School of Design and the Built Environment
Faculty of Humanities

A Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Alfandi Nugroho Yahya

This thesis is presented for the Degree of
Doctor of Philosophy
of
Curtin University

December 2019

Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material that has been accepted for the award of any other degree or diploma in any university.

Signature :

Date : 16 December 2019

Abstract

This research project investigated the area of the design of smart phones for elderly users. The study utilised a methodology drawn from User Experience Design involving small group/individual, semi-structured interviews with participants. These participants were located in both Australia and Indonesia, providing a comparative study of possible variations across two very different language, cultural and geographic areas.

Data shows that the population of the world is growing every year and, at the same time, the number of people aged over 65 years is also increasing. Sixty percent of older adults are now using online technology regularly. This study will investigate new smartphone designs or design criteria that will fulfil older adult users' needs, including in relation to cultural or location differences.

Many older adults have been aware of the potential of smart phones for a long time, but may have never adopted them if they had no specific purpose or need. However, many are finding that they need to adopt smart phones in order to conduct normal daily activities as communications and services increasingly become linked to mobile devices. These late adopters face different challenges and may have different requirements than younger users, whose needs the design of the devices already accommodates.

To achieve more effective smartphone user interface design for older adults, this research project utilised the principles of interactive ergonomics in digital technology, such as easy operation and reduced cognitive load. Semi-structured interviews with participants were employed in order to identify the users' experience and problems, and to document the viewpoints of a representative selection of older adult people who use a smartphone as a means of communication.

The research resulted in an 18-point cognitive ergonomic framework for smartphone user interface design for older adult users in Indonesia and Australia. The findings showed that there was no significant difference between Indonesian and Australian participants in terms of how older adults utilize smartphone technology in their daily life, other than changing the language. The two groups did have in common some special physical, social and legibility/cognitive

priorities. The 18-point cognitive ergonomic framework may be applicable/adaptable to other cultural and geographic contexts, and could inform the design of the physical and software interface of smart phones, and potentially other devices.

Keywords: Older Adult Users, Smartphones, User Interface Design, Communication, User-Centred Design, Cognitive Ergonomics, User Experience Design.

Acknowledgements

First of all, I thank God for giving me the opportunity to pursue this PhD with the support of many people around me. I would like to give an extra special thanks to family: my parents, my brother and family, and also my wife for excellent encouragement and for supporting me throughout my PhD studies and work.

Thank you to my chairperson Dr. Boon Ong, Dr. Ann Schilo, and Dr. Pamela Gaunt who brought me to Curtin and encouraged me to do this PhD at Curtin University.

One special big thanks to Dr. Andrew Hutchison for being a fantastic principal supervisor with a great and positive energy, guiding and helping me to direct my thesis to a timely completion. And also, Co-Supervisor, Dr. Qassim Saad, for extraordinary supervision and guidance, and for challenging me to think about my words and ideas throughout the progression of my thesis. Also, many thanks to a superb thesis editor, Pia Smith, for doing extra work day and night on the thesis document.

Thanks to my wonderful family (my parents, my wife, and my brother and his family), who always provided me with the appropriate distractions from my work to keep me balanced between leisure and work, and keep me happy during the research process.

I would also like to thank all the interviewees from Indonesia and Australia for taking part in my research. Thank you to Dr. Anthony Bartel, Mr. Peter Ciszewski, Mr. Giuseppe Pantaleo from Swinburne University of Technology; ANPC members who have given me support in both my life and research, especially to Ps. Simon van Bruchem and Ps. Gordon Waghorn for the prayers and encouragements. An extra thank you to, Lina and Muli, Dr. Rony Sitorus and family, DMD Studio crew who supported me with not only discussing my research progress, but also giving me information on the research journey; research ideas and creative design in the thesis. Also special thanks to the Tanuadji family members who supported with research concepts and ideas. I would not have been able to complete this research journey without you all.

This research project creates significant moments for me and my participants—whether a colleague, family member, team member or friend. There has been a significant connection between the researcher and the participants regarding an understanding of how to help them

deal with smartphone technology in their life after getting some coaching along with the interview process.

Once again, thank you God for blessing me with my family, relatives and friends, including my two excellent supervisors for supporting me to achieve my goals in life.

Table of Contents

List of Figures

CHAPTER 01:

Introduction

1.1 Need

Elderly people require equal accommodations and compensation in later life in order to deal with the change in their capacity, as their abilities are reduced and their needs increase (Demirbilek & Demirkan, 2004).

This research project is aimed at improving existing smartphone user interface design to meet the needs of late adulthood or older adults. The impetus for this research project came from observed difficulties experienced by older adult users in interacting with smartphones. Meanwhile, Pak and McLaughlin (2011) state that mobile phones (or "handsets") are increasingly used for wide-ranging communication activities beyond just voice communication. This study is targeted at current smartphone users who are categorized as "older adults", most of whom may look for assistance from younger generations on how to operate their phone properly and effectively.

Chen et al. (2011) also describe how older adults tend to have positive attitudes towards technology. This would indicate possibilities to develop smartphone applications for this specific user group. Until more recently, older adults tended to use paper-based copy to find information they needed. Nowadays, 82% of older adults have utilized a search engine to find information online (Fox, 2004). Although there is a lack of specific knowledge about the way older people access smartphones and in how to include these users in the development process, this phenomenon shows a current advancement of technology utilization to improve older adults' quality of life, such as in health (Klasnja and Pratt, 2012).

1.2 Definition of "Older Adult"

In this research project, older adult users – those aged 65 years and above – are presented as the central focus of the investigation.

The term “Baby Boomer generation” can be defined as people who were born between 1946 and 1964 (Australian Government, 2011; Light, 1988). This group of people is currently considered to be in the 50–68 age range. However, this term is not widely representative of the scope of the older adult population in this thesis. as Also, the interpretation of the term is not universal within different cultural backgrounds and all nations. Therefore, the term “older adults” will be used throughout this thesis to represent the targeted users in this research project as representing late adulthood. To understand this older adult generation, it is useful to discuss it further.

In recent years, the population of this demographic group in developing countries has been increasing every year (Worldometer, 2014). Older adults are internationally known as “older people” or “the older adult”. This definition is appropriate for this research project, as the focus is on people defined as people of older ages—above 65 years of age. The terms late adulthood or older adults will be used to clarify the targeted users in this research project. Globally, United Nations (2013) data shows the number of people aged 60 years and above has reached about 841 million people. The projection is for this to be nearly 2 billion people by 2050.

In Australia, older adults hold approximately 40 percent of the net wealth, with an average household net worth of over $1 million. This demographic is one of the fastest growing in Australia, with over 4.7 million older adults now enjoy a new age of unprecedented economic prosperity and freedom (Campaign Brief, 2013). In Indonesia, the UN has predicted that the percentage of Indonesian people who are over 60 years old will extend to 25 percent in the year 2050, or nearly 74 million older adults (Nasir, 2015).

Whitenton (2013) suggests that older people might carry out some everyday tasks using different mechanism. Discussing how older users might adapt to carrying out tasks online, Whitenton writes, “The total cognitive load, or amount of mental processing power needed to use your site, affects how easily users find content and complete tasks” (Whitenton, 2013).

According to Murman., 2015, developing mediations that can preserve cognitive function of older adults can also help to keep up personal satisfaction and independence well into old age.

With the assistance of new technologies such as smartphones, novel cognitive training stages, including computers and video games exercises, can be readily accessed to an older population. Better cognitive ergonomics might assist older adults to carry out and complete tasks, thus decreasing their cognitive loads.

1.3 Overall Approach

The overarching question of this research is: how can smartphone design can be improved to meet the needs of late-adulthood users?

In this research project, a UX/UI approach using semi-structured, small group/individual interviews is utilized to obtain information about the needs of older adult users in Indonesia and Australia, including feedback and recommendations to a new framework for smartphone user interface design. Norman and Nielsen (1998) state that UX (user experience) incorporates all aspects of the end-users' interaction with the company, services and products. Moreover, the comparison between two countries with very different linguistic, cultural and economic characteristics provides a way to ensure the research project takes into account variations due to location differences. A literature review has shown that this difference has not been accounted for in a single study previously. The researcher is well placed to conduct a study between these two locations, being an Indonesian native, and also having worked and studied in Australia.

There are many methods of observation and evaluation that could apply to this type of research project; however, many were not suitable for this specific research project involving older-adult smartphone users. For example, many research approaches apply a one-way method where design is driven from designers to smartphone users in designing and evaluating user interface design without further confirmation.

UX/UI research methods will also be utilized in this research project to discover the issues encountered by older adults using smartphone technology. These methods mean older adult users have the opportunity to contribute to the design development, as along with the researcher's thoughts towards their experience and user interface design improvement.

In this research project, older adult participants were involved in the design development to improve their experience in using smartphone devices. This is discussed in more detail below under research objective number 4. Moreover, cognitive ergonomics plays an important role in showing older adults users the effectiveness of smartphone utilization in their daily life.

Chen et al. (2011) mention that older adults tend to have positive attitudes towards technology, and they want to keep their technology updated. The need for better experiences when interacting with smartphones can be seen in Zhang et al. (2007), who state that designers should follow the principles of ergonomics – such as easy operation, utilization of less memory load, and efficiency – to create the user interface design. An improved method of developing user interface design on a smartphone for older adult users may result in creating a good "bridge" between smartphone designers and users.

This kind of improvement will start with a "before" stage of the user's current needs, and conclude with an "after" stage, where older adult users' needs and expectations are fulfilled in the improved design. To establish the "before" and "after" stages, a cognitive ergonomics evaluation is carried out to support the human–computer interaction process that makes work performance more effective (Long and Whitefield, 1989). In chapter 7, the investigation into cognitive ergonomics frameworks has been broken down into sub-points to identify a broader spectrum of older adults' needs so they can experience their smartphone device in a more effective way.

1.4 Objectives

The aim of this thesis is to investigate the design development process of smartphone technology for older adult users in Australia and Indonesia using the UX/UI research method. This approach will be achieved through the following objectives:

- To investigate how older adult users in Indonesia and Australia perceive and use smartphones in their daily lives
- To assess if there are any differences between Indonesian and Australian older adult users due to cultural/location differences

- To engage one Indonesian and one Australian user group using the UX/UI research process to see how the usability of smart phones could be improved to help older adult users better use the technology in their lives
- To produce a design, or design framework, for a possible new smartphone (software or hardware) that would fulfil needs of older adults, and consider how they might differ if cultural or location differences do apply

1.5 Significance

This research is needed to improve the success of smartphone user interface design development, specifically for older adult users both in Indonesia and Australia.

The key original contribution of this research is to test older-adult behaviour and activities in navigating around smartphone interface design. The cognitive ergonomics frameworks will be evaluated using the UX/UI research methodology to construct a new framework for older adults' smartphone user interface design.

This could also eventually produce more useful and productive smartphone interface design for older adult users, with benefits in bridging the gaps between older adult users and technology, as well as overcoming communication and interaction barriers – which could in turn increase wellbeing.

1.6 Smartphone Technology

Chen et al. (2011) stated that people no longer have to carry multiple technological devices where each device offers only a handful of limited functions to accomplish certain tasks. The advancement of technology will lead to simplicity of technology utilization. As computer markets become more global, the computer–human interaction community must think about user interfaces in more comprehensive terms, including cultural understanding (Russo and Boor, 1993). In addition, people have the opportunity to use smartphones as a means to carry out any tasks that computers can do for them. This research suggests that the Indonesian community is likely to want to give the impression that they own the latest technology,

whereas the Australian community is more focused on the functions of their smartphone device. The idea that a smartphone device today is an important tool or technology that can eliminate the digital divide (Nagel, 2001) informs the significance of this research project. Three key trends have been identified that are set to have a particularly big impact on the sector in the geographic region under focus: youth culture, urbanization and the rise of the smartphone (Ericsson, 2014). These trends show that a wide range of factors is influencing the growth and development of Information and Communication Technology (ICT) in South East Asia and Oceania.

Data also shows that 82 percent of older people have used a search engine to find information online (Fox, 2004). Examples of sectors that may obtain advantages from mobile (smart) phone use include health (Klasnja and Pratt, 2012; Patrick et al, 2008), business (Chang et al, 2009; Chen et al, 2011), finance (Suoranta and Mattila, 2004) and languages (Cavus and Ibrahim, 2008). The use of smartphone devices has covered multi-dimensional sectors of people's lives. It is argued that the main functions of a smartphone is to make phonecalls, whereas most people benefit more from the broader smartphone technology beyond just communication.

Based on Ipsos OTX MediaCT (2012), the global market penetration of smartphone users in Australia has risen to 52 percent of the population, and 58 percent of those users access the internet every day. Harun (2011) found that the market penetration for smartphone users aged 65+ has increased from 12 percent in Quarter 3, 2010, to 18 percent in 2011. People may change their mobile phones regularly to suit their individual situation and personality (Isomursu et al., 2011; Işıklar and Büyüközkan, 2007). Some research indicated that the intelligence, memory, and attention of older adults may degenerate as their age increases (Light and Spirduso, 1990). Therefore, these user groups need a smartphone that suits them as their needs change. Approximately half of older adults aged 65 to 74 are considered cell phone subscribers, while approximately 33% over the age of 75 are willing to pay for smartphone service (Pak and McLaughlin, 2011).

The Indonesian market revealed that in 2014 around 38.3 million people (32.6%) in Indonesia used a smartphone. It is predicted that in four years' time from 2014, that number will rise to

103 million people (45.4%) owning smartphones (Statista, 2014). Moreover, recent findings by Ericsson also support United Nations research that has shown that 50–69 percent of smartphone users in Indonesia are using the internet, with more than 70 percent using social networking and SMS, 30–49 percent using email and instant messaging, and just under 30 percent watching video clips (Ericsson, 2014).

1.6.1 Technology Convergence in Smartphones

Technology Convergence is defined in simple terms as a process by which telecommunications, information technology and the media sectors, which originally operated largely independently of one another, are now growing together (Papadakis, n.d.; Blackman, 1998). There are concentrations of convergence in the ICT industry that have been driven by three factors. First is industry convergence; second is merger and acquisition; and the third factor is the change happening around devices, services and technology in ICT that affect everyone (Curran, 2013).

As a matter of fact, the Indonesian market has a higher number of smartphone brands compared to the Australian market due to the Indonesian market's broader spread than the Australian one.

There are some contributions to the literature on the importance of improving current user interface design to enhance older adults' interaction with smartphone devices, but the existing literature does not specify research that includes two different cultural backgrounds.

1.7 Cognitive Ergonomics

Cognitive ergonomics contributes to human–computer interaction by supporting the interaction between humans and computers, which makes computers effective in performing work (Long and Whitefield, 1989). An understanding has been established of the advantages and disadvantages of human–computer interaction techniques as well as the characteristics of the older adult population (Caprani et al, 2012). Cognitive skills assessments have been carried out on older adult users via computer-assisted assessment (Tsai et al., 2009) and other prevailing instruments (Anstey et al., 2005).

There have been various evaluations carried out to observe the relation between humans and technology; for example, the current utilization of a mouse or other pointing tool (Murata & Iwase, 2005). Other studies have also revealed that external input devices can influence how people react towards computers (Umemuro, 2004).

While most theorists agree that cognitive ergonomics is of valuable consideration for older adults users, a reader might be sceptical as to the implementation of human–computer interaction (HCI) on smartphone devices that have developed rapidly in recent years. It is arguable that the understanding of applying a more ideal cognitive ergonomics to enhance Indonesian and Australian older adults' interaction with a smartphone device is far from complete. While progress has been made, this subject deserves further research. Pak and McLaughlin (2011) stated that the significance of recognizing cognitive processes when designing displays is made apparent when the display appears relatively uncluttered, high contrast, and easy to see – but nevertheless is difficult to understand.

Of the ten usability heuristics for user interface design (Nielsen, 1990), the usability guidelines can be divided into three points that deepen the cognitive ergonomics values:

1. Visibility of system status
2. User control and freedom
3. Helping users recognize, diagnose, and recover from errors.

As Shedroff (2001) advises, the three main components in which experience design can be valuable to users are: attraction, which can consist of cognitive, visual, auditory, or any signal to the human senses to initiate the experience; engagement, which determines the experience itself and is both cognitively important and relevant to keeping on going with the user experience; and lastly conclusion, which could provide some kind of resolution through meaning, story, context or activity to make an enjoyable experience.

1.8 Defining the Terms and Concepts

The key terms relevant to this research project are: Older Adult Users; Smartphones; User Interface Design; Communication; User-Centred Design; Cognitive Ergonomics and User Experience Design. These terms, along with other relevant terms and concepts, are defined below.

Older Adult Users are discussed in section 1.2.

The Smartphone is defined as a form of digital device that involves information and communication technology. The smartphone uses various functions to enable a range of tasks Meanwhile, smartphone development has grown rapidly in the market, giving users options regarding choosing and utilizing a device. Data from Statista.com in 2017 on smartphone users showed that in October 2013, Indonensian smartphone users utilized various operating systems (OS). These were: Android (39.1%); Series40 (24.4%); Symbian (11.9%); Blackberry (4.94%); Samsung (2.7%); iOS (2.31%); Sony Ericson (1.9%); and others (12.6%). Australian users were split between 57.9% on Android and 36% on iOS, with 6.1% using other operating systems.

User Interface (UI) Design

Coleman et al. (2007) state that older adults often experience problems when interacting with technologies such as smartphones. Therefore, designers should place special care on how user interfaces (UIs) are considered and designed, so that they are usable, inclusive and accessible to specific users – the older adults. Meanwhile, guidelines and recommendations regarding designing UIs for older adults have been developed to enhance the capability of older adults in accessing and using the user interface technology (Fisk, et.al. 2009; Pak and McLaughlin, 2011).

Cognitive Ergonomics is the use of supporting, implementable specifications of knowledge required by humans to interact with computers in order to perform work effectively. This type of analytics typically aims to include levels of sensory, motor and cognitive ability (Long and Whitefield, 1989). Cognitive ergonomics analysis examines the requirements for a framework that covers the concepts, methods, interaction development practice and support for the interaction development practice. Cognitive ergonomics also supports the development of the

specifications of knowledge required by interactions, which may take different forms. Goh (2009) stated that some models of aging consider that brain structure and function adapt and reorganize as a result of cognitive and physical training. Individual training is expected to be carried out in order to benefit from the cognitive ergonomics in smartphone utilization, including how to use the phone properly. Meanwhile, some authors have looked at the allocation of cognitive training benefits to daily activities, with the fundamental goal in mind of cognitive training to improve people's lives and maintain humans' independence – especially elderly people.

User-Centred Design and User Experience are a design process that focuses on user experience and requirements, and also aims specifically to develop an understanding of user needs. The process includes a combination of investigation, creation, and design confirmation (Shedroff, 2001).

User Experience (UX)

Nielsen (1994) stated that the only way to a high-quality user experience is to start user testing early in the design process and to keep testing every step of the way. Roto, 2006 stated that the term user experience (UX) could involve a sensation, perception, emotion, mental state, or an attitude. Meanwhile, in Roto, et al., 2011, p. 04 mentioned that the words 'user experience' refer to an encounter with a system that has a starting phase and an end. It also refers to an overall designation of how people have experienced a phase of encountering a system. Moreover, it is also stated "the term user experience is frequently used as an alternative for usability, user interface, interaction experience, interaction design, customer experience, website appeal, emotion, 'wow effect', general experience, or as a main term that integrates all or many of these conceptions" (Roto, et al., 2011, p.04).

Usability is the qualities or characteristics that evaluate how easy user interfaces are to operate. In addition, the word "usability" also refers to methods to improve "ease-of-use" during the design process (Nielsen, 2012). Usability evaluation is also used to determine and improve usability, which measures the effectiveness and efficiency of the site and overall user

satisfaction (ISO 9241 – 11, 1998). Shade (2015) stated pilot testing could be undertaken early on, which allows for any issues to be identified before the official user testing is undertaken. According to Nielsen (2012), usability is outlined by five quality components: learnability, efficiency, memorability, errors and satisfaction. Veal (2019) stated that during usability testing, participants will be required to complete specific tasks while the researchers or observers watch, listen and record notes in order to obtain qualitative data, identify the usability issues and determine participants' overall satisfaction.

Prototyping and testing have become an efficient approach to successful user interface design (Li et al., 2008). This method is employed to build an interface design before it is implemented in order to create an application and/or operating system. Meanwhile, it is important to create and use low-fidelity prototypes at the early stages of the design process as it is an inexpensive way to establish any problems in the design and to test the success of implemented solutions (Murphy, 2018). This allows a quick test of different layouts and trial of what works and what does not on a product (Cao, 2018).

Data in July 2017 revealed that Android users in Indonesia have increased to up to 84% of the overall smartphone users (Statista, 2017). Meanwhile, the iOS users are up to 3% in the same period. The combined use of all other operating systems has reduced to 13%, including Nokia, Series 40, Blackberry, Symbian, Windows and Others. Therefore, there is a significant growth of Android users within the past four years in Indonesia's smartphone market share.

Meanwhile, in Australia, by 2017, the number of smartphone users using the Android Operating Systems had gone up to 64.7%, but iOS users decreased by 1% to 35% of the total users. Meanwhile, the other OS users have increased by 4.2 % from 6.1% to 10.3%.

1.9 Method

This research project utilizes the UX/UI research method using semi-structured interviews with small groups/individuals. It uses a qualitative process where the primary research methods used to conduct fieldwork are user interviews and observation (Mortensen, 2019).

According to Mortensen (2019), semi-structured interviews allow the researcher to make specific inquiries while allowing the questions to remain open to further investigate the participants' perspective. It is frequently combined with other research methods. In this research project, usability evaluations of smartphone devices were also conducted to obtain further knowledge and points of view on products and interactions. To some degree, the semi-structured interviews were organized around a set of topics that the researcher had already prepared and wanted to cover; at the same time, they were still open enough to allow leads to emerge in the discussion and change the structure of the interview and topics discussed.

To support this research project, theoretical investigation using secondary sources – such as heuristic and usability assessment, including semiotic analysis – were used to generate the questionnaires and evaluate changes in specific examples. Through problem identification on the participants' current and older smartphone devices, semi-structured interviews and pre-set questions were be asked to lead the participants in identifying the problems on the phone.

At this stage, the participants produce ideas and define their approximate needs and preferences pertaining to the artifacts of the current user interface design on their smartphone devices.

Allan et al. (1996) stated that there will be some difficulties in extracting information from elderly people due to the gap of ways of thinking and message delivery. Therefore, interview sessions using UX/UI methods are a combination of brainstorming, scenario building and semi-structured interviews with written and oral parts, sketches or gestures. The interview is processed in order to view a direct connection and attachment in decision-making process where the individuals share in social choices that resolve the quality and direction of their lives likes. (Sanoff, 2001).

Each group was then facilitated by the researcher, who has the ability to conduct the survey using two different languages – Bahasa and English – to reflect the observed countries.

Group one contained 10 people from Indonesia, split into 5 working and 5 retired people. The second group contained 10 people from Australia, split into the same user segments. However,

it was challenging to obtain people in the same age bracket who are retired in Indonesia due to the unavailability of welfare provided by the government, which is unlike the Australian culture. Older adults in Indonesia are more likely to fund themselves in retirement, while the Australian government provides welfare for this generation in the form of both superannuation and a pension (Australian Taxation Office, 2017). This research project considers older adult smartphone users who do two activities simultaneously: working and volunteering (Luoh & Herzog, 2002).

In the first part of the interview session, the designer and the elderly participants were involved closely for the first time. The sessions were organized with groups of elderly people who are working and retired. Participants selected a phone that they owned previously to identify the 10 most popular models as a representation of brands, and models matching the earliest devices a participant possessed both in Indonesia and Australia (See Figure 1.1).

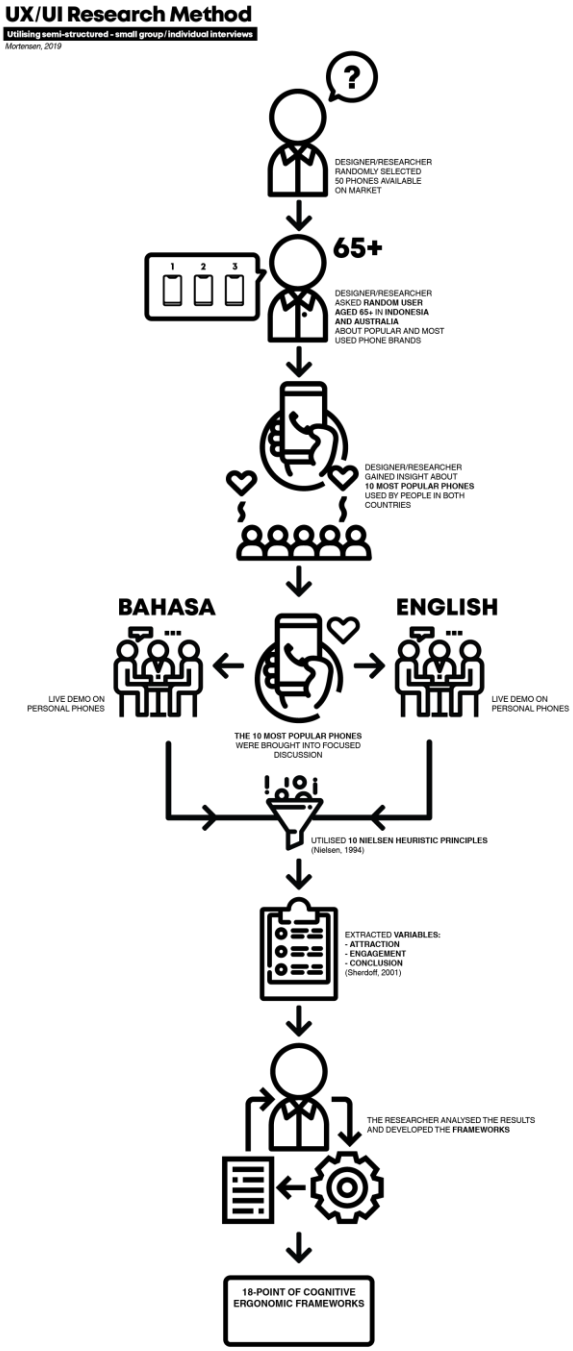


Figure 1.1 UX/UI Research methods to facilitate two groups of older adult participants using small group/individual interviews (Diagram by Yahya, 2019)

The data collected during this identification phase aimed to discover how the older adult users provided information on the old phone that were the first phones they owned. This included how the data might be used to present questions, proposals, requirements and ideas to identify

the problems or issues with their current phone using the same aspects and points as their older models. This method is used to identify how well the elderly people know the basic functions of the older phone models, which will lead them to have the same or similar competency to operate their smartphone device.

