

Identifying User Experience Elements for People with Disabilities

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Abstract—This study aims to identify the elements of the user experience (UX) of mobile products and services for people with disabilities. Although many researchers have emphasized UX in designing new products and services, common understanding of UX for those with disabilities is absent. This study identified UX elements for people with disabilities by analyzing previous studies. A total of 45 articles from the literature were analyzed, and as a result, UX elements for people with disabilities were identified. The results can be used as criteria for developing new products/services or evaluating existing products/services.

Keywords—*User experience (UX); UX elements; Disabled people; Usability; Affect; User value.*

I. INTRODUCTION

User experience (UX) refers to all of experiences resulting from interactions that a user has with a product or service [1][2]. With growing interest in UX in the field of Human-Computer Interaction (HCI), many studies have been conducted in both industry and academia [3].

However, existing studies of UX have rarely considered people with disabilities. People with disabilities have different abilities to sense external information, so their experience with products or services can be different from that of non-disabled people. Understanding the UX of people with disabilities should be a great help to the development of products and services.

This study aimed to identify the UX elements of people with disabilities. We defined UX of people with disabilities as an experience that consists of aspects of interaction between the disabled and products/services which are influenced by assistive technologies. We investigated the elements based on the definition. This study analyzed relevant literatures on usability for people with disabilities and UX of general users, and identified the elements of UX for those with disabilities. During surveying the literatures, the specific types of disabilities were not considered to collect diverse literatures. Mobile devices have been regarded as important products for people with disabilities, so this study focused on the UX of mobile devices/services.

Section 2 presents the existing studies on people with disabilities and their limitations. Section 3 explains how to derive the UX elements for people with disabilities in the study, and presents the results of UX elements. In Section 4, the study analyzes the differences between the UX elements for people with disabilities and that for general users. We present the characteristics of UX elements for people with

disabilities.

II. EXISTING STUDIES ON USABILITY FOR PEOPLE WITH DISABILITIES

Many studies related to the design of products and services for people with disabilities have been conducted and suggested a variety of design concepts related to usability or accessibility. The concept of barrier-free design emerged in the 1950s. It aimed to remove obstacles in houses or buildings for those with physical disabilities [4]. Accessible design focuses on standardizing designs for people with physical limitations to maximize the number of potential users [5]. Universal design is the most recent concept and has as its goal designing products or environments usable by all people without any need for adaptation or specialized design [6]. Inclusive design is a similar concept to accessible design, and design for all is another term used to refer to universal design.

Many studies suggested the concept related to people with disabilities, but they just focus on improving the usability of products and services for people with disabilities. Similar to non-disabled people, however, those with disabilities also experience user affect [7] and user value [8]. It is necessary to consider the comprehensive UX of those with disabilities, not only usability. This study attempted to identify the UX elements for people with disabilities through a literature review.

III. IDENTIFICATION OF UX ELEMENTS FOR PEOPLE WITH DISABILITIES

First, we surveyed the literature using keywords related to UX for people with disabilities, such as assistive technology, accessible design, universal design, and universal usability. Various types of literature, including journals, conference proceedings, magazines, reports, and books, were considered (Table 1), and 34 articles were collected in the literature survey from Google Scholar and SCOPUS databases. UX elements for people with disabilities have not been identified before, so evaluation criteria of products/services for people with disabilities or design considerations for them were considered as the candidates of UX elements in the study. As a result, a total of 49 candidates for the UX elements were identified, such as accessibility, perceivability, coequalness, and independence.

