A Framework of Affordance and Usability of Mobile User Interface for Older Adults

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Abstract. Growing ageing phenomena and prevalence of mobile technology give rise to the unexplored 'silver surfer' group in the local market. Due to ageing, many older adults suffer declination of cognitive, motor and physical abilities. Many of them experience difficulties using certain features when interacting with their mobile phones, especially technology shift from keypad-enabled to touch-screen mobile user interfaces. However, there is still no profound knowledge about how to design for local older adults, and which particular role of affordance might play to ensure usability of mobile user interface for older adults. The role of affordance is very much related to how an older adult perceives a new mobile user interface when they first expose to it that s/he has never seen it before, and have no clues what to do with it. This paper formulates a conceptual research framework for affordance and usability of mobile user interface for older adults.

Keywords: affordance, usability, mobile user interface, older adults.

1 Introduction

1.1 Growing Ageing Phenomena

There is growing ageing phenomena with the rise of ageing population throughout the world. According to the World Health Organization [1], the growing ageing population indicates 694 million, or 223% is expected for people aged 60 and over since 1970 and 2025. By 2030, the percentages are estimated to range from 17% to 29% [2]. This group of older adults is the fastest growing population and majority of them live in the developed world. In addition, the older adult population over the age of 60 is expected to reach 1.2 billion in 2025; by 2050, there will be 2 billion with 80% of them living in the developing countries [1]. Having said this, Asia is described as the world's most rapidly ageing region. Due to longer life expectancies and falling birth rates, Asia is rapidly getting older.

1.2 Ageing Phenomena in Malaysia

By year 2050, Asia will be home to almost two-thirds of the world's population of people over 60 [3]. Developing nations like Malaysia has also shown a sign of declining

C. Stephanidis and M. Antona (Eds.): UAHCI/HCII 2013, Part II, LNCS 8010, pp. 231–239, 2013.

population growth rate due to several reasons such as getting married at an older age, and with fewer children [4].

According to the United Nation, the proportion of Malaysia's population aged 65 and above is projected to reach 7.1% to 3.4 million in 2020 [5]. On one hand, according to the Department of Statistics in 2000 [6], Malaysia is projected to cross that mark by 2020 as well, when the percentage of people in Malaysia aged 60 and above will be 9.9% (or approximately 3.5 million) of the entire population. Often attributed to the United Nation, a society with 65 and above groups that accounts for more than 7% of the total population is deemed as an ageing society. By 2035, Malaysia will be in the category of ageing nations as defined by the United Nations with older adults constituting more than 15% of the entire population. Therefore, we can no longer underestimate the growing ageing population and their significant impacts to Malaysian society as a whole by year 2020.

2 Justification of Senior-Friendly Mobile User Interface for Local Context

2.1 Needs of 'Silver Surfer' in Local Context

There is a large shift appeared in social values and daily lifestyles in Malaysian society in the past decade. Malaysians are exposed to more multimedia technologies and ubiquitous wireless technologies. Malaysia is a fast-paced developing nation with a relatively slow computer-Internet penetration, but a high mobile network growth. By and large, youngsters and young adults aged from 18 to 30s make up the largest share of mobile subscribers, which promises the largest revenue stream for mobile operators from this market segmentation [7, 8]. However, with the rise of ageing population, and prevalence of mobile ubiquitous technologies permeating everybody's daily lives, we should not underestimate the capability of the so-called 'silver surfer' group to stay connected and work as a mobility aid for communication. The local market of mobile phones and their services for senior citizens (or older adult population) remains widely unexplored and potentially lucrative. Therefore, we cannot underestimate the market share of this growing elderly population in using and purchasing mobile telecommunication and IT services in their daily lives.

As a matter of fact, mobile phones and their services have become indispensable for all walks of life in Malaysia. Having a mobile phone is no longer a luxurious item for younger adults, there is an increasing need and growing interest of the older adult population in up taking and adopting the mobile technologies. However, most of the current mobile phones are not designed for the needs and requirements of older adults, especially in terms of usability issues of mobile user interface [9, 10, 11]. Due to prior product experience, learned knowledge, cultural exposure, older adults perceive mobile user interface differently as compared to the younger generations. As such, many of them face many challenges in adopting mobile phones, not to mention interacting with mobile user interface.

Due to ageing, many older adults also suffer declination of cognitive, motor and physical abilities [2, 11, 12]. Many of them experience difficulties using certain features when interacting with their mobile phones. This scenario will be exacerbated by an attitude of *'techno-phobia'* [2], which posed a cognitive challenge of adopting the recent mobile technology shift from keypad-enabled mobile phones model to touch-screen mobile user interfaces in the current mobile market. In return, the elderly group most likely will be excluded from using mobile phones and services.