The interview sessions were videoed to recall all details, such as hand gestures when operating the phone device, and to retrieve clips of similar studies. In regards to ethical issues, participants who did not want to be filmed during the sessions except for their hand movements. The data was compared and contrasted to obtain information on whether the user experience and interface design development process are having an impact on smartphone operation among these older adult users.

1.9.1 Interview using scenario-based testing

These interviews provided the preliminary research data in regard to the reasons why older adult users experience difficulties in navigating smartphones. The interviews included people from the two countries (Australia and Indonesia) to identify similarities or differences in results due to cultural background, which may impact on the user experience and interface design development process. Users carried out a number of tasks or scenarios to determine the functions of their smartphone as well as how to resolve any issues that came up during phone use.

Overall, this research project is original, as the data collected by using the research methods is obtained from primary sources and analyzed by the researcher. Semi-structured interviews were conducted using open-ended questions to find and draw conclusions from the issues experienced in using a smartphone device (Lee, 2007).

1.10 Findings

This research project shows that the UX/UI method makes a major contribution to discovering the differences between smartphone users in Indonesia and Australia who are aged 65 and above in terms of interacting with a smartphone device. It also discovered that a UI/UX

research method can be used to ascertain individual preferences from individual respondents during interview and observation sessions.

This research project also finds that the UI/UX methods combined with a design prototyping method can be implemented to facilitate design development creation. This approach contributes in two ways: it provides a new method of problem discovery for complicated users and proposes new thoughts towards a design or design element.

The findings from both countries showed that, despite cultural difference, some older adult users have similar intentions towards smartphone technology and some have exactly the same preferences. Regardless of whether they are Indonesian or Austlraian, the most important factor in getting the attention of the older adults on the smartphone was was the visibility of the smartphone elements so users could interact with the device.

This research project will design a useful framework to focus on smartphone user interface design quality, embedding cognitive ergonomics application for older adult users. The findings and new design frameworks are reviewed in Chapters 6 and 7 respectively.

1.11 Scope and Limitations of this Research

This research project specifically focuses on older adults from two countries with different cultural backgrounds (Indonesia and Australia) who are actively working or volunteering. Moreover, this research project only involved small numbers of participants (ten participants in each country) due to limited time and resources. Veal (2019) argued that although a UX testing method does not stipulate large samples of feedback from the users, the qualitative feedback can be far more accurate and insightful. Veal also stated that “testing five users is typically enough to identify a design’s most important usability problems” (Veal, 2019).

Moreover, the use of Indonesia and Australia as the comparison resources allows evaluation to be made to represent the developed world and a “developing” nation.

This research project focuses on ICT convergence that is happening around devices, services and technology, and on the effect of this on smartphone users, especially older adults. This

project was limited to certain demographics, including: age range; middle- and upper-income financial/economic status; daily activities using technology; a balance between Asian and Western culture; how the cognitive ergonomics method will be implemented to support the user interface design development, including the cognitive ergonomics factor; and how UX/UI design method will be applied to allow user involvement in the design development process. This study also focused on the use of smartphone technology as a means of communication to support older adults' daily activities. These limitations allowed the researcher to focus on a more specific and comparable group of users.

Not included in the scope of this research is the presentation and delivery of the actual smartphone hardware or application design. However, the deliverables of this research project present other researchers in the same field with directions or methods for investigations using a UX/UI method to create a deisgn framework, specifically working in the Indonesian and Australian cultural contexts.

This research is unlikely to provide one exact smartphone interface design intended for all older adult users as smartphone apps are so broad and have a lot of variants. Therefore, a particular application or hardware will not be created on top of the existing design to fulfil global older adult users' expectations of of a usable user interface design, or even those of users from a certain demographic or cultural background. However, theorical frameworks will be presented on how to create functional and useful smartphone user interface design aimed at late adult users in two different cultural backgrounds.

1.12 Intended Audience

The first audience for the outcomes of this research project is user interface or information architecture designers/researchers who specialize in user experience design, user interface design, interaction design, usability evaluation, and user experience design. The second audience is software designers who need to synchronize the knowledge of design and software engineering. This research project is intended to be particularly useful for an audience of smartphone software developers, user interface designers, and researchers.

1.13 Document Outline

This thesis has eight chapters:

Chapter 1: Introduction

Chapter 2: Literature Review

Chapter 3: Methodology

Chapter 4: Results Overview of the Participants in Indonesia

Chapter 5: Results Overview of the Participants in Australia

Chapter 6: Discussion and Resolution of the Case Studies Using UX/UI Design as a Method to Observe and Identify How Older Adult Users Think and What They Need

Chapter 7: Framework and New Design and Development

Chapter 8: Conclusion

Chapter One describes the key terms relevant to this research project and outlines the significance of the study.

Chapter Two is the Literature Review, which presents an understanding of smartphones and the concept of cognitive ergonomics and user interface / user experience design, related to older adult users. It also presents important ideas from the field of Information and Telecommunication Technology, User Interface Design, User Experience (UX) and User Interaction (UI) Design.

In **Chapter Three**, the methods of this research project are described. This process begins by obtaining information on the issues older adult users are facing with smartphone technology. In this case, the UX/UI design method is utilized to gather all the necessary information. The strength of the method is addressed, including any ethical considerations. After the first interviews and observations were carried out, a sample of an improved design was created to show a draft design prototype to the research participants and ascertain whether their expectations of the new UI Design had been fulfilled or not. Then, the researcher created the final mock up to complete the design.

Chapters Four and Five report the findings of the older adult participants from Indonesia and Australia respectively. Participants describe the pros and cons of their utilization of a smartphone user interface to fulfil their needs. During the interview and observation, users carried out tasks on the smartphone and address their strengths and weaknesses in using that technology. Some examples of how older adults usually interact with their smartphone device are described in detail. Moreover, a broad range of user activities is addressed to show the users' capabilities during their interaction with the smartphone device.

Chapter Six addresses the analysis of the prior findings in Chapters Four and Five. This chapter observes, compares and contrasts the experiences of older adult participants from Indonesia and Australia to discover the similarities and differences between those two cultures in terms of smartphone utilization by older adults. A mechanism of user experience is created to identify the possibility of cognitive ergonomics frameworks for development in Chapter Seven.

In **Chapter Seven**, cognitive ergonomics frameworks for older adult smartphone users are created and illustrated based on Shedroff (2001) and expanded to more detailed categories to respond to the users' comments and suggestions outlined in the findings in Chapters Four and Five. This data has useful future application in creating cognitive ergonomics frameworks to develop better user experience of smartphone device interaction.

Chapter Eight presents a summary of the research project and also identifies future research possibilities envisaged through this study.

1.14 Summary of Chapter One

This introductory chapter has defined the older adults demographic and their needs. It has also outlined the development of a new smartphone user interface design that aligns with cognitive ergonomics frameworks. This lays the groundwork for the development of this research project.

This research has developed towards two points. Firstly, it identifies the needs of older adult users from a user interface design based on their existing device and environment. Secondly,

drawing on various theories, it uses this information to create a new smartphone user interface design framework that UI designers can apply in future development.

CHAPTER 02:

Literature Review

2.1 Introduction

This chapter outlines the various professional and scholarly areas that relate to this research project. These areas include demographics, cognitive studies, technology convergence, and the User Experience (UX) and User Interface (UI) design methods used in this research project.

The research project examines the older adult demographic within two countries, Australia and Indonesia, and the understanding of older adults' needs in relation to technology – particularly cognitive ergonomics, which makes technology effective in individuals' lives (Long and Whitefield, 1989).

2.2 Late Adulthood or Older Adults

This research project focuses on smartphone users aged 65 and over based in either Indonesia or Australia. To a degree this group overlaps with the "Baby Boomer" generation, defined as the generation born in western societies between 1946 and 1965, making them currently in the 50–68 age range (Australian Government, 2007). In Asia, the term "Baby Boomer" is not used; instead, people aged 65 and above are described as 'older adults'. Consequently, the term "Baby Boomer" will not be used in this research project as it does not represent the scope of representative users. Instead this project defines its target subject group as older adults. In recent years, the population of this demographic in developing countries has been increasing every year (Worldometer, 2014). Older adults tend to have positive attitudes towards technology (Chen et al., 2011), using it primarily at home or for domestic matters (Mitzner et al., 2010).

In the US, approximately 73 per cent of males in this age group were still employed or looking for work, while less than 20 per cent of older adults “enjoyed” some form of retirement (Gilleard and Higgs, 2005). In most countries, people encounter almost no or only a minor reduction in their standard of living when moving from later working life to retirement. Data in 2002 from the United Nations shows that the total number of the world’s population is nearing 7.3 billion people, with the number of people aged 60 years or older totalling approximately 629 million.

The number of people aged 60 years and older went up by about 212 million people in 11 years: United Nations (2013) data revealed that the number of ageing people 60 years and above was about 841 million people in 2013. The projection is for this to be nearly 2 billion people by 2050. Data has shown that older people hold 80% of a country’s wealth on average in general (Cowie, 2011). Moreover, Gilleard and Higgs (2002) acknowledge that inequalities of gender and ethnicity continue to dominate the possibilities and opportunities of “later life”. The social identities of “older people” are less easily defined and the social fields they occupy less easily determined.

According to Pak and Mclaughlin (2011), older adults are often classified as “enthusiastic” participants in relation to design and enjoy the opportunity to provide their perspectives and influence design decisions during the design process. Stubbs (2012) stated that 72% of older adults have a positive attitude towards technology. This information is important because older adults are using or are prepared to use technology. Older adult users may have been aware of the technology for a long time but may never have used it without a specific purpose or need. The resulting issue of older adults lacking technological literacy has become more pressing for this generation as technology has increasingly become a necessity (Leung, 2011). This research project is projected to support this group number of users to extend their abilities and skills to use smartphone technology in a better way.

The findings from Klumb and Baltes showed that 90% of older adults are involved in more than one productive activity (such as social activities in an organization) and that wellbeing outcomes – such as making their life better and happier – may vary in response to a

combination of activities. Other data from AgeUK (2015) revealed that over 5 million people said that TV or pets are their main form of company and they spent most of the time in a day watching television.

2.2.1 Older Adults in Australia

As stated in the Sydney Morning Herald (2016) " …in 1968, when Australia's population was half what it is today, just over 1 million people were aged over 65 – about 8 percent of the total. However, the number of over 65s has now swelled to 3.57 million, or 15 per cent of the population. Meanwhile, the proportion of the population aged 14 years and under has fallen from 29 percent to 19 percent in that period".

According to Tan et al. (2010), culture has been regarded as crucial to understanding "successful ageing". Therefore, cultural differentiation can be used to measure the success of the ageing population in a country. This research project aims to explore links the ageing population in two different countries (with two different cultural backgrounds) and smartphone technology.

Data shows that in Australia, older adults hold approximately 40% of the nation's wealth and are worth an average of over $1 million per family. They are one of the fastest-growing demographics in Australia, with over 4.7 million people. Czaja et al. (2013), mention that the 80+ population is expected to increase by 233% worldwide between 2008 and 2040. According to Industry Superfunds (2014), the age of retirement in Australia is 65 years old. Therefore, it is predicted that nearly half of the Australian older adults will lead the nation in terms of level of wealth. This is considered a big market for the telecommunications industry to extend their business among older adult users. It is expected that the market penetration of smartphone technology can be boosted towards the older Australian adults.

2..2.2 Older Adults in Indonesia

The term Late Adulthood or older adults is used to describe older people in Indonesia aged 65 and above. This term is also used to determine the representative users presented in this research project.

Previous research has shown that there is generational change in Asian society, where older people have given their roles to the younger generation as part of the regeneration process. The total population in Indonesia is approximately 260 million people (indoesia-investment.com, 2016) and the population of older adults aged above 65 years old has reached 5.3%, or approximately 13.8 million older adults (World Bank, 2017).

Figure 2.1 (below) shows the proportion of older adults against the total populations in Indonesia and Australia.

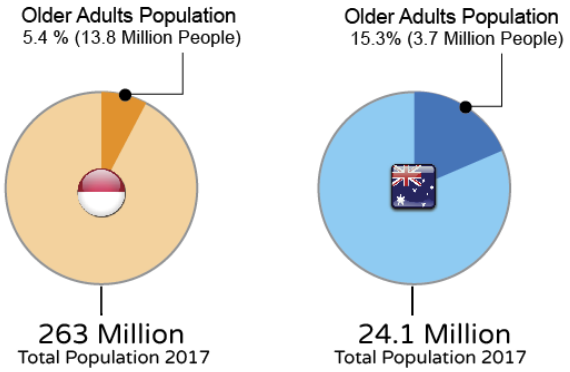


Figure 2.1 Data on the older adult population in Indonesia and Australia

(Data: United Nations, 2016; Diagram by Yahya, 2017)

2.3 Internet Use in Indonesia and Australia

2.3.1 Internet users in Indonesia

Data from Godjali (2010) shows that Indonesian households in 2020 are forecast to have a disposable annual income in the range of $5–$15K (65%) and $15–30K per year (22%). The data also shows that more people in Indonesia are likely to be in a period of sustained consumption of technology in 2020, which includes use of smartphone devices, tablet computers and other web-based services. This also means that more Indonesian people are likely to be active in

using technology such as the internet, either via social media or any sort of utilization to connect people through online media.

Moreover, according to Statista.com (2017), the number of Smartphone users in Indonesia in 2016 had reached nearly half of the population (40.4%), or approximately 104 million users, and was expected to grow by 3.2% or approximately 6–7 million new users in the following year. This number is significant in identifying the growth of internet users in Indonesia considering the spread of population growth in some rural areas.

Figures from the Minister of Information and Communication Technology of Indonesia revealed that within the period 2006–2010, the growth of internet users in Indonesia reached 31.9% annually. According to the data, Indonesia has been categorized as having the 4th-fastest-growing cellular phone ownership rate worldwide. Meanwhile, in Indonesia, there are 53 million people are using the internet, with the share of world internet use being 1.6%. (Internet Live Stats, 2011).

2.3.2 Internet users in Australia

In 2016 there were approximately 16.62 million internet users in Australia, and in 2017 there were around 17.9 million users (Statista.com, 2019).It is predicted that in 2022 the number of Australian people using the internet will reach approximately 19.27 million.

From 2015 to 2018, 88% of the Australian population was categorized as active internet users. (Statista.com, 2019). Therefore, the number of internet users in Australia is predicted to be increasing by around one million users per year, with more than three quarter of them considered as active internet users.

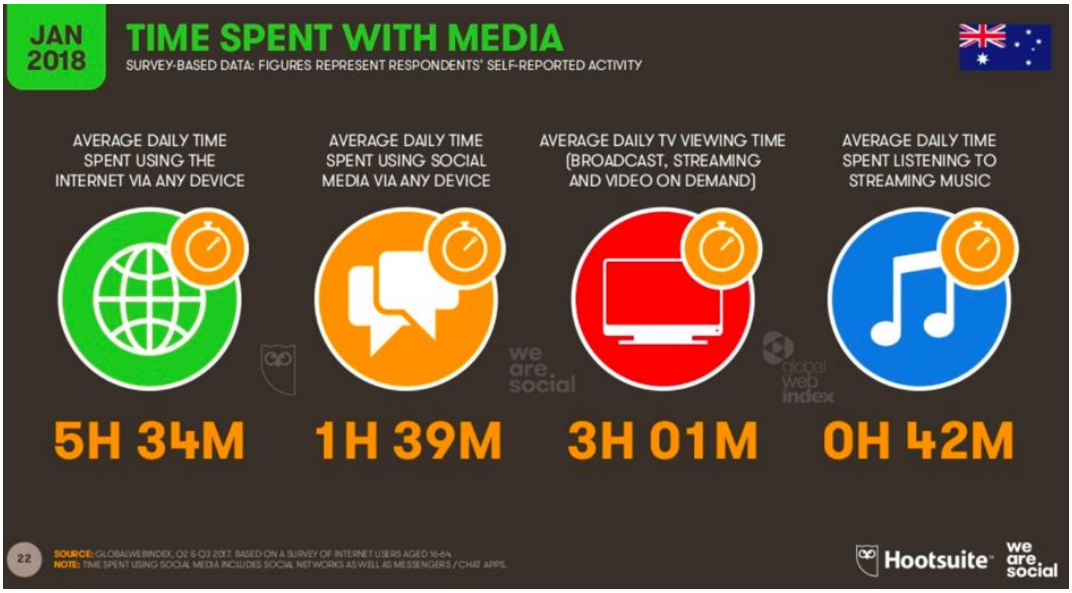


Figure 2.2 Time spent with media for Australian users

Statista.com (2018) released data showing that Australian people spent most of the time online browsing on the internet while they are least likely to use their time to stream music. The second-most time spent with media is video broadcast, streaming and video on demand, such as Stan, YouTube and Netflix. The third-most time spent on the internet is using social media, with an average of one hour and thirty-nine minutes per day.

Data shows that social media as a communication tool is not Australian people's number-one priority in spending the time using the internet and media. On the other hand, Internet connection speed should be properly maintained to enable Australian users to access the internet properly as it is the most significant time spent on smartphones for most Australian users. In 2016, there were approximately 16.62 million people in Australia using internet from the total of 24 million total population in Australia, while the share of world's internet user is 0.6%

2.3 Cognitive Decline and Technology Use in Older adults

A study by Herman et al. (2012) stated that there is a cognitive decline accompanying ageing and this situation can create problems when older people have to interact with technology. Sharma et al. (2012) stated that the current smartphone interfaces on the market have

"haunting" effects from usage by two age groups: i.e., the elderly and kids. The results of the survey they conducted indicated that adults between the ages of 40 and 60 years old found it difficult to use touchscreen-based smartphones. Meanwhile, the authors suggested without further evaluation that smartphone interfaces for the elderly should contain minimalist functionality. This will aim to assist older adult users to perform better on touchscreen-based technology (i.e., smartphones). The elderly may be dealing with changed capacity, reduced ability and increased needs but they require the same accommodations and compensations in late life that they found in earlier years (Demirbilek and Demirkan, 2004).

This study also views the smartphone as a tool to improve the quality of life of older adult users. A research study by Hood (2011) stated that smartphones are bridging the digital divide. Smartphone devices or technologies are expected to "close" the gap between the era of digitalization and traditionals. Meanwhile, three-quarters (75%) of older adults suggest Australians do not see themselves as old, but instead 30% describe this new "Lifestyle" phase between adulthood and retirement as one of the most active of their lives (Stubbs, 2013). This new "lifestyle" phase of the older Australians is expected to expand their lifestyle and encourage them to explore more in the utilization of technology.

2.4 Smartphone Technology

Smartphones are one form of digital device that involve information and communication technology. There are some features on the smartphone device that may be combined to enable its functions for various users. Chen et al. (2011) stated that people no longer have to carry multiple technology devices, where each device offers only a handful of limited functions to accomplish certain tasks. A smartphone device can be utilized to operate various functions, not only browsing on the internet, but also other related tasks such as creating a reminder, communication using text messages, taking and sending photographs to other users via smartphone applications and directing users to a particular destination using maps.

Technology may have a tendency to affect user experience according to age and generally, physical, sensory and cognitive factors will decline along with the person's age (Craig and

Salthouse, 2000; Hitchcock et al., 2001; McCarley et al., 2004). As elderly people get older, they may facing issues with their physical abilities that will affect their proficiency to operate and interact with a smartphone device. Those factors are considered the most essential aspect of how an elderly person interacts with their smartphone.

Weinschenk (2011) states that half of the brain's resources are dedicated to seeing and interpreting what we see. What our eyes physically perceive is only one part of the story while the images coming into our brains are changed and interpreted. Therefore, the smartphone user interface design has the greatest initial impact on the user whether or not users understand the content. What users generally perceive is what they "translate" from the messages coming into their brain through their eyes. There is a difference in how young people and elderly people interpret information, where young people usually obtain interpretation ability through their previous experiences. In contrast, elderly people may not have any prior knowledge of operating a smartphone devices. Therefore, there is a need to give early training in how to understand the functions of technology such as smartphones.

Based on Ipsos OTX MediaCT (2012), the global market penetration of smartphone users in Australia has risen to 52% of the population, and 58% access the internet every day. Harun (2011) found that the market penetration for smartphone users aged 65+ in Australia increased from 12% in Quarter 3, 2010, to 18% in 2011. This shows a significant increase of smartphone users from year to year, with more than half of those elderly users utilizing the internet daily.

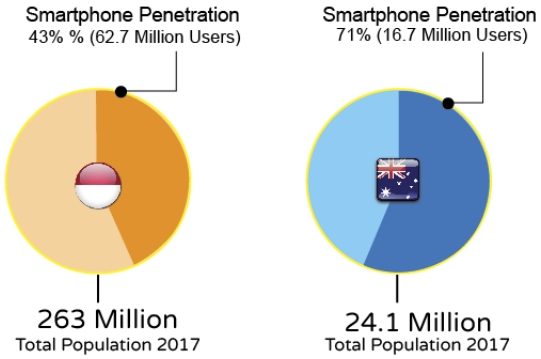


Figure 2.3 Smartphone penetration in Indonesia and Australia compared to the total population of each country (Data: UNITED NATIONS, 2016; Diagram by Yahya, 2017)

2.4.1 Top Smartphone Brands

There are several smartphone brands sold in Indonesia and Australia. Below is a diagram of smartphone market share in Indonesia (figure 2.4) and Australia (figure 2.5) for comparison.

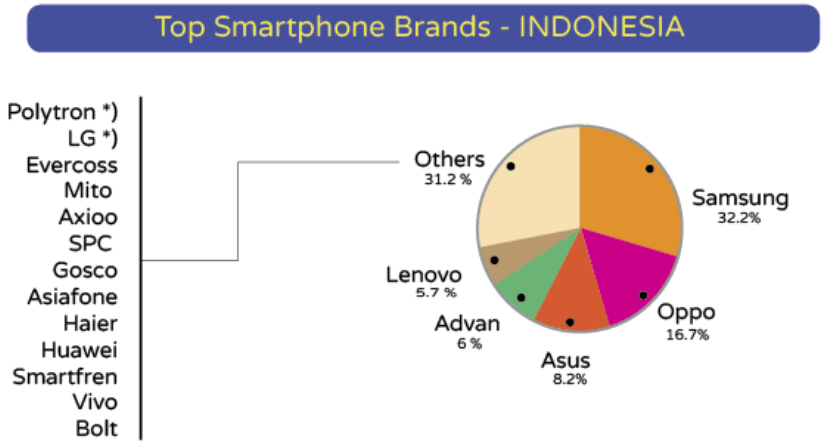


Figure 2.4 Top smartphone brands in the Indonesian marketplace

(International Data Corporation, in Global Business Guide Indonesia, 2016; Diagram by Yahya, 2017)

Based on data from Global Business Guide Indonesia (2017), Samsung and Oppo smartphones are the two most-buy brands in Indonesia with 32.2% and 16.7% market share respectively. Meanwhile, 31.2% of market penetration in Indonesia is dominated by thirteen other low-cost brands such as Evercoss, Mito and Axioo with their 4G capability. Those brands are not offered in any other market apart from the local Indonesian market.

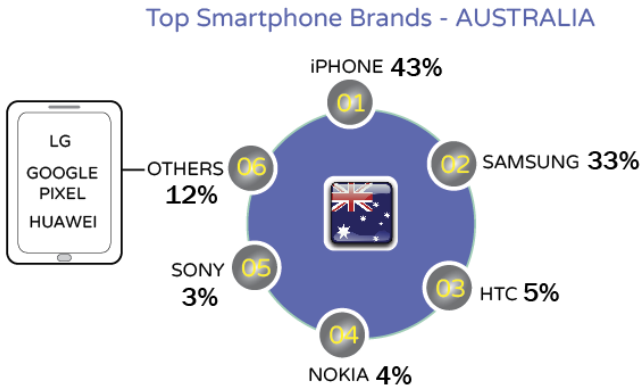


Figure 2.5 Top smartphone brands in the Australian marketplace

(Source: DELOITTE – Mobile Consumer Survey 2016, The Australian Cut, www.deloitte.com.au accessed: 28 August 2017. Diagram: Yahya, 2017)

Meanwhile, the above diagram mentions that the Australian market is dominated by iPhone and Samsung in positions one and two. . However, there are only a few more brands occupying the Australian market due to the limitations on imported smartphone models into Australia.

