith & Hofacker, 1992; Hirunyawipada & Paswan, 2006). For instance, Agarwal and Prasad (1998) added a new construct to the TAM called personal innovativeness in information technology, defined as the willingness of an individual to try out any new information technology. Research studies confirm that individuals with higher personal innovativeness are expected to develop more positive beliefs about the use of new technology (e.g., perceived usefulness, perceived ease of use, perceived enjoyment; Agarwal & Karahanna, 2000; Lewis, Agarwal, & Sambamurthy, 2003; Lu, Yao, & Yu, 2005). A recent study by Khare, Singh, and Khare (2010) also found that individuals' innovativeness among the Gen Y segment was a major determinant of online shopping in India. Based on previous literature in domain-specific innovativeness, e-commerce, and m-commerce, we anticipate that we may find positive relationships between individuals' high-tech involvement and perceptions of using mobile devices for communication. Therefore, we hypothesize the following:

H1: High-tech involvement has a positive impact on perceived ease of using mobile devices for communication.

H2: High-tech involvement has a positive impact on perceived usefulness of the devices for communication.

H3: High-tech involvement has a positive impact on perceived enjoyment of using the devices for communication.

In previous studies, researchers asserted the need for modifying and extending TAM to be more suitable in the mobile technology context (e.g., Jayasingh & Eze, 2009). These researchers pointed out that although TAM has been supported with its applications and validations through numerous studies, it does not account for the possibility of influence from social and personal control factors. Venkatesh and Davis (2000) found that computer self-efficacy and objective usability are important antecedents influenced by individual experiences with the system. In the present study, we define the individual's experiment proclivity as one's personal trait and

inclination toward the new technology/environment where one possesses less reservation and more adapting, as compared to those who are reluctant to use new technology. Thus, they may find using mobile devices easier, more useful, and more fun as compared to their counterparts. For that reason, we hypothesize that individuals' proclivity toward conducting experiments or the experiments themselves may enhance perceptions regarding the use of mobile devices as easy and enjoyable, as well as useful for communication and commerce:

H4: Experiment proclivity has a positive impact on perceived ease of using mobile devices for communication.

H5: Experiment proclivity has a positive impact on perceived usefulness of the devices for communication.

H6: Experiment proclivity has a positive impact on perceived enjoyment of using the devices for communication.

Fashion/Brand Leadership

In this study, we operationally define fashion/brand leadership as not only one's involvement in and knowledge about fashion but also one's level of influence over peers in regards to selecting fashion products and brands related to being fashionable. Previous studies show that consumers' involvement affects their level of attention, information processing, comprehension, decision making, and response to advertising (Celsi & Olson, 1988; Isomursu, Isomursu, & Leinonen, 2006; Maheswaren & Meyers-Levy, 1990). Hoffman and Novak (1996) found that highly involved consumers would pay greater attention to relevant Web sites, compared to less involved ones. Balabanis and Reynolds (2001) found a significant relationship between consumer involvement and consumer attitude toward online shopping. In addition, it has been proven that social influences have an important impact as one of the antecedent constructs to explain the TAM model (Venkatesh & Davis, 2000). Sproles (1979, cited in Miller, McIntyre, & Mantrala, 1993, p. 143) defined fashion as "a way of behaving that is temporarily adopted by a discernible proportion of members of a social group because that chosen behavior is perceived to be socially appropriate for the time and situation." Such individuals closely monitor what is considered as fashionable in the given period and place and spend substantial amounts of time and effort to collect information regarding fashion. In other words, those who considered themselves as fashion leaders are highly involved in the subject matter in our case: fashion. For instance, Kincade, Kim, and Gibson (2010) also found that consumers with a higher level of fashion leadership were highly involved in fashion products and exhibited a higher level of willingness to try on fashion products, compared to counterparts. Their finding implies a positive association among fashion involvement, fashion leadership, and experiential proclivity. Another study found a positive linkage between fashion leadership and use of multiple retail channels (Cho & Workman, 2011). Their finding may be explained by the consumer's use of mobile devices as fashion statement. For instance, when a brand new mobile device (e.g., iPhone) is launched, fashion leaders consider it fashionable and innovative to acquire the newly launched mobile device. According to Totten and his colleagues (2005), Gen Y consumers tend to view their mobile phones as a means for self-expression. Therefore, we anticipate that the self-expressive nature of

mobile device uses in public would influence the perceptions of mobile communication as easy, useful, and enjoyable. Based on the previous findings, we hypothesize the following:

H7: Fashion/brand leadership has a positive impact on perceived ease of using mobile devices for communication.

H8: Fashion/brand leadership has a positive impact on perceived usefulness of the devices for communication.

H9: Fashion/brand leadership has a positive impact on perceived enjoyment of using the devices for communication.

TAM Variables as Predictors of Attitudes toward Mobile Communication and toward M-Commerce

A number of studies have already empirically supported the relationships among perceived ease of use, usefulness, and enjoyment in the context of adoption of mobile technology (e.g., Kwon & Chidambaram, 2000; Kim et al., 2009; Nysveen et al., 2005a, 2005b). Previous studies showed positive and direct relationships among those variables. Kim et al. (2009) found that perceived ease of use, subjective norms, perceived usefulness, and perceived enjoyment were significant factors influencing consumers' attitudes toward mobile communication and toward m-commerce, which in turn led to their behavioral intention to use m-commerce technology for the purposes of searching for and purchasing fashion products. Therefore, we propose the following:

H10: Perceived ease of using mobile devices for communication has a positive effect on the perceived usefulness of mobile devices for communication.

H11: Perceived ease of using mobile devices for communication has a positive effect on the perceived enjoyment of using mobile devices for communication.

Perceived ease of use, one of the main structural variables of the TAM model, refers to a user's belief that using a particular system is without difficulty and effort (Davis, 1989). Perceived ease of use has been investigated as an important factor in understanding acceptance of information technology (Al-Gahtani & King, 1999), the wireless Internet through mobile devices (Lu et al., 2005), e-commerce (Jiang, Hsu, Klein, & Lin, 2000), and m-commerce (Kwon & Chidambaram, 2000; Kim et al., 2009; Nysveen et al., 2005a, 2005b). In previous studies, the effect of perceived ease of use on attitudes is considered an indirect effect mediated by perceived usefulness. However, recent studies claimed the direct influence of ease of use on attitude toward accepting the technology (Chiu, Huang, & Yen, 2010; Yu & Tao, 2009). Therefore, we hypothesize the following:

H12: Perceived ease of using mobile devices for communication has a positive impact on the attitude toward using mobile devices for communication.

Perceived usefulness refers to users' beliefs that using a particular system may improve their performances (Sadia, 2011). In the fashion retailing industry, it is critical to deliver contemporary trends to consumers in a timely manner due to the inherent nature of the goods, especially for fast fashion (Byun & Sternquist, 2011). A useful Website should provide all possible information, especially the tracking information of specific products. For instance,

Park and Kim (2007) showed that time-related information, such as stock availability and time for shipping/handling of the ordered items, influences consumers' perceptions of the time-related risks of and attitudes toward online shopping. M-commerce extends e-commerce by using the wireless network. Therefore, the influence of perceived usefulness will be an important factor to investigate regarding users' attitudes toward fashion-related mobile communication and m-commerce. In addition, previous studies have already demonstrated that perceived usefulness was one of the crucial factors influencing the adoption or acceptance of m-commerce services (e.g., Huei, 2004; Mariga, 2003). Recently, Kim et al. (2009) and Yaseen and Zayad (2010) provided additional empirical evidence to this relationship in the m-commerce context. Therefore, we propose the following:

H13: Perceived usefulness of using mobile devices for communication has a positive impact on the attitude toward using mobile devices for communication.

Literature in e-commerce with image interactive technology showed that consumers' emotional pleasures and/or affect acquired in the online shopping environment influenced consumers' attitudes toward online shopping (e.g., Childers, Carr, Peck, & Carson, 2001; Fiore, Jin, & Kim, 2005; Kim, Fiore, & Lee, 2007). The importance of perceived enjoyment has been emphasized by van der Heijden (2004), who claimed that perceived enjoyment dominated perceived usefulness in influencing the adoption behavior of hedonic information systems. Gentry and Calantone (2002) demonstrated that perceived enjoyment and perceived usefulness significantly explained consumer attitudes toward technology in a variety of contexts, including e-commerce. Kim, Park, and Oh (2008) also showed in their study that perceived enjoyment, perceived monetary value, perceived usefulness, and perceived ease of use were four major factors facilitating the adoption of SMS in South Korea. Based on a literature review related to perceived enjoyment, we hypothesize the following:

H14: Perceived enjoyment of using mobile devices for communication has a positive impact on the attitude toward using mobile devices for communication.

H15: Perceived enjoyment of using mobile devices for communication has a positive impact on the attitude toward using the devices for m-commerce.

Attitude Shifts Among the Retail Channels

Using the media dependency theory (Ball-Rokeach & DeFleur, 1976), Kim and Park (2005) illustrated a significant attitudinal shift from a traditional brick-and-mortar retailer to an online version of the retailer. Their study was one of the first empirical attempts to establish the theoretical argument that consumers' attitudes toward the new and/or technologically advanced retail channel is based on their present attitudes toward the traditional channel of that retailer. Based on this finding, Kim and her colleagues (2009) proposed a positive causal linkage between the attitude toward using mobile devices for communication purposes and the attitude toward using mobile devices for commerce. Kim et al. (2009) empirically demonstrated that consumers' attitudinal shifts occurred in the mobile technology context. Similarly, Bigné, Ruiz, and Sanz (2007) found that the frequency and the duration of mobile device use influenced the frequency of using m-commerce. Thus, based on the previous literature, we propose the following:

H16: The attitude toward using mobile devices for communication purposes has a positive impact on the attitude toward using the devices for m-commerce.

METHOD

Sample and Data Collection

We obtained a total of 504 usable responses from college students who reported existing subscriptions to mobile services on their devices. Respondents were recruited from six academic courses in a mix of general education and fashion merchandising disciplines in two large U.S. universities, one in the Midwest region and the other in the Southeast Coastal region, using a nonrepresentative convenience sampling technique. Students who volunteered for participation received extra course credit as an incentive during a 2-month period in spring 2011. For this study, we adopted a college student sample because the majority of the students represent Gen Y. This generational segment is critical for examining perception and evaluation of mobile uses due to their extensive usage of mobile devices (Burns, 2005; Ehret, 2011). For instance, they often use mobile technology to stay connected with family and friends by checking e-mails, sending text messages, or updating their statuses on social media sites, as well as applying the technology to diverse activities for entertainment (Cross-Bystrom, 2010; Totten et al., 2005).

Instruments

To measure an individual's personal traits, we researchers adopted scales from previous literature, as shown in Table 1. To measure high-tech involvement, six items from Goldsmith and Hofacker's (1992) domain-specific innovativeness scale and two items from Dickerson and Gentry (1983) were adopted and modified to suit the high-tech product category. To measure the experiment proclivity, three items were adopted from Joseph and Vyas's (1984) open processing scale. To measure fashion/brand leadership, we adopted three items from Lumpkin (1985) and two items from Hawes and Lumpkin (1984). To measure three perception constructs in the TAM—perceived ease of use, perceived usefulness, and perceived enjoyment—regarding mobile device uses for communication, we adopted Childers et al.'s (2001) scales. All items were measured on a five-point Likert scale from 1, *strongly disagree*, to 5, *strongly agree*. All TAM scales were modified to suit the mobile communication context (See Table 2).

A six-item attitude scale (e.g., bad–good, unfavorable–favorable, dislike–like) developed by Stayman and Batra (1991) was used for measuring both attitude toward mobile communication and attitude toward m-commerce on a five-point semantic differential scale. The preface, “Using a cell phone for communication with others would be...” was used for attitude toward mobile communication, whereas “purchasing music, phone ring tones, wallpapers, etc., using cell phone would be...” was used for attitude toward m-commerce. We also gathered participants' demographic information including age, sex, ethnicity, and disposable income. Prior to distribution, four graduate research assistants and two faculty members pilot-tested the questionnaire to ensure the clarity of item wording and appropriateness of modified items in the mobile usage context.

Table 1. Exploratory Factor Analysis of Personal Trait Variables.

Factor dimensions and items	Factor loadings	Total variance explained (%)	Eigen values	Cronbach's alpha
Factor 1: High-tech Involvement		23.78	4.81	.92
▪ High-tech products bring me comfort and convenience.	.55			
▪ In general, I am among the first in my circle of friends to buy a new high-tech product (e.g., MP3, PDA, cell phone, digital camera, etc.) when it appears.	.87			
▪ If I heard that a new high-tech product was available in the store, I would be interested enough to buy it.	.83			
▪ Compared to my friends, I own a lot of high-tech products.	.87			
▪ In general, I am the first in my circle of friends to know the titles/brands of the latest high-tech product.	.85			
▪ I will buy a new high-tech product if I haven't heard/tried it yet.	.70			
▪ I like to buy a high-tech product before other people do.	.86			
Factor 2: Experiment Proclivity		11.17	2.05	.81
▪ I like to experiment with new ways of doing things.	.83			
▪ I like to fool around with new ideas even if they turn out to be a waste of time.	.82			
▪ I like to try new and different things.	.80			
Factor 3: Fashion/Brand Leadership		10.01	1.79	.81
▪ I closely monitor fashionable trends.	.88			
▪ I enjoy pursuing something fashionable and exciting.	.87			
▪ Products and brands are central topics of my conversation with friends.	.63			
Total variance explained		44.96%		

Table 2. Exploratory Factor Analysis of the TAM Perception Variables.

Factor dimensions and items	Factor loadings	Total variance explained (%)	Eigen values	Cronbach's alpha
Perceived usefulness of mobile devices		49.70	7.95	.93
Communication using cell phone is:				
▪ useless–useful	.83			
▪ worthless–valuable	.83			
▪ unhelpful–helpful	.86			
▪ not functional–functional	.86			
▪ time wasting–time saving	.74			
Perceived enjoyment of using mobile devices		17.98	2.88	.94
Communication using cell phone is:				
▪ not entertaining–entertaining	.80			
▪ not enjoyable–enjoyable	.83			
▪ boring–interesting	.86			
▪ not fun–fun	.87			
▪ unexciting–exciting	.88			
Perceived ease of using mobile devices		9.62	1.54	.89
Use of cell phone:				
▪ is clear and understandable	.76			
▪ does not require a lot of mental effort	.87			
▪ is easy	.87			
▪ allows me to communicate in the way I want to	.77			
▪ is easy to learn	.82			
Total variance explained		77.30%		

FINDINGS

Sample Description

Slightly more than one half of our respondents were female ($n = 266$, 52.5%). Respondents ranged between 18 and 26 years of age at the time of the data collection. Most respondents (94.6%) fell in the age range between 18 and 23 years, with almost three quarters being aged 20 to 22 years (74.6%). The majority were Caucasians (87.9%), followed by Asian Americans (4.6%), African Americans (2.8%), and Hispanic Americans (1.2%). Slightly over 35% of the respondents reported that they had a monthly discretionary income of less than \$100, and another 36.5% had that of between \$100 and \$299. Descriptive statistics of the respondents' demographics are shown in Table 3.

Preliminary Analysis

Exploratory factor analysis using a varimax rotation was conducted to test construct validity of research variables and to determine whether multiple indicators for each research variable

Table 3. Demographics of the Survey Respondents ($N = 504$).

Demographics	Categories	Frequency	Percent (%)
Age	18	22	4.4
	19	42	8.3
	20	94	18.7
	21	161	31.9
	22	121	24.0
	23	37	7.3
	24	15	3.0
	25	9	1.8
Sex	26	3	0.6
	Male	226	44.8
	Female	266	52.8
Ethnicity	Missing	12	2.4
	Asian American	23	4.6
	Black or African American	14	2.8
	Latino or Hispanic American	6	1.2
	Native American	2	0.4
	White or Caucasian American	443	87.9
	Other	12	2.4
Region	Missing	4	0.8
	Midwest	159	31.5
Disposable income	Southeast coastal	345	68.5
	Less than \$100	185	36.7
	\$100 to \$299	184	36.5
	\$300 to \$499	74	14.6
	\$500 to \$699	24	4.8
	\$700 to \$899	16	3.2
	More than \$900	8	1.6
Did not disclose	13	2.6	

comprised one factor dimension (Cronbach & Meehl, 1955). Factor loadings above .55 (Nunnally & Bernstein, 1994) and less than .30 on other factors (Kline, 2004) were considered evidence for construct validity. Cronbach's alphas of all research constructs were above .81, indicating good reliabilities of measures (see Tables 1 and 2). Means of summated multiple item variables were used to represent model constructs for testing the proposed model and research hypotheses.