TABLE I REPRESENTATIVE SOURCES OF THE SURVEY

Journals
<ul style="list-style-type: none"> - Disability & Rehabilitation - Technology and Disability - American journal of physical medicine & rehabilitation - Journal of Visual Impairment & Blindness - International Journal of Design - Design studies - International Journal of Industrial Ergonomics - International Journal of Human-Computer Interaction
Conferences
<ul style="list-style-type: none"> - Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI Conference) - International Conference on Universal Access in Human-Computer Interaction - Proceedings on the conference on Universal Usability - The ERCIM Workshop on User Interfaces for all
Books/Reports
<ul style="list-style-type: none"> - Design and Use of Assistive Technology - Plenum Series in Rehabilitation and Health - The universal access handbook - Universal Access in Human Computer Interaction - Design Council Report

Second, we collected the UX elements for general users to get the insights for UX elements for people with disabilities. 11 journal papers and reports which state the UX elements for general users comprehensively were collected and 92 candidates for the UX elements were identified.

Then, we integrated all of the candidates and removed candidates not appropriate to people with disabilities and mobile products or services based on three criteria; importance of elements, relevance to disabilities and mobile products/services, and relevance to the purpose of using a product/service. For example, translucency and durability were excluded. Those were important aspects of mobile devices to general users, but color and shape, which were essential characteristics of product to recognize a product, were much important than translucency to people with disabilities. Durability usually was not the purpose of using a mobile product or a service.

Lastly, we grouped the elements with similar characteristics or meanings. Based on the existing UX studies, the UX elements were classified as usability, affect, and user value [9]. The UX of people with disabilities would also follow the same classification. Finally, the UX elements of people with disabilities and their definitions were identified as presented in Table 2.

TABLE II. THE UX ELEMENTS OF PEOPLE WITH DISABILITIES AND THEIR DEFINITIONS

Elements		Definitions	Examples or similar concepts
Usability	Accessibility	Degree to which a product or a service is enable the user to approach or operate	Accessible size, Input assistance, Visibility, Audibility
	Effortlessness	Ability of a product or a service to require no effort of the user to use it	Efficiency, Effectiveness
	Flexibility	Degree to which a product or a service can accommodate to changes in tasks or environments	Adaptability, Interoperability
	Informativeness	Degree to which the product is informational and giving all the necessary information to the user in a proper manner	Comprehensiveness, Explicitness
	Learnability	Degree to which a product or a service is enable the user to learn how to use it	Memorability, Predictability, Consistency, Familiarity, Intuitiveness
	Simplicity	Degree to which the way that a product or a service works looks simple and uncomplicated	Modelessness
	User support	Ability of a product or a service for the user to use it easily	Helpfulness, Error prevention, Recovery, Feedback, Easy to installation
User Value	Attachment	Ability for the user to have subjective value on a product or a service by giving special meanings to it	Preciousness, Affection, Reminiscence
	Customer need	Degree to which functions of a product or a service satisfy the user's functional needs	Comfort, Convenience, Usefulness/Utility, Intelligence, Security, Trust
	Identity	Ability for the user to percept the distinct personality of an individual by using a product or a service	Self-esteem, Self-respect, Self-satisfaction
	Independence	Ability for the user to have confidence to achieve something without any aid of somebody	Self-determination, Autonomy
	Relaxation	Feeling of being relaxed or pleased by interacting with a product or a service	Pleasure, Fun, Enjoyment, Taking a rest
	Sociability	Degree to which a product/service satisfies the users' desire that they want to interact with society as a member	Social emotion, Social value, Social belonging, Relationship, Friendship
Affect	Sensory affect	Primitive and direct images by interacting with a product or a service	Shape, Color, Brightness, Sense of grip, Texture, Heaviness
	Descriptive affect	Impressions of a product or a service that the users would describe based on their experience	Delicacy, Simplicity, Rapidity, Rigidity
	Evaluative affect	Attitudinal or judgmental images about a product or a service	Attractiveness, Reliability, Comfort, Convenience

IV. DISCUSSION

There are some differences between UX elements for general users and people with disabilities. With regard to usability, accessibility should be more emphasized for people with disabilities than for general users. People with disabilities tend to have an insufficient sensory or physical ability to use mobile phones or services, thus it is necessary to make mobile phones or services easy to use for them. In other words, accessibility is the prerequisite of usability. Accessibility has also been emphasized in studies on design, such as accessible, universal, and barrier-free design [10][11].