Therefore, this research project will particularly look at these models, which are the most used by elderly people. These two models will be used as a reference to question the participants, while other models may also come up during the interview sessions and in the in-depth research development.

Nagel (2001) mentions that smartphones are one of the communication technologies that can eliminate the digital divide. There are many sectors that would like to obtain the advantages of mobile (smart) phones, including the presence of smartphone technology in the older adult community, which will "close" the communication gap among them in their community or with others. Some real examples are the utilization of smartphone technology into four significant categories related to health (Klasnja and Pratt, 2012; Patrick et al., 2008), business (Chang et al., 2009; Chen et al., 2011), finance (Suoranta and Mattila, 2004) and languages (Cavus and Ibrahim, 2008). Data also shows that more than three quarters (approximately 82%) of older people have used a search engine to find information online (Fox, 2004). That means there are no limitations on obtaining information which was considered difficult to find.

2.5 Technology Convergence

Technology Convergence is defined in simple terms as a process by which the telecommunications, information technology and media sectors, which originally operated largely independent of one another, are now growing together (Papadakis, n.d.; Blackman, 1998). There are some mutual benefits in how these sectors can be developed by having elements that work together, such as wifi technology and the collaboration in electronic components manufacture.

There are some concentrations of convergence in the ICT (Information and Communication Technology) industry that have been driven by three factors. Firstly industry convergence;

secondly mergers and acquisition; and third, the changes happening around devices, services and technology in ICT that affect everyone (Curran, 2013). Curran (2013) also stated that convergence entails even more facets, including science convergence, demand convergence and convergence in regulation. This research project will be focusing on the ICT convergence that is happening around smartphone devices, services and technology, and the effect of this convergence on smartphone users, particularly on older adult users.

Ericsson (2014), shows that a wide range of factors are influencing the growth and development of Information and Communication Technology (ICT) in South East Asia and Oceania. Ericsson mentions hree key trends that are set to have a particularly big impact on the sector in the region: youth culture, urbanization and the rise of smartphone technology.

2.6 Smartphones for Older Adult Users

In this research project, a number of statements from the participants reinforce the evidence emerging from the literature that mobvile phones have potential for use as memory aids for older adults. The properties of the smartphone that would be supportive and promising for older adult's users as a memory aid are (Alex et al., 2007):

- Portability
- Easy backups
- Flexibility and revision
- Proactive alarms
- Consolidated information
- Interactivity
- Easy of carrying
- Creating a routine of use
- Communication support

Based on this data, the research project will focus on these items to narrow down the research scope and streamline the investigation process in identifying and observing the older users' behavior in using smartphone devices.

Alex et al. (2007) also mentioned that there are some features that might work against the smartphone as a memory aid, including:

- Poor conceptual design
- Complexity
- Hardware designed inappropriately for seniors
- Radiation and health concerns
- Fear of changing routines
- Fear of breaking the phone
- Impersonal nature of technology

The items mentioned above will be integrated into questions to the users to validate and verify existing issues of smartphone interface design. Some other issues may arise during the interview session to enrich the researcher with the data and identification processes. Alex et al. (2007) also stated that when an older adult customer purchases a phone, it does not mean that he or she will use it extensively. For example, an older adult person might leave the phone in the car for use in emergencies, while a younger person might carry the phone with them all the time. There is no specific need for the older adult users to have the device in hand all the time, while the younger generation tends to hold them most of the time as they are mobile.

Moreover, the general consensus is that mobile gadgets and technology, such as smartphone devices for older adults, should be developed with large buttons, loud volume, and large screen layout (Kurniawan and Zaphiris, 2005; Leonard et al., 2005; Massimi et al., 2007; Omori et al., 2002). Goebel (2007) and Hawthorn (2000) also found that crowded menu selections can be challenging for older adults operating mobile phones and suggests employing mechanical metaphors for the menu design to enhance the ease-of-use and heuristics in particular for the older adult user.

2.6.1 UX Research Approaches to smartphone use in older adults

A range of observation and feedback gathering methods are utilized for User Experience (UX) research, which is defined as procedures for understanding user behaviors, needs, goals, motivation and attitudes (Ghazaryan, 2015). Ghazaryan (2015) also states that the above UX research method allows the researcher to understand how people live their lives in order to respond to the users' needs with informed design elucidation. According to Veal (2019), this method is advantageous to validate assumptions and design solutions. Meanwhile, Veal also argues that designers could not exclude the users in the design process, either in observation of application, website or product design.

Turner (2019) states that UX research comes at the earliest stage in the UX design process as the experiences and assumptions of a researcher could not be used as the basis of a new design. Moreover, Veal (2019) states that the real significance of UX research is in UX research playing a role to reduce uncertainty in terms of what users want and need in the era of digital product development.

Veal (2019) also mentions that there are three benefits from the product, business and user points of view as a result of UX research. The **product** can be developed based on the end-user data, including how and when the users would like to operate the product, and main issues can be solved. This also benefits the researcher in deciding between multiple design solutions. From the **business** point of view, UX research could speed up the business processes, including eliminating redesign cost and increasing user satisfaction. From the point of view of **users** or customers, UX research can create unbiased feedback to build a bridge between users and the company or manufacturer. In other words, UX research provides strong awareness that allows companies to cultivate customers and integrate their needs throughout the conceptual, iterative design, and launch stages of a product.

Some problems that occur among older adult users in their interactions with technology can be solved by better design and standardization, but some complex issues are tied up more in social and emotional concerns during the interaction between technology and social life. It is critical

that technology designers understand pre-existing practices and seek to explore the gap between users and technology to enhance the interaction, rather than replace the technology itself (Alex et al., 2007). This will also be useful in achieving a better user interface design and assisting the user to properly and fully utilise the smartphone functions.

Incorporating older adults in usability evaluation can involve some aspects of the user-centred design process, such as:

- Creating clear task instructions for the test
- Being aware of differing levels of technology experience
- Recognizing that the testing session will take longer
- Understanding that more practice could be necessary compared to usability evaluations conducted with younger adults

Siek (2008) examined a number of studies that looked at the ability of older adults to use a computer input device. Older adults were observed as to how familiar they have been with a kind of computing technology in their daily life and activities. Moreover, O'Connell (2007) highlights that the most important usability factors when designing for the older adult relate to reliability and a predictable approach to functionality. The characteristics of a technology for older adult users are more complex than for younger users, due to some factors that need to be considered in the making of the technology specifically for older adult users.

Maguire and Osman (2003) found that there were differences in how older adult users approach mobile phone technologies compared with younger users. Older people mainly considered mobile phones as a support in emergency situations, whereas younger people mostly utilize the phone to interact collectively. Ishihara et al. (2013) mention that if the older adult can fully utilize the smartphone's functions, they will be more likely to find work opportunities, easily communicate with their friends and families, and be involved in social communities. Results from recent studies on the adoption of mobile phones by older people stipulate that there is still possibility for development and improvement to enhance the level of usability (Conci et al., 2009; Pedlow et al., 2010).

From the user experience (UX) methods, an overall approach has emerged on how technology is being observed and researched. Moreover, this UX/UI approach has primarily looked at how older adult people use technology in their daily life. This method is now the dominant industrial design approach not only for digital design, but also for broader design problem-solving where design methods should be embraced to improve the experience in problem-solving through digital solutions (Punchoojit and Hongwarittorrn, 2017).

According to Farrel (2017), there are four activities in a UX/UI approach in the product or service design cycles: discovery, exploration, testing and listening. Farrel also mentions that at every phase in the design process, different UX methods can keep product-development endeavors on the right track, in agreement with true user needs.

According to Tseng (2017) and the Victorian Government (2019) UX embraces all factors of the end-user's interaction with the company, its services, and its products. Moreover, UX is all about usability and functionality, where usability is the ability to do something intuitively and easily, and functionality refers to the quality of a function (of a product or a service) working as intended. This research project carried out these two distinct research foci, where older adult participants conducted usability and functionality evaluations in the interview session.

While the technology community has identified the major barriers to general use, and mobile phone ads have targeted older adults, it is important to step back from the hardware to look more broadly at the phenomena occurring (Mihaildis et al., 2008). This research project will analyze and identify issues with smartphone UI for older adult users

Salah et al. (2005) state that mobile phone development requires not so much innovation in new sets of applications, but rather a reassessment of the existing applications' smartphone user interface is required so that the older adult can be included. This especially applies to older adult users where specific requirements need to be considered to enhance the utilization of the applications where such innovation might otherwise not be considered necessary.

2.7 User Interface Design, Prototyping, and Icons and Metaphors

2.7.1 User Interface Design

Jones and Marsden (2006) made a specific recommendation for mobile applications designed for users in the developing world that the use of the visual language of cellular handsets should be at the initial point of interaction with the device. The mobile app design would be affected by the local communities and users. For example, if people in the community tend to use instant messenger services to communicate, then the messaging applications would likely be installed in the device to support their needs in communicating with others.

The user interface, from a software point of view, is indeed a simple program, but from the user's point of view – or from the point of view of cognitive ergonomics – the user interface involves everything that allows users to perform their tasks properly and correctly (de Haan, 2000). As a general example, where spoken languages consist of words and rules of grammar, the design languages consist of design elements and guidelines to enhance their combination. Product designers use design languages to design expressive objects (Rheinfrank et al., 1996).

2.7.2 Prototyping

Paper prototyping is a method that involves creating hand-drawings of user interfaces in order to enable them to be rapidly designed, simulated and tested (Mifsud, 2012). One main purpose of carrying out paper prototype design is to communicate ideas between designers, developers, users and other stakeholders. A second purpose of prototyping is to observe human interaction with user interfaces before the design and development phases are carried out. It is an inexpensive and simple way to identify any usability issues in the early stages of planning before investing too much time and money in the development of digital prototypes.

Prototyping and testing have become an efficient means for successful user interface design (Li et al., 2008). This method is employed to build the interface design before it is implemented to build an application and/or operating system. According to Li et al. (2008), informal prototyping tools are aimed at the early stages of a design process, and are used to create early stage prototypes for testing key design ideas rather than building fully fledged final systems.

Nodder (2017) states that design examples and tests are utilized to design a new item that would not only be user friendly but also convey the changes more in an efficient way to the users.

This type of testing is commonly done before generating and designing a product as it is important to view the interactions participants carry out while the facilitator observes the task being carried out until completion (Thornton 2019).

In this research project, paper prototypes were tested with the same participants from the previous evaluation sessions; therefore, they had prior knowledge of the tasks they were being asked to complete. According to Babich (2018), people feel more comfortable criticizing sketches rather than polished designs.

A follow-up questionnaire was administered following the completion of each task to gain insight into the underlying thought processes that the older adult participants went through. Conducting this questionnaire assists in evaluating why participants completed actions in certain ways and allows participants to explain their actions and express their impressions of the phone interface design.

2.7.3 Icons and Metaphors

Hawthorn (2000) found that the interface of a smartphone should help elderly users find items easily and should keep their attention focused on them, and a simple layout based on clarity and consistency should be applied. According to Sahrrma et al. (2012), smartphone interface design for elderly people should contain minimalist functionality and icons and text should be bold as the increasing age may be accompanied by low vision. On the other hand, Kobayashi et al. (2011) argued that, based on their findings, larger buttons, icons and links (minimum of 8 milimeters) should be used, and the gap between intended and actual touch location should be addressed. Hoober and Berkman (2011) defined an icon as a visual representation that provides users with access to a final destination or a function in a “cursorily” (cursor-like) way.

Older people may have no prior understanding of icons as they were not born in an era where iconic symbols were first introduced in a digital medium. The understanding of digital icons is

based on prior knowledge or experience with other digital forms, such as television remote control, digital clocks, car dashboards and so on. Other research has found that users may have difficulties in visualizing icons (Goebel, 2007). Moreover, some interface design utilizes terminologies and expressions that are difficult to understand (Tang and Kao, 2005).

Furthermore, according to Ware, 2004, an "icon" can be defined as a graphical representation of a concept that symbolizes a computer action to help users distinguish the action to be taken. Exponents of icons argue that iconic interfaces enjoy many benefits (Shank and Darke, 1999). Shneiderman and Plaisant (2009) and Wiedenbeck (1999) also stated that one of the advantages of an icon being present is that icons are more universally recognized and understandable than text. This relates to the evaluation of two different cultural backgrounds where language can become one of the barriers.

Icon understanding may lead to decisions where users have to think in a different way using their own language syntax. In terms of design decisions, a more concise definition of aesthetic judgment may place emphasis on the sensory – primarily the visual – nature of input to judgment (Bloch et al., 2003; Lindgaard & Whitfield, 2004; Hekkert, 2006). In other words, aesthetics may be narrowed down to the physical attractiveness or beauty of the product. An investigation of associative words individuals generate for 'aesthetics' generated 'beautiful' and 'ugly' as the most prototypical for aesthetics judgment (Jacobsen et al., 2004). A study by Jacobsen et al. in 2004 also stated that only 5% of Jacobsen's respondents associated aesthetics with 'attractive', 'enjoyable', or 'cool'.

The use of icons and text from different cultures may have an impact on the use of digital technology. User interface design was created on the basis of testing from the country of origin where users may have been introduced to some sets of different text on the same icon. That may impact on user perception where text is linked to the user language and is limted by their understanding of that particular language.

Studies have found that the visual and cognitive features of icons have a significant effect on an icon's effectiveness (Rogers, 1984; Blattner et al., 1989; Familiant & Detweiler, 1993).

Moreover, Marcus (2003) emphasized that good icon design should be simple and clear, representing both the referent and its attributes, association, and state (Giffins, 1986). Graphic images help users memorize and recognize functions available within an application (Siau, 2005). The use of metaphor could be significant as elderly users might not be familiar with the metaphor of the icon on a smartphone interface.

'Metaphors' are often counted as culturally sensitive (Gibbs, 2008), and when metaphors in the form of icons are used to represent an action, culture plays a significant role in how these metaphors or icons are identified and interpreted, and in how they influence and convey messages to an audience without using words (Blashki & Pedro, 2014). Evaluation should be able to determine how icons and metaphors are perceived in different societies or communities. Moreover, according to Van der Veer (2011), culture-centered design is a significant parameter to be considered when creating a design for worldwide users where different cultures may have different perceptions and interpretations of metaphors.

Lakoff (1993) states that metaphor can be utilized as a universal mode of understanding as project patterns from one experience can structure another different field of experience. The use of metaphor could also be observed or identified in how users operate some kinds of machinery, such as washing machines. According to Lakoff and Johnson (1980), metaphor is a rhetoric figure whose essence is in understanding and experiencing one kind of thing in terms of another.

2.8 Cognitive Ergonomics and Analysis

2.8.1 Cognitive Ergonomics

Cognitive ergonomics contributes to human–computer interaction by supporting the interaction between humans and computers that makes computers operate more effectively in performing work (Long and Whitefield, 1989). The analysis of this research project determined the requirements for a framework that covers the concepts, methods, and support for the interaction development practice. Meanwhile, cognitive ergonomics supports the development of the specifications of the knowledge required by interactions, which may take different forms.

Ergonomics is concerned with “designing for human use” and it aims to maximize safety, efficiency and comfort by matching the requirements of the operator’s machine (or indeed any aspects of the user’s workplace which the user has to utilize) to the user’s capabilities (Oborne, 1982). A frequently used technique is to present the cognitive ergonomics approach in the form of guidelines for design (Gardner & Christie, 1987; Smith and Mosier, 1986). Salzman (1992) emphasized that ergonomics considerations focus on the physical capabilities and limitations of humans and the designs required to obtain optimal machine performance, rather than any intrinsic value to the operator.

As mentioned in Long and Whitefield (1989), the use of cognitive ergonomics can be understood as supporting the development of implementable specifications of knowledge required by humans to interact with computers to perform work effectively. This method typically aims to include more users with lower levels of sensory, motor and cognitive ability (Goodman-Deane et al., 2014).

Vierra (2014) described some tips to reduce injury and pain when using a smartphone and tablet for a safer workplace, such as:

- Using a smartphone that has a full keyboard
- Learning and using shortcuts to copy and paste text
- Using a straight and relaxed wrist
- Using the fingertips on the pad to type and avoid using fingernails

2.8.2 Cognitive Analysis

Cognitive analysis is largely carried out by providing a formal analysis of the requirements of the job, improved by knowledge-gaining methods like interviewing domain experts, probing domain practitioners and observation in context (Potter et al., 2000; Roth & Paterson, 2005). In addition, Hollnagel et al. (2006) stated that in the evaluation phase, only a partial and limited set of tasks and situations can be examined, which is by definition a subset of all tasks and situations.

2.8.2.1 Cognitive task analysis

Cognitive Task Analysis (CTA) is a type of task analysis that is aimed at understanding tasks that involve cognitive activity from users, such as problem solving, use of memory, getting user attention, decision-making, and human judgment (User Experience Professionals' Association, 2012). Furthermore, the designed tasks should reflect the users' goals and the researcher's questions (Nodder, 2015; Snyder, 2003; and Farrell, 2017).

According to Westrenen (2010) and Wei & Salvendi (2004), cognitive task analysis is a logical, hierarchical breakdown of the mental tasks used to analyze how users interact with a system and what the user interface should prevent. Moran (1981) and Van der Veer (1990) defined cognitive ergonomics as being about user interfaces providing human beings with the means to use cognitive tools and devices.

The term "user interface" in cognitive ergonomics is and should be extended beyond the most common definition as a piece of software. In addition, user interfaces should be defined as all the knowledge users need to perform tasks with a computer system. In addition to that, task analysis is a technique of dividing a continuous task into its step-by-step actions to identify the specific physical and cognitive demands. Task analysis is also useful to illustrate the complexity of apparently simple tasks.

2.9 Usability, Heuristics, and Interaction

The key challenge in designing new technologies is how best to take advantage of users' skills in creating the most effective and productive working environment. This is called the "usability challenge". For the most part, state Adler and Winograd (1992), a product semantics approach has failed to clarify the following:

- The overall experiences that result from the combination of objects, interpretation by users and interaction between people and objects or products
- The feelings or attitudes that people create about those experiences
- How designers can use an understanding of these experiences and feelings in their work

Usability evaluation is a method of determining and improving a site's usability, which consists of the effectiveness and efficiency of the site and overall user satisfaction (ISO 9241 – 11, 1998). Usability evaluation helps the researcher identify problems before the coded stages to identify the issues at the earliest time and minimize the cost of fixing them (Veal, 2019; Nielsen, 1994). Meanwhile, the main goal of usability is to improve user satisfaction and performance. Design for usability must include design for coping with novelty, design for improvisation, and design for adaptation. Heuristic Evaluation is a method of quickly assessing a user interface or system for its adherence to a set of predefined usability principles (Pak & McLaughlin, 2011). Veal (2019) stated that the usability data result is qualitative, where the feedback is more accurate and insightful.

The technology itself, even when it is not intended as a communications product, serves as a communication medium between user and user, and between designer and user. The usability assurance efforts will be most effective when they begin early in the design process, rather than taking the form of a supplement at the tail end.

While psychological issues will always be relevant, the development of new technologies has forced us to focus on the cognitive and social aspects of users when designing equipment. When the effectiveness of a system depends on how well it supports higher-order cognitive activities and social interaction, there is often no substitute for direct user participation in the design process.

In UX research, heuristic evaluation is used as a process to assess then make a quick decision upon an application, website or a product. The process consists of rules of thumb based on evaluation of the user friendliness of interactive products (Nielsen, 1994). Danino (2001) stated that a heuristic evaluation involves researchers and participants assessing a user interface to examine any potential usability issues against Nielsen's 10 usability principles (Nielsen, 1994), specifically for smartphone user interface design. Moreover, heuristic evaluation is a method of quickly assessing a user interface or system for its adherence to a set of predefined usability principles (Pak & McLaughlin, 2011).

These principles are considered as one means of useful and quick identification of any existing usability issues in the early stage of smartphone user interface design aimed at elderly users. In this research, a quick preliminary assessment was used to discover usability issues to improve the redesign process, which was appropriate given the limited time and resources of the project.

The heuristics for the smartphone application can also be divided into six sections (Hawthorn, 2000), as follows:

- **Cognitive**, where many deep menus will cause complication and confusion for older adult users.
- **Visuals** should be clear for older adults with eyesight problems and this can be rectified by adding haptic (vibration) or sound alarms to indicate feedback. Moreover, colour and graphics can be considered as one of the solutions (Strengers, 2012)
- **Input,** which should react accordingly using a small delay and feedback when a button is pressed (Fisk et. al., 2009). According to Chisnell (2004) and Kurniawan (2005), the mechanism of double clicking and scrolling up and down should also be avoided for older adult users.
- **Audio**: approximately half of the male population aged above 65 and approximately a third of women in that population suffer from hearing problems (Fisk et.al., 2009). Therefore, volume adjustment and suitable audio frequency should be considered when designing technology that involves an audio component.
- **Haptic** should also be considered to indicate alarms/warnings and signals. This can be useful to help older adult users identify incoming notifications.
- **Generational** or **cultural** elements may present non-comprehensive information to older users, such as the instruction “press any key to continue” which could attract various interpretations (Fisk et.al, 2004).

2.10 User Profiles and Persona

According to Pak and McLaughlin (2011), user profiles are useful for recruiting participants for usability testing sessions or interviews. it is important that research participants are reflective of the target audience to ensure validity of the test results (Mortensen 2019; Nodder 2015). Moreover, a persona is used to visualize the intended user of a system – a fictional individual based on an existing user profile.

Averbukh et al. (2008) stated that the 'sign' nature of the human–computer interface and visualization reveals the sign systems and determining interaction, visualization and communications. A user or an observer (interpreter) in a determined context perceives the idea caused by representation that is the interpreting idea (an 'interpretant'). These are all relations described of 'semiotics': the procedure of translating signs or sign process.

2.11 User-Centred Design and User Experience

In examining the findings of participants in Indonesia and Australia, this research applies Shedroff's (2001) theory of User-Centred Design and User Experience. Shedroff (2001) stated that there are three factors leading to user-centred design and user experience: attraction, engagement, and conclusion (see figure 2.6). These variables are decoded into "where is it?", "how to do it" and finally "Yes, I can do it" and were utilized as the foundation of the investigation. Khaslavsky and Shedroff (1999) also state that the first step of the involvement is enticement, where there is an initial contact to catch the attention of a potential user or customer.

The second step is to ensure that a product is interesting, exciting, or beautiful. However, it is more directly connecting with the goals and emotions of the users or audiences. Then, the last point is that the product has to be completed based on its function and feel.

According to Krippendorff (2004) "Human-centeredness takes seriously the premise that human understanding and behavior goes hand-in-glove; that what artefacts are is inseparably linked to how their users perceive them, can imagine interfacing with them, use them and talk

about their stake in them with others." The terms "user-centred design" or "human-centred design" are often used to describe the process of designing something from the human perspective.

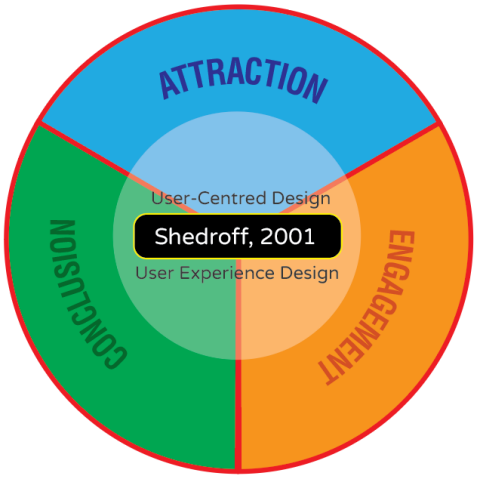


Figure 2.6 User-Centred and User Experience Theory by Shedroff (2001)

In this research project, these three significant factors are extracted to create the elements of new frameworks of a smartphone user interface design and to map out the older adult user's experience.

2.12 Cross-Cultural Learning

Fundamental learning behaviour that leads to cross-cultural understanding as described by Yamazaki and Kayes (2004) includes the following:

- Regular interaction with others
- Expressing interest for the host culture
- Spending time studying the host culture
- Understanding ambiguous situations, and
- Making sense of new experiences.

According to de Barros (2014), choice of words needs to be taken into account to identify the differences in educational and cultural backgrounds to suit older adults' semantic field. Meanwhile, Van der Veer (2011) mentions that culture-centred design is also considered as a

highly important parameter when designing for a global audience, and project-based collaboration can be carried out in facilitating cross-cultural learning (Shadiev et al., 2015). Design for older adults in this context would distinguish the differences and similarities in Indonesian and Australian cultural values. Assumptions on the elderly having a usable mental model should be avoided when referring to a specific cultural background, especially when dealing with particular terminologies that are considered technical to older adult users, such as a "drag-and-drop" mechanism or "scroll down" to display the next page of a continuous page on their smartphone (Carmien and Garzo, 2014).

Rowan (2012) discovered that cross-cultural users may have a difficult time using a product or adapting what the product can do to meet their unique needs due to ignorance of the socio-cultural context surrounding the artifact, as technology use is often decontextualized. Jenkins (2013) also discovered that a culture has low barriers to artistic expression and public engagement, and strong support for creating and sharing where information mentorship – in which the experienced pass on their knowledge to beginners – is evident.