Causal Model Analysis: Hypotheses and Model Testing

The proposed model consists of three exogenous variables (high-tech involvement, experiment proclivity, and fashion/brand leadership) and five endogenous constructs (perceived ease of use, perceived usefulness, perceived enjoyment, attitude toward using the mobile device for communication, and attitude toward using mobile device for commerce). Descriptive statistics and correlation coefficients among constructs for the model are presented in Table 4.

The path analysis of the causal model was conducted by a maximum-likelihood estimation procedure using AMOS 20.0. To assess the model fit, a chi-square statistic, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), parsimonious goodness-of-fit index (PGFI), normed fit index (NFI), and root mean square error of approximation (RMSEA) were used. The chi-square test assesses the adequacy of a hypothesized model to reflect variance and covariance of the data. We used Kline (2004) and Schumacker and Lomax (2004) criteria as an indicator of good model fit to the data (GFI > 0.95, AGFI > 0.90, PGFI < 0.50, NFI > 0.95, RMSEA < 0.07, chi-square/df < 2). For the statistical significance of parameter estimates, *t*-values were used.

Table 4. Descriptive Statistics and Correlation Matrix of the Model Constructs.

Constructs	1	2	3	4	5	6	7	8
1. High-tech involvement	1							
2. Experiment proclivity	.31**	1						
3. Fashion/Brand leadership	.43**	.30**	1					
4. Perceived ease of using mobile devices for communication	.21**	.21**	.18**	1				
5. Perceived enjoyment of using mobile devices for communication	.12**	.09*	.23**	.26**	1			
6. Perceived usefulness of using mobile devices for communication	.07	.13**	.17**	.38**	.62**	1		
7. Attitude toward using mobile devices for communication	.08	.13**	.25**	.42**	.49**	.55**	1	
8. Attitude toward using mobile devices for commerce	.11*	.10*	.26**	.10*	.30**	.23**	.30**	1
Mean	2.70	3.78	3.10	4.35	3.85	4.39	4.31	3.07
SD	0.94	0.76	1.03	0.64	0.83	0.73	0.72	0.37

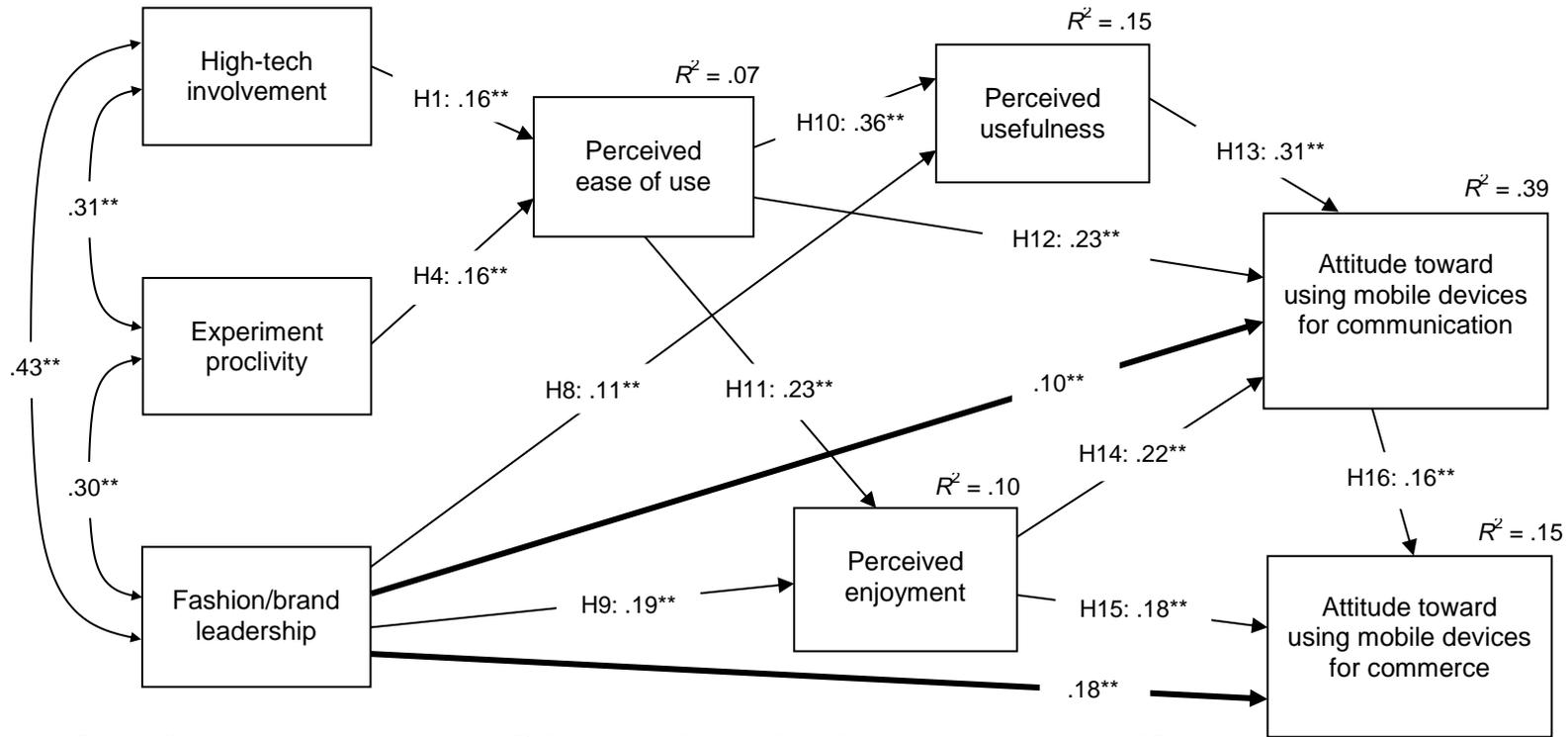
The results of the causal model analysis of the proposed conceptual model revealed a chi-square of 69.88 with 9 degrees of freedom ($\chi^2/df = 7.77$; $p < .01$). The GFI was .97; AGFI was .87; PGFI was .24; NFI was .76; and RMSEA was .116. The fit indices were not acceptable according to the Kline's (2004) criteria. Thus, we deleted the insignificant paths from the model. Then we revised the model by including two additional causal paths suggested by the modification indices (i.e., fashion/brand leadership to attitudes toward mobile communication as well as toward m-commerce). The causal analysis of this revised model achieved a chi-square of 12.56 with 11 degrees of freedom ($p = 0.32$). The GFI was .99; AGFI was .98; PGFI was .30; NFI was .98; and RMSEA was .017. The fit indices indicate that the revised model fit the data very well and is parsimonious. Figure 2 exhibits the results of testing the revised model, including significant standardized path coefficients and t -values for each relationship as well as squared multiple correlations (R^2) for each endogenous construct. The revised model explained a small to large amount of variance in dependent variables, including perceived ease of use ($R^2 = .07$), perceived usefulness ($R^2 = .15$), perceived enjoyment ($R^2 = .10$), attitude toward mobile communication ($R^2 = .639$), and attitude toward m-commerce ($R^2 = .15$).

Eleven hypotheses received statistical support, while five were rejected. Hypothesis 1, examining the effects of individuals' high-tech involvement on perceived ease of use of mobile devices, was statistically significant ($\gamma_{11} = .16$, $p < .01$), while it had no significant impact on perceived usefulness (H2: $\gamma_{21} = .08$, $p = .11$) nor perceived enjoyment (H3: $\gamma_{31} = .01$, $p = .86$). Hypotheses 4 through 6, testing the positive effects of individuals' experiment proclivity on perceived ease of use, perceived usefulness, and perceived enjoyment, only received statistical support for its impact on perceived ease of use (H4: $\gamma_{12} = .16$, $p < .01$), while it did not have significant direct effects on perceived usefulness (H5: $\gamma_{22} = .04$, $p = .38$) nor perceived enjoyment (H6: $\gamma_{32} = .01$, $p = .84$). Hypotheses 7 through 9 proposed a positive and direct influence of fashion/brand leadership on three TAM variables. The findings indicated significant statistical support regarding the influence of fashion/brand leadership on perceived usefulness (H8: $\gamma_{23} = .11$, $p < .01$) as well as perceived enjoyment (H9: $\gamma_{33} = .19$, $p < .01$), while not exhibiting its impact on the perceived ease of use (H7: $\gamma_{13} = .09$, $p = .08$).

As we proposed, perceived ease of use exhibited positive and direct effects on perceived usefulness, perceived enjoyment, and attitude toward mobile communication (H10: $\beta_{21} = .36$, $p < .01$; H11: $\beta_{31} = .23$, $p < .01$; H12: $\beta_{41} = .23$, $p < .01$). Hypothesis 13, which tested the positive relationship between perceived usefulness on the attitude toward mobile communication, also received statistical support (H13: $\beta_{42} = .31$, $p < .01$). Hypotheses 14 and 15 investigating perceived enjoyment's positive and direct impact on the attitude toward mobile communication as well as toward m-commerce also received statistical support (H14: $\beta_{43} = .22$, $p < .01$; H15: $\beta_{53} = .18$, $p < .01$). Lastly, Hypothesis 16 proposed that attitude toward mobile communication positively predicts attitude toward m-commerce, and results showed that this positive prediction received statistically significant support (H16: $\beta_{54} = .16$, $p < .01$).

DISCUSSION

As mobile technology has become a venue for the next generation of e-commerce (Ktoridou et al., 2008) and an important part of young consumers' lifestyles, it was imperative to



Note: Standardized path estimates are reported. Bold arrows indicate additional paths suggested by the modification indices.
 ** $p < .01$ using two-tail test

Figure 2. Causal model analysis results of the revised model.

examine the effect of personal traits on consumer perceptions of using mobile devices as well as attitudes toward mobile communication and toward m-commerce. The present study's findings showed that individuals' high-tech involvement and experiment proclivity were important factors influencing individuals' perceived ease of using mobile devices for communication, although they did not explain perceived usefulness and perceived enjoyment of using the devices for communication. As indicated earlier, perceived ease of use is defined as users' belief that using a particular system is without difficulty and effort (Davis, 1989). Consumers who are already highly involved in technology and who are likely to try new things are most likely to find using mobile devices not difficult. However, those individuals probably have used technological devices other than mobile ones, and would not necessarily find mobile devices more useful and enjoyable than other devices. Another possible explanation may be the mediating role of the perceived ease of use between the personal trait variables and perceived usefulness and perceived enjoyment of using mobile devices. This is consistent with previous findings related to the TAM model that the effect of external variables on attitude is mediated by the perceived ease of use (Venkatesh & Davis, 2000).

This study revealed that fashion/brand leadership had a positive effect on both perceived enjoyment and perceived usefulness of mobile devices for communication, yet no significant effect on perceived ease of using the devices. This result is consistent with findings of previous studies related to fashion innovativeness: Consumers with higher fashion innovativeness tend to engage more often in experiential shopping that is motivated by a desire for pleasure rather than practical purposes (e.g., Cho & Workman, 2011; Peck & Childers, 2003). Thus, those individuals with higher levels of fashion/brand leadership would find mobile devices more enjoyable compared to those with lower levels of fashion/brand leadership. In addition, this finding is in line with the UGT studies that demonstrated the strong influence of nonutilitarian gratifications, including sociability, symbolizing one's status, and fashionability, as very prominent for mobile uses (Leung, 2001; Leung & Wei, 2000; Thorbjornsen et al., 2007).

In addition to the proposed hypotheses, fashion/brand leadership exhibited a significant and positive impact on the attitude toward using mobile devices for communication as well as the attitude toward using the devices for commerce. Although not anticipated, these results dovetail with recent theory and research on the expressive nature of the mobile devices as a part of the individual self (e.g., Totten et al., 2005). Most smart phones equipped with mobile Internet technology are rather highly priced and designed to exhibit cutting-edge, technologically advanced functions. For instance, the iPhone 4s has unique design elements and features that make the device easy to differentiate from other devices. Thus, mobile devices can be used as means of self-expression or developing one's identity (Shtykh et al., 2009; Taylor & Harper, 2001) by purchasing custom cases. As a result, mobile devices function as visible products that possibly modify the users' projected image in the same manner as fashion products do (Sproles, 1979, in Miller et al., 1993).

Another possible explanation for the positive effect of fashion/brand leadership on attitude toward mobile devices is the young consumers' cultural issues. Whether young consumers already perceive mobile devices as fashionable products or not, using mobile devices has become the most distinctive cultural factor among Gen Y consumers. Thus, leaders in fashion may exhibit even more positive attitudes toward using mobile devices for communication and commerce to reconfirm their leadership in innovativeness toward new things. Therefore, this

visibility, as well as the quintessential cultural value of using mobile devices, may enhance consumers' attitudes toward mobile devices for communication as well as for commerce.

This study adopted three different behavioral theories, S-O-R, UGT, and extended TAM, to form an integrated theoretical model for understanding the mobile behavior of contemporary young consumers. The findings of this study are consistent with the previous studies (Kim et al., 2009; Kwon & Chidambaram, 2000; Nysveen et al., 2005a, 2005b; Pagani, 2004) that exhibited direct and positive relationships among three TAM variables: perceived ease, perceived usefulness, and perceived enjoyment of using mobile devices.

Consistent with prior studies (e.g., Kim et al., 2009), all three TAM variables also were found to be significant antecedents of attitudes toward using mobile devices for communication as well as commerce. In addition, the findings showed that the proposed model based on the paradigm of the S-O-R model also exhibited the robustness of the paradigm in the mobile communication and m-commerce context. Personal traits exhibited various direct relationships to the organism (three perception variables), which in turn had a positive impact on the responses (attitudes toward using the mobile devices for communication as well as commerce).

IMPLICATIONS FOR RESEARCH

Previous research by Kim et al. (2009) provided empirical ground for the causal linkages between attitudes and behavioral intention toward mobile communication and toward m-commerce. Thus, in the present study, we focused on revealing the crucial antecedents of the TAM perception variables, which in turn influenced attitudes toward mobile communication and toward m-commerce. The findings of the present study exhibited the important roles of three personal trait variables—high-tech involvement, experiment proclivity, and fashion/brand leadership—on the consumers' perceptions of and attitudes toward using mobile devices for communication and commerce. Although only some research hypotheses received statistical support, the findings of this study contribute to contemporary research on mobile communication and m-commerce by demonstrating these specific personal traits as antecedents of the three core belief constructs in the TAM—perceived usefulness, perceived enjoyment, and perceived ease of use—in the m-commerce context.

Moreover, the findings of the present study exhibited additional direct relationships explaining the impact of individuals' fashion/brand leadership on attitudes toward using mobile devices for communication and mobile commerce. These direct relationships were not previously found in any other study related to mobile technology. Thus, these findings will contribute to the study of mobile technology and retail industry, especially when considering that fashion/brand leadership needs to be taken into account as a critical antecedent variable for understanding contemporary young consumers' perception of and attitudes toward using mobile devices.

IMPLICATIONS FOR PRACTICE

Our research findings offer some pragmatic implications for the marketers and retailers that have already adopted or are considering adopting mobile technology as additional channels to reach out to their customers. The Gen Y consumers have been identified as one of the most

influential segments of the mobile industry due to their heavy use of these technologies (Lenhart et al., 2010). Their personal traits, such as significant high-technology involvement, higher predilection toward experimentation or trying new things, and stronger fashion/brand leadership, should be considered when developing mobile marketing strategies targeted for young adult consumers. Mobile retailers and marketers should look for these key personality traits because the individuals possessing these characteristics would be more inclined to be opinion leaders or innovators within their communities. In addition, these characteristics of Gen Y consumers may positively impact buzz marketing, that is, the favorable word-of-mouth impression generated among users/consumers based on their perceptions of innovativeness and opinion leaders.

Fashion/brand leadership displayed both direct and indirect impact on most endogenous variables in the proposed model. Ubiquitous use of mobile devices by young adult consumers as a means of social connectedness (Kolsaker & Drakatos, 2009) and to expand social relationships (Pertierra, 2005) are deemed closely related to their fashion/brand leadership embodied in the visible, social use of the devices in public. Thus, it may be helpful for mobile marketers and retailers to adopt this construct to examine how mobile device use impacts the consumers' establishing and/or maintaining brand loyalty toward certain mobile device brands or m-commerce applications.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Several limitations of the study should be noted. First, some important variables are not integrated into the conceptual model. For example, possible predictor variables that may significantly influence consumers' attitude toward using mobile devices include trust (Gefen, Karahanna, & Straub, 2003; Pennington, Wilcox, & Grover, 2003) and privacy concerns (Dinev & Hart, 2005). In addition, other gratification factors, such as a more diverse sample of the same cohort (i.e., ethnic background, other regions of the world, or social and economic status), may grant an opportunity to provide deeper understanding among this Gen Y consumer segment around the globe. In addition, future research may expand the present study using other generational cohorts (e.g., baby boomers, Gen X, Gen Z) throughout the USA to provide characteristics of the cohorts and their beliefs about and attitudes toward m-commerce, which can assist in developing effective marketing strategies for the mobile retail industry.

