Research Statement

As I study topics around user-centered product design and development, I always try to keep the broader implications of my research in mind. Research on user-centered design is closely related to what is happening in the real world, including technological developments, social changes and market trends. Also, user models and design principles need to co-evolve with advancements in the related fields, including human factors, engineering and consumer studies. Due to the dynamic, socio-technical nature of my research on understanding underrepresented user populations for improved system design, it is essential for me to exchange ideas and collaborate with academics and practitioners in various fields and to be constantly updated with societal trends and issues.

Current research: older adults’ interactions with technology

During my doctoral program at the MIT Engineering Systems Division, I have been actively involved in research activities and projects around older adults’ interactions with various technologies. As more people are living longer, many areas of society are facing new problems and challenges. From a systems perspective, technology for the older population is not only a safety or a medical topic, but a complex issue with various interrelated subsystems. Traditionally, successful aging has been defined as living longer, and the design of technology for older adults has focused on physical changes and their implications on clinical care or detailed ergonomics. However, the aging of the Baby Boomers is challenging existing assumptions about the characteristics of older adults. As a result, an incorrect and incomplete understanding of the population thus prevents wide adoption of technology-enabled products and services.

My doctoral research focused on this problem. While the issue of technology adoption has often been studied only from the user perspective, my doctoral dissertation took a more integrated approach by including other related stakeholders – the designers and managers. During the first stage of my doctoral research, I conducted in-depth interviews with older adults and a comprehensive review of literature to identify factors that affect and determine their decisions and adoption behaviors (Lee et al., 2013a; Lee & Coughlin, 2015). Based on the findings, I was able to identify and define 15 factors that play important roles in older adults’ adoption and use of technology. While technology adoption has been a popular topic in related fields, my findings were unique in that they included factors related to psycho-social perceptions and contexts of use in addition to technical design and observable characteristics, and not only the initial adoption stage, but also the continued usage experiences.

In the following stage, I conducted a national survey on a sample of over 600 adult respondents in the United States to empirically validate and describe the adoption factors and their roles. With a rich set of quantitative and qualitative data gathered from the survey, I applied statistical techniques, data mining methods and content analysis to describe the relative importance of the factors and to explain the effects of life stage variables on technology perceptions. Finally, I developed case descriptions around three existing aging-in-place solutions. The case study was conducted to describe the industry practices and perceptions on the role of the adoption factors in design, development and distribution of technology for older adults.

The findings from my doctoral research revealed that the topic of technology adoption among older users is more complex than previously recognized. Analysis on the data gathered from the user survey and the case study showed that adoption factors are closely interconnected with one another, and that design and
adoption decisions often rely on evaluation of a collective set of needs rather than individual factors. Also, my research found that life stage characteristics and living arrangements were more closely related with people’s perceptions around technology adoption factors, compared to observable characteristics such as age and gender. In summary, the dissertation confirmed the need for a more comprehensive understanding of older adults and the danger of relying on stereotypes.

As a Postdoctoral Associate at the MIT AgeLab, I am continuing my work on empirical analysis of perceptions, decisions and interactions involved in older adults’ use of technology. I am currently working on three projects. First, I am investigating how people of various generations learn about, download and use smartphone apps using survey data collected from over 1300 American adults. Based on the self-reports of smartphone use behaviors, I am seeking to describe patterns with which people use smartphone apps, and to analyze how usage patterns vary between generations or between people with different technology experiences. The second study includes a large-scale national survey on perceptions of retirement. For this study, I’ve collected photographs from a US Census-balanced sample of 1000 American adults showing what their lives are like now, as well as what they think their lives will look like after retirement. Detailed descriptions and comments were collected along with the photographs. I plan to use various data mining techniques to the multimedia data collected from this online ZMET (Zaltman metaphor elicitation technique) study in order to find implications for design of services in various industries including financial services and caregiving. Lastly, I am using data from younger and older drivers to study the relationships of hands-on experience, health conditions and preconceptions to people’s expectations toward technology (Lee et al., 2014; Lee et al., 2015).

Past research: usability of products and user experience in service environments

In addition to my dissertation research, I collaborated with researchers at the MIT AgeLab during my doctoral program on several projects around understanding older adults to inform the design of products and services. For example, in a project titled “e-Home for Seniors”, I led usability inspection and interaction design for development of a home solution targeted at managing medications and improving family communications. Also, I worked on participant recruiting and system implementations during an 8-week field study for observation of user behavior and evaluation of system usability (Lee et al., 2011; Lee et al., 2013b). As a follow-up to the e-Home project, I helped design and implement a Web-based survey on analysis of older adults’ behaviors around management and consumption of medications. In addition to demographics and self-reported consumption information, the survey collected over 200 photographs showing where and how medications are stored. Based on the photographs, I took the lead on developing a coding mechanism and used data mining techniques to find usage patterns and to identify personal and behavioral characteristics that lead to undesirable behaviors, such as storing medications near heat or water (Lee et al., 2013c).