2.13 Summary of Chapter 2

With the rapid development of the smartphone industry and technologies that affect the way in which users – specifically older adult users – are experiencing issues in interaction as well as their needs, it is evident that research on the implementation of cognitive ergonomics frameworks has changed.

The very fast rate of smartphone technology evolution in the global market makes any study rapidly expandable, and this is the challenge for the researcher: to develop this research project into the marketplace and apply the proposed frameworks design into the two cultural backgrounds. This research project aims to expand on previous studies of smartphone interaction development in the literature by undertaking an in-depth study to create new cognitive ergonomics frameworks taking into account their relation to two different cultural backgrounds, Indonesia and Australia, focusing on older adult users' experiences.

CHAPTER 03:

Methods

3.1 Introduction

This chapter will describe the overall research approach in the area of User Experience and User Interface (UX/UI) Design to investigate the fundamental questions of this thesis: an investigation of a cognitive ergonomics framework of smartphone user interface design for older adult users. A critical viewpoint of this survey is the researcher's involvement and experience in the UX/UI assessment/investigation using small groups or individual interviews. The UX/UI approach has shown how it is now the dominant industrial design approach not only for digital design, but also for broader design problem-solving. Norman and Nielsen (1998) state that the term 'user experience' (UX) incorporates all aspects of the end-user's interaction with an organization, services or products. The overall research approach used by this research is in the area of User Experience and User Interface Design (UX/UI) where the researcher has expertise in usability analysis and meets the requirements to be considered as a digital designer.

There are age-related challenges to performing usability testing with older adults, such as caregiver interference, obstacles to using think-aloud, or location selection (Dickinson, Arnott, & Prior, 2007; Sonderegger, Schmutz, & Sauer, 2016). The UX/UI design method allows the interviews to be carried out in participants' workplace, homes, or wherever they find it comfortable and on-device demonstration can be carried out using the UX/UI approaches. Using places where older adults usually meet as venues (such as senior centers or local churches) may help with the practicalities of recruitment and encourage attendance but may also affect the participants' behaviour (Ataie & Morgan, 2015).

The way UX/UI design methods were conducted in this research project was to experiment with a range of research techniques to develop a new smartphone interface design for older adults.

Some possible scenarios were created to allow user interaction in a consistent workflow, but also in the range of smartphone use for daily activities.

To summarize, the argument for the significance of this research project has four key points:

- Improved user interface (UI) designs are needed on smartphones used by older adults
- Better UI Design can enhance the interaction of older adults with their smartphones
- The use of the UX/UI method is significant to improve design research across a range of aspects.
- The study is between two different cultural backgrounds to compare and contrast the needs of older adults in using smartphone technology.

Chapter 8 details the contribution of this research project for future smartphone user interface or application design development involving older-adult populations in any country. This research project is shown to make a beneficial contribution to the theory and practice of user interface design development.

The researcher has experience in digital technology capabilities, such as designing user experience and analyzing usability issues of digital technology platforms. The researcher's academic education, personal knowledge and experiences with digital design and technology inform this research project as a concrete foundation. Empirical and structured methods are also applied to the methodological design analysis. These methods are significant as they extending the similarities and differences between the Australian and Indonesian smartphone users, which is one of the objectives of the research project. Further, the cultural and experiential gap can be big when developing new technology for older people (Malik & Edwards, 2008).

In this chapter, primary research methods used to conduct the necessary fieldwork are outlined. These take the form of user interview, case studies and monthly data gathering. The UX/UI approach, which involves designer and users in the smartphone user interface design development, was used to support the process.

3.1.1 The overall objectives of this research project

- To examine in detail the experience of the older adults who participated in the research project, examining how they utilize smartphones in their daily life
- To employ UX/UI methods to study detailed characteristics of each participant and to assess if there are any differences between Indonesian and Australian older adults users due to cultural/location differences
- To distinguish what factors can influence older adults' preferences in utilizing a smartphone in their daily activities, and also supplement the data from online resources, subject matter experts; and other users
- To implement the theory of Cognitive Ergonomics (Long and Whitefield, 1989), Usability (Nielsen & Molich, 1990), and User-Centered Experience (Shedroff, 2001) to develop a benchmark on how a new smartphone user interface for older adults users should be developed and improved
- To produce a design, or at least design criteria, for a possible new smartphone (software or hardware) that would fulfill the needs of this participant group
- To draw conclusions on the likely future changes or development methods that should be applied to enhance smartphone user interface design for older adults users from each cultural background

3.2 Practical Application of the Research Methods

A hands-on view of older adults' activities was undertaken in this research project. From a practical point of view, two simultaneous activities – working and retired/volunteering – were considered and analyzed based on how these groups of people interact with smartphone devices (Hao, 2008; Luoh & Herzog, 2002).

To obtain the existing experience of older adults' users, the following steps were undertaken:

Document experiences through scenario-based assessment

As outlined in Chapter 4, this research method was implemented by using the real experiences, daily activities and life stories of older adult users. The participants were encouraged to use their personal smartphone/s to demonstrate a more ideal design for older adults to interact with their phones. The scenarios were analyzed and amended to match the condition and situation of the existing aspects of users' activities or works, procedures, usage workflow, and pros and cons of the technology being used. A pilot test was undertaken that allowed for any issues to be identified before the official user testing was undertaken (Shade, 2015).

The interview session also provided some examples of commonly used smartphones based on global classification. An early stage of participant selection involved approximately 50 people randomly selected based on the assigned demography to identify phone preferences, issues with the smartphones, whether the device could be fully operated or not, and the most common issues in using smartphone devices, to identify the initial problem. Time taken to do this was approximately three to five minutes. A testing board with the most predominant or popular models sold in Indonesia and Australia was presented to the participants as an aid to help them recognize previous phone models they'd owned. Then, the elderly people's selection was narrowed down to 10 phone models to represent the most preferred models based on market views, as well as the most common phones used by the users in earlier days.

Moreover, the researcher administered the participants to carry out live demonstrations, including answering questions and filling out a questionnaire. The other approach to this model is asking direct questions of the participants where questions are read out as a script. The interview script is sometimes amended to allow better user understanding to the context of the enquiries (Interaction-Design.org, 2019). Audio and video recording upon user agreement was also used to keep the information for further review processes.

Smartphone user interface design and development

Chapter 4 outlines the prototypes of the interface design development used to implement the iterative design of the user interface. The design development was presented to participants

during the interview session and paper mockups showing the main features of the application were used to discuss changes to the existing design (Buxton, 2007).

Chapter 4 also details the initial analysis carried out using smartphones based on the researcher and users' created scenarios. Sketched paper prototypes were then created to confirm the users' suggestions or recommendation on the new user interface design, and participants completed pre and post questionnaires to identify the participants' profiles and their thoughts on the usability testing event respectively. In the final stage of the user interface development, a high-fidelity or colored version of the user interface design was developed to verify the final product.

Data analysis and evaluation

The similarities and differences among twenty people from two countries (ten from Australia and ten from Indonesia) were identified after they went through a filterisation event for who will proceed into the next, more detailed steps of the question-and-answer sessions. These selected participants were then requested to analyse results and give suggestions and recommendations before the development of the new smartphone user interface design was further created. This aimed to clarify a discussion on the design process for older adult users. Cultural comparison can involve some points such as the daily activities of working and retired people, including the ability to understand the interface design scheme to operate the functions (i.e., accessing a wrench tool to activate settings).

3.3 The usability evaluation

A usability test is a primary qualitative method used to evaluate an interactive's usability by observing representative end users using the interactive to perform realistic tasks (Nielsen and Landauer, 1993; Ruben, 2008). Veal (2019) stated that usability testing helps identify issues on an application, website or product before it is launched and coded, and to identify usability problems, collect qualitative data and identify users' overall satisfaction level.

Meanwhile, Adler and Winograd (1992) described usability as a dialogue of change where the key foundation of a system's usability is the limit to which it supports the capability of people

who work with it to comprehend it, to learn and to make changes (Adler and Winograd 1992). This statement suggests that the technology itself, even when it is not intended as a communication product, serves as a communication medium between user and user, and between user and designer. A usability assessment would also be the most suitable basis for redesigning a smartphone user interface design, especially for older adult users. As a qualitative data processes, the UX testing method presents qualitative feedback that can be accurate and insightful.

The ten usability questions to guide the usability evaluation were obtained from Nielsen and Molich's Usability Inspection Methods (Nielsen and Molich, 1990). The categories of usability questions evaluate the following aspects in the design process:

Visibility of system status

The system should keep users notified about what is happening through an appropriate, immediate response. For example, a button that is highlighted indicating as active stage to indicate distinctly what is being selected during navigation.

Match between system and the real world

The system should speak a language developed from the users' point of view, with words, phrases and concepts recognized by the user rather than system-oriented terms. It should adhere to real-world conventions, making data show up in a natural and logical order. For example, there are sensible indicators of battery status, signal strength, or sound profiles. The indicators clearly notify the user of the condition of the smartphone using symbols that easily convey the meaning, such as a symbol of a battery representing the condition of smartphone's battery or power level.

User control and freedom

Users often misidentify a system operation and may require a clearly marked "emergency exit" to exit the unwanted state without having to go through a prolonged dialogue. In other words, the control supports undo and redo. For example, the "OK" or "CANCEL" buttons give the freedom to users before carrying out an operation rather than forcing the system to override

the user's action. Users have the opportunity to freely leave the system through the "emergency exit".

Consistency and standards

Users should not have to question different words, conditions, or actions which would give similar or the same meaning on an operation. Following the platform conventions will give better direction and understanding. For example, is it possible to slide up and down or swipe left to right on each page or window? Consistency is necessary to avoid confusion as to whether different actions, words or situations could have the same meaning to the users.

Error prevention

Good error messages that are created and designed carefully can stop problems from happening in the first place. Errors can be avoided by either removing error-prone conditions or checking for them and showing a confirmation option to the users before they execute an action. For example, there is a friendly message to indicate that the phone number field should contain numerals only.

Recognition rather than recall

Making objects, actions, and options noticeable will minimize the user's memory load . The user should not have to memorize information from one part of the phone to another. Guidelines on how to use the system should be visible or easily retrievable when applicable. For example, a highlighted button would give the user better notification of access than greyed-out buttons. Users should not have to remember any information from one part of the dialogue to another.

Flexibility and efficiency of use

Accelerators that are unseen by the novice user may often accelerate the interaction for the expert user with the end goal that the system can provide for both experienced and inexperienced users. This needs to permit users to modify frequent actions. For example: the "<" and ">" signs are to indicate that the previous (<) and the next (>) are offered by the system to go to the previous or next screen.

Aesthetic and minimalist design

Dialogues should not contain information that is irrelevant or rarely needed, which will diminish the relative visibility. Decorative elements are likely to cause a distraction for users.

Help users recognize, diagnose, and recover from errors

Error messages should be expressed in plain language with no technical jargon, precisely indicate the problem, and constructively propose a solution or answer. For example, an error message gives a warning to users that deleting one of the files will cause system instability: "Uninstalling or removing system application will normally cause an error on other applications or systems".

Help and documentation

It may be necessary to make help and documentation available although the system will look better without them. Any such information should be easy to find, focused on the user's task, list the practical steps to be carried out, and not be too large. For example, a question asking whether additional or further assistance is necessary to be provided as an item for selection.

3.3.1. Practical implications

This research project is most obviously using a UX/UI method to gather the information from late-adult users from two different cultural backgrounds – Indonesia and Australia. The data will then map the user experiences on how older-adult users are interacting with their smartphone to enhance their daily life activities. Chapter 2 introduced three variables in the theory of user-centred design and user experience: Attraction, Engagement, and Conclusion (see Figure 3.1).

In this research project, the researcher builds and extracts the three variables from Shedroff's (2001) theory and utilizes them to analyze the mapping of experience of the older adults' interaction with smartphone devices. The user experience data is examined and expanded to the mapping of experiences built on Shedroff's (2001) techniques. The mapping model is explained in Figures 3.2, 3.3 and 3.4 below.

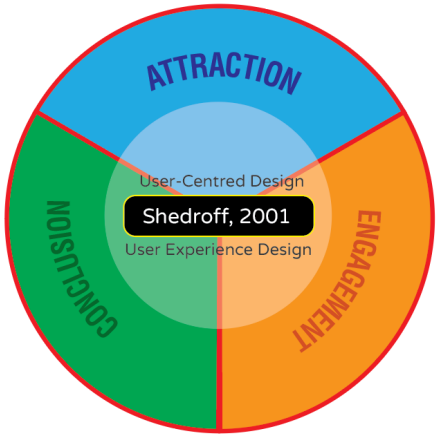


Figure 3.1 Shedroff (2001) User-Centred Design and User Experience Theory

1: Attraction

Shedroff (2001) stated that before conducting an activity on a product, an attraction is important to start the experience. In this research project, the users' attraction is obtained by understanding the icons or symbols of the smartphone user interface design. Findings reported that an older adult person is likely to be afraid of doing something wrong, especially in regards to technology, due to unfamiliarity with the objects or elements. Therefore, the meaning of icons or symbols should be communicated and recognizable early. Figure 3.2 shows the users' options for instant messenger and telephone.

The attraction is important to start the experience. In the research project, users will first be attracted to the elements of the smartphone user interface. The attraction will involve the users' senses, such as touch, vision and hearing.

Level of Experience	Object		Remarks
ATTRACTION			The user is required to be attracted to the desired apps (WhatsApp Instant Messenger). Therefore, the user should be able to distinguish between these two icons to point out the selected application.
	WhatsApp	**Phone**	

Figure 3.2 User options visibility on two options

2: Engagement

After the process of being attracted to the icons or symbols of the smartphone user interface design, the user can start engaging with the application. There are gestures older adult users will use frequently to interact with their smartphone. Users need to be informed of these prior to their interaction with the smartphone interface. In this research project, the level of user engagement is determined by the interactivity between user and smartphone, as shown in Figure 3.3.

Once users' senses have been "attracted" to the source of attraction (Shedroff, 2001, p. 4), they might start undertaking some possible actions to engage deeper with the attraction. The user's engagement should be adequately different from the surrounding condition of the experience to grasp the user's awareness in order to maintain the experience.

Level of Experience	Action	Remarks
ENGAGEMENT		Once the user has recognized the icon, a selection can proceed by tapping the selected icons to activate the the application.
	Click on the object	

Figure 3.3 User's engagement with an application (WhatsApp Messenger application)

3: Conclusion

Shedroff (2001) stated that the conclusion should deliver a kind of resolution where older adult users may or may not be aware of what appears on the screen as a result of their interaction process; for example, that a list of people on the screen appears as a result of the previous process (see Figure 3.4). The conclusion can come from multiple points of view; however, the conclusion should provide a kind of resolution, whether through meaning, story, context, or activities, to create a pleasant experience.

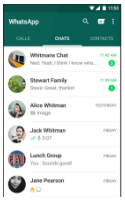
Level of Experience	Outcome	Remarks
CONCLUSION		This screen appears when the application has been selected as a result of user engagement in Figure 3.3.

Figure 3.4 The result of the application after selection (The screen of WhatsApp Messenger)

3.4 UX Research within Design Research

As the research project is aligned with the design field, practical interviews and observation will be undertaken in the field towards interaction design. This research project is categorized as practical-based – that is, tied to practice and driven by its needs. Moreover, the ideas in the design development are driven by the research literature where practical research concerns will be prioritized over scholarly ranking (Roth, 1999).

3.4.1 Practical implications of the research method

The existing requirements of smartphone user interface development aimed at older adultusers are based on preliminary questions, observation and some scholarly data. The method selection is based on various considerations and agreement between the researcher and participants. Schensul (1999) stated that participant observation in research can be beneficial to help the researcher become known to the cultural group, thereby facilitating the research process.

Overall, the research project will be original through using these research methods, as the data collected will be used as primary sources and analyzed by the researcher. A semi-structured interview method was conducted, using open-ended questions to find out and draw conclusions around the issues for older adult users in using smartphones (Lee, 2007). Meanwhile, Wilson (2013) stated that a semi-structured interview process would commonly use a guide or schedule that contains the following:

- Introduction of the interview topic and purpose
- A list of topics and questions to ask
- Suggested probes and prompts
- Conclusion of the interview

In addition, the locations selected for the interview sessions were intended to create a relaxed atmosphere and encourage an open dialogue (Thompson et al., 1989). In-depth interviewing was applied to obtain perspectives on the proposed topic from a variety of users across different cultural backgrounds to generate comparable data and balance some potential user bias.

3.5 The Steps Undertaken in the Research Project

There were three steps used in the research project methods as to how the older adult users were assessed before, during, and after the interview session completed.

Concept Initialization and resource exploration

This aims to familiarize the researcher, designers and users with the way in which they will work together. This step involves analysis of the users' demographic, activities and behavior, including aspects regarding smartphone technology (Strengers, 2012). This analysis step also involves brainstorming on older phone models in the market, observations of current smartphones with a scenario-based creation (Fulton and Marsh, 2000), semi-structured interviews, walkthroughs and organizational visits, and examinations of phone artefacts using pre-set questions (Mortensen, 2019). At this stage, the participants produce ideas and define their exact needs and preferences pertaining to the artefacts on their existing phone device or on older ones. In this session, a task card is provided to the participants using a written form of the tasks to ensure the participants are able to refer back to the instructions at any time. This also ensures that the participants' memory is not overloaded by other tasks (Information & Design, 2019). Meanwhile, in-depth discussion and smartphone walkthrough will be conducted between the researcher and users at the interview location.

Smartphone operational problem identification and design suggestions with respect to vision, hearing, touch and cognition

Strengers (2012) stated that the analysis should involve problem identification, in which the areas of vision, hearing (audio), touch, and cognitive aspects are scoped.

Therefore, the second step of the analysis involves the demonstration of participants utilising applications on their phones. These include basic operations of making a phone call, taking pictures using the phone camera, contact management in the phone book and adding an agenda (meetings or other appointments). It then continues with interaction with email, operation of GPS navigation, browsing the web, listening to music, social games on social media, reading e-materials, watching movies, and other services. In the second stage of the problem identification of the smartphone model, the user expresses the issues with the smartphone operation and the researcher will then analyze the problems.

Some techniques of the design process are implemented in this step to create the best organizational and operational systems, where the researcher prepares a feasibility study and tries to find an optimal solution to the problem by satisfying the requirements and proposals of the older adult users. Veal (2019) mentions that due to the characteristics of the interview, a user's concerns and misunderstandings can be directed and cleared up.

This step involves the researcher and the users in a deep interaction with the existing device to clarify the user's goals and values, and the desired outcomes of the research project. The researcher's knowledge base is constituted of three different sources: "media, domain, and community" (Demirkan, 1998; Demirbilek and Demirkan, 2004, p. 233). Relevant media involves knowledge from sources such as academic journals, books and videos where the domain area consists of observed instances from another source, and the experience of the researcher or other relevant experts in a particular field. Lastly, the community aspect taking into account all users of the object, experts and other pertinent societies. In this project, workflow models and interpretation sessions will be applied in this step using a scenario-based testing method based on the cognitive ergonomics framework.

Development of prototype design

The third stage of the identification addresses the potential new interface design based on the problem identification in stage 2. This covers the development of vision, audio, touch and cognitive functions based on the design suggestions in stage two. The problems are then formulated as negative statements (Strengers, 2012).

Buxton (2007) mentions that paper mockups are useful to show the main features of the main application of the design, while a sketched design allows for emphasizing the main application as far from finished. Moreover, the participants have the opportunity to criticize and provide feedback on the mockups. Buxton also mentioned that sketches are intentionally ambiguous and much of their value derives from their being able to be interpreted in different ways.

The prototyping method allows designers and participants to shape the design together, including the development of hardware and/or operating system workflow design to fit into the goals, values and outcomes emerging from the above steps. Snyder (2003) states that paper prototyping is a technique to brainstorm, design, create, test and communicate a user interface. This prototyping method uses only paper, pencils, sticky notes, scissors, and highlighters to create a mock-up of the system design. The benefit is this technique requires less budget and time to develop and will specifically fulfill objective four of this research, which is about designing a prototype of an improved operating system and/or smartphone hardware for older people.

The analysis may be conducted on-site or in a testing lab and may involve one or more participants. During the process, the researcher will facilitate the testing workflow, video the process and take appropriate notes. At the end, the participants will be given a concluding questionnaire about other aspects that may not be covered during the testing.

In addition to the significance of the design value, prototyping and testing are considered an efficient way to achieve successful user interface design (Li et al., 2008). This method would ideally be employed to build the interface design before it is implemented to build an application and/or operating system. According to Li et al. (2008), informal prototyping tools

are aimed at the early stages of a design process and are used to create early-stage prototypes for testing key design ideas rather than building fully fledged final systems. This process creates sets of design flows and allow researchers and users to reiterate the interface design at a later stage.

3.6 Contextual Enquiry

Martin and Hanington (2012) describe a human-centered approach as advocating active user and stakeholder engagement throughout all phases of the research and design process, including co-design activities.

3.6.1 Initial participant recruitment

Veal (2019) stated that a small number of participants, such as a minimum of 5 people, is considered sufficient to identify a design's most significant usability platforms, stating "Testing five users is typically enough to identify a design's most important usability problems" Veal, 2019, p.05.

Meanwhile, Mortensen (2019) stated that the participants should possess the characteristics already established by the researcher. In this research project, this refers to the older adult users as the target group, both in Indonesia and Australia. Moreover, the researcher recruitment process was based on several different phone models and services that have a wide range of different types owned by older adult users in order to take advantage of the varieties. It is also suggested that the participant recruitment should represent the target group or end users where the characteristics can be as broad or as narrow as the type of the project that is related to the ownership of the latest models during the interview session. However, elderly people from the same businesses or industries, colleagues, or relatives in both countries would not be employed as participants in this research project due to the potential bias during the research process (Mortensen, 2019).

In this research project, the researcher selected twenty older-adult participants (ten in Indonesia and ten in Australia) to be interviewed, spread across various norms, such as: age

range (65 years old and above); working in a range of occupations or in retirement; possessing a range of skills and expertise; and involved in diverse activities including community services. These people should already have experience in using a smartphone in their daily life. Their cultural background was also taken into consideration to identify how the interaction might differ if cultural differences are applied. This method is used to fulfill the **third** research objective, which is to engage one Indonesian and one Australian user group in a UX/UI design process.

The participants who are part of the research and investigation of this research project are located in Australia and Indonesia. Participants were recruited based on their stating they own and have the capability to operate and carry out a live demonstration on a smartphone device. Some participants in Australia were recruited from a community, such as "Curtin FM" Radio Station at Curtin University Campus, church, and community organizations. This type of recruitment aimed to obtain diverse user groups within each cultural background. Mortensen (2019) mentions that researcher can possibly make the interview process more comfortable by having the sessions as convenient as possible for the participants to carry out the interview process.

The differentiation between how older adult users from these two different cultural backgrounds interact with their smartphones is essential to the purpose of the research project. The application of a UX/UI design research method is practical in order to identify issues and to support the development of a smartphone user interface design.

3.6.2 Interview duration

Two phases of interview sessions were conducted. Phase 1 interviews were carried out using the test board along with the users' demonstration on their existing phone models of how they used to interact with those devices from the test board. The phase 2 interviews were then conducted to confirm the improved smartphone model after the design was developed, including the display screen layout, navigation controls and overall interaction.

Each interview session was completed within the range of 20 to 45 minutes, depending on the nature of the user's experience, the problems identified and participants' skills in operating the smartphone. According to Veal (2019), the duration of 20 to 45 minutes falls within the range of 90 minutes as the expected period for best practice. The conversations were recorded and transcribed to ensure accuracy in quoting their life experience, reviews and new ideas that might arise down the track. The transcribed document was rearranged to maintain the flow of conversation in portraying the content. The participants were given the opportunity to demonstrate their ability to operate their smartphone while a testing board (Figure 3.5) was presented as part of the interview and observation process.