2.2 Role of Affordance for Senior-Friendly Mobile User Interface

Industry and research are recognizing the importance of older adults as a target group of mobile phone users. However, there is still no profound knowledge about how to design for and with this special user group, and which particular role of affordance might play to ensure usability of mobile user interface for older adults. The term of 'Affordance' refers to 'the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used……' [13].

According to Norman (1998), he raised the fundamental issue of the concept of affordance by explaining, 'when you first see something you have never seen before, how do you know what to do?' For instance, a door affords pushing, a chair affords sitting, glass is for seeing through, thus affords breaking. Norman [14] also stressed that 'affordances provide strong clues to the operation of everyday things.' Thus, the concept of affordances is very much applicable to user interface design, in which explain how users perceive the meaning of an object through its property that portray to users in their surrounding in the daily life. As such, the role of affordance is very much related to how an older adult perceives a new mobile user interface when they first expose to it that s/he has never seen it before, and have no clues what to do with it. Currently, there are limited research studies that address the applicability of affordances theory and its concept that influences usability of mobile user interface for older adults in Malaysia context.

As a result, this paper aims to review the current literature and formulate a conceptual research framework for affordance and usability of mobile user interface for older adults. The research context will be grounded on the context of Malaysian older adults.

3 Literature Review and Related Research Work

3.1 Prior Literature on Mobile User Interface for Older Adults

In terms of literature gap, prior related works on mobile studies for older adults are mostly conducted in Western cultures, which may not be suitable to local context [9, 10, 15, 16, 17, 18, 19, 20, 21, 22]. Albeit there are universal characteristics that shared among the older adults worldwide, in terms of declination of physical, perceptual and cognitive capability, their research findings may not entirely be applicable to local

older adults due to different local society's values and cultural norms. For instance, older adults in Western countries (e.g. United States, United Kingdom, and Europe) generally receive better and higher educational backgrounds with high literacy rate [10, 15, 18, 21].

Studies on mobile phones' usage and user needs will be different as compared to the local older adults' profiles and requirements. Having said this, there were some previous studies conducted on mobile usage for elderly in Malaysian context. However, all these prior research studies mainly employed survey, or using interview for the questions in the questionnaire with local older adults in Malaysia. For instance, [23] investigated the pattern in using mobile phones and language use amongst the Malaysian elderly. Other studies using survey include mobile usage pattern with elderly in Malaysia [24, 25] with the replication of research design by [9]. It is noticeable that there are inadequate research studies of user-mobile interaction in-depth in local context that will bring insights and benefit to local mobile industries. Thus, this research study intends to find out the user needs and requirements of mobile user interface for local older adults via usability evaluation study and exploratory in-depth interviews.

3.2 Methodological Gap in Research Discipline

Some prior research studies done on investigating user needs and acceptance of mobile phones for older adults can be found in technological literature, particularly in the field of Information System (IS). IS researchers are generally interested to study user acceptance for local older adults by adopting Technology Acceptance Model (TAM) [26] and Unified Theory of Acceptance and Use of Technology (UTAUT) Model [27] from macro perspective [28, 29, 30, 31, 32, 33]. By and large, IS studies generally employ quantitative research approach to study user perception by using survey and questionnaires as instruments for data collection.

Conversely, Human-Computer Interaction (HCI) research studies are more keen on solving the usability issues of user interface and individual users on task performance using interactive system, many research studies focus on user requirements, design and evaluation of how users interacting with system or product design. HCI researchers usually employ experimental research to study in-depth mobile-user interaction in addition to other research approaches such as survey, interview and heuristic study. As such, this research study does not focus on general user perception at macro level; instead, its focus emphasizes on user-mobile interaction in-depth, in particular to resolve usability issues of mobile user interface for older adults rather than on macro level.

3.3 Theoretical Gap of Affordance

From the theoretical point-of-view, the term of affordance was firstly coined by J.J. Gibson [34, 35], a perceptual psychologist from an ecological perspective. Grounded on the field of visual perception, the concept of affordance refers to the actionable properties between the world and an actor. To Gibson, an affordance of an object is a characteristic of the environment that happens to allow an actor (user) to act upon the

environment [36, 37, 38]. However, the concept of affordance is populated by Donald Norman, a design psychologist, amongst Human-Computer Interaction and User Interface Design communities [13].

Norman defines affordance as slightly different from Gibson's concept, where he refers affordance as 'the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used.' For instance, a chair affords for support, and therefore, affords for sitting [13].' There is an argument between the concept of affordance between Gibson and Norman [37]. Gibson claimed that the existence of affordance is independent of an actor's experience and culture; whilst for Norman, affordance is based on an actor's perceptual capabilities, and tightly related with the past knowledge and prior experience. Norman stressed the importance of distinguishing real from perceived affordances. To him, design is about both, the perceived affordance are what determine usability [13 cited in 37].