Although it was not hypothesized in the present study, our results showed that there was a more dominant impact of perceived usefulness of the mobile devices for communication purposes as compared to perceived enjoyment on the attitude toward using mobile devices for communication purposes. This finding is contrary to the previous findings (e.g., Kim et al., 2009; van der Heijden, 2004) on the dominance of perceived enjoyment over perceived usefulness in influencing one's attitude toward the information system. This finding raises an opportunity for future research to investigate the relative impact of the TAM's perception variables in various retail or IT settings.

ENDNOTE

1. We adopted a newer categorization of the generational cohort in the present paper. The Gen X refers to the individuals born between 1965 and 1976, Gen Y to those born between 1977 and 1995, and Gen Z to those born between 1996 and 2005 (Yan, 2006). It should be noted that another school of thought identified the millennials as a generational segment consisting of individuals born between 1982 and 2004, which encompasses most of Gen Y and Gen Z populations (Strauss & Howe, 2010).

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MAPPING THE USER EXPERIENCE: DEVELOPMENT OF A VALIDATED INSTRUMENT FROM THE PLANS AND SCRIPTS OF THE COMPUTER COMMUNITY OF PRACTICE

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Abstract: *A plethora of surveys for assessing computer use for usability or technology acceptance exist today. This article discusses the Systems Acceptance Indicator, a validated survey instrument for assessing the user experience from a cognitive–ergonomic perspective. The action research discussed in this paper utilized grounded theory analysis to establish the data-driven emergent theoretical constructs that provided the system acceptance categories (criteria) for the survey. These data-driven emergent theoretical constructs were the basis for the proposed theoretical abstraction hierarchy of the survey criteria. Principle component analysis of the survey data produced an abstraction hierarchy identical to the theoretical model. This result confirmed the alignment of the human–computer interaction theoretical constructs with the data-driven emergent theory. The intent behind the human–computer interaction theoretical rationale for the emergent abstraction hierarchy was to provide a consistent and repeatable interpretation of the user response to the survey.*

Keywords: *validated survey, interaction design, community of practice, intuitive, HCI, user experience, cognitive ergonomics.*

INTRODUCTION

This article is focused on the emergent theoretical constructs that shaped a survey for system acceptance. The survey, the System Acceptance Indicator (SAI; Lehane, 2012a), was developed for the specific purpose of assessing system acceptance and the user experience (UX) from the pragmatic perspective of a human–computer interaction (HCI) practitioner. The typical numerical index or summarized qualitative description of the analysis of the participants’ responses to a survey can be less than useful in regard to how the HCI practitioner should proceed in regard to the users’ perceptions of the system—an uncovering of any useful design and development concepts—or action based on the solicited user feedback. Where this survey differs is that the analysis practice associated with the SAI (Lehane, 2012b) is intimately linked to the proposed theoretical rationale derived from the underlying HCI precepts.

The theoretical constructs discussed here are 12 criteria that emerged from a grounded theory analysis (Dick, 2005; Glaser, 1994, 1998) of notes collected from focus group interviews with users as part of the survey. The purpose of the survey was to provide a general indication of the users' system familiarity based on their then-present usage and their leverage of prior knowledge and experience. The concept of *intuitive* computer use by a community of practice (Vygotsky, 1978) provides the foundation for interpreting the responses to the survey (Lehane, 2010). In particular, the concept of leverage of prior knowledge, expressed as previously learned or scripted behavior patterns, was an important concept in this study. Scripted behavior (Bødker, 1991; Suchman, 1987) is a key concept used for considering a design as intuitive and for the subsequent resolution of arising use issues.

When the survey responses are viewed as a time series comprising a benchmark, transition, and familiar use, the UX is presented in terms of HCI design concepts. The strength of the survey is that the time series of responses can show changes in high-level user perceptions, and an associated remedial program can be implemented if a shortfall is identified. In such situations, usability engineering concepts (Nielsen, 1993) are not applied generally at the process level as a learned behavior; rather, they are applied at the keystroke level as the conscious operationalization of the scripts, which establish the users' expectations for interacting with the system. That subtle variation was observed during the investigation into users' interaction with large enterprise systems with limited or no customizations (Lehane, 2012a).

In this article on intuitive design, I discuss the underlying theoretical rationale developed for understanding and implementing concepts associated with plans and scripted behavior in system design. The HCI theoretical rationale addresses familiar concepts, such as usability (Nielsen, 1993), distributed cognition (Hutchins, 1995, 2000), and activity theory (Bødker, 1991; Nardi, 1996a; Vygotsky, 1978), before dealing with extensions made to these existing models. I then introduce the innovative interpretation that the use of these extensions allows.

THEORETICAL RATIONALE FOR EMERGENT CONSTRUCTS

At the start of the research project, it became very clear to me, as the systems analyst, that the way the users described their experiences mirrored issues typical of UX, but differed significantly in regard to the application of specific terms and concepts as compared to those used in the HCI literature. Thus, if an appropriate direction toward understanding the UX was to be found, I realized I needed to reconcile these discrepancies.

Systematic note-taking was the initial response, followed by a process of coding the concepts and comparing them to HCI literature. (A fuller description of the process can be found in Lehane, 2012b.) Resulting from this iterative process, concepts from a number of paradigms were brought together to form the contextual interpretation presented here in explaining the emergent theoretical construct, which is the classification criteria of the survey. The concepts behind these criteria characterize the users' descriptions of their computer-use experiences and included, but was not limited to, activity theory (Bødker, 1991; Nardi, 1996a; Vygotsky, 1978), situated action (Suchman, 1987), distributed cognition (Hutchins, 1995, 2000), usability engineering (Nielsen, 1993), soft systems modeling (Checkland, 1999; Checkland & Holwell, 1998), cognitive systems engineering/cognitive work analysis (Rasmussen, 1994; Vicente,

1999), scientific management (Taylor, 1911), and the unified theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003).

One premise for grounded theory is that the theory is concealed within the data. To reveal this theory implicit in the data, the data collection, analysis, and theory formulation are approached in an iterative process. Thus, the research process is an inductive investigation in which relevant data is systematically gathered and analyzed. The objective is not to test a theory but to observe and seek further emergence that will build onto the existing theory (Dick, 2005). The use of grounded theory as the vehicle to expose emergent theory from the research data ensures that the data are not forced unquestioningly to conform to espoused theory (Carroll, 1991; Glaser, 1998; Kuutti, 1996).

The final phase of the implementation of grounded theory requires a propositional theoretical base, developed from the data collection and analyses, which is used to develop criteria for the theoretical sampling and associated classification method (Dick, 2005; Glaser, 1994, 1998). The SAI survey (see Lehane, 2010, 2012b) is that final stage of my grounded theory analysis. The analysis of this final-stage data was to confirm or refute the relationships between categories and, where applicable, to limit the relevance of the categories in the proposed theoretical constructs. The discussion about the influence these paradigms have on the UX and system acceptance presented here accounts for the HCI theoretical rationale used to interpret the users' responses to the survey.

Extensions to Existing Models

While developing the theoretical rationale to explain the emergent constructs and to question categories as presented in this article, it was considered opportune to include in the original models the theoretical tenets not represented but which were important to the interpretation of the survey results. Extensions were made to the original models of activity theory (Engeström, cited in Kuutti, 1996; Hasan, Gould, Larkin, & Vrazalic, 2001; Vygotsky, 1978) and usability engineering (Nielsen, 1993). In addition, soft systems modeling (Checkland, 1999) was used to develop a theoretical rationale for the abstraction hierarchy of the usability engineering criteria; concepts from cognitive HCI were used to operationalize activity theory. This restructuring helped establish the theoretical rationale for the survey criteria, which are the grounded theory sampling classes.

Two concepts that describe activity theory principles are context and consciousness (Nardi, 1996b). I interpret the Vygotsky/Engeström model as being focused on the context. Both context and consciousness are important to activity theory as it is applied in this article and to practice in general. Consequently for the development of the theoretical rationale, consciousness as orientation was mapped into the model.

The pictorial representation of Nielsen's model of the attributes of system acceptance in usability engineering did not include functionality (Nielsen, 1993, p. 25), yet the criteria usability and utility qualify functionality. Functionality is a key concept in a system's analysis, design, and practice. Therefore, the human factors definitions of tasks and functions were used to establish functionality in Nielsen's model (Lehane, 2012a).

Soft systems modeling has two important pairs of concepts: emergence and hierarchy, and communication and control (Checkland, 1999, p. 75). The application of these principles

to usability engineering, in conjunction with the incorporation of functionality, allowed the system acceptance criteria to be structured theoretically into an abstraction hierarchy.

The tenets of activity theory are broad-scope concepts with high-level abstract explanations. Consequently, minimal detail on their implementation is available. Thus, HCI models and theories were used, where applicable, as methodologies to provide the low-level implementation detail missing from activity theory. The incorporation of the HCI concepts into the structure of the activity theory model provided pragmatic methodologies to articulate activity theory within the HCI domain. By incorporating these methodologies in this study, activity theory subsumed those cognitive HCI models and theories.

Finally, as a user requirement, system designers are frequently asked to “make it intuitive.” This article surfaces one way in which this requirement can be considered in design. That solution, scripted behavior based on the practice of a use community, emerged from the theoretical backdrop developed to understand the role and influence of the community of practice on the users’ day-to-day computer-use experiences. The following discussion outlines the implications and outcomes of applying the communities of practice paradigm to the analysis and interpretation of the user experience, as exposed by responses to the SAI.

The User Experience

The integration of information and communications technologies (ICTs) into everyday activities at work, at home, and at play has made computer use a holistic experience. People now talk of their UX as they engage in the multiple activities that compose their days. Each use instance of engaging with technology contributes to the users’ UX, building up a mosaic of experiences across a spectrum of occurrences. Each experience results in a script of contextualized actions appropriate to the environment and the task. Later these scripts can be recalled as planned activities to resolve user interaction issues.

Concept-wise, the challenge today is not only for design to build on and improve the UX, but also to monitor and evaluate the UX across myriad contextual situations made possible by the enabling technologies. To do this, both design and evaluation need to consider aspects of the situated activity and associated scripted behavior in an integrated manner, so as to present familiar artifacts and use experiences to the user. Users who recognize familiar artifacts and their use possibilities are led to a UX in which they perceive the system to be easy to learn and use. This result is the intuitive design presented in this article.

Cognition in Interaction Design

In 1987, Suchman wrote about purposeful action and the context that defined the meaning of such actions. Suchman stated that artifacts built on a planning model confuse the concepts of plans and situated action. Plans are based on previously experienced conditions, as well as the consequences of actions that accounted for the actions in a plausible way. Plans and goals do not provide a solution to the problem; they simply restate it. The term *situated action* underscored Suchman’s view that every course of action depends upon its material and social circumstances. These scripts are extremely numerous, one for almost every occasion (e.g., a restaurant script, a birthday script, etc.). Each situation has its “plan” comprising ordered action sequences, with each action producing the conditions that enable the next action to occur. The integration of

situated action into an activity is an emergent property of moment-by-moment interactions, based on previous experiences, between the individual and the environment of his/her actions.

In the same way that buying a cup of coffee at Starbucks is not the same as buying a cup of coffee at McDonalds, the environment and context are distinct constructs. People behave differently in response to the conditions because of various learned responses, that is, scripts. Plans associate intentions with action sequences, and scripts associate action sequences with typical situations, thus forming the precursors to an intuitive response.

Similarly, Bødker (1991) used activity theory concepts in discussing the context of human activity that defined the meaning of such activities. The individual activity is conducted through actions that take place at a nexus of time, space, and specific intentions. An action is conducted through one or more operations. Operations are the sensorimotor deeds that a human performs, without consciousness, in a specific situation to fulfill the conscious actions. The appropriate action is triggered by the material conditions, that is, the script. If these triggers do not exist, then the action is not operationalized and the action has to be performed with conscious attention to detail.

In the workplace, which is a controlled community of practice, individuals share the practice at the same time as they are participating in the activities constituting the practice. Through learning (i.e., special learning activities or in daily work activities), individuals come to possess a context-sensitive repertoire of operations to be used in a specific activity. In the workplace, practice is passed from one person to another. The novice becomes familiar with the artifacts, interactions, and business processes necessary to produce the required work outcomes. Issues arise when the existing system is replaced by another that has the same business capabilities but a different look and feel. In such cases, the interaction design is completely changed by the unfamiliar screen layout and artifacts. Significant changes to the look and feel of a system or a process within a system can produce a replacement that is counter to the design goal of producing an intuitive system. Consequently, the material conditions, learned from past experiences and executed as scripts, are the elements that must be transported to the screen and presented on the new interface for intuitive interaction design.

Emotional User Response in a Cognitive World

Norman (2004) assigned three levels of processing to the human brain: visceral, behavioral, and reflective. Visceral is the instinctive processing that instantaneously makes a value judgment on what is good or bad (physically, mentally, and emotionally) and sends appropriate signals to the muscles and the brain. Affective processing, which includes emotional response, starts with the visceral. Everyday behavior, best described as skilled or operationalized activity without conscious consideration of the activity, is the behavioral level. Finally, the reflective level involves cognition, the contemplative processing of past, present, and proposed experiences.

The lowest of these three levels is the visceral, which responds to sensory stimuli and initiates motor behavior. The second level is behavioral, which also responds to stimuli and can initiate behavior. The behavioral level can be influenced by the reflective level, whereas the visceral cannot. The highest level is the reflective level, which is isolated from the sensorimotor actuators. It monitors the behavioral and visceral levels and influences the behavior.

Irrespective of the cognitive processing and the meaning attached to an object or event, it is the emotional response that assigns value to that object or event. Paraphrasing Norman (2004), a user, after consideration of all the “facts,” may still respond, “It does the job but it’s the wrong color: I don’t like it,” and that is the final decision. Therefore, in considering system acceptance and the UX, for the research reported in this paper, the user’s emotional response is always given higher precedence over the reflective level.

Affordance in Intuitive Use Design

The move from the command line on a blank screen to a menu on the graphical user interface changed the mode of interaction between the user and the computer. A graphical user interface application incorporates windows, icons, menus, and pointers for the user to monitor and control the interaction, and thus what-you-see-is-what-you-get elements present the content. These screen attributes are important when considering intuition and future and continued use: Screen layout based on artifact selection and location is fundamental to the direct manipulation paradigm for interaction design.

The term *affordance* (Gaver, 1991; Hartson, 2003; Norman, 1988) refers to the cognitive (perceived) and physical (actual) properties of an artifact. Artifact affordances encapsulated in the physical properties of an object, such as its size, shape, color, component materials, location, and so on, are visually discernible and provide the observer with clues as to the object’s nature and purpose. By design, then, affordances should provide strong visual clues to the use possibilities and to the operation of the artifact so that, on inspection, the user knows what it is used for and how to use it.

In practice with new artifacts, users typically are unfamiliar at first with the visual representation of the related commands and the methods to apply those commands in the direct manipulation interaction paradigm. Consequently, large discrepancies can take place between what inexperienced users expect to occur and the actual outcome of their actions. To counter the problem of misinterpreting screen artifact affordances, the artifacts usually are made to visually resemble the real-world object in form and affordances, and they operate in a similar manner as in the real world. Similarly, objects encountered only on the screen are made visually and operationally consistent over platforms.

The need to develop these attributes in screen artifacts is explained by distributed cognition (Hutchins, 1995, 2000). Distributed cognition moves beyond the individual to the system, identifies the mechanisms by which the individual shares within the praxis of a community and how tools propagate that praxis across the members of the community over time, and then subsequently provides the user with what is already known. Distributed cognition adheres to the principles that the use practice and associated cognitive processes are

- distributed across the members of a community and consequently across locations,
- distributed between the cultural artifacts and tools, and
- distributed across time.

In applying these principles, the intent of design should be to use as much of the users’ expertise as possible, and where that is not possible, to align the new activities as closely as practical with existing tools and practices. In this context, design is not a clinical analysis, but rather the interaction with use experts to extract, understand, and extend existing practice.