I have also researched various issues related to user-centered design more generally, including usability evaluation, Kansei engineering and behavior observation. During my doctoral study at MIT, I participated in workshops held by the Strategic Engineering Research Group. As a usability specialist of the multidisciplinary group, I led a usability testing experiment for studying the effectiveness and efficiency of SpaceNet, an open-source software tool developed by MIT students and researchers to assist the planning and analysis of logistics involved in space exploration campaigns. I presented the study at conferences in
the related fields of human factors, computer science and aerospace engineering, as it opened up a new application area for usability testing methods (Lee et al., 2012; Grogan et al., 2011; Grogan & Lee, 2011).

During my master’s study at the Department of Industrial Engineering at Seoul National University, I communicated with practitioners from multiple industries on projects around user experience and usability of interactive systems. In a project funded by Samsung Electronics, I took part in questionnaire design, experiment design and data analysis for a comparison of perceptions around various mobile phone form factors between people in their 20s and older adults in their 60s. I have practiced various methods of observation, including eye-gaze analysis and participant shadowing, to analyze pedestrian navigation within large train stations in Korea (Bahn et al., 2010). The findings from this project, which was done in collaboration with Yonsei University and funded by the Korea Railroad Company, informed the redesign of a large subway station in Seoul.

**Future research: holistic and inclusive user models**

In my future research, I want to extend what I know about older adults’ adoption and use of technology in order to develop more comprehensive models that describe other underrepresented user populations. In my previous research, I learned that people’s interactions with products and services are not only affected by functional capabilities and technical interface characteristics, but also by related environmental aspects, sociocultural conditions and personal experiences. The results from the large-scale survey portion of my doctoral research found people’s prior experiences, family relationships and living conditions to have more significant effect on their adoption and use of technology, compared to their age, gender, income or level of education. The case study also suggested that relevance to successful past interactions and positive social visibility may increase a product or a service’s adoption and usage. Based on the usability evaluation of SpaceNet, my team found that people without relevant domain knowledge, or those who are new to aerospace engineering, were not only less capable of using the tool, but also showed different learning behaviors. Also, I found it important to use a mixed-method approach in order to capture the influence of the broader sociocultural contexts on how different users interact with systems.

Research in the domain of technology adoption and human-computer interactions has mainly focused on technical features, physical and cognitive ergonomics, and observable individual characteristics. Furthermore, discussions around research implications on design and distribution of products have often been limited in that they mostly considered young and healthy users who are relatively easier to reach and considered to be the market mainstream.

I plan to develop more holistic user models that include generational characteristics, social contexts and experiential issues in order to broaden researchers and practitioners’ understanding or different users. I plan to include users of underrepresented populations, such as older adults, children, people with disabilities and other minority groups to address the heterogeneity of today’s consumer population, and to develop and describe more inclusive user models.

My future research will take an ethnographic approach in realistic field-based settings. While research in the laboratory setting is easier to design and control, people’s responses and behaviors can be affected by the artificial environment and thus may not reflect real thoughts and experiences (Rosenthal & Capper, 2006). It has also been suggested that developing a continuous relationship and having deep conversations in comfortable environments are effective for capturing latent needs, thoughts and expectations that are
hard to capture with structured question-and-answer approaches (Eisma et al., 2004). In my previous research, I found that participants become more open to talking about their life and experiences when they meet researchers multiple times and when inquiry is done in a setting that’s familiar to them, such as their homes. I have also learned that relying on a single source of data can generate results that are not only incomplete but also incorrect. For collection of user inputs, I plan to take a mixed-method approach, with which data from various methods of user inquiry - including interviews, questionnaires and observations - will be triangulated to generate meaningful findings.

I plan to apply the mixed-method field-based user research framework in order to understand users’ experiences, needs and related contexts. I will then develop comprehensive models describing how different users interact with various technology-enabled products and services. I am especially interested in studying how underserved groups of people perceive and interact with newly developed systems, such as cloud computing services, home sensor networks or in-vehicle automation systems. In order to develop research projects around these topics, I am highly interested in establishing industry partnerships and collaborating with research organizations to acquire funding, transfer knowledge and develop findings that can be applied across disciplines. Also, as findings around the needs and behaviors of people often have social and policy implications, I will also be involved in writing grant proposals for government funding.

In short, my research experiences and skills include quantitative and qualitative methods for collection and analysis of people’s thoughts, behaviors and social context. My research combines ideas and techniques from human factors, consumer studies, social science and systems engineering to provide a more comprehensive understanding about people and their interactions with systems. In the future, I plan to continue taking an interdisciplinary approach and to communicate with researchers and practitioners in various related fields.

References