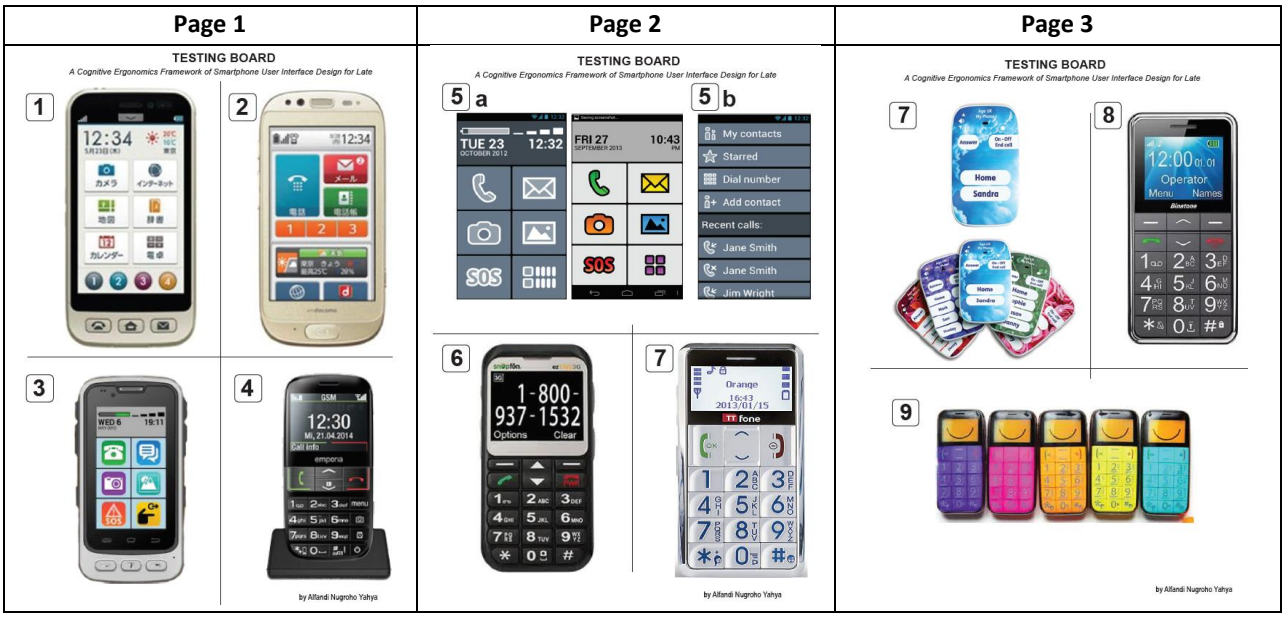


Figure 3.5 The phone models on the testing board after being streamlined

Originally, there was no specific allocation on how long the interviews would take in order to give the participants enough time to express their ideas. In general, participants used most of the time (75%) to convey their life experience with their smartphone. The remainder of their time was used to review the test board. This is to fulfill the **first** research objective which is to investigate how older adult users in Indonesia and Australia perceive and use smartphones in their daily lives .

3.6.3 The research questions

The interview and observation was undertaken to analyse users' performance using a smartphone in their daily life without any formal scenarios or task-based practice. This method was employed to identify phenomena that exist among older adult smartphone users in both Australia and Indonesia. To achieve this, several questions were set up and arranged into diverse categories to ensure a wide spread of assessment points based on the research in the industry overview, discussion with usability professionals and experts, and the literature references (see the detailed questionnaires in the appendices). Some questions were asked directly in response to the participants' actions during the evaluation, while some other questions were asked while the participants were carrying out the tasks on their smartphone device.

As discussed earlier, designed tasks should reflect the users' goals and requirements and the researcher's questions (Nodder 2015; Snyder 2003). Therefore, the interview and observation questions are made up of a number of parts, as follows:

Part 1 Questions about a participant's demography

Part 2 The elderly participants have been given a set of cellular or mobile phone or smartphone device photographs to use to identify phones they had previously owned. This technique was used to help the researcher identify and streamline the most commonly used phones before the partipants made the decision to get their current smartphone model. Then, a test board consisting of ten phone models was generated as a result of the streamlining processes from the models, and used as a means for the participants to give an overview of different choices of phones in the market in the phase 1 interview

Part 3 Different set of questions were used to examine the display screen, navigations or interaction on the participant's phone device. These questions were used to determine the phase 1 and 2 interview sessions. The questions involved aspects of smartphone device utilization by older adult users.

Part 4 Researcher's observation on participant interaction on the phone hardware, which covers the use of home, volume controls, and power button.

Part 5 Recommendations on further development of the phone user interface design asked of the participants using the post-questionnaires.

The assessment of how the older adults are interacting with their smartphone device is broken down into several evaluation points:

Hand-grip

This evaluates how users are grasping the smartphone device before performing any actions. There should be a particular reason from someone who is left-handed or right-handed in terms of how they hold their phone and interact with it.

Menu or applications selection

This examines whether users are selecting applications directly using the shortcut or via the apps menu list.

Icons or symbols identification

This is to identify whether the users have the ability to distinguish icons or symbols to execute a system or activate an app on the smartphone interface. This type of evaluation would also be relevant to the recognition of icons and metaphors on the user interface design layout.

Navigation/buttons compatibility

This evaluates the way users press the buttons or icons using different fingers and have their fingertips measured on the screen. Tasks include the slide up/down and swipe left/right on the screen display. And also, the evaluation includes the identification of gaps between each button to avoid elderly people making errors.

System or application setup

The evaluation covers how to set up and adjust the systems on the smartphone. The tasks include setting up information in the smartphone phone book, adjusting the screen tools (such as the brightness and contrast), controlling the ringtone volume, and activating/deactivating the voice command.

Text and image clarity on the smartphone interface

This evaluates how well users read and type text and numbers on various applications, for example the way users read and reply to an SMS or dial a phone number to make a phone call.

3.6.4 The questionnaires

As briefly discussed elsewhere in this thesis, designed tasks should reflect the users' goals and the researcher's questions (Nodder 2015; Snyder 2003). Questionnaires are considered as a means of collecting data regarding target audience or participants, as they are a tool consisting of a predetermined set of questions (Lack, 2006).

The questions below were used to examine the participants' interaction using the Usability Inspection Methods (Nielsen and Molich, 1990), categorized into 20 main questions and broken down into sub-questions. The categories of the usability inspections are divided into the following questions:

Q01: "What applications or features on the smartphone do you use regularly?" *(More rows can be added if the participant has used more than three apps)*

This question examines what applications the participants used regularly for a particular length of time. This question also identifies that although users have operated the applications regularly, they may experience issues in the same applications or functions. Basic scenarios have been created, such as making a phone call or sending out text messages using Short Text Message Services (SMS).

No	Application	Frequency of use (Hourly, daily, weekly)	Duration of use (Minutes, hours, etc)	Purpose	Level of Difficulties
1					1 2 3 4 5 1 = Very Easy 5 = Very Difficult

Q02: "How do you rate the design of the navigation button on your smartphone?"

This question examines how users feel about the overall button design against the ease of use of the individual application. For example, a good navigation design does not always equal good function. This process idenfities the presentation of navigation buttons and the gaps between

each button that might affect how participants will perform on the screen. As mentioned in Chapter 2, elderly people might have difficulties in pressing particular buttons due to the weakening of their tactile and visual senses.

No	Application	Ease of Use 1 = very easy | 5 = very difficult	Aesthetics 1 = very bad | 5 = very good	Comments
1		1 2 3 4 5 1 = Very Easy 5 = Very Difficult	1 2 3 4 5 1 = Very Easy 5 = Very Difficult	

Q03: "How easy do you find the navigation buttons of an application on your smartphone?"

This question identifies whether an icon of an application without text is more apparent than an icon with the text underneath as illustrated on the table below. The icons and text can possibly have different text when switched over to a different language than English. Barros et al. (2013) mention the older adults' preference to tap the icon even when both the icon and text work as a button. This evaluation will also identify whether or not the icons are familiar to the users without having to include the text underneath. The identification will also cover the participants' understanding of icons and metaphors (such as the gear or wrench icon to represent settings) when they use the smartphone device for just a short period of time.

1. Icon only	2. Icon + Text	3. Other preferences, please specify below
	 WhatsApp	

Q04: "How easily do you distinguish the following icons for an operation?"

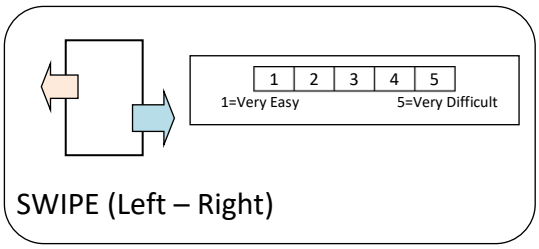
Older adult users had some difficulties in agreeing or disagreeing when making a judgment using the 'OK' or 'CANCEL'; 'YES' or 'NO'; or the icons ☑ or ☒. This question identifies users' understanding before making a decision. Icons with the 'tick' ☑ and 'cross' ☒ and the text of 'OK' and 'CANCEL' and 'Yes' and 'No' may present different impressions or meaning perceptions to the users.

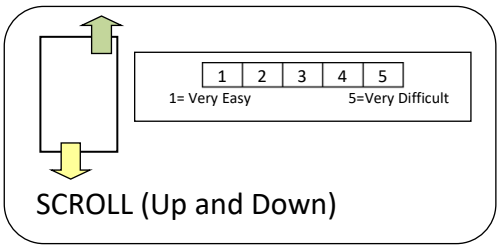
OK or CANCEL 1 2 3 4 5 Very Easy Very Difficult	☑ or ☒ 1 2 3 4 5 Very Easy Very Difficult	YES or NO 1 2 3 4 5 Very Easy Very Difficult

Q05: "How easily do you operate the following functions: (The 'Slides' and 'Swipes')".

Question five identifies users' difficulties when carrying out finger movements on the smartphone screen. Some brands have different mechanisms for how the smartphone pages appear on the screen. This evaluation particularly evaluates the working memory load of older adult participants when dealing with multiple-page views on their smartphone device, including how they will perform if some area of a page is not visible on their screen.

This evaluation supports Barros et al. (2003), who mention that while performing swipes the older adult participants tended to drag objects rather than trying to drag the whole screen.





Q06: "Have you ever or never changed your language setting to languages other than what you understand? And why?" *(i.e. Changing from English to Dutch and vice versa).*

This question evaluates how users may change the language on the smartphone and interact using the selected language without having difficulties.

Q07: "What would you do if an error happened while interacting with the phone?"

Question 07 examines how users would identify the recovery action from an error on the device. The users are expected to recover from the error before they seek further assistance externally.

Q08: "What errors do you usually make when interacting with the Smartphone? And why?"

This question identifies whether an error occurred due to a problem on the device or whether it was the user's fault.

No	**Application** (i.e., WhatsApp)	**Functions** (i.e. adding emoticon)	**Level of Severity** (1 = Low | 5 = High)	**Comments** (I.e. why does that happen?)
1			1 2 3 4 5 Low Severity High Severity	

Q09: "Is there anything you are confused about on your Smartphone?"

The set of questions on Q09 evaluate the level of consistency or inconsistency on the smartphone user interface system and the applications that may lead users to make mistakes.

No.	**Items** (i.e. Why such items are confusing to access or navigate)	**Where does it occur?** (i.e. page, icons, texts)	**Level of Severity** 1 = low | 5 = high
1			1 2 3 4 5 Low Severity High Severity
2			1 2 3 4 5 Low Severity High Severity
3			1 2 3 4 5 Low Severity High Severity
4			1 2 3 4 5 Low Severity High Severity

Q10: "How do you experience the following items on your smartphone?"

Users might experience different complexity or simplicity on some functions in the smartphone UI design. Therefore, the detailed questions below will evaluate the functions in relation to a user's experience.

a) The standard or general functions

This is to evaluate the user's experience on the general functions, such as the volume control buttons, the power button, and the home button.

b) The detailed entities of an application or system

This question evaluates the font type and design, icons, symbols, and other supporting objects that allow users to interact with the phone accurately.

Q11: "How do you find the Object, Action, Options visibility on your smartphone as explained below? How do you recognize the presence of those elements on your Smartphone?"

This set of questions at Q11 evaluates user interpretation in operating the functions below:

a. [OBJECT] Icon Text or Labels (the text is placed underneath or on the side of the icon)

b. [ACTION] The [<] and [>] button (the indicator of slide left and right)

c. [OPTION] Text/button is "greyed out" (the indicator of inactive navigation)

Q12: "How familiar are you with the general functions of the smartphone, such as making a call and sending SMS, compared to your older phone device?"

This question (Q12) compares the user's experience on the current smartphone device and the previous phone (or smartphone) in terms of the functions usability.

a. Smartphone Brand		**Model/Type**		**Year**	
b. Old-Phone Brand		**Model/Type**		**Year**	

No	Functions (add more if necessary)	Smartphone 1 = very easy | 5 = very difficult	Old Phone Model 1 = very easy | 5 = very difficult	Comments
1	Phone Call	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	
2	Send SMS	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	
3	Turning on/off	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	
4	Playing game	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	
5	*Other, please specify*	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	

Q13: "How could the functions in Q12 be better designed to improve your experience with the phone device?"

This question is trying to obtain recommendations based on the user's previous experience in using the current and previous (smart)phone models using the main or default navigations on the smartphone. Some participants with different phone models might find it difficult to switch over from one device to the other.

No	Features on the Smartphone	Comments
1		

Q14: "Have you ever used or been using any other Smartphone devices?" *(If participants have never used any other device, then go to Q15)*

This question is to evaluate and compare how users feel when using other similar or different smartphone devices as compared to others. This question will also evaluate any uncertainty in operating the same programs or functions where different devices do apply, such as the alarm, torch, calendar and messaging programs.

No.	Your Device(s)		Other Device(s)	
	Brand	Model / Type	Brand	Model / Type
1				

Q14 (1): "How do you rate the overall visual aesthetics on your Smartphone as compared with the other phone or smartphone devices (e.g. Tablets)?"

This question and its subsequent questions examine the overall design of the smartphone user interface including the items mentioned below.

No.	Your Device(s) 1 = Very unsatisfactory | 5 = Very Satisfactory	Other Device(s) 1 = Very unsatisfactory | 5 = Very Satisfactory
1	1 2 3 4 5 Very easy Very Difficult	1 2 3 4 5 Very easy Very Difficult

The assessment will include the following attributes:

a) Icon-set for tools, utilities, messengers, browsers, and dialogue boxes

b) Icon-set against the background design/layout

c) The overall clarity of the icon, text, colour, object detail

Q15: "Have you ever used a PC or Laptop to connect to the smartphone? How do you rate the experience in operating the functions? For example, photo transfer through USB connection and charging" *(If NOT, go to Q16).*

This question evaluates the user's experience in connecting the laptop to the smartphone (i.e., to download pictures or transfer files).

Q16: "How important is assistance or guidance to operate the smartphone's basic functions?"

Question 16 is to identify difficulties on the user's side with even the basic functions of the smartphone.

Q17: "How do you find the experience of customizing your smartphone for personal use?"

This is to evaluate participants' familiarity with the system settings to fulfill personal needs in using customized features on the smartphone.

Q18: "How do you rate these attributes in using the smartphone in your daily life?"

This question will identify the attributes of skill, comfort, privacy and satisfaction on the smartphone device. This will also evaluate a participant's self-experience interacting with the smartphone to support their daily activities.

No	Items	Level of expertise 1 = novice | 5 = expert					Remarks/Comments
1	Skill	**1**	**2**	**3**	**4**	**5**	*Participants were given the opportunity to write personal comments in question 18.*
2	Comfort	**1**	**2**	**3**	**4**	**5**	
3	Privacy	**1**	**2**	**3**	**4**	**5**	
4	Satisfaction	**1**	**2**	**3**	**4**	**5**	

Q19: "How do you rate your interest in using a smartphone over any other communication device for daily use?"

This question compares the user's current smartphone to other communication devices.

Q20: "Overall comments or suggestions for the next development."

Participants are given an opportunity to give some ideas or recommendations for the future design development of the smartphone.

By employing this questionnaire, the **second** objective, which is to differentiate the experience of adult smartphone users from diverse cultural backgrounds, will be achieved.

3.6.5 The Interview procedure

The interview consisted of several sections to allow participant experiences to be recorded accordingly. One section was allocated to the participants' scope of action including the internal actions they performed on their smartphone device.

For example, the participants' office layout will determine how loudly the smartphone ringtone needs to be set to be heard from a distance. From this example, the researcher had to assess how aware of the importance of a volume control on a smartphone device the participant was. Such observations became apparent from one of the participants.

The interviews conducted were semi-structured, which allowed each participant to contribute their own opinion. A set of questions was provided by the researcher to guide the interviews and keep them on track. The following scopes were included in the interview questions (but interviews were not limited to these):

- Smartphone technology
- Smartphone user interface design and layout
- Smartphone usability features
- Smartphone user experience factors

Before the interview and observation session started, the researcher explained how the interview and observation sessions were to be operated. The researcher outlined the points to be examined and observed, both in the general and specific aspects of the participant's personal phone device. The researcher also explained the tasks to be conducted, either based

on the researcher's or the participant's scenario, to ensure a broad spectrum of the participant's interaction.

3.6.5.1 The interview sequence and procedures

The interview and observation sequence was broken down into several steps, as follows:

Step 1: identify and record the profiles of selected participants using pre-test questionnaire that will be given before the evaluation session starts.

Step 2: identify the reasons for smartphone utilization in order to discover why the participants use the smartphone and what they usually use the smartphone for

Step 3: assess and observe the reaction to phone models being observed on the test board by allowing the users to select the preferred models they had in the past and give comments on the selected models. This method aims to identify the user's phone evolution from the older model to the latest one.

Step 4: assess and observe the participant's interaction on their personal phone, including the utilization of commonly used applications, the screen layout or display, and also the hardware configuration (such as the position of the power, home and volume buttons). To enable this, some tasks were created to specifically for the evaluation process.

Simple scenarios were provided to the participants, which included making a call and sending an SMS. However, participants were given opportunities to carry out their own 'scenarios' based on what they have been familiar with. The participants might do more than just making a phone call or sending a text message on their phone; this provides opportunities for them to demonstrate other programs that are different from one participant to another, such as games, reminders, photo editor, phone-to-PC transfer, and some social media links. A quick sheet of questions was provided to the participants or researcher to fill out.

Step 5: assess and observe the potential "gap" between selected phone models on the test board and the participant's personal phone device. Participants will be given post-questionnaires to obtain information about how they think the evaluation was.

Answers to the questions on the questionnaires are divided into several styles, as follows:

Tick boxes for selection

Participants are given the opportunity to select their preferred answer by giving a ✓ on the tick box ☐ or to write their own preferences on the answer field.

The 5-point scale of answers

The purpose of the scaling is to measure people's attitude in responding to a series of statements about a topic, in terms of the extent to which they agree, as stated by Likert (1932).

Tick boxes ☑ to indicate "Yes" and ☒ to indicate "No".

These options are placed below the questions to allow participants to provide an appropriate answer to the given questions.

Additional fields for commenting

The questions may not cover all answers for the participants. Therefore, participants are allowed to add their own comments in the box provided.

All interviews were recorded and transcribed to ensure accuracy in quoting the participants. According to Ravden and Johnson (1989), a detailed recording is not usually used as a research material but the transcript is, due to the technical and administrative demand on the evaluation and the complexity of results analysis.

The transcripts were then edited slightly for coherence to exclude discourse conversation pointers, but have included most aspects in discussion. An empirical view of the significance of smartphone user interface interactivity can be developed from the data directly available from online sources, although these sources may change over time.

This research project used the "talk through" or "think aloud" method (Ravden and Johnson, 1989) as the participants carried out a task. The benefit of this method is that it yields a "verbal protocol" of participants' comment about their experience on the smartphone device.

Participants were asked to think aloud to enable better understanding of the current issues with their phone, in real time. As the evaluation was recorded, their action could be played back for further investigation. Some participants might not be willing to be recorded; therefore, photographs will be taken during the evaluation to at a minimum capture the process of the interaction. The photographs will be taken closely to portray the participants' actual action on the phone when clicking on the buttons.

It is argued that usability issues are often left until very late in the process, by which time modifications are more expensive to make. While physiological issues will always be relevant, the development of new technologies forced designers to focus on the cognitive and social aspect of users when designing tools (Adler and Winograd, 1992).

3.6.6 The questionnaire measuring method

Various types of questionnaires are employed in this research project. Each participant obtained a set of documents containing some questions to identify their preferences regarding the use of a smartphone device. Some questions were asked to the participant directly and, due to time limitations, the researcher assisted the participants to perform the tasks directly on the device.

Some of the questions may require direct actions on the phone to allow direct observation on the functions, such as the icon recognition, navigation or buttons clarity, and interface design layout that affects the use of a smartphone device for particular users in both countries. The number of steps and duration of the evaluation will also be recorded to examine the usability issues encountered on the participants' smartphone devices.

The questions also utilize a Likert Scale rating (Likert, 1932). The purpose of this type of rating is to measure attitudes by asking people to respond to a series of statements about a topic in terms of the extent to which they agree with them, and so tapping into the cognitive and affective components of attitudes. In questionnaire form, the Likert Scale uses a five- or seven-point scale to allow the individual to express how much they agree or disagree with a particular statement (Likert, 1932).

This method will then be used to identify the most frequent issues in the current design and/or the severity of the issues regarding the cognitive ergonomics.

The appearance of the questionnaire is vital: it should adequately space the questions and response boxes to check, or the code numbers to circle. The next step is to make the questionnaire look shorter by squeezing questions into the smallest space possible (Williamson & Johanson, 2013). Unstructured observation is more often associated with quantitative research approaches while structured observation is mainly linked to qualitative research. According to Adler & Adler (1998), qualitative research approaches, conducted in situations deliberately designed to ensure standardization and control, differ markedly from observation framed by the paradigm.

An advantage of observation is that it permits researchers to study people in their natural environments in order to understand them and their context more deeply than it is possible to gauge through interviewing (Patton, 2002).

Observation is a widely used technique or tool, regarded by many as fundamental to research. Adler & Adler (1998) state that where the future of observation shines most brightly is in the use of this technique as an integrated rather than a primary method. Observation is very often combined with interviewing (Williamson & Johanson, 2013).

However, the results of this type of questionnaire may vary, depending on the smartphone brand being operated. If the participant updated the smartphone device, the complexity and simplicity of smartphone use may vary. Some users may have two or more smartphones, and their interaction will be distinctive. The main objective of carrying out this interview using the Likert Scale method is to measure how important a smartphone is as a means of communication for a particular participant.

The overall data falls into two categories, both of which are relevant to this study. First is material gathered from journals or publications about the research project, and the second category is data gathered from the interviews and observation with the participants.

Finally, an additional column or row is included on the document to allow the participants to write up personal comments or ideas.

3.7 Discussion of Design Practice

In chapter 7, the design and development stages are documented to reveal the discussions around the iterative design process. The development of the new user interface design is based on the users' requirements and task analysis, which is described in chapter 6. This research project needs to be explicit and thorough in the presentation of evidence of competency (Curtin University, 2012). Jones (1992) stated that good design practice combines intuitive and rational approaches, and is iterative. The researcher, designer and participants' involvement is essential in the UX/UI design method to obtain the best results. Nielsen (2016) state that one of usability's most hard-earned educations is that 'you are not the user'.

3.8 Ethical Considerations

Codes of ethics for survey research apply to relations between survey researchers and participants. This research project complies with the ethical standards for academic researchers, and this is necessary because of the involvement of respondents in more than one country.

3.8.1 Additional considerations on ethics by Curtin University Ethics Committee

Ethics clearance was granted by Curtin University's Ethical and Research Practice Committee, and the research also complies with the National Statement on Ethical Conduct in Research Involving Humans. The participants are obviously fully informed of the benefits and the how the method is carried out through their participation during the interview and observation session and there are no potential risks or privacy issues being breached.

3.8.2 The consent form

The participants in Australia signed a consent form to ensure their privacy and confidentiality was protected. As part of the Australian research code of conduct, the researcher asked the

participants in Indonesia to sign a consent form before taking part in the survey. However, the participants in Indonesia were not willing to sign a consent form as this is considered as too formal for them. None of the participants' names will be identified in the research project to protect their privacy and confidentiality. Further, a coding system has been employed to de-identify the individual participants from each geographical region.

3.8.3 Disclosure of information about the participants

The main ethical consideration for this research project relates to how information is disclosed and the publishing of participants' images. The researcher must acknowledge that the interviews and observation require that the researcher carefully consider the participants' privacy. The researcher is concerned for how participants are portrayed in telling their individual experience. In this research project, the participants are fully informed of the research process throughout their participation. During the interview process, participants' hands and finger movements are filmed or photographed. However, a participant's face is not recorded or visible in any results. Figure 3.6 shows how a participant's hands were photographed to show the participant holding and interacting with the device.

Figure 3.6 How a participant held the smartphone device

The camera was set up in a specific way to capture the participants' gestures during the interview session (see Figure 3.7 for layout setup).

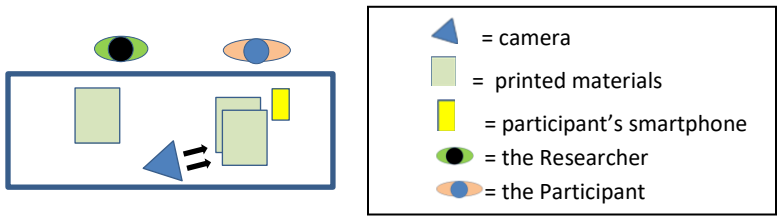


Figure 3.7 Camera setup for the interview sessions

According to Ellis (2007), Having angry participants might harm the personal relationship and result in lower involvement in the research project. Therefore, this research project aims to be valuable and avoid being in direct conflict with the participants.

Face-to-face interviews took place mainly in cafés or restaurants, or in the interviewee's workspace. The space used was not specified as an "office" for participants who had already retired, but these people did some work in that particular area.

It is notable that this type of interview was not always easy to perform due to restricted funding and scheduling.

3.9 Summary of Chapter 3

This chapter has described the methods that were fostered to investigate the cognitive ergonomics framework of a smartphone user interface design for older adult users. The techniques are relevant to both countries that are being observed: Indonesia and Australia. Based on the existing research explained in chapter 2, the UX/UI design methods utilize unique, original and co-design perspectives on smartphone user interface design development, and integrate the smartphone utilization data that will be observed in more detail in chapters 4 and 5 – the Initial Results of Participants in Indonesia and Australia respectively.

In summary, this research project utilizes the UX/UI design methods with the aim of developing new frameworks for smartphone user interface for older adult users.