This means that the artifacts and their cognitive and physical affordances, including their location on the screen, should be drawn from the praxis of the largest subset of users in the community of practice. To design with this in mind means that the majority of users are already familiar with the artifacts and how to use them (Lehane & Huf, 2006, 2007). By design then, the activity praxis is distributed over time, location, and people: This leveraging of prior knowledge is a contextual example of distributed cognition. From the developers' perspective, the cliché used in requirements analysis to implement this concept is “make it intuitive.” For this article, which ascribes to the concept of scripted behavior, the definition of *intuitive* is to “give the users what they already know.”

Consideration of the community of practice was used to examine both the crystallized practice in the artifacts and the means by which the practice was both crystallized and propagated (Kuutti, 1996). Good interaction design based on distributed cognition/user-community praxis should place the appropriate artifact in the right place on the screen most appropriate for its use and at the right stage in the sequence of actions for that activity. The mantra “Know your user” should be considered a condensation of the broader and more fundamental concept from distributed cognition, which is “Know your users' community of practice.”

This concludes the pragmatic HCI-focused discussion on how intuitive design as scripted behavior drawn from exemplar communities of practice (i.e., Mac users vs. PC users) is implemented in the interpretation of the responses to the SAI. The concept of scripted behavior has been well-documented in the discipline of HCI. Scripts have been used in the discussion on how experienced personnel, such as firefighters, plant operators, and air controllers, analyze and respond to known and, in particular, unfamiliar situations (Bainbridge, 1997; Jones, Chu, & Mitchell, 1995; Kontogiannis, 1996; Pawlak & Vicente, 1996). In this case study, I am explicit in stating that the premise of scripts was fundamental for the development of the theoretical rationale used in the discussion to explain the observed user behavior.

INTERACTION AND SYSTEM DESIGN CONCEPTS

In this section, I discuss the inclusion of functionality in the usability engineering model (Nielsen, 1993) so that concepts from soft systems modeling could be used to construct a theoretical rationale for the emergent construct of the usability engineering criteria. Similarly, the HCI concepts used to consider the inclusion of intuitive criteria in design, along with other HCI concepts that were used to classify the observations and data collected from users, are assembled to operationalize activity theory. Finally, these concepts are put together into a framework that provides a design rationale and checklist for implementing the praxis of a community of practice.

Usability in System Design

Throughout the 1990s, one design paradigm underpinned all others: usability (Carroll, 1991; Nielsen, 1993; Preece, Rogers, & Sharp, 2002, 2007; Preece et al., 1994). Nielsen (1993) defined the system acceptance attributes. For a system to be accepted, it had to be socially and practically acceptable. System performance considered the mechanical attributes of the system and whether the system was fit for its intended purpose. Nielsen addressed system performance by assessing the usefulness, functionality, utility, and usability of the system. Functionality is a key criterion

for requirements and gap analysis, and for the design of industrial/commercial systems, but functionality was not represented in the graphical representation of Nielsen’s published model (1993, p. 24).

To relate a grounded theory analysis of the survey responses to the commercial domain of mandatory-use systems for the research project on which this article is based, it was necessary to develop a theoretical relationship between functionality and the other usability engineering criteria. Both utility and usability are, by definition, dependent on and qualifying attributes of functionality, drawing on the human factors definitions of tasks being assigned to humans and functions allocated to machines (Stammers & Shepherd, 1995). Functionality, thus, was deemed to be how well the system could support each of the individual functions allocated to it in the breakdown of the work. This aligned with the users’ interpretation of system functionality being the functions programmed into the system and the requirement to assemble functions into action sequences for business processes (Lehane, 2012b). Therefore, functionality had to be a node between usefulness and the functionality qualifiers of utility and usability. A modified Nielsen model of the criteria determining system acceptance that includes functionality and emotional acceptability (Norman, 2004) is presented in Figure 1.

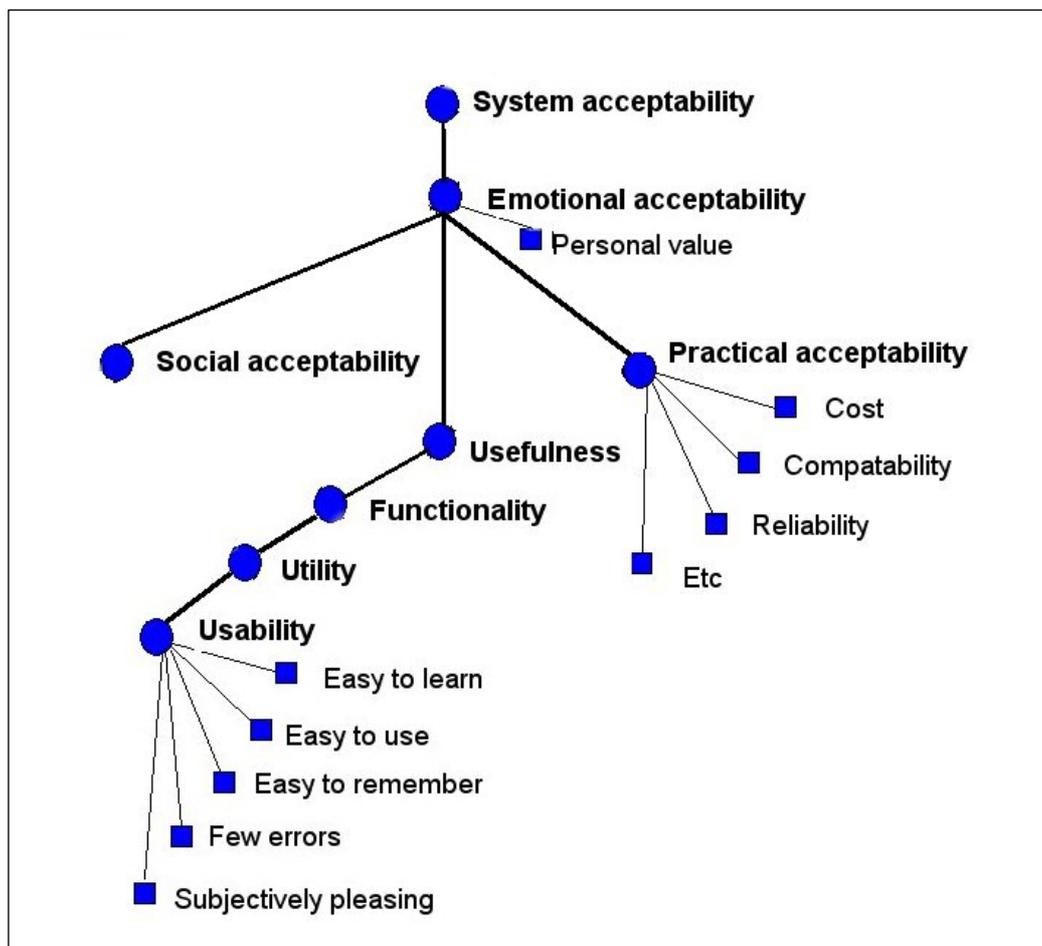


Figure 1. Functionality as a node between usefulness and utility in a system acceptability model.

The five attributes of usability relate as well to requirements for induction into a community of practice: the learning experience in general and the operationalization of an action and reflective appraisal on usefulness (Lehane & Huf, 2005). From this perspective, the system acceptance attributes of usefulness, functionality, utility, and usability are usability engineering criteria that can be used to assess the effect of technological change on the cognitive UX (Lehane, 2008).

Abstraction Hierarchy for Structured Interaction Design

From a theoretical perspective, systems engineering was founded on two pairs of concepts: hierarchy and emergence, and communication and control (Checkland, 1999). Hierarchy addresses concerns with the fundamental differences between one level of complexity and another. It provides both an account of the relationships between the different levels and an account of how observed hierarchies come to be formed: What generated the levels, what separated them, what linked them? Emergence at one level in a hierarchy is associated with constraints upon the emergent elements. The emergent properties are meaningless within and cannot be communicated by the language appropriate to the lower level. This imposition of constraints upon activity at one level is a control action that harnesses the laws at that level to yield activity meaningful at the higher level.

Checkland (1999) illustrated emergence with the example of the genetic code within the structure of DNA, where the genetic code was an emergent property from chemistry and marked the transition between chemistry and biology. As such, DNA structured by the constraints of chemistry on the genetic code characterized biology. In a similar manner, the usability engineering properties mark the transitions in the emergent hierarchical structure of the interactions that characterize but do not define system acceptance.

For the research reported in this article, the soft systems modeling theoretical concepts of hierarchy and emergence and communication and control were applied to assemble theoretically an abstraction hierarchy for usability engineering. This theoretical hierarchy defines the relationship between artifact and interaction. It also facilitates the classification of the screen artifacts within the structure of the usability engineering. In so doing, the abstraction hierarchy links the artifacts to the interaction and the interaction to activity–system acceptance. The establishment of these relationships between artifact, interaction, and system acceptance was necessary for the theoretical integrity in explaining/justifying the interaction model that validated the grounded theory analysis-derived classification of the emergent UX characteristics.

Returning to the implications of Checkland's (1999) genetic code exemplar interpreted for the parallel realities discovered in the interaction model, an instance of emergence is artifact affordance, which is emergent from the constraints imposed on artifact design by use. The artifact's affordances impose constraints that structure the artifact's usability and characterize its interactions. In other words, the only interaction possibilities are those provided by the affordances of the artifacts. Affordances, as the vehicle of distributed cognition, are the use community's praxis crystallized in the artifacts; they transport the history of use across time, location, and the population of the community of practice. These constraints produce the specific actions and scripts for the usability of an artifact and characterize the interactions. Affordances mark the transition from the level called artifact to the level called interaction, as depicted in Figure 2.

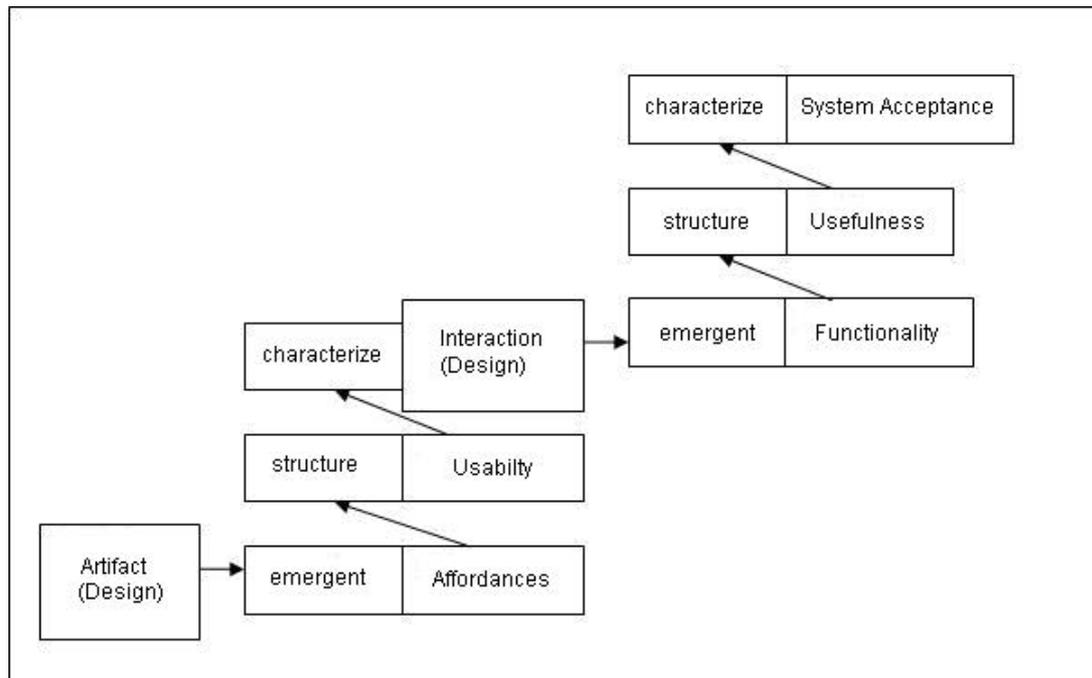


Figure 2. Emergence abstraction hierarchy for usability engineering.

At each stage of any human–computer interaction, myriad operational options exist. But to successfully complete the activity, the sequence selected from the available actions is critical and that sequence constitutes the interaction and the realization of a situated plan. For a system to be accepted, the functionality built into the system by interaction design must support all the tasks assigned to the human by workplace task allocation, as well as all the functions allocated to the machine for the operation of the system. To deliver the required business/operational capabilities as outcomes, the functionality must be perceived to support the tasks in a useful manner, thereby positively influencing the affective systems of the user. If all the tasks are not supported, the usefulness of the system is compromised.

System acceptance, as depicted in Figure 2, is an emergent level characterized by the usefulness of the system. Usefulness structured by the functionality is constrained by an interaction design based on artifact-use possibilities. These interaction design constraints result in the activities supported by the functionality, an emergent property that marks the transition from the level called interaction (with the system) to the level of system acceptance. Functionality embodies the expert-user praxis built into the system by interaction design. As such, it constitutes the functions allocated to the computer to support the tasks assigned to the human as purposeful activities.

Functionality constrained by interaction design provides a structure for the emergence of usefulness, which characterizes but does not define system acceptance. Well-structured usability, based on artifact affordances, is required to ensure comprehensive interaction design so that the user will interact usefully with the functionality for system acceptance. The artifact–interaction transition is an operational state change negotiated between the object and the activity. The interaction–system acceptance transition is an affective-behavioral-reflective system state change negotiated between the activity and the motive for the activity, which is

why usefulness characterizes but does not define system acceptance. The trisystem response is not controlled solely by the situated usefulness considerations of efficacy, efficiency, effectiveness, ethics, and elegance (Checkland, 1999); it also is influenced by the value the user attributes to the meaningful outcome of the interaction (Norman, 2004).

System acceptance, by definition, is a measure of the system's ability to satisfy all the needs and requirements of all the users and potential stakeholders (Nielsen, 1993, p. 24). Two things need to happen for system acceptance. First, the usability of the artifact's affordances, constrained by artifact's design in a series of interactions at the action level, has to produce an activity system wherein the usefulness of the functionality, constrained by the interaction design, facilitates the user in attaining an objective. The second and more important thing that needs to happen is that the experience within the cognitive meaning of the task influences the user's affective system to apply value to the activity.

The UX is the internalization of these affective, behavioral, and cognitive experiences. The emergent subjective assessment is an overarching experience that is integral to the theme of this article. In this context, a fit for purpose and a value-adding experience are both required for a system to be considered useful, leading possibly to user acceptance.

Activity Theory and Interaction Design

This article proposes activity theory as a capstone theory to explain the phenomenon observed and studied but does not always look to activity theory to investigate each of the individual activities. Activity theory considers consciousness—as well as the asymmetrical relation between people and things—and the role of artifacts in everyday life (Nardi, 1996a). Consequently, information processing and information systems should not be seen as something to be modeled in the same way for both people and machines. The activity of an individual is part of the collective activity of various groups. Within these groups, each specific activity consists of communication with others to organize, coordinate, and control the actions directed towards the artifacts and facilitate the activity (Kuutti, 1996). The coordination and organization are called the communicative side of human activity, and the control directed towards the artifacts is called the instrumental side.

The communicative side of human activity makes use of a rich array of linguistic, nonverbal, and inferential resources to understand actions and events. However, on the instrumental side, machines rely on a fixed array of sensory inputs, mapped to a predetermined set of internal states and responses. The result is an asymmetry that substantially limits the scope of possible interactions between humans and computers (Kaptelinin, 1996).

Consequently, when problems arise, they cannot be resolved from the instrumental side unless the issue was previously considered in the design and the resources to re-establish or maintain the interaction are already available. However, the operator has, from experience or training, a repertoire of scripts and action sequences with which to attempt to reopen or maintain the interaction. When the interaction is re-established and can be successfully concluded, a work-around has been established from the communicative side. Subsequently, user practices should confirm the explicitly supported activities, and expose the tacitly supported activities, which will require task-specific functionality in the interaction design.

Activity Theory Operationalized

Activity theory does not accept the duality of an isolated and independent mind; the internal side of an activity cannot exist without the external in activity theory (Bødker, 1991; Hutchins, 1995; Nardi, 1996a; Suchman, 1987; Vygotsky, 1978). Typically, before an action is performed in the real world, it is consciously planned using a model. The term for this is *orientation*: the representative of the internalization of the motive for the activity. Orientation directs the individual's assessment of the activity, linking the internalization of the motive and the formulation of a response structured by the external influences of experience and environment.