More diverse elements of user value were derived than those for general users. Products or services with assistive technology enable people with disabilities to do daily activities, such as reading a book, taking a walk, and making a phone call to someone, which they cannot do in their daily life, and this fact led diversity of user value elements. Specifically, independence and identity are unique and major elements of user value, which are also main elements of quality of life [12][13]. There are few studies on the affect of people with disabilities while usability was widely considered for designing products or services. However, affect should not be overlooked in the design process in the sense that people with disabilities use more diverse sense organs than general people while getting information.

This study composed the UX elements with consideration for various types of disability. However, the elements or importance of each element can differ according to types and severity of disability. For instance, a visually impaired person mostly feels affect from a sound, while a hearing impaired person mainly from a vision. Therefore, different UX elements according to types of disability should be considered before designing products or service with consideration of types of disability.

The study conducted the literature survey systematically to define and identify UX elements for people with disabilities. To verify the UX elements that identified in the study, experiments or interviews with people with disabilities should be conducted in the future study.

V. CONCLUSION

This study analyzed the literature on disability and UX, and identified the elements of the UX of people with disabilities. Previous studies on designing products and services focused mainly on product and service usability, but this study suggested that user value and affect should be considered in the design stage. The UX elements for those with disabilities can be used as criteria for developing new products/services or evaluating existing products/services.

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REFERENCES

- [1] P. M. Desmet and P. Hekkert, "Framework of product experience," *International Journal of Design*, vol. 1, no. 1, pp. 57-66, 2007.
- [2] ISO CD 9241-210 Ergonomics of human-system interaction. Part 210: Human-centred design process for interactive systems, ISO, 2008.
- [3] J. Park and S. H. Han, "Defining and Analyzing User Value of Smartphones", *Proceedings of Spring Conference of the Ergonomics Society of Korea 2012*, 2012, pp. 312-315.
- [4] W. F. Preiser and K. H. Smith. *Universal design handbook* 2nd ed., McGraw Hill Professional, USA, 2010.
- [5] ISO/IEC Guide 71 Guidelines for standards developers to address the needs of older persons and persons with disabilities, CEN/CENELEC Guide 6, ISO, 2002.
- [6] The Center for Universal Design. *Environments and products for all people*. [Online]. Available from: http://www.ncsu.edu/ncsu/design/cud/about_ud/about_ud.htm 2014.12.22
- [7] J. H. Park and H. Y. Rvoo, "Emotion of People with Visual Disability for Enhancing Web Accessibility." *Journal of Korean Emotion and Sensibility*, Vol. 11, No. 4, pp. 589-598, 2008.
- [8] L. Demers, R. D. Wessels, and R. Weiss-Lambrou, B. Ska, L. P. De Witte, "An international content validation of the Quebec User Evaluation of Satisfaction with assistive Technology (QUEST)," *Occupational Therapy International*, Vol. 6, No. 3, pp. 159-175, 1999.
- [9] J. Park, S. H. Han, H. K. Kim, Y. Cho, and W. Park, "Developing elements of user experience for mobile phones and services: survey, interview, and observation approaches," *Human Factors and Ergonomics in Manufacturing & Service Industries*, Vol. 23, No. 4, pp. 279-293, 2013.
- [10] G. Dewsbury and M. Edge, "Designing the Home to Meet the Needs of Tomorrow," *Open House International*, Vol. 26, No. 2, pp. 33-42, 2001.
- [11] H. Petrie and N. Bevan, The evaluation of accessibility, usability and user experience, *The universal access handbook*, pp. 10-20, 2009.
- [12] M. Wehmever and M. Schwartz, "The relationship between self-determination and quality of life for adults with mental retardation." *Education and training in mental retardation and developmental disabilities*, Vol. 33, pp. 3-12, 1998.
- [13] M. J. Scherer and L. A. Cushman, "Measuring subjective quality of life following spinal cord injury: a validation study of the assistive technology device predisposition assessment." *Disability & Rehabilitation*, Vol. 23, No. 9, pp. 387-393, 2001.