CHAPTER 04:

Results Overview of the Participants in Indonesia

4.1 Introduction

This chapter presents detailed results of the interviews and observations from the Indonesian participants. The Indonesian interviews were conducted in an informal environment that meant the participants would feel relaxed. Initially, the researcher asked the participants to fill out a consent form as part of a formal research process to ensure compliance to proper Australian research procedures . To ensure their privacy, the participants are identified only by their given and family name initials.

Each participant was given the same generic tasks and questionnaire by the researcher to retain consistency, as well as carrying out their own tasks, and the summary data for each interview presented in this chapter illustrates how each participant has a unique combination of interactions with smartphone technology due to their work and social circumstances.

As mentioned in chapter 3, the researcher presented a test board to prompt the participant's memory of the phone models they had owned in the past. It was also stated that the participant's decision to purchase a new phone could be influenced by their prior experience and preference.

4.2 Participants

4.2.1 Participant 01 (IH)

4.2.1.1 Participant profile

Participant No. /Code	01/IH	**Location**	Indonesia
Period of Interview	07 July 2018	**Education**	Professor
Age Range	70–75 (exact age is 71)	**Occupation**	GP (TCM)
Gender	Male	**Other info**	GP community member, Consultant, Lecturer
Device used 1	O2	**OS**	Symbian
Device used 2 & 3	Samsung (Galaxy S4 and Ace Series)	**OS**	Android
Device used 4 & 5	Nokia 3310 & 3350	**OS**	Symbian
Device used 6	Blackberry	**OS**	Blackberry RIM
Device used 7	ZTE (Chinese Smartphone)	**OS**	Symbian with Chinese Operating System

4.2.1.2 Participant biography

IH is a 71-year-old Professor in Traditional Chinese Medication (TCM) and a member of the Indonesian Traditional Chinese Medicine Association, which has members from around the country. The Indonesian TCM East Java charter has full-time and part-time members and holds meetings every two months. Moreover, the Indonesian TCM Association has a nursing academy, which is managed by IH. The academy provides training to female candidates who graduated from nursing training courses to become a professional nurse, and especially in East Java, to obtain a Diploma 1 in Nursing. This Academy specialises in Traditional Chinese Medicine and is under the license of the Chinese Medicine Association in China. The academy employs approximately 15 to 20 certified trainers and 3 to 4 academic staff members, who also work as training supervisors. The TCM headquarters in China often sends professors or practitioners to the academy in Indonesia to enhance knowledge and skills in the TCM area.

4.2.1.3 Participant phone ownership

As the leader of the Indonesian TCM East Java Charter, IH is required to maintain relationships with colleagues and friends. Moreover, IH also needs to keep his network with other Chinese Medicine General Practitioners in China and around the world, including TCM members in Malaysia and Singapore. Therefore, IH needs a smartphone to maintain communication with these people and exchange information. To maintain the frequency of communication, IH owns seven mobile phones from various brands and each phone has its particular function, such as:

- One phone is used to send messages through instant messengers (Samsung Galaxy S4)
- One phone has a big storage capacity for messages and contacts (HTC O2)
- One phone is popular among most phone users in Indonesia (Blackberry Gemini)
- One phone has the Chinese operating system, reliable for Chinese characters (ZTE)
- Two phones are used as backups when errors occur in other phones (Nokia 3310 and 3350)
- One smartphone is used as a backup (Samsung Ace)

Overall, IH finds these phones useful to support to support his daily activities as a professor and a general practitioner in Traditional Chinese Medicine (TCM) and to carry out tasks such as sending out information, contact numbers and photographs.

Figure 4.1 IH's Phones

High Frequency Use		Medium Frequency Use			Low Frequency Use	
1	**2**	**3**	**4**	**5**	**6**	**7**
						
Samsung Galaxy S4	HTC O2 PDA	Samsung Galaxy Ace	Nokia 3350	Blackberry Gemini	ZTE (Chinese OS)	Nokia 3310

Figure 4.2 IH's seven phone devices

As stated above, IH's phones each have their function. However, according to IH, each phone is used to communicate and do some daily activities, such as:

- To make an appointment with other lecturers, professors, or training staff locally or internationally to deliver a course in the academy; IH would normally use instant messengers with these people
- To organize the teaching schedule with the lecturers, professors, or training staff on a regular basis
- To document IH's daily appointments with colleagues or friends
- To contact suppliers or distributors when making a purchase of medical equipment from local and overseas suppliers. This task includes controlling the shipment progress and customs clearance

According to IH, his phones could be classified by frequency of use as follows:

	HIGH FREQUENCY	MEDIUM FREQUENCY	LOW FREQUENCY
Frequency of use	*Daily and frequent use, approximately 6–8 hours per day.*	*Weekly or fortnightly use, depending on when it is needed.*	*Less than fortnightly.*
Model	**Samsung Galaxy S4 (#1)**	**Galaxy Ace (#3)**	**ZTE - Chinese OS (#6)**
Usage	Most applications are installed on S4, such as messenger, internet browsers, camera, and photo gallery.	Backup: acting as the second Smartphone.	Backup: phone and SMS, watching TV from the phone.
Model	**HTC O2 (#2)**	**Nokia 3350 (#4)**	**Nokia 3310 (#7)**
Usage	Large contact storage and SMS capability. Other functions: Alarm, reminder, digital diary.	Backup: phone, SMS, physical buttons, black and white display screen, and the body are unbreakable.	Backup: phone and SMS, the body is unbreakable.
Model		**Blackberry Gemini (#5)**	
Usage		Blackberry Messenger (BBM) contacts, physical buttons	

Figure 4.3 The list of IH's phones based on the frequency of use

Based on IH experiences, there are some unique features on each phone model and brand that influence him to purchase them, as follows:

- Blackberry Gemini was the most popular phone in the Indonesian market and most people communicate using the Blackberry messenger. This type of messenger is unique as Blackberry Messenger contact IDs are different from general phone contacts, as the items

are stored as six to seven digits, combining letters and numbers. Whenever IH saw the 6-digit ID, he could easily refer that to the Blackberry ID.

- HTC O2 XDA was manufactured by Telefónica Europe PLC and announced to the public in 2006 (GSMARENA, 2006). Telefónica Europe PLC was a European broadband and telecommunications company that traded O2 (marketed as the O2 model) that runs on Microsoft Windows Mobile 5.0. This phone was IH's last device that operated on the Windows platform. Therefore, IH has difficulties when the phone has issues and the Operating Systems need to be repaired.
- Nokia phones were considered as IH's strongest phones. IH stated that the battery lifespan could last for almost three days on a normal standby mode. Nokia
- ZTE with Chinese Operating system was also one of IH's unique phone devices where this phone could connect to some TV stations within range. According to IH, this was the first phone that allowed him to watch TV programmes on a small device.
- Samsung Galaxy phones were the latest phone IH purchased due to their capabilities and functions in providing different applications for different needs. IH found that Samsung phones offered applications that various phones had combined into one device. That is IH's main reason for purchasing this brand, although he still needed the old phones.

IH experienced an unfamiliar situation when he tried to contact guest lecturers from China, who were also categorised as older people and found that most of these people did not have any mobiles at all; in particular, they did not have a smartphone device. Over the past three to four years, IH decided to only invite guest lecturers who owned a smartphone in order to get in touch more easily. Most of the time, IH had problems when making appointments or sending relevant information to his fellow lecturers in China who did not have a smartphone. This task included keeping updated with the current teaching materials.

4.2.1.4 Participant's overall comments for the selected models on the test board

Once given the test board, IH selected models 1 and 2 due to the clear visibility of the smartphone functions/buttons, such as the implementation of the touchscreen technology on the device that makes the phone look attractive. IH thought that it he would be able to perform

some tasks on models 1 and 2, such as making a phone call, sending an SMS and taking normal pictures. He found it easier than other models on the test board. Moreover, IH also observed the overall navigation of those two models to be more applicable to him as an older adult user interactacting with the device. According to IH, the most significant difference between models 1 and 2 was the aesthetic quality of the interface and clarity of the navigation buttons (see Appendix A for the details of the test board),

IH observed phone models 1 and 2 on the test board and found differences in the aesthetic values. IH preferred model 2, followed by model 1. The reasons for this were:

- IH preferred the display clarity on model 2 over model 1
- The text on model 2 had better and more attractive display style (layout wise) than model 1
- The icons on model 2 were more easily recognized than model 1
- The layout on model 2 had more shapes and colours on the navigation than model 1

Therefore, IH's preference was model 2.

Participant suggestions on the test board

Based on the test board, IH made some suggestions as follows:

1: A good smartphone user interface design should be clear and compelling, and be aesthetically pleasing.

Once IH had the smartphone, he identified that somehow the smartphone layout on the user interface can be customised. IH stated that a plain and overly simple display would not be attractive to older adults because they need to be able to clearly and properly distinguish the navigation buttons. For example, high contrast between buttons and background would enable people to interact easily. IH thought that unclear representation of buttons and background design would cause confusion to the users and lead to errors.

2: The icons on a smartphone should be made clear and meaningful to older adult users.

IH thought that the “gear” icon that represents the settings is confusing for some older adult users who had bought a mobile phone, although the icon styles looked similar to other old phones. However, older adults should be re-trained when they purchase a new smartphone to be able to recognise new styles. Different models feature different icon styles to represent “settings”. Alternatively, accompanying text placed below the icon to represent a function could also be helpful.

3: A creative design could be applied in the user interface standard to cater for older adult users’ needs.

IH stated that a “plain” and non-colourful display layout would reduce the smartphone’s attractiveness to the users. IH indicated that older users should be taught to change the phone theme to get a better layout and display. IH also thought that a creative design could reduce the ‘”gap” of phone ownership between the older and newer device.

4.2.1.5 Participant opinion on smartphone software and display screen on the phone UI

As the ambassador of the Indonesian TCM East Java Charter, IH needs to maintain communications with other TCM members in Indonesia and overseas, such as in China, Malaysia, and Singapore. Therefore, IH demonstrated his ability and skill in utilizing the instant messenger applications, such as WhatsApp, WeChat, Line messengers, and SMS to send and receive messages from and to his phone. IH also showed his capability to change the keyboard to different regions and type messages using different languages (Indonesian, English, and Mandarin), including attach pictures, add icons, and send a message out on the Samsung Galaxy S4. IH could also make a free voice call to other users using the instant messenger application.

Moreover, IH also showed his ability to recognize some of the common symbols or icons on the WhatsApp messenger, such as the “paper-clip” that represents attaching a file, the “box with a mountain” graphic representation that represents photos or videos, the “camera” representing a picture, and “paper” representing a document. Other than that, IH never used the other functions, such as sending out contact information or location, due to a lack of information on functions that IH was not familiar with.

Figure 4.4 WhatsApp Messenger on IH's Samsung Galaxy S4.

IH used WeChat messenger with some clients and suppliers in China due to the limitations on using other type of instant messengers imposed by the Chinese Government. IH found that some of the guest lecturers or professors did not even know how to use instant messengers to send messages, and they used SMS instead. In some cases, IH had to teach the visiting professors how to operate instant messenger properly and easily and made some recommendations on how to operate other functions. IH also found that 'the way Chinese people wrote the characters was unfamiliar to him in that they applied the character strokes on the smartphone screen.

During the observation sessions, IH performed the following tasks repeatedly:

- Recognize some icons or symbols on the display and operate them
- Turn on and off the touchscreen keyboard before he typed the text on an instant messenger
- Open and close applications using the "X" icon, or access "exit" or "quit" on the application menus, or just simply go to the home screen by pressing the "home" button.

Therefore, IH suggested that older adults might be required to carry out some tasks regularly and repeatedly to get them used to operating the phone easily and properly. Moreover,

according to IH, the clarity of the navigation should be taken into account as the elderly may have difficulties viewing and distinguishing objects.

4.2.1.6 Participant opinion on the hardware and usability design of the phone device

Identifying the tactile on physical buttons versus touchscreen

During the interview session, IH demonstrated his ability to carry out some tasks on one smartphone and do the same tasks on another phone. IH showed the differences between sending a text message (SMS) using a Nokia Phone and a Samsung Galaxy smartphone where the Nokia phone had the physical buttons to interact with while the Samsung smartphone used the touchscreen keyboard. Meanwhile, IH also demonstrated his skill in using the Blackberry Gemini device to send messages using the Blackberry Messenger application. There is a significant difference between the Nokia and the Blackberry Gemini regarding how the tactile, physical keyboard feels to type messages compared to the touchscreen. Meanwhile, a Samsung smartphone uses a touchscreen keyboard to enable users to perform the same action. IH mentioned that the Blackberry Gemini with a physical QWERTY keyboard was small for his fingers, while Nokia phones had a physical keypad instead of a keyboard. The physical keyboards were easier and offered a better touch than the touchscreen. Keyboards also reduced the potential for mistakes that users might make.

"I keep this phone due to the battery lifespan. And also, this phone is powerful and not complicated to use.

This is just another phone I have"

Figure 4.5 IH's Nokia 3350 that is used as a backup phone

Participant comments on the phone keyboard

IH thought that the typing experience on the Nokia and Blackberry phones was better than on the Samsung Galaxy S4. IH thought that the physical buttons provided more precise touch compared to the touchscreen system on the Samsung Galaxy S4. In fact, IH preferred to use a phone with physical buttons, but the smartphone had more functions than the Nokia and Blackberry Gemini. Therefore, the only thing IH could do was to practice regularly to avoid mistyping using the touchscreen keyboard. IH suggested that older adult users might need to practice using touchscreen technology because the typing mechanism or interaction was different from a Nokia phone or Blackberry Gemini.

"Blackberry was the first phone which had the capability to take and send photographs easily for me"

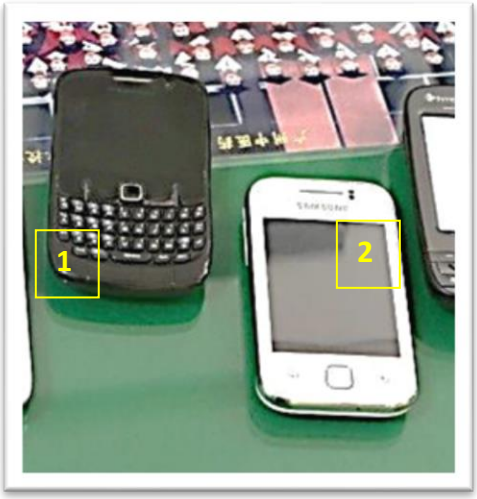


Figure 4.6 IH's Blackberry Gemini (1) and Samsung Galaxy Ace (2)

Issues and Ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Send text messages	Physical keyboard	Touchscreen keyboard	User needs more practice to get used to it.
	Using messenger with users in China	Ability to communicate with people in mainland China	WeChat is the only messenger for users in mainland China	Need to allow more messenger applications for users in mainland China to communicate with people outside the country.
	Change the phone setting	Consistent icon (the gear)	Different theme may present different icon	Retrain users to recognise the changes
	Battery Power Durability	Nokia phones	Samsung phones	Powerbank should be provided to solve the battery issue in smartphone devices
	Screen display design	Colourful display screen on smartphone device	Black and white on older models	Display screen should be clear to cater to older adult users' vision

4.2.2 Participant 02 (AS)

4.2.2.1 Participant profile

Participant No. /Code	02/AS	**Location**	Indonesia
Period of Interview	08 July 2018	**Education**	Electrical and Mechanical Engineer
Age Range	70–75 (exact age is 72)	**Occupation**	Senior ME building consultant
Gender	Male	**Other info**	Freelancer
Device used 1	Lenovo YOGA Tab-3 – 8 inch	**OS**	Android
Device used 2	Xiaomi Mi-4	**OS**	Android, Chinese Version
Device used 3	Nokia 1200	**OS**	Old Nokia OS

4.2.2.2 Participant biography

AS is a 72-year-old mechanical and electrical engineer who is specialized in residential and office building electrical installation. AS has more than forty years' experience in the mechanical and electrical industry and been involved in some mechanical and electrical association activities in main cities both in Indonesia (Jakarta, Surabaya and Bali) and overseas (China and Hong Kong).

AS likes travelling and the main purpose of his visits is usually gathering new information or knowledge of products in the mechanical and electrical industry from workshops or corporate exhibitions. AS also frequently travels to China to purchase electrical and mechanical equipment and get suppliers to deliver the goods to Indonesia. Moreover, AS also makes frequent contact with some courier services in China and Indonesia to obtain the best service from them. Furthermore, AS is also involved in the Information Technology industry, especially telecommunication technology devices.

4.2.2.3 Participant's overall comments on the selected models on the test board

As an engineer and a person who has knowledge on the IT industry, AS was attracted to purchase a smartphone that fit his needs as well as having older phone models.

During the interview, AS was interested in observing the phone models on the test board. He commented that a good phone device should have a clear and bright user interface display, including clear icons, text and layout. Therefore, AS's choices were as follows:

- Models 1 and 2, where these models represented smartphone designs with clear and neat layout, icons and text (although the text was in Japanese, which AS did not understand – but the level of screen clarity and visibility were significant for AS).

In the improved design, AS commented on the SOS button, which confused him as to its functions. AS mentioned above that the text 'SOS' should help users do something when in emergency. However, the red dot would be meaningless to some people because the shape could be interpreted as an on/off button. According to AS, the SOS button was clearly visible, while the SOS text could be more useful if placed below the icon. Meanwhile, some people in Indonesia may not understand what 'SOS' means. AS thought that eastern and western societies would have different understandings regarding icon and symbol representation: in westerm society a red button attracts most attention from users; meanwhile, in eastern society, that does not necessarily apply. However, the red button visually attracted AS to think about what it is.

According to AS, models 4 and 6 on the test board would be suitable for older adults to commence proper and precise interaction using the keypad. They might feel the touch of the buttons to press the precise number. This would not happen on a smartphone with a touchscreen. AS mentioned that older adults liked to visually observe an object without having to think much or question. Moreover, the keyboards on models 4 and 6 would always be visible on the device display, and this means the users are able to interact directly with the keypad.

Meanwhile, AS pointed out model 2 had more colour than model 1, whereas model 1 was more simple and clean than model 2. Therefore, model 1 would make it easier for older adult users to distinguish the navigation than model 2. AS also questioned the use of buttons with the text 'one' to 'three' (model 2) which might not make any sense to users, especially older adult users. The use of the orange color may attract the user but this is not a specific function.

4.2.2.4 Participant opinion on the software and display design on the phone UI

During the interview, AS demonstrated the ability to operate the functions on his two phones and a tablet. Those two phones were a Nokia 1200 and Xiaomi Mi-4, while the tablet was the LENOVO Yoga Tab-3 8". AS mentioned that the two phones and tablet have different functions for him to support his daily activities, as follows:

- **Nokia 1200:** AS liked this phone model because the keypad is visible and it has quick access buttons to access phone-calls, contact, speed dial, and SMS. AS needed a maximum of a three-page depth of navigation to find rarely used specific words such as "home" or "daughter" for an emergency contacts shortcut due to safety and security reason. AS stated that crimes were happening involving utilization of mobile phone devices in such a way. Therefore, this issue needed to be considered and addressed to older adult users. Moreover, AS stated that the Nokia 1200 model has longer battery power for regular/daily use (i.e., this model could be put in standby mode for 2–3 days).
- **Xiaomi Mi-4:** AS owns a Xiaomi Mi-4 phone which was made by Xiaomi Company in China. AS bought this smartphone to interact with instant messenger applications such as WeChat, WhatsApp and Facebook. AS spends most of the time using instant messenger to communicate with his clients and mechanical and electrical suppliers, both in Indonesia and overseas. AS bought this model (Xiaomi Mi-4) when he was visiting China and found it very attractive due to its capability and accessibility, as well as cheaper in price compared to the Korean product, such as Samsung phones. Therefore, AS bought Xiaomi Mi-4 smartphone to carry out some online browsing using internet data. AS stated that a good photograph could be produced using the Xiaomi Mi-4 phone as it has a high resolution camera and screen display.
- **LENOVO Yoga Tab-3–8 inches screen:** AS usually uses the Yoga Tablet to carry out some formal presentations to his clients as this tablet has an 8-inch display and includes MS Office programs. AS also uses the tablet to do some computation of project costs using Microsoft Excel and make proposals using Android-based Microsoft Word. AS showed some video presentations from YouTube on the tablet as the Lenovo Yoga Tablet has a

bigger display resolution than his other phones. AS utilized some web browsers on a daily basis to search for information on the internet regarding mechanical and electrical technologies/products and other things related to those topics. AS mainly uses the Google Chrome application on the tablet. AS also demonstrate how to download videos, open the folders and play them individually during the interview session.

AS stated that he could perform some general tasks in addition to his duties mentioned above, such as:

- Turning the WiFi, Mobile Data, and Bluetooth connection on and off from the settings menu
- Adjusting the display brightness and contrast manually or setting in auto-mode
- Rotating the screen to get a wider and bigger preview

1	2	3
		
Nokia 1200	**XIAOMI Mi-4**	**Lenovo Yoga Tablet 8”**

Figure 4.7 AS’s phone devices

4.2.2.5 Participant’s opinion on phone hardware and usability design

AS suggested some improvement points should be considered when developing smartphone hardware in conjunction with software for older adult users, as follows:

- **A built-in GPS function should be readily available to pinpoint the exact location of an older adult.**

This feature will help the older adult person locate their exact position, especially if they are missing or disoriented.

- **A flashlight application should also be available by default and be operated by using a shortcut button on the hardware, not on the screen display.**

AS suggested to create a physical button on the hardware to activate the flashlight application easily and be accessible within reach of the main screen.

- **The emergency button should always be clearly visible on all screens or placed on the hardware.**

This button could be located on the side of the smartphone hardware, not on the screen within an application. Alternatively, voice activation could also be considered and developed to directly call emergency contacts when the older adult person is in an emergency situation.

- **The emergency alert systems should be easily activated using the auto-dial system on the hardware.**

The navigation could be linked with a button to activate an emergency alert and send a signal of urgency to someone in the emergency contact list. However, may occur when an older adult user has to do an initial setup as these people may be unfamiliar with the steps they need to perform.

- **The address book should include the contact's photograph to easily recognise the person.**

This function should be able to store a person's name and picture at the same time. The system should ask for the person's photograph before the record is saved into the phone system/phone book.

- **Icons and language should be in line with the user understanding and easily set up in any region or country.**

A user needs to know how to change the language to their preferred language on the first day they buy the phone. This may affect how older users would be able to read the application name, install and interact with a specific application. For example, the WhatsApp application should be understood as an application, not known as "Whats" and "App".

- **An alignment is necessary to fill the gap between the Usability and User Experience Design on any phone models with the same Operating System.**

Different smartphone devices might have different operation procedures and user experience design, although the operating system is the same. AS stated older adults were not supposed to learn complex procedures and configuration on a new system when they purchase a new device. Older adult users should be able to easily adapt to the new device and build on their previous experience.

“I want my technologies support my daily work as an engineer. I don’t use ‘fancy’ applications anyway” (AS)

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Operating the navigation button	Physical keyboard on Nokia	Touchscreen keyboard on smartphone	A little vibration when the button is touched would give a bit of device reaction to the touch. A reasonably big gap between buttons could also be helpful.
	Quick access	One-touch button	Need a proper setup	Guidance on how to set up the shortcut or quick access buttons
	Browsing	Big display on the tablet	Battery life	A tablet with longer battery lifespan would be helpful
	New device update on the market	Up to date with latest technology	Have to re-learn the technology	Main procedures and configuration should be maintained on the new device. One-on-one assistant could also be helpful
	Going to bathroom at night using flashlight app	Handy application on smartphone device	No shortcut on the hardware, which sometimes is required to find the app	A shortcut button should be placed on the hardware to enable quick access. The button design should be different from the volume control and power button.

4.2.3 Participant 03 (TY)

4.2.3.1 Participant profile

Participant No./ Code	03/TY	**Location**	Indonesia
Period of Interview	08 July 2018	**Education**	High School
Age Range	90–95 (exact age is 93)	**Occupation**	Housewife
Gender	Female	**Other info**	Member of the church choir, swimming club for old people, and yoga
Device used 1	Very old Nokia – used to have it a long time ago	**OS**	Nokia Symbian

4.2.3.2 Participant biography

TY is a 93-year-old retired female and lives on her own at home. TY has a personal assistant and a nurse due to her health situation but is still considered very healthy for her 93 years of age. TY is considered to have excellent vision for her age and showed the researcher that she still had the ability to write and do some maths.

TY likes talking to her fellow friends on the phone using the house phone and is actively involved in some church organisations, including one organization that helps poor people across the city of Surabaya. TY has to travel from one place to another on a regular basis to do this work. When she was 88 years old, TY had an old mobile phone in addition to the house phone. One of TY's children bought the cell phone to equip her with a wireless communication tool in case of an emergency. TY was very confused when trying to operate the cell phone for the first time. After approximately three weeks, TY had the techniques required to use it properly. However, TY preferred to use the house phone and only used the cell phone when travelling. TY has a little diary filled out with a list of phone numbers.

4.2.3.3 Participant's overall comments for the selected models on the test board

TY now has more interest in using a wireless communication device than a 'wired' house phone because she likes walking around the house while making a phone call. When TY saw the phone

models on the test board, she remembered approximately two models that looked similar to the phone she owned. As far as TY remembered, her first phone had a keypad and the display was in black and white.