Engeström (cited in Kuutti, 1996) extended Vygotsky's element-mediated relationship of tool, subject, and object to include the relationships between rules, community, and division of labor. To represent the theoretical base of this article, additional operational detail was incorporated into the Engeström diagram (see Figure 3). This was achieved by positioning the individual's response in the model as an orientation activity between object and outcome: Orientation locates the subject's consciousness as the affective, cognitive, and physical responses with and in the context of the object–outcome transformation process (Checkland, 1999; Norman, 2004; Preece et al., 2007; Shiizuka, 2007).

With this extension, the contingent, responsive, and improvisatory emphases of situated action and the conscious human motives and systemic goals of activity theory and distributed cognitions are included in the model. Adding the orientation activity to the transformation process of the model brought together the two activity theory themes of context and consciousness (Nardi, 1996b) and made them explicit in the representation. The iterative cycle was placed around orientation to indicate that the realization of the motive and the synthesis of the means to achieve an outcome are not linear processes.

As illustrated in Figure 3, activity theory was used to provide the rationales for both the evaluation of a community of practice and an activity. Cognitive HCI research into artifact design and development has provided models and theories to explain artifact selection and use. The conceptual intent of the action research project was to investigate the individual activities and describe them using the original philosophical and cognitive HCI paradigms under which they were first examined: HCI concepts such as the active user (Carroll & Rosson, 1987), which was the means to consider the individual in the greater use community; affordance (Norman, 1988) as the mechanism for imparting practice into tools and artifacts; direct manipulation (Shneiderman, 1982, 1983) for the protocols to physically engage with and use the tools and artifacts; distributed cognition (Hutchins, 1995, 2000) as the means for propagating that praxis over time, location, objects, and communities of practice; and soft systems modeling (Checkland, 1999; Checkland & Holwell, 1998) as the mechanism to establish tool–use rules for the community and thereby individuals, and consequently the means to conceptualize between the object and the outcome. Scientific management (Taylor, 1911) provided the rationale for the division of labor within the community of practice, and situated action (Suchman, 1987) explained purposeful activity as the contextually determined implementation of the object as an outcome.

One HCI paradigm does not clearly and solely relate to each of the elements in the extended activity theory model; they overlap. The HCI paradigm that was perceived to be dominant in this research was placed at the top of the list and the others were placed by order of perceived influence. The concepts presented in this article were incorporated into the original action research project to establish its theoretical framework for interpreting the user response to

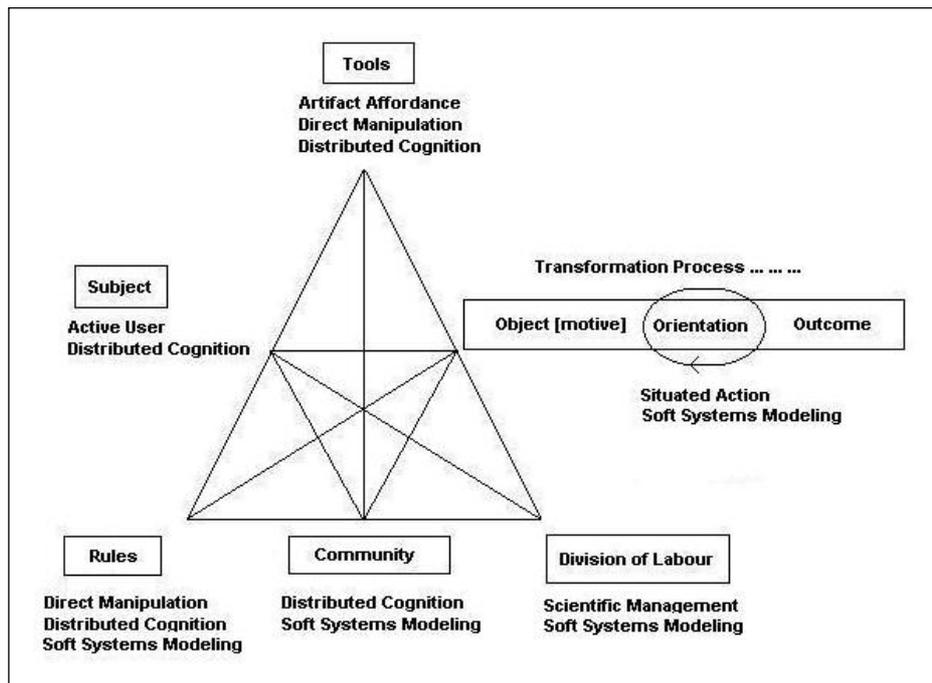


Figure 3. Concepts from cognitive HCI to operationalize Engeström's activity theory model.

the SAI. The project's pragmatic interpretation of activity theory showed, in this instance, that by subsuming these models and theories of cognitive HCI, activity theory provides an encompassing theoretical basis for explaining the complexities of HCI and, conversely, these models and theories of cognitive HCI are a plausible methodology for operationalizing activity theory.

Community of Practice Interaction Framework

This section distills the essence of my interpretation of the HCI models and theories as presented in this article and used in an operational context in the case studies of earlier publications (Lehane, 2008, 2012b; Lehane & Huf, 2006, 2007). Humans mediate their activities with tools. The introduction of technology to mediate human activity is a learning process that markedly reshapes the nature of the activity during the period that the artifact transitions to a tool. To understand the present use of a tool, it is necessary to understand the way the tool's use and design change over time. The community focus for tool use is on ease of learning, ease of use, and usefulness within the use goals and context. The development of the tool arises out of these needs. It is important to note that a tool can be a physical object, such as a computer, or a concept, such as intuitive design.

In design, the desire or design objective to make the use of a tool intuitive can be achieved by drawing on previous experience and building on the knowledge the intended users already possess. The experiences on which the design is based must originate from the practice of the largest subgroup of the use community and be nearly universal within that community. If the experiences are familiar to only a small subset of the use community, the practice will have to be learned by the extended community. The accretion of knowledge and the acquisition of new skills are then crucial to acceptance. This learning experience is shaped by the culture of the

community and the learning process itself. In this context, the use of the tool is made explicit by its affordances. The computer screen, by way of the layout and artifact design, establishes the terrain for the interaction and contains the ecological attributes and contextual constraints necessary to realize the objective as a computer-mediated activity. The interaction framework derived from consideration of these concepts is presented in Figure 4.

The models and theories of HCI as structured in Figure 4 are about interpretation and learning. They embody the distinction between the optimization paradigm of hard systems thinking and the learning paradigm of soft systems thinking (Checkland, 1999). In hard systems thinking, the social world is assumed to consist of systems whose performance can in some sense be optimized. Soft systems thinking, and the soft systems modeling that embodies it, assumes a more fluid social world, one that both persists and changes. This means that, in accord with Checkland and Holwell (1998), this interaction design model seeks interpretation and learning rather than optimization.

The model begins with an individual or group interested in learning to use an application. As an active user, the individual or group initiates interest in the application and its use. The active user is proactive in gaining familiarity with the application. This endeavor involves self-learning and assisted learning. The learning materials and trainers come from the community of practice. The training provides familiarity with the praxis of the community of practice. The praxis integrates not only the use practice, but also the history, the myths, the champions, the artifacts, and the culture of the community. These constitute the distributed cognition of the community. In the ICT domain, the distributed cognition encompasses the screen layouts, the design of the screen artifacts, the users' expectations for interactions with the icons and menus, and the expected machine responses from user interactions with the screen. The use practice necessary to produce

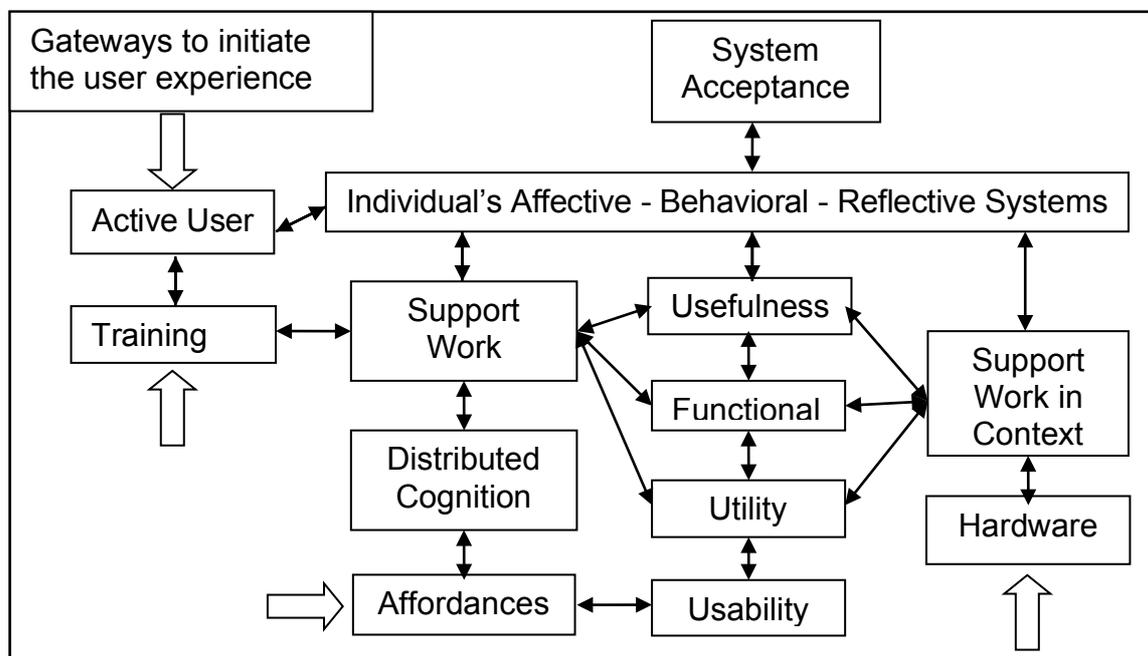


Figure 4. Computer community of practice interaction model.

the desired outcomes is intrinsic to the artifacts' physical properties, which are shaped by use and use possibilities.

The community of practice has measures for artifact performance that are used to determine if the tool is fit for purpose and acceptable; concept-wise they are usability, utility, functionality, and usefulness. Usability relates directly to the use of the physical objects (or concepts) and their affordances. Utility is the efficiency of the use actions, while functionality is the scope of the use activities. Usefulness is the fit-for-purpose reflective assessment. These integrated contextual activity concepts address the use of the artifacts with respect to the quality of the interaction and the outcome.

The system typically is considered usable when all these elements come together so that the user gains enough familiarity with the application to use it and to produce the desired results. In addition, if the experience of using the application to achieve the desired results evokes a positive emotional response, the system may be accepted by the user and used again. But irrespective of the system producing the desired outcome, should the experience evoke a negative emotional response, it most likely will not be repeated. This negative outcome holds especially true in voluntary-use situations. However, in mandatory-use situations, acceptance is independent of the end user's emotional response and is determined alone by management's perspective on usefulness. Nielsen's (1993) criterion of practical acceptability would have been established by the management decision to purchase the system.

THE SURVEY AND GRAPHS

Before discussing the statistical analysis, it is necessary to introduce the basic concepts behind the survey and the graphical presentation of the users' responses. More detail and use instances from case studies are available in previous publications specifically for this purpose (Lehane, 2012a, 2012b). The SAI (Lehane & Huf, 2005, 2006) survey contains 25 questions about the positive and negative aspects of system use. Each question is assigned a value from 0 to 4, with 4 representing *strongly agree* with a positive aspect of use in the odd-numbered questions but *strongly agree* with a negative aspect of use in even-numbered questions. (See Lehane, 2012b for a fuller description.) Even-numbered questions were adjusted so to allow for a perfect score of 100. The global index for one survey is the summation of the values assigned to the response to each question; the SAI global index for a survey campaign is the average of the individual indices. This is similar to the way that the system usability scale (Brooke, 1986) works: The questions were grouped and the responses averaged to create graphs during the analysis.

The SAI provides three measures. The first element is a global index as a number between 0 and 100. Fifty is the value of the global index indicating a neutral disposition towards the system. Zero indicates a system that is perceived unfavorable for all questions and 100 is the score for a system that received the maximum of favorable responses.

The second measure is the graph for the data determined by the technology acceptance model (TAM; Lehane, 2012a; Lehane & Huf, 2005, 2006), which is a 12-element presentation of the users' perceptions of the system. An example of this graph follows in Figure 5. The criteria for this graph are expressed in analytical terms for technical consideration of the results by the system developers.

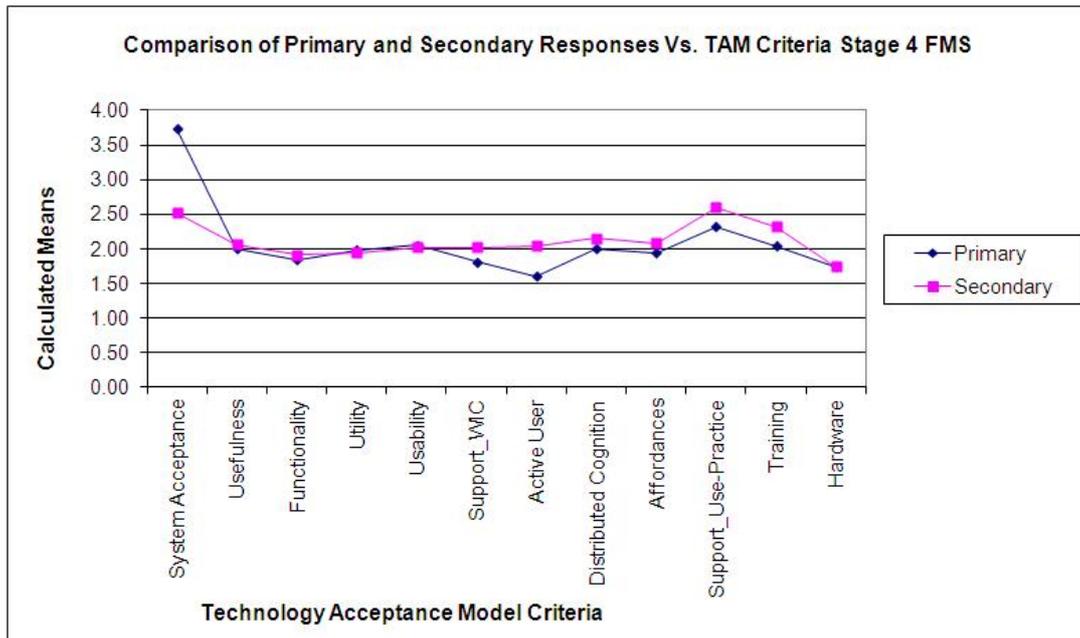


Figure 5. A graph of the technology acceptance model.

The five criteria from usability engineering describe immediate use:

- System acceptance is how well the users relate positively to the system.
- Usefulness is how well the overall system supports users in achieving their objective(s).
- Functionality is how well the system's functions support the designed activities.
- Utility is how efficient the system is in facilitating the actions.
- Usability is how effectively the actions can be operationalized.

The seven concepts identified as the use-community criteria compare the use of system with previous use knowledge and experience:

- Support for Work-in-Context (Support_WIC) is how well the system integrates into the extant workplace systems.
- Active User is the level of proactive interaction initiated by the user.
- Distributed Cognition is how well the praxis of the domain's community of practice was transferred to the software (i.e., does it have a familiar look and feel?).
- Affordance is how well the context of that praxis was embedded in the artifacts (i.e., was use intuitive?).
- Support for Use-Practice (Support_Use-Practice) is the level of immersion of the user into the community of practice (e.g., an accounting background for a finance officer ensures comprehensive contextual knowledge).
- Training is the formal training and its cognitive and behavioral artifacts used to transfer use-practice from experts to novices.
- Hardware is concerned with issues related to the situated technology (i.e., computers and network).

The third measure is the SAI graph, wherein the survey responses are regrouped to a 10-element graphic presentation of the users’ experience in nontechnical terms. The SAI graph is used as the basis for discussions with the business users of the system being surveyed. Figure 6 is a graph from the case study of a financial management system (see Lehane, 2012b). The TAM technical criteria of active user and distributed cognition are grouped in the SAI graph as EZ2Learn, while affordances and support for use practice are combined as EZ2Use. EZ2Learn is an indication of the active user’s ability to leverage prior knowledge through the use of distributed cognition. EZ2Use is an indication of the affordances and use community praxis facilitating recall and operationalization of activities. Conceptually these two categories are associated with and provide an indication of the “look and feel” of the system and how intuitive the software is to use.