The concept of affordance has ever since been debated and evolved among HCI researchers such as Technology Affordances [36]; cognitive, physical, sensory and functional affordances in interaction design [39]. In this particular research, I would argue to refer to Norman's perceived affordance as it is highly related to usability of the property of an object, in this particular case, mobile user interface, for particular targeted user group (older adults). In addition, some prior research work on affordance related to mobile technologies revolves around features on mobile phones. For instance, metaphor analysis on 3G mobile handset [40]; conversional affordances of mobile messaging [41]; role of physical affordances in multifunctional mobile device design [42]; mapping user interfaces on electronic appliances [43].

Raudaskoski [44] from Finland looked at the affordance of the mobile phone from making phone calls, sending SMS and WAP application. Other related works studied on affordance for non-mobile research include Sadler and Given [45] on students' information behavior in the academic library; [46] on usability and affordances for teaching and learning in Second Life; [47] on conceptualizing design affordances from a cognitive perspective. However, it is arguable that none of these works look at the current components and integrated features of mobile user interface in details with the underlying affordance concept. Therefore, the focus of research study investigates the current elements of mobile user interface [48, 49, 50], which encompass icon design (e.g. concrete and abstract), screen design (different screen resolution), menu design (single versus multi-layered) and input styles (e.g. keypad-enabled versus touch screen).

4 Conceptual Framework of Affordance and Usability of Mobile User Interface for Older Adults

Based on the abovementioned literature review, Fig. 1 below is the proposed conceptual framework for this research study. There are two (2) Independent Variables (IVs), which are Elements (or Components) of Mobile User Interfaces and Socio-Economic Status (SES). The elements of mobile user interface consists of icon designs (abstract

versus concrete), screen design (various screen resolution), menu design (single versus multi-layered) and input styles (keypad-enabled versus touch screen interface) as stated in the earlier section. The Socio-Economic Status (SES) comprises of prior product experience, learned knowledge (as both refer to Norman's affordance concept [13]); other criteria include education level, physical health condition, age, marital status, income, language and race.

Both IVs will directly influence the expected outcome on Dependent Variable (DV), which is usability of mobile user interface for older adults. Usability is defined as *'the extent to which a product can be used by specified users to achieve goals with effectiveness, efficiency and satisfaction in a specified context of use*' as stated in ISO 9241-11, 1998 [51]. Due to the decline of cognitive, perceptual and motor ability of older adults and age consideration, efficiency is not the main concern for older adults for task performance. Hence, this research study will only consider effectiveness and satisfaction as measureable metrics from the usability perspective.

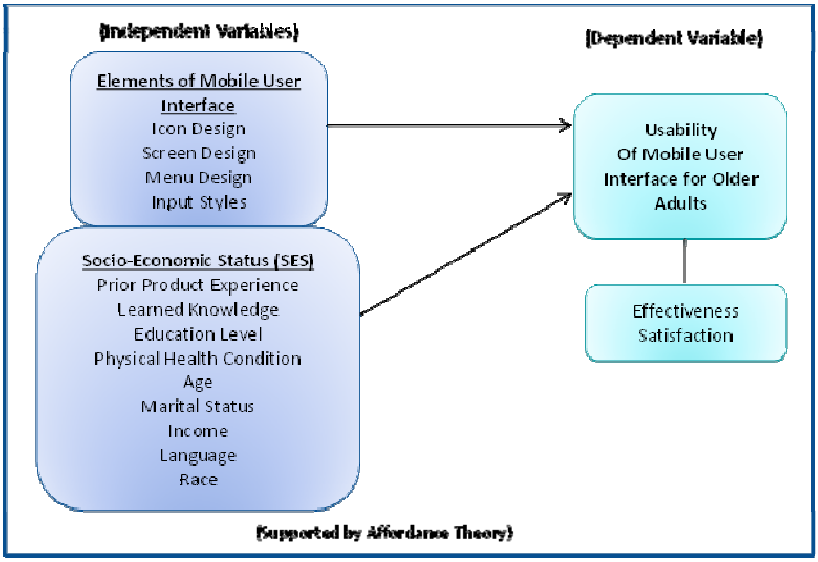

Fig. 1. Conceptual framework of Affordance and Usability of Mobile User Interface for Older Adults

5 Conclusion

In closing, the concept of affordance has been well-known among HCI and user interface community, especially the term after being populated by Norman [13]. With the rise of technological shift from keypad-enabled mobile phone model to recent touch-screen mobile user interface, there is raising awareness among the telecommunication industry, mobile designers and developers of tapping into the 'silver surfer' market worldwide and also local market due to growing ageing population. However, there

are still limited studies investigating how the role of affordance in influencing the usability of mobile user interfaces for older adults, especially looking into the local context in Malaysia. As mentioned, older adults experience declination physical, motor and vision ability due to ageing phenomena. It is also important to recognize that one cannot simply adopt mobile user interface guidelines and transform the research findings that are mostly catered for young adult mobile market to older adults target group. As such, this conceptual research framework provides groundwork for further investigation to look into the role of affordance in influencing usability of mobile user interface for older adults.

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