Therefore, TY selected two pairs of models from the test board, which were models 3 & 5, and 4 & 6. TY stated that models 3 and 5 were the most suitable and comfortable for someone like her due to her eyesight when looking at icons and navigation to touch the buttons precisely. Her reasons included:

- The “phone” button was obvious and clearly located on the top left corner of the screen.
- TY is familiar with the “camera” icon, which indicated a button to take photographs.
- However, TY could not identify the meaning of the “SOS” text on model 3 regarding what would happen if the button were pressed.
- The four small squares on the bottom-right corner of model 5a did not make sense for TY as they did not have any labels.

Meanwhile, TY thought that models 4 and 6 were appropriate phone choices because they looked similar to the first phone TY owned, around the year 2007.

- According to TY, these models had clear physical buttons and could be easily operated because TY was only required to make phone calls. The numbers on the keypad were clearly labelled to enhance her main utilization.
- TY understood that the green button is used for making and receiving calls, and the red button is used to end a call. TY stated that there was no issue with those icons as she used a phone with similar functions. Therefore, TY recognised them well.

4.2.3.4 Participant opinion on the software and display design on the phone UI

TY stated that some people her age were very enthusiastic about new technology, especially mobile phone devices. However, an older adult like her was always frightened of making mistakes when operating a technology, especially a mobile phone.

During the interview session, TY demonstrated her skills in performing some tasks on the phone. In this session, the researcher assisted TY to operate the phone from a general scenario using some common functions, including TY's own tasks to fulfill her needs.

TY operated the following applications during the interview session:

Photo gallery application

TY could carry out the following tasks and complete them herself:

- Sliding across the screen to preview the next and previous pictures.
- Pinching the screen inside and outside to zoom in and out on a specific image.

Online news application

TY commented that the default text on the phone was originally too small for her and TY could not properly read the text. Then, the researcher gave TY assistance to enlarge the font size to make it more convenient and visually readable for TY. TY was not sure how to get to that point without assistance from somebody else. However, TY is now able to read text properly and more conveniently.

A video call using free video-call on WhatsApp messenger application

This is one of the most attractive features for TY as she could use the video call feature and see the person's face on the other side. During the demonstration process, TY could spot the phone front camera on the devce and position herself in front of it. However, TY could not possibly perform this task from the beginning without supervision, such as assistance with how to activate the application and start the video call to a person, starting from the contact list.

4.2.3.5 Participant opinion on the hardware and usability design on the phone device

Clear markings on the number display button

TY also stated that older adults might be confused by looking at clarity of the number as it is not clear enough on buttons located on the mobile phone or smartphone keypad as this will lead users to make mistakes, and she could potentially not get back to the previous page when she had no idea how to press the buttons properly.

TY stated that it was not easy for older adults or someone like her who did not have experience in using such a technology to recover from an error on the phone device because they did not know how to troubleshoot this type of phone technology. The indicator of such a support should be clear and easy to understand in order to ensure that the users could operate the functions properly themselves. However, clear and meaningful physical buttons and assistance from others could be helpful for older adults to engage with smartphone technologies properly.

“I need help from someone when I cannot perfom my task” (TY)

Issues and Ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Interacting using the phone keypad	Physical touch makes it easier to interact	Button labels are not clear, the labels could be peeled off	More representative button design including the labels, i.e. using a kind of embossed print.
	Reading online news	Similar readability as on screen	Small display and control make it hard to scroll up and down the pages	Transparent control in the middle of screen should be designed
	Making a video call	Enable the live interaction, able to see the caller’s face	Need assistance to activate/initialise the video call feature	Video call navigation should be more representative, including sub-controls such as turn on/off the camera, mute/unmute the audio, and accepting incoming video call.

4.2.4 Participant 04 (CN)

4.2.4.1 Participant profile

Participant No./ Code	04/CN	**Location**	Indonesia
Period of Interview	13 July 2018	**Education**	Bachelor
Age Range	70–75 (exact age is 72)	**Occupation**	Formerly a Magician
Gender	Male	**Other info**	There is a little issue with his memory capability.
Device used 1	Samsung Galaxy Ace (taking turns with wife)	**OS**	Android

4.2.4.2 Participant biography

CN is a 72-year-old male, working as an entertainer (a magician). CN loves his job as a magician because the magic is not just a show, but also entertainment. Besides that, CN is involved in church activities as the leader of a choir group, and one of CN's tasks is organising a weekly practice schedule. CN also owns community housing in a place located approximately 85 km south of his city. This community housing was built for church members to have a picnic, a short recreation trip or even a community meeting. The community house employs three staff members, helpers and some outsourced cleaning services.

CN has no specific office to do his main job as a magician. However, CN has a work station at his house that is equipped with video and audio systems, such as television, CD/DVD players, audio amplifier, and a small projector. CN needs all of the video and audio equipment to do presentations to potential clients because he records most of his magic shows using a video camera.

In this scenario, CN is very familiar with functions of the video and audio equipment, such as the use of a remote control to play the video, and the fast-forward and backwards buttons, as well as the stop and pause buttons. CN can also switch and change the TV channel/programs or

the connection selectors to a HDMI or AVI connection, but CN could not perform an auto-search of the TV channels settings.

4.2.4.3 Participant's overall comments for selected phone models on the test board

CN recalled some featured games on his first phone:

"I am good in playing 'snake' games on my phone. Keep the phone simple so that I can use it."

When the researcher showed the test board, CN pointed at models 4 and 6 to be his preferred models on the test board. CN mentioned that those models were similar to the first "wireless communication" devices in his life. During the interview, CN could recall the phones by looking at their keypads, which looked similar to CN's first phone.

CN also recalled some core functions of the device, such as the snake and card game, but CN never won the game. CN mentioned that games were "good to play in your leisure time, but overall games would waste people's time".

Furthermore, CN also commented on the test board as follows:

1: Terminologies and text clarity

CN would have been using the traditional way to call other people if he was using models 4 and 6, but CN had to write the person's contact details on a piece of paper instead of storing the information to the phone as he could not do it. CN stated that it was not easy to get into that function (storing a new contact detail correctly) and he was frustrated by it.

However, models 4 and 6 have clearer visual and display navigation. Moreover, both models also have a physical keypad, which he preferred.

If CN were asked to buy a smartphone, CN would prefer models 1, 2 or 3 due to the display screen clarity. Apart from that, CN could be confused by some icons or symbols and their meanings. Some terminologies, such as 'abort', 'retry', and 'ignore' were confusing for CN as he did not understand proper English regularly. CN stated that he might not be able to understand some of the terminology unless someone explained it to him in the beginning.

4.2.4.4 Participant's opinion on the software and display design on the phone UI

YouTube and its navigation controls

CN found that the YouTube application was very appealing as he could perform a search for some videos that did not exist anymore in the market. CN could also find some old videos of his favourite singers, such as the Beatles, the Bee Gees, and also Michael Jackson.

CN's friends sometimes sent a video through an instant messenger, such as WhatsApp or Line messenger. CN could open and save the video files after being given directions by his wife. Eventually, CN was familiar with a button that enabled him to play the video by clicking on the play  button on the display screen.

Pizza Hut delivery application

CN could also order a pizza from the Pizza Hut delivery application. However, CN had to spend approximately fifteen minutes to place the right order and get it submitted properly due to limited navigation understanding.

CN struggled when he had to fill in the details on the online form as he was not familiar with the fields, or system's ability to recognise the address – CN did not realise that the application must recognise the location before delivery could be made. Therefore, CN requested assistance to finalise the pizza order.

4.2.4.5 Participant opinion on the hardware and usability design

Familiarity of the audio player control systems

CN claimed that he could perform some tasks very well on the car audio systems unit installed in his vehicle. Therefore, CN stated that he should not have any problems with the smartphone device functions. As he was familiar with the complexity of the car audio systems, CN mentioned that he usually carried out the following tasks in the car:

- Selecting his favourite radio stations and listening to the news on local radio station programs

- Adjusting the volume level up and down, and switching the audio mode selection to USB or CD/DVD mode
- Playing a CD or DVD when his grandchildren were in the car, including changing the audio to video setting, and adjusting the sound equaliser and video quality
- Operating the remote control car key to open the car doors and the trunk/baggage compartment.

Games applications on the smartphone

According to CN, he should find a smartphone device should be easy to manage and control as he had demonstrated the ability to operate some functions of his car navigation systems. When CN used the smartphone on the first day, his grandchildren taught him to turn the device on and off, make a phone call and send an SMS. Finally, CN also learned how to play a shooting game, which happened to be one of CN's favourite games on the smartphone. In the end, CN demonstrated his 'gaming' ability to the researcher, included adjusting the volume control or selecting different sound themes in the game to enjoy the audio effects of the games while he was playing. CN could also identify most of the icons or symbols on the game he was playing after being initiated by his grandkids. However, CN thought the game was just a waste of time.

Overall, CN felt that assistance might be necessary for older users to gain an understanding of and become familiar with a new technology (such as using a smartphone).

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Operating YouTube application	Icon metaphors are consistent or aligned with the ordinary audio player system	So far, CN found the functions are straightforward because no new control is presented	The icons or symbols should be designed so users can understand them based on their existing knowledge base. Older adult users might not have the ability to relearn new things easily.
	Operating audio systems	CN has the ability to operate the functions on the audio system	CN could not recognise some features or navigations of a new audio player/system	Navigations or controls should be made consistent with older models to allow older adult users to recognise and adapt to the functions.
	Games	Familiar with the functions and symbols	CN needed an introduction to the games.	A step-by-step tutorial to guide users to the game play would be beneficial. If it was a game for therapy, the instructions should be much clearer to allow users to play the game.

4.2.5 Participant 05 (RN)

4.2.5.1 Participant profile

Participant No. /Code	05 /RN	**Location**	Indonesia
Period of Interview	09 July 2018	**Education**	Dentistry
Age Range	70–75 (exact age is 74)	**Occupation**	Dentist
Gender	Female	**Other info**	Church choir, elderly church community, elderly sport community
Device used 1	Samsung Galaxy Ace	**OS**	Android
Device used 2	iPad	**OS**	iOS

4.2.5.2 Participant biography

RN is a 74-year-old dentist, and used to work at the navy base in East Java province in Indonesia. To be accepted into the military was not easy for a female unless that person had an excellent reputation, knowledge or skills. RN started her career as a dentist in 1978. At that time, RN had to deal with the dentistry technologies that were owned by the navy base to support the job. RN had to learn how to use the machines and the technologies herself while at the same time also dealing with a complex X-Ray machine in the X-Ray laboratory for dental assessment purposes.

Moreover, RN owns a pharmacy and a dentistry clinic, which are under the supervision of RN's husband and some employees. The pharmacy opens every day except Sundays and RN has to deal with some suppliers to place an order and purchase medicines on weekdays. RN is also involved in church communities, such as the choir group and ladies community as the leader of the church's Indonesian Women Commission.

In the early days of wireless technology's appearance in the market, RN was not even familiar with a cellular phone and its functions as she did not need one. She used to operate a traditional rotary dialing phone at her house. In the end, RN had to purchase a cell phone due

to her mobility as a dentist and her role a leader in the ladies community services at church. The phone allowed her to travel between one place and another without having to worry if someone called her, or she would make a phone call on the road.

“I had been using the rotary dialling phone for ages and I’m used to it. I’m not sure if I can operate something wirelessly, such as using a mobile phone” (RN)

4.2.5.3 Participant’s overall comments for the selected models on the test board

RN selected models 4 & 6 on the test board, which appeared to be similar to RN’s first phone. RN mentioned that her first phone model was more like brick than a proper phone because of the thickness of the phone hardware.

However, according to RN, the buttons of the applications seemed similar to a pager device that she also used in her job.

Rotary phone models versus wireless phone

RN commented that models 4 and 6 could be the best selection for people like her, as older adult users can have difficulties interacting on a phone device properly when the phones did not have physical buttons. When her landline phone systems have been replaced by digital ones, RN had to change her landline device into a wireless or cordless phone to match the configuration. However, the home phone device was still dependant on the digital transmitters that were not fully developed for wireless connectivity. Apart from that, RN could still use the rotary phone, although there were connectivity issues at some points. CN did not mind having the rotary phone as she thought that the device was uniquely designed, integrating human motorics to operate the phone by rotating the dial clockwise.

Physical buttons as preferred functions

CN selected models 4 and 6 due to clear the physical button design on the keypads. CN was used to touching the keypad on her older phone models, as illustrated on the test board. In fact, RN’s preferrences were for models 4 and 6 due to functionality, as she was only required to make a phone call using the phone. RN was not even capable of storing people’s name on

the phone book. Therefore, she would normally use pen and paper to write the names down. The navigation button appearance on models 4 and 6 were noticeable and easy to read.

4.2.5.4 Participant's opinion on the software and display design of the phone UI

Older phone models to support participant's regular activites

One of RN's activities was making phone calls to other people in the community (such as church friends and relatives), or to other dentists in the local area. RN stated that all the contact names and numbers were written and stored in her diary or physical address book. RN found that storing contact information on the device was problematic. RN found that she had made a mistake when trying to call friends with similar names.

RN used the paper address book as her reference to make a call. Therefore, RN required a phone with a large display screen and keyboard or keypad. RN usually entered the numbers into the phones individually.

4.2.5.5 Participant's opinion on the hardware and usability design of the phone device

Pager, Intercom and handy-talkie device as the main and only communication tool

RN used to have a "pager" device to receive messages from the navy base where she worked. RN found that the navigation controls on the pager device was easier than the first cellular phone she bought. RN stated that a pager generally had four main buttons: the on/off button, scroll up and down, and the delete button. The pager device had clear physical buttons that made it more usable for users to run the functions on such a small device.

Moreover, RN used to use an intercom unit in the navy base to communicate with other people in the base. RN stated that an intercom device was very easy to use because the device consisted of eight destination numbers and a buzz button to activate or place a call.

As a lecturer in the Faculty of Medicine, RN had to be able to operate a laptop and be familiar with the functions. RN stated that the laptop has been very useful in performing her daily tasks.

RN also mentioned a handy-talkie device that was used to communicate with people who are located outside of the navy base. Only certain people had permission to use that device due to security and privacy concerns.

4.2.5.6 Participant's overall suggestions

RN thought that technology had changed rapidly and people – especially older adults – did not have the chance or time to keep it updated. RN suggested that the development of technology for older adult users should be followed by having thorough technical assistance:

"Don't change the technology rapidly, especially if the technology is aimed at the older adult users".

According to RN, an easy-to-use technology would be more beneficial to older adults rather than a complicated or fancy technology. Prior experience in using technology – such as the use of the TV remote control – would help older adults to get into newer technologies.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Operating older phone models	Clear Navigation	Black and white dotted display	Maintain the navigation, improve the display screen colour configuration, but maintain the object clarity.
	Pager, intercom, handy-talkie	1-touch navigation to operate	Take turn when talking	Simple operations should be kept for further improvement on the smartphone device, but adding more supporting features could be beneficial to the new digital technology
	Turning on/off TV using remote control	Clear navigation and operational, like the idea of physical navigation	No improvement on types of remote controls from time to time	Maintain the simplicity of operational models on other similar devices, including the icons or symbol appearance, but adding more interaction features would be more interesting for a smartphone

4.2.6 Participant 06 (KY)

4.2.6.1 Participant profile

Participant No. /Code	06/KY	**Location**	Indonesia
Period of Interview	12 July 2018	**Education**	Master of Science (Statistics and Mathematics)
Age Range	65–70 (exact age is 67)	**Occupation**	Lecturer in Statistics, Mathematics and Sciences. Senior consultant in statistics and economics.
Gender	Male	**Other info**	Church community, economics expert/consultant forum, business analyst and consultant.
Device used 1	Samsung S3	**OS**	Android
Device used 2	Microsoft Phone	**OS**	Windows 10 for Mobile
Device used 3	Nokia Lumia	**OS**	Windows 8 for Mobile

4.2.6.2 Participant biography

KY is a 67-year-old statistician and mathematician who works as a statistics and mathematics lecturer at a government-based university and is involved in an organization of the National Statistics Bureau. KY has a business consulting company and is the director of that company.

KY actively participates in seminars related to business, innovation, research and development nationally and internationally. KY's duties also include researching presentation materials and making presentations in some seminars using Microsoft Office Programs, such as PowerPoint. KY could also operate facsimile machines in his office for sending messages to certain companies and institutions. KY mainly used the phones to obtain news from WhatsApp Group or any instant messenger services as well as the news application such as Detik apps.

4.2.6.3 Participant's phones

During the interview session, KY demonstrated some of his skills in operating his smartphone devices, as he owned three mobile phones that have various functions and utilization as follows:

- **Samsung S3:** KY stated that he put unlimited data volume on his Samsung S3 phone due to its function as his main smartphone device. Moreover, KY mentioned that the phone is used to store a number of contact names and browse online. KY could add detailed information to the phone book provided by the phone default settings. As the phone was getting slower recently, KY usually transfers the names on to another phone (Microsoft Phone – point B below) to free up some space. Meanwhile, KY used this Samsung S3 phone as an internet hotspot hub to activate the internet connection on the other devices.
- **Microsoft Phone:** This smartphone is used as KY's main backup phone in case the other two phones (Samsung and Nokia phones) break. KY generally used this phone to browse the internet, read online news, chat using instant messengers, make and receive phone calls, and send and receive SMS. This Microsoft Phone has the largest internal storage and KY has added another 64 gigabyetes of external memory to cater for photographs and videos.
- **Nokia "LUMIA" phone:** This smartphone is used as the other phone in case the other two break, and as a backup for the contact names and photographs/videos. The Nokia Lumia phone was KY's first smartphone model. KY used to own a Blackberry Onyx 2.

4.2.6.4 Participant's overall comments for the selected models on the test board

The ease of navigation

KY observed the phone models listed on the test board and found that the navigation on model 1 had the clearest structure for his eyesight to be able to distinguish the buttons properly. However, the space or gaps between the individual buttons could be made more apparent.

Meanwhile, phone models 4 and 6 on the test board were considered to be very old in the marketplace although KY bought one many years ago. However, those models were the most suitable phones for older adults to use as a means of communication due to the simple and clear keypad. KY was referring to his mother who owned a similar phone model.

According to KY, models 4 and 6 could also be offered to older adult users as they only need to have simple communication devices for making phone calls and sending messages through SMS.

4.2.6.5 Participant's opinion on the software and display design of the phone UI

During the interview sessions, KY demonstrated his skills operating the phone applications that assist him to run his daily activities. He also made some comments during the session regarding some issues that came up during the interview.

The phone should meet personal expectations and requirements

KY stated that the use of smartphone technology for older adult users might be undesirable if the phones could not meet their expectations. According to KY, his three phone devices have already met most of his main expectations and needs in supporting his daily activities, such as:

- Reading online news daily from national and international e-newspapers, including getting notifications for certain news
- Sending and receiving instant messages via messengers: WhatsApp, Line, and KakaoTalk
- Watching video clips online via YouTube
- Taking photographs using the smartphone camera and reviewing them in the gallery before sending out to other people via instant messengers, such as WhatsApp

According to KY, those activities were made possible due to the following:

- The Microsoft Phone and Samsung S3 smartphones have a big display screen which makes KY feel comfortable to read digital text, such as online news or watch video via YouTube.
- The functions work well with KY's fingertips, such as when KY used thepage sliders on the side of the phone to find a person from the contact list. It could be difficult for other older adults to proceed to this function due to the size and position of the sliders. KY also demonstrated his ability to type a message using the touchscreen keyboard without making mistakes or typos.

- The screen on the phones was a high-resolution display. This high-quality screen is important for older adults to be able to determine different digital objects on the smartphone properly.

4.2.6.6 Participant's opinion on the hardware and usability design of the phone device

KY had the opportunity to comment on the phone hardware while doing the demonstration on his three devices. In this case, KY thought that older adults are expected to adjust the volume control on the side of the phone hardware to ensure a proper volume level.

From KY point of view, there are some activities that require consideration on the smartphone hardware:

- KY likes watching video clips via YouTube and plays the clips using the phone speaker. According to KY, the position of the volume control buttons may vary from one smartphone to the other. Therefore, KY suggested that the older adult users may have the flexibility to re-adjust the volume level depending on the place or situation using the volume presets.
- The ringtone should be automatically set to a medium or slightly higher level to be able to hear the alarm or incoming calls while he is listening to a music or watching a video on his phone. Some people might forgot to bring the ringtone volume down if they are not used to it.
- The touch vibration would also help older adult users "feel" the touch and make these people confident that they are able to control the navigation. The phone vibration can also be utilised to indicate an incoming call when the phone is muted. KY also suggested that there could be flashing objects, such as flashing lights, to indicate the incoming calls.

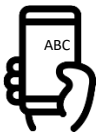
4.2.6.7 Participant's general comments and suggestions

Blackberry physical keyboard as a reference

Overall, KY stated that changing a smartphone device from one brand to another would affect the user experience and the phone's usability. Older adult users might not differentiate between the phone they were currently using and previous phones, and the users may

therefore have difficulties operating a different device. KY stated that a physical QWERTY keyboard on a Blackberry device (made by Blackberry RIM) presented a different experience and sensation from the touchscreen based keyboard on Android phones.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Activate audio on the speaker phone	Users have the abilities to adjust the volume control	Users may be confused in accessing the volume control as well as adjusting to the proper volume level	• Specific indicator should be placed to clearly indicate the current volume level • Some presets should be provided to overcome the volume being too loud or muted.
	Navigation touch on physical navigation	Physical buttons would enable the real 'feel' of the touch	Unable to properly and appropriately navigate around on a touchscreen based interface.	• Specify better gaps between keyboard letters. • Space out the application icons more evenly to improve the vision clarity between the background and a particular object
	Typing messages using keyboard	Using Blackberry QWERTY model	Using touchscreen	Blackberry QWERTY keyboard could be adapted into the new models for older adult users.

4.2.7 Participant 07 (SS)

4.2.7.1 Participant profile

Participant No. /Code	07/SS	**Location**	Indonesia
Period of Interview	14 July 2018	**Education**	High School
Age Range	75–78 (exact age is 75)	**Occupation**	Housewife
Gender	Female	**Other info**	Owned a Home Business
Device used 1	Nokia 7230 (White)	**OS**	Symbian
Device used 2	Nokia 3500 (Black)	**OS**	Symbian
Device used 3	Tablet – Samsung 7”	**OS**	Android
Device used 4	iPad	**OS**	iOS
Note	Shared use of smartphone devices including a tablet. Wi-Fi is currently installed at SS’s home.		

4.2.7.2 Participant biography

SS is a 75-year-old housewife who lives in a house with her husband and three personal assistants, including one driver. SS has four sons, two of whom live in the same city as her while the other two live out of town. Therefore, SS maintains communication by using her phones, especially with the family members who live out of town. SS makes regular contact with other family members using video call, which is installed on the instant messengers. Meanwhile, SS has a house phone installed in her house located in the living room. Moreover, SS owns two smartphones, one Android tablet and an iPad. SS usually uses the house phone to make outgoing calls when she is at home, while the other phones are mainly used to access the internet. Furthermore, SS owns a villa located out of the town and there is no phone installed in that area. Therefore, the cell phones are used most of the time and it is more convenient for SS to use the devices in such an area due to the location.

4.2.7.3 Participant’s overall comments for selected models on the test board

Colour and visual clarity on phone display screen

As soon as the researcher handed her the test board, SS recognised the phone models 4 and 6, as those looked like suitable phones compared to other devices that she was currently using, in terms of the colour and visual clarity of those models. In general, SS usually prefers these types of wireless phone models to make outgoing calls compared to the home phone, but she would rather not use it to send SMS due to her unfamiliarity with the function.

The significantceof navigational operations

SS stated that a good phone for older adults should be able to minimize the use of unnecessary navigation operations. A phone with big yet simple buttons was more important than a phone with fancy buttons. According to SS, models 4 and 6 had larger display and text size than the other models. On the test board, the screen of phone model 4 displayed the time clearly. Phone models 4 and 6 on the test board had a standard keypad (numeric) to enable users to type or punch numbers correctly, including having a clear layout, with clearly visible numbers.

Meanwhile, device models 3 and 5 could also be considered as preferred because these models have clear screen display including big and clear buttons to operate.

4.2.7.4 Participant's opinion on the software and display screen on the phone UI

Quick and easy access to navigate around applications

As SS is living a fast-paced metropolitan lifestyle she requires a phone that responds as quickly as possible, such as giving clear directions to a designated navigation, especially when SS needs to make a phone call quickly without having any issues in finding the navigation. At the moment, SS has made herself familiar with applications such as:

- **Instant messengers (WhatsApp and WeChat)**: This app is mainly used to communicate with her relatives. Apart from that, she also communicates with her friends and also some people in her community. Meanwhile, SS uses th eWeChat application to communicate with her relatives located in China, where WeChat is the only messenger service that can be connected globally.

- The camera and the photo gallery: The apps are used to take photographs and upload them to messengers. However, SS stated that she could only perform 10% of the camera application's functions.
- **YouTube:** This is accessible through the YouTube application or web browser. SS only used this application to listen to music and watch videos.
- **The internet browser:** SS uses the internet browser to find online images and some actors or actresses.
- **Skype:** SS rarely uses this application unless being assisted by other people to carry out a video call.

SS believed that her phones gave easy-to-find and easy-to-locate navigation due to the presence of a physical keyboard on the phone, and clearly visible text menu and numbers on the display screen (although the the display is in black and white). However, SS requires a shortcut or quick-access buttons to access the most frequent contacts, such as access to her children's phone numbers in case of emergency.