The adjusted individual survey responses are collated to compile the collective response to the UX. The survey ratings scale of 0 to 4 thus covers the range of the collective response from strongly negative to strongly positive. The guide for interpreting the scale is

- 0 – total rejection
- 1 – poor response < 1.5 indicates a criterion to be looked at
- 2 – normal expectation, no significant influence
- 3 – good response > 2.5 indicates a criterion that was well received
- 4 – full acceptance.

The SAI was designed to provide a global indication of user satisfaction and identify the users’ rationales for reaching that decision.

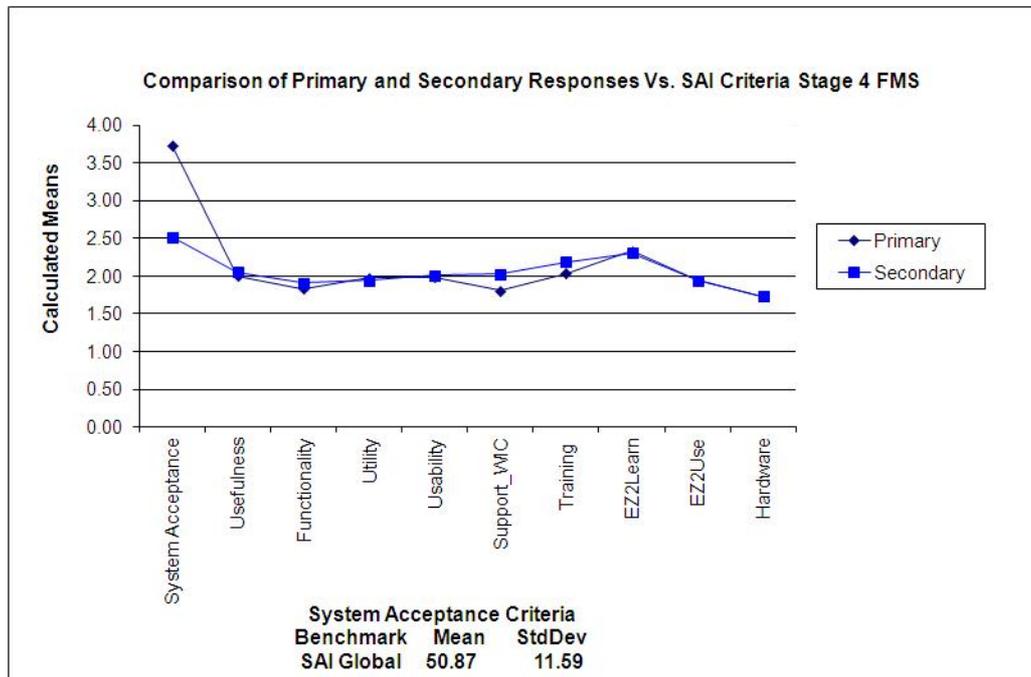


Figure 6. A graph of the System Acceptance Indicator.

STATISTICAL ANALYSIS RESULTS

The SAI data underwent statistical analysis and the details are provided in Lehane (2012a); only the results are presented here. The survey is the data-driven emergent theoretical questioning that is integral to the grounded theory analysis. A tenet of grounded theory is that the data and associated theory emerge conjointly and dependently upon each other. In Table 1, the emergent structure from the data analysis closely aligns with the grounded theory–emergent theoretical structure. This confirms the methodology, wherein the analysis is driven by the data in such a manner that the final theoretical constructs are a good fit to the research context.

Principal component analysis of the data ($N = 376$) identified a Component 1 that accounted for 41% of the variance in the user responses. The variable Usefulness was the greatest contributor to Component 1. The variables of Component 1 were elements from the abstract concept of usefulness (fit for purpose in situated use), and the effectiveness and efficiency of the system being used. Because of this consistent theme in the variables of Component 1, it was called *Situated Use*.

The analysis also identified a Component 2 that accounted for 28% of the variance. The variable EZ2Learn was the greatest contributor to Component 2. The variables in Component 2 carried the theme of familiarity in acquisition and implementation of use-practice. A theme in this article is intuitive or scripted behavior, which was interpreted as giving the users what they already know. For this reason and the variables concerned, Component 2 was called *Intuitive Use*.

The structure of the variables in Table 1 follows that of an abstraction hierarchy emergent from the user description of their interactions with computers. Usefulness is the highest and most abstract reflective concept. The relationship between the usability engineering and user community criteria is that the usability engineering criteria present the response to current use and interaction with a system, and the user community criteria present the use of knowledge from previous computer-use experience. The user community criteria relate to relationships between the system and the work. The conceptual requirements of usability are easy to learn

Table 1. Data Analysis Supports the Abstraction Hierarchy of the Emergent Theoretical Construct.

Technology Acceptance Model Reflective Criteria	Reflective Elements in Key Concepts	Reflective Elements in Component 1 Situated Use	Reflective Elements in Component 2 Intuitive Use
Usability Engineering Criteria	Usefulness	.781	
	Functionality	.749	
	Utility	.736	
	Usability		.815
Use Community Criteria	Distributed Cognition		EZ2Learn
	Active User		.949
	Support Use Practice Affordances	EZ2Use .734	
Ecological Criteria	Support Work in Context	.695	

and easy to use: These concepts are presented in the user community criteria as the characteristics EZ2Use and EZ2Learn.

The component Situated Use comprises variables from all three criteria classes. The contribution of the variables to the component reveals the influence of reflection in use assessment. The structure of this component indicates the importance of the high-level abstract concepts of usability engineering in shaping the user's response to system use, with usefulness emergent as the dominant consideration in system acceptance. The component Intuitive Use indicates the importance of usability as a secondary consideration. If the usability is such that it allows a user to gain enough familiarity with the system so as to be able to determine its usefulness, then, upon reflection, an evaluation may consider the system fit for purpose.

The development of the theoretical structure was integral to the development of the criteria, as they both evolved with the grounded theory analysis and sampling. The presentation of the abstraction hierarchy for the system acceptance criteria beside the emergent experimental data structure clearly shows the relationship between the theoretical constructs and research findings.

CONCLUSION

In this article I discussed the development of the theoretical rationale for classification criteria for the SAI survey, which came from applying concepts from a grounded theory analysis to users' responses to surveys and focus group interviews. Grouping the users' responses to the interviews and surveys ensured consistent analysis and interpretation of analysis results. The users described the system requirements and the problems they encountered, and from those descriptions the survey criteria surfaced classifications that grouped the issues.

Once classified, a number of concepts from HCI paradigms could be applied to specific issues in the users' descriptions of their problems and their requirements. In addition, this work indicated that it might be possible to use the HCI concepts to develop a structured theoretical rationale to support the recommendations made using the notes and analysis coding system. Consequently, concepts from a number of paradigms were brought together to form the contextual interpretation rationale for the survey presented in this article.

A grounded theory analysis ensures that the research data is theoretically accountable. The survey campaigns presented a large sample of numerical data on the software upgrades and the associated UX (see Lehane, 2012b). Those data were used for statistical analysis to assess and confirm the emergent theoretical construct of the usability engineering criteria and the user community criteria. The statistical analysis validates the SAI survey.

Usefulness, a characteristic of the theoretical constructs of this research, was emergent as the dominant variable in the principle component analysis of the research data. In addition, data dependent on and emergent from the component variables supported the abstraction hierarchy, which mirrored the proposed theoretical interaction hierarchy. The emergence of usefulness, the most abstract variable, as the greatest contributor to the component Situated Use is significant. It is seen to endorse the soundness of the data-determined theoretical model developed and used in this project.

When a series of surveys is taken over a period of time at critically specific transition points, the subsequent graphs present the UX in HCI terms. The strength of the SAI, a

validated survey instrument, is that its methodology incorporates the analysis interpretation and an issue mitigation premise; both are based on HCI models and theories.

Finally, the analysis methodology utilizing community of practice concepts has been used successfully in various applications to resolve real-world issues associated with software upgrades. The central theme for the analysis interpretation and issue resolution was community-of-practice scripted user behavior, based on the tool-associated practices of the use community. This HCI convention of leverage of prior knowledge was implemented as “give the users what they already know” and interpreted as intuitive design. Because the survey identified user concerns at a high level of abstraction and also presented a means to rectify those issues, the survey and the premise behind it were seen to be validated in practice.

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Author's Note

The SAI and an Excel worksheet with notes on use are available for use by those assessing the introduction of technology into the workforce (<https://eportfolio.usq.edu.au/view/view.php?t=Zw1TAYBxKMOG5fUPunyi>). The only prerequisite for the use of the SAI or the inherent analysis practice is that any published report should acknowledge the source of the measure and practice.

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ANALYZING THE INFLUENCE OF DIFFUSION OF INNOVATION ATTRIBUTES ON LECTURERS' ATTITUDES TOWARD INFORMATION AND COMMUNICATION TECHNOLOGIES

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Abstract: *This study investigated the influence of the five attributes of diffusion of innovation theory—relative advantage, complexity, compatibility, trialability, and observability—on lecturers' use of information and communication technologies. A structured questionnaire was used to collect data from 213 lecturers across the seven faculties and one institute at the National University of Lesotho (NUL). Cronbach's alpha reliability coefficient was used to determine the internal consistency of the instrument; the reliability of the multiple item scales ranged between 0.71 and 0.97. Collected data were first structured into grouped frequency distributions, and stepwise multiple regressions were used to test the five hypotheses formulated. At 0.05 level of significance, the attributes relative advantage, complexity, and observability were found to have a positive influence on attitude of lecturers toward using ICTs, with observability having the highest influence. To enhance widespread use of ICTs, it is recommended that NUL's administration organize relevant training and deploy user-friendly ICTs.*

Keywords: *ICT adoption, National University of Lesotho, diffusion of innovation, ICT use, university lecturers.*

INTRODUCTION

The pervasiveness of information and communication technologies (ICTs) has brought about rapid technological, social, political, and economic transformation, which has eventuated in a network society organized around ICTs (Yusuf, 2005). E-learning is currently becoming one of the most common applications of ICTs, with online teaching offered via Web-based systems to students both on and off campus. Considering the role of education in nation building (van Ginkel, 2001) and the exploding secondary school population in some African countries that is expected to impact future higher education enrollment, the use of ICTs in the

teaching–learning process becomes imperative. This is true because its adoption by the teachers will enhance effective teaching (Isaacs, 2007). Issues such as good course organization, effective class management, content creation, self-assessment, self-study collaborative learning, task-oriented activities, and effective communication between the actors in the teaching–learning process and research activities will be enhanced by the use of ICT-based technology. These trends strongly indicate that the era of teachers without ICT skills is gone. Classroom teachers with adequate and professional skills in ICT utilization will find their students performing better in learning, because modern technology offers many means of improving teaching and learning in the classroom (Lefebvre, Deaudelin, & Loiseau, 2006). ICT facilities used in the teaching–learning process in schools, according to Bandele (2006), Babajide & Bolaji (2003), and Ofodu (2007), include radio, television, computers, overhead projectors, optical fibers, fax machines, CD-Rom, the Internet, electronic notice boards, slides, digital multimedia, and video/VCD machines.

One major trend of educational reform is geared toward teachers and students acquiring and using information technology as a valuable asset to the learning process. Growing interest in the integration of information and communication technologies (ICTs) into classrooms is based on assumptions that successful integration will offer a wide spectrum of valuable benefits for teaching and learning (Cope & Ward, 2002; Naidu, Cunnington, & Jasen, 2002). However, although the availability of ICT use in schools has increased, all the envisaged gains have not always been achieved (Gobbo & Girardi, 2001). This is because when ICTs enter the sociocultural setting of the school, they may trigger changes in the activities, curriculum, and interpersonal relationships in the learning environment, and are reciprocally affected by the very changes they cause (Salomon, 1993).

Sife, Lwoga, and Sanga (2007), Isaacs (2007), and Farrell, Isaacs, and Trucano (2007) argued that, particularly in many developing countries, ICTs have not permeated higher education learning as needed, due to various socioeconomic, technological, and infrastructure circumstances. They noted that although some institutions of higher learning have achieved much in particular academic areas, they remain challenged by the ICT adoption process. The challenges reflect deficiencies in several areas: a systems approach to learning, awareness of and attitudes toward ICTs, administrative and technical support, staff development, personal ownership of technologies, inadequate funds, and the transforming process in higher education.

Public expectations for ICTs and educational systems have increased with the ubiquity of digital technologies in daily life. Currently, the discourse has been predominantly instrumental, focusing on skills and the use of ICTs in the service of the curriculum and instruction. Despite the fact that computers have been available widely in educational settings in some developing countries, particularly in Africa, for more than two decades, teachers are neither confident nor competent users of ICTs. Studies by Kerrey & Isakson (2000) and Wang and Liu (2005), for instance, indicated that many practicing teachers feel unprepared to use ICTs in their classrooms, with Wang and Liu (2005) underscoring that many student teachers have low self-efficacy and negative attitudes toward ICTs. These findings represent a major concern in that both corporations and institutions of higher learning increasingly are adopting ICTs as tools for learning, collaboration, communication, curriculum development, and staff development. The implications of ICT use in education and training become ever more critical today since new means of improving instructional methods are triggering a change in the delivery of education (Pajo & Wallace, 2001). Undoubtedly, ICTs make access to education more flexible and reduce

the barriers of time and place. Asynchronous Web-based technologies, for example, can advance the effectiveness of learning by bringing learners into contact with learning peers from around the world (Lea, Rogers, & Postmes, 2002). In addition, ICTs and their access to diverse knowledge resources and applications can also enhance the quality of university teaching and research. Many developing countries in the Southern African Development Community region are following the lead of industrialized countries in efforts to restructure their educational practices through utilizing the potential of ICTs. It is expected that ICTs will improve the quality of learning, motivate students, allow them to exercise complex skills needed for professional careers, and make accessible the extended knowledge resources of the Internet, which, taken together, facilitate the development of agency needed for mastering the future (Bose, 2004; Bose & Tsayang, 2005; Ramharai & Goodoory, 2003; Senteni, 2005).

Despite its poor ICT infrastructure and high levels of poverty, Lesotho has begun to take the necessary steps toward promoting higher levels of ICT access and usage in its communities and education institutions. The Government of Lesotho has adopted a national ICT policy that makes some references to the education sector. Since 2007, the NEPAD eSchools Demo Project in Lesotho has been a catalyst in focusing attention on the potential that ICTs hold for enhancing education in the country (Isaacs, 2007). Lesotho has three main institutions of higher learning, although the National University of Lesotho (NUL), established in 1975, is the country's only university.¹ According to Isaacs (2007) and the *World Factbook* (2012), Lesotho has a severely underdeveloped ICT infrastructure. Although Lesotho does not have an explicit independent national policy on ICTs in education, the government adopted a National ICT Policy in 2005 in which are embedded considerable references to and implications for the education sector (Isaacs, 2007). Lesotho also has an education strategy that includes the role of ICTs. The National ICT Policy highlights ICTs as tools to enable the country to achieve its development goals, as articulated in the Lesotho Vision 2020 policy document Ministry of Development Planning, 2003) and the Poverty Reduction Strategy papers (World Bank, 2000). The Vision of the policy also provides a brief stakeholder analysis and the roles that are expected in realizing the policy goals. It identifies 10 catalysts in the implementation of the policy, which include education and human resource development as well as health, agriculture and food security, tourism, gender, and youth (Isaacs, 2007).

The Vision policy's goal is to create a knowledge-based society within Lesotho that is fully integrated into the global economy by 2020. This vision anticipates, by 2015, the successful development and deployment of ICTs that will respond to national needs and priorities, reduce inequalities between the sexes, decrease the digital divide between urban and rural areas and the haves and have-nots, improve governance and deepen democracy, develop the human capacity needed to drive and sustain an information economy, and support economic activities at home and throughout the world. To achieve this mission, the goal is to integrate fully ICTs throughout all sectors of the economy, thereby achieving rapid, sustainable socioeconomic development.

Some of the strategies toward this end, as Isaacs (2007) noted, include investing in ICT education and human resource development by

- requiring the availability of ICT literacy and training programs throughout the education system and within the public at large;
- growing the resource pool of ICT professionals with standardized skill sets and ensuring that appropriate incentives are in place to retain these workers;

- encouraging lifelong learning among the population at large and promoting on-the-job training and retraining within the public and private sectors; and
- promoting electronic distance learning to maximize scarce resources and expand access to educational training and research.

Educational institutions also feature among the key stakeholders identified to play a role in realizing the policy by improving teaching and learning mechanisms that promote ICT literacy and produce local ICT products and services. These institutions should ensure that ICT literacy is part of the core curriculum and they must use ICTs to expand access to education as well as improve the quality of education. The policy proposed investment in ICTs at all levels of formal education, and that policy efforts be directed toward use of ICTs to facilitate lifelong learning and to support efforts of the private sector in its delivery of on-the-job training and retraining programs (Isaacs, 2007).

It is in this connection that NUL has attempted to fulfill its ICT initiatives. In January 1994, a feasibility study was initiated to determine the worth of establishing the Thomas Mafolo Library Information Systems. This was completed in January 1996, leading to the establishment of the Library, followed by the implementation phase in which 41 data points of a local area network and an integrated library management system were installed. The main library is connected to the campus-wide network; all library computers have full Internet connection. The library also subscribes to a large number of databases and full-text electronic publications, and provides online access to students and faculty members. In addition, a Technology Enhanced Learning Initiative of Southern Africa was established in the form of a telecenter at the Institute for Extra Mural Studies based at NUL with the aim of providing access to ICT facilities, but the project is no longer functional as of the time of this study.

Despite the progress in some important areas of ICT access in educational resources, and the fact that faculty members have ready access to some ICTs through the library, a key challenge for NUL remains: getting ICTs into the hands of lecturers and equipping them to use the technologies for teaching, research, and other functions. The responsibility for the ICT-use situation at NUL, specifically the support for teaching, learning, research, and administrative activities, as well as staff training, falls to the Computer Service Unit. Even with the support services provided by this unit and NUL's huge investment in its ICT infrastructure within a tight budget environment, the cost effectiveness of the ICT infrastructure has been neither monitored nor evaluated. The actual number of lecturers who are competent in ICT use and the extent to which they optimize ICTs for teaching and other functions is unknown. In addition, the factors that could influence the attitude of lecturers in ICT adoption remain unidentified, at least empirically, creating a gap that this study hopes to fill in supporting NUL's success in its vision for quality in higher education.

PRIOR RESEARCH ON ICT USE

With the ongoing development of ICTs and diversification in the fields they affect, theoretical studies have been carried out in order to ensure a better understanding concerning their diffusion, adoption, acceptance, and usage (Davis, 1989; Rogers, 2003; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003; Yi, Jackson, Park, & Probst, 2006). In his diffusion of innovation (DoI) theory, Rogers (2003) mentioned

that the rate of adoption is partially influenced by perceived attributes, namely, relative advantage, compatibility, trialability, complexity, and observability as innovation characteristics. Four of these characteristics—relative advantage, compatibility, trialability, and observability, as perceived by members of a social system—are positively related to the rate of adoption. However, the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption.

The theory is used to explain DoI in numerous fields, such as medicine, agriculture, and information technologies. Rogers (2003, p. 223) stated, “The first research on attributes of innovation and their rate of adoption was conducted with farmers, but studies of teachers and school administrators suggested that similar attributes predict the rate of adoption for educational innovation.” Bussey, Dormody, and VanLeeuwen (2000) stated that the strongest predictor of the level of adoption of technology education was the teacher’s perception of the attributes of technology education. They also concluded that Rogers’ theory of perceived attributes could be a valuable tool for instructional developers working to increase the utilization of their products.

Although a consensus has formed on the idea that certain innovation characteristics have predictive power, there is disagreement about which characteristics are predictive. For instance, Aşkar, Usluel, and Mumcu (2006) stated that complexity is a commonly perceived innovation characteristic for preparation, teaching delivery, and managerial tasks in schools; observability is a perceived attribute in teaching delivery in some specific tasks performed during the class period; and relative advantage and compatibility are important for teaching preparation tasks. Yi et al. (2006) concluded that prior studies provided evidence that relative advantage, complexity, result demonstrability, and image are among the most important factors in predicting users’ intentions to use technology. In a study carried out in Brazil on the use of the Internet as an instructional tool, Martins, Steil, and Todesco (2004) found that the two most significant predictors are trialability and observability. Mumcu (2004) highlighted in her research that there is a positive relationship between relative advantage, compatibility, and visibility and the use of ICTs in vocational and technical schools. Surry and Gustafson (1994) concluded that compatibility, complexity, and relative advantage could be important considerations when introducing an innovation into instructional settings.

The diffusion and adoption patterns of an innovation are functions of several interrelated elements involving the innovation, the individual, and the environment. In his innovation decision process, Rogers (1983, 1995, 2003) identified four primary components: (a) the innovation itself, (b) communication channels, (c) social system, and (d) time, which interact to describe how individual adoptions combine to represent diffusion. In this current study, we concentrate on the five key elements that affect both individual adoption and the larger collective diffusion of the innovation as identified by Rogers (1995), namely: relative advantage, compatibility, complexity, trialability, and observability. Each is described as follows:

The relative advantage of an innovation is an individual’s perception that the innovation will be better, when compared to similar ideas, products, or practices. Those innovations that are perceived to be better will be adopted more rapidly.

Compatibility is the perception that a particular innovation is similar and congruent with existing understandings of similar or past ideas, products, or practices. Innovations that fit into an individual’s existing understanding or schema will be more easily adopted.

Complexity refers to the perception of how difficult the innovation is to comprehend. It is hypothesized to be negatively related to the rate of adoption of an innovation (Rogers, 1995). In other words, if an innovation is found to be too complex, it is not easily adopted. Therefore, in this study, we took the alternative perspective of this construct, hypothesizing that if an innovation is easy to use, it is more likely to be adopted.

Trialability refers to an individual's access to an innovation for experimentation before adoption and use.

Observability is characterized by how available and visible an innovation is to an individual. The idea behind observability is similar to unspoken peer pressure: If influential others possess an innovation, the observer is more likely to adopt it as well. Observability leads to a social threshold at the point where an innovation becomes so pervasive and/or desirable in a culture that even those who would not normally be a user of an innovation consider adopting the product.

However, despite the fact that many researchers agree that some characteristics are typically associated with innovation adoption, and that the five included in this study are among the most commonly cited, some scholars raise concern in regard to how many researchers have approached the study of these characteristics. The nature of research biases, particularly as they apply to individual adoption choices, raise important considerations in our approach to the challenge of ICT adoption by faculty at NUL. The pro-innovation bias, characterized as the assumption that all innovations are good and thus should be adopted by all members of a community (Haider & Kreps, 2004; Jeyaraj, Rottman, & Lacity, 2006; Rogers, 1991, 1995), is a significant concern. In our study, we sought to test the possible influence of each of the five attributes of innovation diffusion defined above on potential users' attitudes, and thus intention to use ICT without the assumption that the individuals would perceive the technologies or their implementation as inherently good and important for uptake and use. Therefore, considering the fact that more than half of NUL's lecturers have not integrated ICTs into their teaching (Isaacs, 2007), we hypothesize as follows:

Hypothesis 1: The relative advantage of using ICTs will not positively affect the attitude of lecturers toward using the technology.

Hypothesis 2: The complexity (i.e., ease) of the use of ICTs will not positively affect the attitude of lecturers toward using the technology.

Hypothesis 3: The compatibility of ICTs will not positively affect the attitude of lecturers toward using the technology.

Hypothesis 4: The trialability of ICTs will not positively affect the attitude of lecturers toward using the technology.

Hypothesis 5: The observability of ICTs will not positively affect the attitude of lecturers toward using the technology.

The remainder of this paper is structured as follows: The next section details the methodological approaches adopted, then the results are presented, which are followed by a discussion of the findings. The study's implications and suggestions for future studies conclude the paper.

METHOD

Research Design, Sampling and Instrumentation

A survey research design was adopted. The study was conducted at NUL, with the study population comprising all full-time lecturers in all academic departments (33 departments within 7 faculties, and a separate education institute), except those either in managerial positions or on sabbatical leave. A complete enumeration of the study population was carried out, whereby all qualified members of the population were included in the study. According to Aina and Ajiferuke (2002), four variables determine the sample size: the size of the population, the variations in the characteristics being measured, the number of ways in which data is to be stratified in the analysis, and the precision required of the data. In the case of this study, we considered the population not too large, hence a total enumeration of the population was carried out, bearing in mind that the larger the sample, as a proportion of the total population, the more reliable the results (Aina & Ajiferuke, 2002; Leech, Barrett, & Morgan, 2005).

A structured questionnaire, divided into two sections, was used for data collection. A 4-point Likert scale was used in designing the questions. Section A of the questionnaire comprised closed-ended questions on the demographic characteristics of the respondents; Section B collected data on the influence of the five constructs of DoI theory on the lecturers' adoption and use of ICTs. No open-ended questions were included in the survey instrument.

Before the questionnaire was distributed, five local experts in ICT research examined it. Their comments to clarify the instrument were integrated to arrive at the final version. Cronbach's alpha coefficient was used to determine the internal consistency and reliability of the multiple item scales (see Table 1), with a value over .70 indicating acceptability, over .80 indicating good, and excellence when over .90. The questionnaire is provided in the Appendix.

Data Collection and Analysis

Data were collected in January and February 2010. The questionnaire was distributed by the researchers to the 250 eligible lecturers in NUL's seven faculties and one research institute. Each survey instrument was hand delivered to the office of the lecturer. All questionnaires were self-reported, in that the lecturers filled them out. Respondents were allowed 3 weeks to complete the survey; the data collection period was staggered over 5 weeks. At the end of each respective 3-week period, the questionnaires were retrieved in person by the researchers. All participants

Table 1. A Test of the Reliability of the Key Constructs of the Survey Instrument.

Construct	Cronbach's Alpha	Items in Construct
Relative advantage	.71	5
Complexity	.97	5
Compatibility	.81	5
Observability	.92	4
Trialability	.74	5

were informed of their right to refuse participation or withdraw from the study at any point, but all agreed to participate in the study. Confidentiality was guaranteed by the use of identification codes instead of names. Of the 250 copies administered, 213 were returned and all were found useful for analysis, resulting in an 85.2% response rate. Table 2 provides details on the survey distribution and return rate by faculty.

Even with the lecturers who were in management or on sabbatical removed from the data collection, nearly all lecturers in all faculties and the research institute were surveyed. The only faculty with a significant number not surveyed was Humanities. Regarding return rates, three faculties had rates at or near 100% (Education, Health Sciences, and Humanities). The lowest rate of return was from the faculty of Law, with just two thirds of the surveys returned.

The demographic profile of the respondents showed that a majority of them are males (55.8%). This was surprising since the 2009 adult literacy level of females (95%) is higher than for males (UNESCO, 2012). The report noted further that although Lesotho's education system has achieved progress in raising literacy levels, major issues in terms of drop-out, student flow, quality, and equity (UNESCO, 2012) remain to be addressed. Throughout all levels of education, statistics show that a higher number of girls than boys are enrolled in school, a scenario that is different from most of the other sub-Saharan countries. However, the total enrollment for girls is still very low and the enrollment of girls decreases significantly as the grades increase, indicating a very high incidence of dropout and a larger number of out-of-school girls. In 2009, 25% of girls at primary level and 64% at secondary level were not attending school. Thus, despite the higher level of enrollment of girls in secondary education and the women's high literacy rate, drop-out rates for girls remain very high. This can be attributed to social, economic, and cultural factors, such as poverty, distance from school, the impact of HIV and AIDS, and teenage pregnancies.

Table 2. Population, Sample Size, and Responses Across Faculties.

Faculties	Total Population of Lecturers	Number of surveys distributed	Institutional Percentage (%)	Response Rate across Faculties	
				<i>n</i>	Return Rate (%)
Agriculture	35	32	13	24	75
Education	15	15	6	15	100
Health Sciences	23	22	9	22	100
Humanities	56	50	20	49	98
Faculty of Science and Technology	53	51	20	40	78
Faculty of Social Sciences	55	55	22	45	82
Faculty of Law	19	19	8	13	68
Institute of Education	6	6	2	5	83
TOTAL	262	250	100%	213	85%

In addition, a 2010 Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) report (Saito, 2010) noted that girls' learning achievement in mathematics was slightly better than that of boys in 2000, but seven years later it decreased and was lower than that of boys. Abagi (2003) had earlier showed that girls' course selection and performance in secondary education were influenced by the persistence of traditional gender roles and cultural norms. For example, the perception that boys are good at mathematics, science, and technology while girls are good at languages and home economics is widespread among teachers, parents and, consequently, male and female students. In addition, teachers and principals are often not gender-sensitive in their attitude, behavior, and teaching practices, which negatively influences the opportunities of girls' access to, retention in, and completion of secondary education, which leads to fewer numbers of girls at tertiary levels. This situation thus implies that although literacy level among girls is higher than boys, access to education is not empowering girls and that gender disparities persist, not only in education but in all spheres of life: Decision-making and leadership roles continue to be reserved for men, regardless of the educational outcomes of boys.

Regarding the age distribution of the respondents, those aged 35–44 constituted the largest group at 31.5%, in comparison with those aged below 25 (3.3%), 25–34 (20.7%), 45–54 (23.9%) and 55–64 (19.2%). Only three respondents (1.4%) were older than 64 years, which might be due to the fact that the retirement age is 65 years in Lesotho. The academic rank of the respondents showed that 58.2% indicated they were lecturers, followed by senior lecturers (23%), assistant lecturers (14.6%), associate professors (3.3%), and professors (0.9%).²

Descriptive and inferential statistics were adopted for data analysis. Collected data were first structured into grouped frequency distributions, and stepwise multiple regression was used for data analysis to test the five hypotheses. Stepwise multiple regression provides a means for identifying predictors of a particular dependent variable on the basis of statistical criteria. Essentially, the statistical procedure indicates which independent variable is the best predictor, the second best predictor, and so on. Stepwise is the most sophisticated of regression statistical methods, and was determined most suitable because of our emphasis on finding the best predictors at each stage of the analysis. Each independent variable was entered in sequence and its value assessed. The variables contributing to the model were retained and retested to see if they continued to contribute to the success of the model. Variables that no longer contributed significantly to the model were removed. The analysis method ensured that the model ended up with the smallest possible set of predictor variables. For our study, stepwise regression was found to be the most appropriate analytical tool as it helped identify the most parsimonious set of predictors (i.e., the DoI constructs) for potential users' attitudes toward ICT adoption in their work.

RESULTS

Test of Hypotheses

The scores used for the constructs in this study were standardized using Excel software before being imported into SPSS for regression analysis. In order to test the hypotheses, stepwise multiple regressions were carried out. The following tables are the results of that process, using

the constructs relative advantage, complexity, compatibility, observability, and trialability as the independent variables and attitude as the dependent variable. Table 3 presents the regression result showing that complexity, observability, and relative advantage were the significant constructs. Further results presented in Table 4 show the prediction level of each of the three significant constructs.

The ANOVA result in Table 5 gives the general significance of the model. Because the value of p is less than 0.05 for the three variables, the model is significant. Thus, the combination of complexity, observability, and relative advantage significantly predict the dependent variable (attitude).

Table 3. Stepwise Multiple Regression Results on the Constructs.

Attitude (10.592)	Relative Advantage (0.303)	Observability (0.309)	Complexity (0.317)
Standard error (1.262)	.116	.103	.087
Significance (.000)	.009	.003	.000

Table 4. Model Summary Showing Prediction Level of the Constructs.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.221 ^a	.049	.044	1.3620
2	.321 ^b	.103	.094	1.3259
3	.363 ^c	.131	.119	1.30778

Note: a. Predictors: (Constant), complexity; b. Predictors: (Constant), complexity, observability; c. Predictors: (Constant), complexity, observability, relative_advantage

Table 5. Analysis of Variance (ANOVA) Results.

Model	SS	Df	MS	F	Sig
1 Regression	20.112	1	20.112	10.842	.001 ^a
Residual	391.418	211	1.855		
Total	411.531	212			
2 Regression	42.334	2	21.167	12.040	.000 ^b
Residual	369.197	210	1.758		
Total	411.531	212			
3 Regression	54.083	3	18.028	10.541	.000 ^c
Residual	357.447	209	1.710		
Total	411.531	212			

Note: a. Predictors: (Constant), complexity; b. Predictors: (Constant), complexity, observability; c. Predictors: (Constant), complexity, observability, relative_advantage; d. Dependent Variable: attitude.

Table 6 reveals the standardized Beta coefficients, which give the contributions of each variable to the model. The *t* and *p* values show the impact of the independent variables on the dependent variable. From Table 4, it is clear that complexity, observability, and relative advantage were revealed to be significant constructs.

Based on the analyses, the following inferences were drawn in relation to the hypotheses. From Table 6, the Beta values for relative advantage ($\beta = -.303$, $p = .009 < 0.05$); complexity ($\beta = .298$, $p = .001 < 0.05$) and observability ($\beta = -.364$, $p = .000 < 0.05$) show that these attributes positively affect attitude of the lecturers toward using technology. Thus we reject the three null hypotheses based on the fact that they had a positive effect on attitude. In the case of Hypotheses 3 and 4, as stated in Table 4, the attributes compatibility and trialability do not contribute to attitude, hence we accept the two hypotheses, meaning that these attributes had no positive effect on attitude.

Table 6. Beta Coefficients Showing Contributions of Variables to the Model.

Model	Unstandardized coefficients		Standardized coefficients	<i>t</i>	Sig
	β	SE	B		
1 (Constant)	5.882	.636		9.252	.000
Complexity	.298	.091	.221	3.293	.001
2 (Constant)	8.285	.917		9.040	.000
Complexity	.314	.088	.233	3.558	.000
Observability	-.364	.103	-.233	-3.555	.000
3 (Constant)	10.592	1.262		8.395	.000
Complexity	.317	.087	.235	3.647	.000
Observability	-.309	.103	-.197	-2.992	.003
Relative Advantage	-.303	.116	-.173	-2.621	.009

Note: Dependent variable: attitude

DISCUSSION

For decades, Rogers' DoI has been the main starting point for much research into the ICT innovation and adoption domains, and still provides a widely used framework for forecasting purposes, service and infrastructure requirements, business modeling, and policy measurements (De Marez, Evens, & Stragier, 2011). Profound transformations in the ICT environment, however, have led to questions about the validity of the assumptions of diffusion theory in today's complex technology ecosystems. Although the theory has been frequently updated, criticisms for its lack of attention to use contexts gave rise to new user research paradigms, such as the domestication approach. While some consider the adoption and domestication approach

simply competitive frameworks for the same research area, they should be seen rather as complementary sides of the same innovation coin (Boczkowski, 2004). Therefore, in distinguishing between adoption diffusion and use diffusion (Shih & Venkatesh, 2004), a first delineation would be the theory's value in today's ICT environment. Whereas Rogers' diffusion theory should be used for gaining insights into an innovation's potential in terms of penetration pattern, adoption determinants, and segment profiles, domestication research should lead to a better understanding of the actual usage and the context wherein the technology is adopted.

This study investigated the underlying relationship between ICT adoption determinants and the attitude of lecturers in a higher education setting. The five ICT adoption determinants in the DoI theory were hypothesized to not positively affect the attitude of lecturers toward use of ICTs, but when tested, three of them (relative advantage, complexity [ease of use], and observability) were found to have a positive effect on the attitude of the lecturers. This is consistent with the findings of Choi, Choi, Kim, and Yu (2002), who discovered that relative advantage, observability, image, and enjoyment were significant in influencing attitude toward information technologies' adoption. On the relative contribution of each of the constructs to the attitude of the lecturers, observability had the highest contribution, which concurs with the finding of Olatokun and Igbinedion (2008) that observability had the highest impact on attitude, while trialability had the least, among ATM users in Jos, Nigeria. In contrast, however, their study confirmed that all the constructs had a significant positive effect on the attitude toward ATM use. In this study, the fact that observability contributed the highest influence could be because the lecturers were able to observe others using ICTs before using the technologies themselves. Other studies (e.g., Tan & Teo, 2000; Taylor & Todd, 1995) have demonstrated the contribution of observability to the DoI model. Also, Schillewaert and Ahearne (2001) observed the same when they reported that the acceptance of ICTs by peers and colleagues spurs adoption because it signals the benefits of the system to others and creates a form of social pressure within the organization for others to comply.

The contribution of the complexity construct was positively significant to the model and hence supported in this study. The complexity of a technology affects how well it diffuses in a social system because if the technology is easy to use, more people are likely to adopt its use (Rogers, 1995). The significant contribution of complexity to the diffusion model was supported by previous studies, such as those by Kolodinsky, Hogarth, and Hilgert (2004), Chen, Gillenson, and Sherrell (2002), Lau (2002), and Taylor and Todd (1995). This contribution of complexity makes it imperative for NUL authorities to deploy easier-to-use ICTs to enhance adoption by lecturers. There was no significant correlation between trialability and the attitude of lecturers toward ICT usage, implying that no previous attempts are needed to try out ICT before using it. This meant that potential adopters of ICTs feel they do not need trial demonstrations as an introduction to using them. This is in line with the findings of other studies, such as those of Chang and Cheung (2001) and Davis, Bagozzi, and Warshaw (1989). The compatibility construct was also found as having no significant contribution to the attitude of lecturers in using ICTs. This contrasts with previous studies that have found compatibility to be a significant factor in attitude toward ICT use (Chen et al., 2002; Tan & Teo, 2000). The positive and significant contribution of relative advantage that was found in this study is consistent with previous research involving information system acceptance (Horton, Buck, Waterson, & Clegg, 2001; Morris & Dillon, 1997). This finding is not surprising because one would always expect that the benefits of ICTs will have a strong influence on amount of usage. This also is in line

with Agbonlahor (2006), who found that relative advantage significantly influenced the number of IT applications used by respondents. Thus, relative advantage has been found to be a significant motivator both for the number of computer applications used by respondents and the frequency with which they used computers.

Findings from this study thus provide further evidence of the appropriateness of DoI to measure attitudes toward ICT usage in higher education in a developing country. The findings complement and contribute to the body of literature that seeks to validate existing DoI models in academic communities and a developing country like Lesotho. Most previous studies on African universities and DoI have been conducted in west- and central-African settings. Only a few prior works exist on ICT adoption and use in universities in the South Africa Development Community region (Adam & Woods, 1999; Anandarajan, Igbaria, & Anakwe, 2002; Farrell et al., 2007; Oyelaran-Oyeyinka & Adeya, 2004; Isaacs, 2007). The results of this study provide to administrators at NUL further empirical evidence regarding which attributes influence lecturers at that institution toward adopting ICTs, with implications for policy and planning on manpower development.

Of course concerns such as the pro-innovative bias are apparent in ICT diffusion research studies (Rogers, 1991). By looking at the factors that influence attitude but also those that had no influence on lecturers' use of ICTs at NUL, this study has generated valuable insights that are not possible within a pro-innovative bias perspective. In regard to theory, therefore, this study extends the knowledge about existing diffusion theories in information systems studies. On the practical side, this study was timely because it responds to the continuing interest in and addresses the dearth of literature about ICT diffusion research in developing countries, especially in Africa. Finally, it contributes to a new knowledge and data on the ICT diffusion literature in Lesotho.

To conclude, we confirm that diffusion theory is still a valuable framework for research on ICT diffusion as long as the scope of the research is adoption diffusion and that the reorientations concerning the shape of diffusion patterns, segment profiles, and adoption determinants are taken into account. However, it is important to point out that ICT adoption determinants may no longer be powerful enough to be used for predictive purposes and a metamodel is highly desirable for future research to increase the predictive power of the model. Thus, a combination of models could be used for analyzing adoption scenarios in university settings. Broad theories and frameworks are evident and pertinent for analysis. No one theory is sufficient for devising a generic framework for analyzing the adoption of an innovation.

A clear and sensible path for NUL would be to identify and target early adopters of various ICTs and ensure that potential enthusiasts are alerted to the innovations at an early stage. Furthermore, as indicated above, deployment of user-friendly ICTs that are accompanied by a training plan for staff, students, and administrators is essential. The diffusion of ICTs at NUL could also be studied from the perspective of non-users to determine the factors responsible for persistence in not using an innovation. A SWOT (strengths, weaknesses, opportunities and threats) analysis of ICTs available and/or used at NUL will be equally pertinent to determining the scope of integration of ICTs as an enabling tool at the institution to help realize its goals and mandates, as well as to improve the efficiency within teaching and learning processes. Furthermore, such more detailed research could help inform related internal audiences about policy and decision-making procedures and practices in regard to ICTs. Such efforts will ensure

that future initiatives in ICT deployment at NUL are focused on maximizing limited institutional resources, and attaining high ICT-related outcomes from the resource investments.

ENDNOTES

1. NUL was established by the National Assembly through Act No. 13 of 1975 (National University of Lesotho, 2010) on the Lesotho (Roma) campus site of the former University of Botswana, Lesotho, and Swaziland on October 20, 1975. Today, it is a growing institution striving to meet the needs of the nation, through production of competent graduates who could assist in the development of Lesotho. The sole national university in the country has a student population of over 9,000 within seven faculties (Agriculture, Education, Health Sciences, Humanities, Law, Science and Technology, and Social Sciences) and an Institute of Education.
2. At the time of this study, the number of full professors was lower at NUL than is common at other universities.

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Appendix

QUESTIONNAIRE DISTRIBUTED TO LECTURES AT THE NATIONAL UNIVERSITY OF LESOTHO.

Dear Respondent,

This questionnaire is designed to collect data on a study titled, “Analyzing the Influence of Diffusion of Innovation (DOI) Attributes on Lecturers’ Attitude toward Information and Communication Technology.” Kindly fill out your responses as frankly as possible. The data you provide will be treated in confidence. Thank you for your anticipated cooperation.

Section A. Demographic characteristics of Respondents (Tick as appropriate)

1. Gender Male Female

2. Age Group Under 25 25-34 35-44 45-54 55-64 65

3. Academic Rank Assistant Lecturer Lecturer Senior Lecturer Associate professor Professor

4. Department _____

Section B. The influence of the five constructs of Diffusion of Innovation theory on your adoption and use of ICTs. This section aims at finding out your opinions about the statements listed below.

5. Please read the following statements and circle the number that best describes your use of ICTs, where Strongly Disagree (SD) = 1: Disagree (D) = 2: Agree (A) = 3 and Strongly Agree (SA) = 4).

Relative advantage and ICT use	SD	D	A	SA
ICTs improve my efficiency when I use them.	1	2	3	4
Mistakes with ICT transactions are easier to correct than manual ones.	1	2	3	4
There are enough advantages of ICTs for me to consider using them.	1	2	3	4
Mistakes are more likely to occur with ICT usage than with manual operations.	1	2	3	4
ICTs help me to better manage my time.	1	2	3	4
Compatibility and ICT use				
I do not need ICT in my work.	1	2	3	4
ICT makes lecturers redundant.	1	2	3	4
It bothers me to use ICTs when I could do my work manually.	1	2	3	4
I worry about the privacy of my information when using ICTs.	1	2	3	4
I worry that ICTs are not secure enough to protect my personal information.	1	2	3	4
Trialability and ICT use				
It was easy to use ICTs more frequently after trying them out.	1	2	3	4
A trial convinced me that using ICTs was better than using manual systems.	1	2	3	4
I do not need a trial to be convinced which ICTs are the best for me.	1	2	3	4
It did not take me much time to try ICTs before I finally accepted their use.	1	2	3	4
It is better to experiment with ICTs before adopting them.	1	2	3	4

Observability and ICT use

I was influenced by what I observed as the benefits of using ICTs.	1	2	3	4
I observed others using ICTs and saw the advantages of doing so.	1	2	3	4
Observing ICT users before using ICTs is unnecessary.	1	2	3	4
I have seen how others use ICTs before using them.	1	2	3	4

Complexity and ICT use

ICTs are complicated to learn.	1	2	3	4
ICTs are difficult to understand and use.	1	2	3	4
ICTs are convenient to use.	1	2	3	4
ICTs are confusing.	1	2	3	4
It is easy to use ICTs even if one has not used them before.	1	2	3	4

6. Kindly indicate how your experiences/attitude with the use of ICTs have affected your intention to continue to use the technology, where Strongly Disagree (SD) = 1: Disagree (D) = 2: Agree (A) = 3 and Strongly Agree (SA) = 4).

The benefits of ICTs will make me continue to use them in the future.	1	2	3	4
I intend to continue to use ICTs because they help manage my time better.	1	2	3	4
Because ICTs are appropriate to my profession I will use them in future	1	2	3	4
ICT usage is appropriate for my working style and I will continue using it	1	2	3	4
The ease of use of ICTs will make me continue to use them	1	2	3	4
The difficulty in learning to use ICTs will make me not use them in future	1	2	3	4
Seeing my colleagues use ICT will make me continue to use it	1	2	3	4
What I have observed about the use of ICTs in my department will make me keep using them.	1	2	3	4
Trying out the opportunities of using ICTs in my profession will make me continue using them in future.	1	2	3	4

BOOK REVIEW

Alač, Morana (2011). *Handling Digital Brains: A Laboratory Study of Multimodal Semiotic Interaction in the Age of Computers*. Cambridge, MA, USA: MIT press; 199 pages.

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One of the fundamental themes in human–technology studies relates to grasping better the processes of interaction and the ways they are meaningful to us. Related to this, one can currently witness a shift from traditional cognitive science to a position where the focus is on the constitutional role of human body as a basis of cognition and experience. This new philosophical position of *embodiment* conceptualizes the human mind essentially in terms of the living body being involved actively within its environment. The book by Morana Alač quite tangibly illustrates the issues of embodiment being pervasively present in human meaning making and social interaction. Through an ethnomethodological account, Alač’s book specifically reveals the view of the bodily engagement involved in interactions and social cognizing held by neuroscientists in an fMRI (functional magnetic resonance imaging) laboratory environment while working with brain imaging data.

The theoretical stance of the author is a mixture of various disciplines, including the phenomenology of Merleau-Ponty and Heidegger, distributed and situated cognition, social sciences, and the Peircean paradigm of semiotics. However, the emphasis of the study is on its ethnographical endeavor for the “inside look,” that is, from within the cultural framework of a given community of practice. In Alač’s study, the focus is on how science is being conducted practically in a sociotechnological domain of an fMRI laboratory. The method utilized by the author is based on conversation analysis, while importantly extending its scope of examination beyond verbal interaction. With videotaped documentation of the interactions as a starting point, the method taps into the embodied dynamicity of the setting in which the scientists’ verbal and nonverbal communication with each other and their engagement with technological tools, computer screens, or ad hoc drawings takes place.

Although the study deals with the scientists interacting with technology, its goals differ from typical studies of human–computer interaction (HCI). Rather than trying to, for example, optimize the interaction process or to offer design solutions, the author’s goal has been to bring

forward the gestural acting (or enacting) engaged within communication and thinking processes, as well as the metaphorical ways in which scientists handle brain scans as if they were material objects. These bodily events may at first appear as mere trivial routines of interaction but, through the author's analysis, they lead to some significant implications.

One of the consequential arguments of the author is that brain-imaging data should not be seen merely as visuals, but rather as something that scientists engage with in a multimodal manner. Moreover, these brain visuals should not be simply taken as representations with some self-standing meanings, even though they have undeniable indexical relations to the brain's structures and functions. Rather, the author suggests, these visuals should be conceived as diagrammatic *fields of interaction*. Thus, what is seen in the image is grasped by enactive inspection of visuospatial features that are actively engaged in a manner similar to how we treat the objects and processes of the everyday world. In practice, such engagement often comprises physical gesturing over the image that highlights the tangible and dynamic nature of the comprehension. The shift from a representational object to a process of its enactment puts the focus on the active agent trying to understand what he or she sees (or what remains hidden), but it also brings forward the process of distribution, in other words, how knowledge and meaning-making are distributed in practices of a research community that bring together social agents and technology.

Although not the main topic of the book, a convenient added benefit of taking an ethnographical peek into the practices of neuroscience is that the reader has a chance to learn a thing or two about fMRI research itself with respect to both its strengths and restrictions. The very choice of studying the work of neuroscientists is interesting and relevant, keeping in mind the rather high expectations laid out on brain imaging methods for revealing the underpinnings of the human mind. However, this choice is not coincidental: Alač explicitly acknowledges that the social sciences need to develop their position in relation to neurostudies. For example, she points out the narrowness in cognitive neuroscientists' interpretation on the embodiment of the human mind. In particular, her critique is addressed to the supposition that the mind resides only in the brain.

Alač's book is well written and thought provoking, and it should make good reading for people interested in issues of, for instance, ethnographic research, science studies, interaction analysis, or cognitive science. By emphasizing the social dimension of cognition, Alač makes a worthy contribution to the still rather scattered and disconnected theoretical field that deals with the embodiment of the human mind. Nevertheless, in my opinion, this theoretical development falls a little short in its integration with comparable trends of embodied cognition. For example, leaving out the theories of Francisco Varela and Alva Noë is a bit of a missed opportunity because these notable philosophers of embodied cognitive science also have defined cognition and perception fundamentally in terms of enaction. They too have emphasized the interaction-oriented aspects of cognition that go beyond the human brain, and it would have been interesting to read a discussion about the similarities and differences between their theories and the book's approach.

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