4.2.7.5 Participant's opinion on the hardware and usability design on the phone device

Blackberry Phone Keyboard

SS commented on a blackberry device that SS owned for a short period of time (approximately a month) where she had various issues in order to operate the device properly. Therefore, SS thought that the next phone development should be made better and more usable via the following criteria:

- Phone devices should have physical buttons rather than a touchscreen because people could "feel'" the touch. Therefore, according to SS, a phone with physical buttons could make it easier for her to navigate.
- Phone devices should have a keypad instead of a QWERTY keyboard as SS is more familiar navigating with a keypad compared to QWERTY keyboard, especially on a touchscreen-based smartphone.

- Phone models should have similar navigation to the ones that older adult users used previously to enable people like her to adapt easily to a new device. The operational method should also be similar or the same to avoid users getting confused.

Phone device speaker

One of SS's phones has a conventional loudspeaker that is useful to activate the phone alarm. A decent speaker would also be beneficial for older adults who have a problem with hearing so that they could put the audio on the phone speakers. SS used to experience some difficulties when she attempted to adjust the volume levels on some different occasions, such as in a quiet place as compared to a busy environment. SS could not easily find and locate the volume control navigation on the display, only the ones on the hardware/device.

4.2.7.6 Participant's phones

The participant's phones are shown in Figure 4.8 below.

1	2
	
Nokia 3500 (Black) **(with a keypad)**	**Nokia 7230 (White)** **(with a keypad)**

Figure 4.8 The cellular phone devices of SS

"I can operate this phone really well. The keypad is very useful and easy to use as I can feel the touch. The display is clear although it is smaller than a smartphone"

Figure 4.9 Participant's (SS) interaction with the cellular phone device

Issues and Ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	General interaction involving multiple icons	Clear colour and visuals on display screen	Need more tactile sensation	Combining these two interaction elements could make the older users perform better
	Access to frequently used applications	NA	User had to dig into the phone to find the appropriate apps. User could not perform the 'application search' function	Most frequently used application should be located on the main page using a block of area to enable quick and direct access.
	Operating physical keyboard	User could feel the touch	Bulky and the keyboard does not look clean	Combination between the tactile and the operation.
	Listening to music through the phone speaker via YouTube or player	The audio output will generate clearer audio quality on the right volume adjustment	Hard to find the volume control buttons on the hardware	Audio control buttons should be placed on the hardware and distinguished by shape, touch and position to avoid being confused with the power buttons

4.2.8 Participant 08 (KF)

4.2.8.1 Participant profile

Participant No. /Code	08/KF	**Location**	Indonesia
Period of Interview	14 July 2018	**Education**	GP in Traditional Chinese Medicine
Age Range	75–80 (exact age is 78)	**Occupation**	KF was a GP in Chinese Medicine
Gender	Male	**Other info**	Owned a home business industry
Device used 1	Nokia 7230 (White)	**OS**	Symbian
Device used 2	Nokia 3500 (Black)	**OS**	Symbian
Device used 3	Tablet – Samsung 7”	**OS**	Android
Device used 4	iPad	**OS**	iOS
Note	Shared use of smartphone devices including the tablet. A fast internet connection is installed at home. Participant has the ability to understand both Mandarin and a bit of English.		

4.2.8.2 Participant biography

KF is a 78-year-old retired Chinese Medicine GP. As he has already retired, KF spends most of his time watching television and video clips of Chinese singers and movies. KF has a 60-inch television and subscribes to a cable TV company to watch overseas TV broadcasts in his lounge room using high-speed internet connection. During the interview session KF demonstrated his ability to operate different remote controls that consist of various navigation buttons in order to show that he is competent to operate a kind of technology (i.e., TV remote control). As the television was not equipped with the YouTube application, KF normally used his Tablet to watch video clips, such as movies or songs on the internet.

Moreover, KF also has a medium-sized video and audio system installed in his bedroom. Currently, KF has two cell phones (Nokia phones) and two tablets (Samsung and iPad). KF stated that the phones had a similar operation to the remote controls. KF likes trying something new in his daily life. Therefore, he said that the remote controls will make him obtain more knowledge about the technology.

KF mainly uses his phones to make a phone call or video call using instant messenger applications like WhatsApp or WeChat messenger to communicate with others, such as his relatives. KF also uses the phones' video conference tools to contact his sons, who are located in other cities.

4.2.8.3 Participant's overall comments for the selected models on the test board

During the interview and observation session, KF had some preferences among the phone models on the test board. If KF was to choose the most suitable phone models for him from the test board, he would choose phone models 1 and 2. Those models have a big display screen and big touch panel navigation buttons that fit his eyes and fingers. However, KF would prefer to use phones with physical buttons than a touchscreen due to the level of comfort and getting used to it.

Icon styles and representation on the display screen

The icon styles on phone model 1 are more distinct that model 2, although KF did not understand the meaning of the text underneath the icons. KF mentioned that it would be much easier to reconise the icon than the text because an icon could give the best representation of the meaning

KF thought that the screen layout on phone model 1 is more consistent than model 2, although a significant "phone" icon to indicate a phone call had been placed as it should be in the top left corner of the phone. KF mentioned that he was more familiar with this phone model, including the icon and symbols used on the phone, which would enable him to proceed with interactions.

4.2.8.4 Participant's opinion on the software and display design on the phone UI

Users' demonstration on the smartphone and 7-inch tablet

"As long as I can dial the number on my phone, I will be okay. I don't use many of the functions. Once I have time, I will play with my tablet" (KF).

In the interview session, KF showed skill in operating his phone devices. He showed that he could change the screen brightness and contrast in the setting menus to display the best screen

brighthness based on the application he was currently watching, such as messenger or video application. KF had to be familiar with this function due to his habit of watching movies at night, before going to bed. Therefore, KF needed to dim the screen brightness when he was using the phone.

Using **Samsung Tab 7 inches**, KF demonstrated that he could open the web browser and search for information using specific keywords, such as KF's favourite Taiwanese singer, Teresa Teng. KF indicated that he could perform the task properly by entering the exact names in the field. He could also open YouTube to listen to Teresa Teng's song clips, make a full-screen view, and rotate the phone screen layout from a portrait to landscape position to get better views of the video clip.

4.2.8.5 Participant's opinion on the hardware and usability design of the phone device

Flexibility in handling the volume control

During the interview session, KF demonstrated the ability to type messages using the touchscreen keyboard on the tablet and the keypad on the cell phone. KF could also control the volume level up and down using the button on the right-hand side of the device.

Tactile interactions using the phone keyboard

KF commented that a smartphone device would generally be equipped with physical buttons to enable the users to feel the touch, especially for older adults that have weakening tactile sensations. KF stated that the phones with physical buttons were more likely to contribute to precise control because of the "feel" of the navigation touch. KF stated that the buttons on the cordless house phone were easier to use than the Nokia phones, although the buttons look similar. Therefore, KF suggested that the design of physical buttons should be maintained on the device in order to fulfil the tactile needs of older adult users.

Tab 1

Samsung Tablet 7”

Figure 4.10 Participant’s interaction with the tablet device

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Adjusting the screen brightness	There is a shortcut from the pull down	That is the only position where the screen brightness can be controlled	Screen adjustment control buttons could be located on the hardware device to allow users to use shortcut buttons.
	Adjusting auto-rotate screen	Users could preview images or videos in portrait or landscape mode	User has to find this control in the system setting	As this was part of the user’s regular activity, it would be nice if the settings could be placed in a location that is easier to find. Otherwise, there should be a simpler way to adjust the appearance of the most and least important buttons, and this needs to be more adaptable
	Adjusting the volume control	There is a direct access to the volume control	Accidentally pressed when holding the phone	Volume control buttons could be placed in a position that is more secure for fingers and movement so that accidental interaction can be avoided.

	Typing using the phone keyboard	Easier to type using physical object to get the tactile interaction	Harder to use the touchscreen-based keyboard when there is no tactile interaction involved	The touchscreen-based keyboard should always be given the vibration to enable similar reaction to the physical feel.

4.2.9 Participant 09 (SY)

4.2.9.1 Participant profile

Participant No. /Code	09/SY	**Location**	Indonesia
Period of Interview	16 July 2018	**Education**	Architect
Age Range	65–70 (exact age is 68)	**Occupation**	Entrepreneur, Businessman
Gender	Male	**Other info**	Types of business: electrical, mechanical, telecommunication; Supplier & distributor
Device used 1	Samsung Galaxy S3	**OS**	Symbian
Device used 2	Samsung Galaxy A5	**OS**	Android
Device used 3	Samsung Tablet 7”	**OS**	Android for Tablet
Device used 4	Blackberry Onyx 2	**OS**	Blackberry

4.2.9.2 Participant biography

SY is a 68-year-old businessman who runs a company in the electrical, mechanical and telecommunication industry. The business involves the power plant and telecommunication sector, including government and private-based trading. SY has a working space at home and a warehouse outside of the CBD. One of SY’s interests in this type of business is dealing with power plant engineers, IT people and company directors or managers. This kind of industry is rapidly developing in the engineering area due to consistent improvement and support from the government to expand the industry to rural areas. Meanwhile, there are also various investments in Indonesia from IT and electrical companies from overseas. Therefore, according to SY, the opportunity for SY to build a network with these people from other countries is wide open.

4.2.9.3 Participant’s devices

SY owns four types of phones (see Figure 4.11) with different functions as follows:

- **Samsung Galaxy S3:** According to SY, this phone is not equipped with a data connection. Therefore, the phone will only be allowed to make and receive phone calls and SMS. SY uses this device using a very old number that he has had since 1995. Therefore, SY does not anticipate to change the phone number as the number is known to all of his old friends.
- **Samsung Galaxy A5:** This phone has unlimited data connection, which allows SY to go online anytime, anywhere, without any limit.
- **Blackberry Onyx 2 (by Blackberry RIM, USA):** This device is used to send Blackberry Messages to people, such as SY's colleagues, friends or relatives who still own a Blackberry device.
- **Samsung Tablet 7-inch:** SY utilizes a Samsung Tablet device to carry out video calls with other people via instant messenger video call mode. Apart from that, SY uses the tablet to preview images on a larger display screen than a smartphone screen.

1	2	3	4
			
Samsung Galaxy S3	**Samsung Galaxy A5**	**Blackberry Onyx 2**	**Samsung Tablet 7"**
No data connection, just for phone and SMS	**Full data connection is available on this device**	**Communicate with other Blackberry owners**	**Used to view images or play videos**

Figure 4.11 The phone devices of Participant SY

4.2.9.4 Participant's overall comments for the selected models on the test board

During the interview and observation session, SY was not attracted to any of the models listed on the test board as he had already owned the Bang & Olufsen (B & O) phone as his first phone and he had made a full use of the device functions. SY also thought that the B & O brand was not popular in the Indonesian market when he bought it first time in a retail store in Singapore. However, if SY had to choose from the models on the test board, his justification would be as follows:

Similar navigation to his first phone device

SY selected models 4 and 6 from the listed models that he was attracted to on the test board. Although SY was looking a phone that looked similar to the B & O phone models that he bought the first time, he thought that models 4 and 6 could satisfy his needs similarly in terms of the screen size, layout and buttons. The only difference is that the B & O brand has a little antenna that can be pulled out when making a phone call.

Suitable navigation buttons to handle complex interaction

SY also considered selecting models 3 and 5, which have bigger navigation buttons. SY stated that the size of the navigation buttons on both phones would be pleasing to older adults' eyesight and these models could also fit SY's fingertips so that he could click on the buttons precisely and accurately. SY is also concerned with the current smartphone because the navigation buttons are smaller than his fingertips. SY stated that he had made a lot of mistakes when clicking through the phone's navigation. Moreover, his current smartphone could possibly handle more applications on the screen compared to the models on the test board.

4.2.9.5 Participant's comments on software and display design of the phone UI

The messengers as the most frequently used applications

SY mostly interacted with the Samsung A5 to operate instant messenger applications, such as WhatsApp or Line messenger. SY mostly used the instant messenger services to communicate with other people, both as an individual user and in a messenger group. SY found that the Samsung S5 model was very powerful and useful in operating messenger services as it has

functions to attach photographs, video or document files into the chat sessions, and to create and join other WhatsApp groups. Therefore, SY is more familiar with the operations of the instant messengers than the other applications on this particular phone.

Camera or video and preview gallery

Apart from the instant messenger application, SY is also familiar with the camera functions as it is one of his hobbies in his leisure time, or at an event such as a wedding party or a seminar. SY could also demonstrate other operations after taking photographs, such as zooming in and out, adjusting the brightness and contrast, and deleting the photographs when he longer needs them.

Browsing on the Internet using Google Chrome or Android Browser

SY stated that browsing was the most challenging activity for him (SY was not sure of the loading status of a page on a website). Therefore, below are some comments that present the challenges in how SY interacted with the internet browser:

- SY uses his Samsung A5 to go online because the screen size is reasonably suitable for him to browse information using the browser application
- Internet interaction on a smartphone is considered harder than on a tablet due to some difficulties in scrolling up and down the pages and clicking on specific text links
- SY was unfamiliar with the process used to download and locate photos, videos, or even a document from the internet using the browsers
- SY used the internet browser to search for and watch the first minute of a video and will watch the rest of it using the YouTube application
- SY used the smartphone to read online news on the browser, but thought that the feeling was different to reading a hard-copy newspaper.

Applications that require unlimited data bandwith and digital display

According to SY, the YouTube application was one of his favourite applications because he could watch old movies on the phone that had unlimited data.

“I really like watching tutorial videos on Youtube” (SY).

Participant comments on digital display

“I require sending photos of products, invoices, images, or videos of product samples to my customers through WhatsApp messenger as it is so convenient, but sometimes I struggle a lot in doing multiple actions on the phone” (SY).

According to SY, there are other factors that relate to the level of comfort of the smartphone display –the most significant factor in smartphone utilisation – as follows:

1: A digital display would have different visibility comfort compared to a hard-copy one

Digital information will have different readability comfort compared to paper-based newspaper due to the size of the paper-based layout.

2: A colourful display could possibly distract older adult users and make it difficult to distinguish multiple objects properly

Based on SY’s experience, colours should assist the eyes’ ability to differentiate objects properly, such as looking at photos, watching videos, and creative designs. However, colours could possibly cause problems when users are trying to find specific applications on the smartphone pages.

3: Smartphone with 5.5” display resolution gives a better experience that a cellular phone.

Old phone models with small display screen sizes present different experiences to an Android smartphone with 5.5” display screen size. These experiences include the level of comfort in using such a big display.

4: Icons and symbols that could be misleading

Older adults should be provided with explanations of the icons or symbols, including their meanings and functions. Older adult users would not be familiar with them when they looked at their display screens, especially when the screen is packed with applications.

5: Language preferences

Language selection could become a serious issue for older adults when the systems do not match the user's main spoken language. This situation would affect the whole user interaction and accessibility, so this should be the first step a user could perform on a smartphone device before they could interact further with the phone.

6: Users could possibly uninstall an application when errors occurred due to an inability to recover from the issue.

Based on SY's experience, he used to reformat the whole smartphone's systems due to errors on his phone that he could fix. SY was worried that a smartphone got infected by viruses and he could not take any action to wipe the virus off the phone due to a lack of skills in handling a virus on the phone. Therefore, the easiest way to overcome this situation is by reformatting the smartphone operation systems to get a freshly installed system that is free from viruses.

4.2.9.6 Participant's comments on the hardware and usability design on the phone device

In addition to SY's comments on the display screen, SY stated that his first phone was a Bang & Olufsen brand, made by Bang & Olufsen Company. SY described that the B&O phone device looked more like a brick than a communication device. However, according to SY, the B&O model had very simple navigation and interactivity. Thinkin gabotu the B&O phone, SY considered the most significant items were as follows:

- The phone body was very thick and safe to prevent damage from dropping
- Navigation buttons were designed using physical buttons
- The battery lasted a long time – approximately 24 hours while continuously powered on. However, if there was a sudden drop and the batteries were damaged, two to three spare batteries were provided by the company as part of the package

- The B&O phone was considered a very stable phone when making a phone call due to its transmitter and receiver equipment inside the phone

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Interaction using messengers to type messages		Hard to type fast using touchscreen keyboard	The combination of suitablysized keyboards and tactile vibration should be implemented to allow users feel the 'touch'
	The fingertips on older phone models	The fingertips can be accurately positioned on the buttons	User might not be able to press the buttons precisely	Better gap between buttons should be considered to allow more precise interaction
	Making a phone call using older phone model	Better hand grip on a big device	The device looks like a brick	Device size could be reduced to make it slimmer, but the width and length could cover the whole hand to enable better grip.
	User is facing an error on the display screen		User could not recover from significant error due to inability to understand the error message	Easy-to-understand along with easy-to-recover error message could make the user feel more secure when having issues or problems on the device

4.2.10 Participant 10 (TF)

4.2.10.1 Participant profile

Participant No. /Code	10/TF	**Location**	Indonesia
Period of Interview	16 July 2018	**Education**	N/A
Age Range	65–70 (exact age is 67)	**Occupation**	Housewife, Entrepreneur
Gender	Female	**Other info**	Involving in electrical trading
Device used 1	Nokia 8300 – Touchscreen, Slide Phone	**OS**	Symbian
Device used 2	CDMA Phone	**OS**	Android
Device used 3	Samsung Tablet 7”	**OS**	Symbian for CDMA

4.2.10.2 Participant biography

TF is a 67-year-old housewife, and used to work as a ballet instructor in a ballet academy. TF’s hobbies include gardening and arranging flowers as well as creating fashion design. TF spends most of her spare time watching movies, such as Korean or Chinese old-folk drama, and orchestral/ballet performances on YouTube.

TF started her own business in approximately 1996 and worked together with her husband. Both TF and husband are currently running a small-medium business in the cable industry and have clients locally and nationwide. TF has one employee and runs her business on weekdays and half a day on Saturday. TF’s main communication tools are her cellular phones and a house phone to maintain connection with her customers. TF stated that she owns two smartphone devices (a Nokia 8300 and a Samsung phone) and one Samsung tablet (seven inches). The two smartphone models are both on a GSM-based network, but each has a different mechanism. The Nokia 8300 is a GSM-based phone, while the SAMSUNG brand is a GSM-CDMA phone that works on GSM and CDMA data connection. TF uses CDMA phone data connection that is considered to have cheaper calling data and calling rates than the GSM prices.

In this business, TF has limited time to deliver goods from the suppliers to the customers. Therefore, TF needs to maintain good communication between her office, her suppliers, and her customers to keep these people updated with the delivery schedule.

Other than work routines, TF has a retreat accommodation out of the city, located approximately 70 kilometres south of the city, where she spends the weekends. On the weekends, TF usually travels to her villa and does a bit of leisure, such as meeting friends or having a small barbeque party.

4.2.10.3 Participant's overall comments for the selected models on the test board

Simple and adaptable navigation of the Nokia device

In the interview session, TF selected phone models 4 and 6, which looked similar to her old Nokia phone. TF stated that the Nokia phone had been used for nine to ten years, but there was a small problem with the keypad and TF decided to purchase a new phone. TF thought that the phone was no longer useful since the main control was broken, (the keyboard). Therefore, TF purchased a new Nokia 8300 series to replace the older model. Apart from that, TF considered that the Nokia phone is the easiest device to operate based on her experience.

Moreover, TF commented that phone models 4 and 6 were the most appropriate device for people at her age due to their simplicity. TF also mentioned that she would be comfortable to use model 4 or 6 as she had experience in using that type of phone. However, the touch level could have been adjustable to give better individual experience based on user preference.

The other reasons for TF selection phone models 4 and 6 are as follows:

- These models have a clear and clean display. These points are beneficial to older adults who have low vision and have to change glasses when they are reading. However, the general body size of the phone is relatively small as compared to the standard Nokia series 3.
- The navigation buttons are considered big enough to interact with and fit the fingertips.

Models 3 and 5 are TF's second selected group. They seemed to have a similar navigation style to the other smartphone device she is currently using. Overall, a phone with physical buttons is TF's preferred model compared to phones with touchscreen functions.

4.2.10.4 Participant's devices

TF uses three different phone devices: a Nokia 8300 with a colour screen, a ZTE cell-phone and a Samsung 7-inch Tablet. The main differences between the two phones and the tablet are described in the following table:

Category	1	2	3
			
	Nokia 8300	**ZTE Phone**	**Samsung Table 7”**
Display	Full Colour	Colour CGA/XGA	Full Colour
Software	Basic Symbian; minimum access to the internet	Basic ZTE OS	Android + Software
Most used features	Phone, SMS	Phone, SMS,	Browsing, YouTube, Skype and Facebook messenger.
Band	GSM	GSM and CDMA	GSM data only
Calling rate	Full rate, approx. 20–30 cents per minute talk	CDMA rate, approx. 5 cents per minute, free SMS	Unlimited data bandwidth. Not available to make a phone call.
Coverage	Nationwide. No data plan installed.	Local in the City, approx. Radius of 5–10 kilometres outside the outer boundaries.	Nationwide data connection.

Figure 4.12 Comparison of device software and display of TF devices

TF preferences on her devices (see Figure 4.12) are mainly based on the following:

- **ZTE Phone:** This device has physical buttons that enable easier control on its numeric pad, as TF uses the phone to make calls only. Therefore, a precise touch on the buttons is easily carried out when making a phone call using the ZTE Phone.
- **Samsung Tablet:** One of TF’s reasons for purchasing digital communication technology is her mobility. Apart from that, a big screen and navigation also influence her decisions around the most appropriate models for her. According to TF, a Samsung Tablet has a bigger screen resolution that a smartphone. However, a tablet device is more difficult to

carry compared to a smartphone as the tablet would not fit into TF's bag unless she bought a new bag that suits the tablet.

- **Nokia 8300:** This Nokia 8300 model had the latest technology at the time of the interview when TF purchased it. She was really pleased with its simple functions and screen display layout.

4.2.10.5 Participant's opinion on the software and display design of the phone UI

Icons clarity and recognition

TF stated that some elements on the phones had clearly visible phone icons, but some did not. For example, the touchscreen panel on the Nokia 8300 was not easy to activate compared to the Tablet due to the slide that needed to be pushed in order to reveal the keypad. And also, the icons on the Nokia 8300 are more meaningful than those on the Tablet as TF is more familiar with the older phone model icons. Meanwhile, TF's Nokia 8300 was still equipped with physical buttons/navigation to allow her to navigate through the phone more easily, as TF was familiar with the functions.

In addition to the point mentioned above, TF stated that the ZTE phone had the best physical buttons/navigation. However, the phone device is no longer compatible with the latest technology due to the 2G systems installed on that ZTE phone.

4.2.10.6 Participant's opinion on the hardware and usability design of the phone device

The visibility of the main functions on the phone device

TF highlighted some aspects of the hardware design of her phone. According to TF, the ZTE phone looked more like a toy than a real mobile phone, but had very simple navigation and interactivity, allowing her to access the phone easily. Meanwhile, the sliding compartment where the keypad is hidden made TF uncomfortable when receiving calls. She had to open the keypad by sliding the front cover up in order to reveal the keypad.

The need to having flashlight application

There is one interesting feature on the ZTE Phone, which is the flashlight. TF suggested that the flashlight tool or application, which happened to be important to her, could have been made simpler by locating a shortcut to activate the application. Moreover, according to TF, the phone batteries should also be made to last long enough in order to make the flashlight stay longer and to avoid older adults users getting a sudden power cut-off or having difficulties finding a charging station when mobile.

“A flashlight application is very helpful when I need to go to the bathroom at night. And also, a proper security information should be made clear if we want to do internet banking” (TF).

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Operating regular functions such as phone call using Nokia	Quick access to phone call		The method should be implemented into a smartphone device with touchscreen operation.
	Accessing the 'phone call' and 'WhatsApp' messenger icon		The icons' similarity could lead to confusion, misallocating the icons	Text should be placed below the icon to clearly distinguish between 'phone call' and 'messenger' applications due to the frequent utilisation of the applications
	Device main functions visibility	As it is being invisible, the buttons are protected from mistouch	Users have to slide to open the main navigation	The system should allow an auto reveal of main navigation operation
	Instant messengers	TF can perform video call for better communication	TF found it a bit more complex to initialise the video call, especially if the data connection is not turned on.	A clear indicator should be provided to allow users to see the connection status
	Flashlight	Helpful at nighttime in giving light to the bathroom	Battery could not last long on a particular device No shortcut to activate	• Battery life should be further considered • A shortcut on the hardware is recommended

4.3 Key Research Insights from Indonesian Participants

The researcher gained a better understanding of how the participants from Indonesia utilised and interacted with their personal mobile devices from the older adult perspectives. Using semi-structured, small group/individual interviews, the researcher was allowed to dig into the participants' daily activities and habits as needed.

Some of the key aspects of the research findings during the observation sessions in Indonesia are as follows:

1. It is quite challenging for the elderly from Indonesia to own more than two mobile phones that are all functional, although one person owns seven phones. The semi-structured, small group/individual interview method in this research project allowed the researcher to investigate the dynamic of older adult users in Indonesia as they demonstrated their experiences in figuring out how to operate their phones themselves. This included the demonstration of ususual features that the users may have, which would determine uniqueness of one user compared to the others.
2. The older adult participants in Indonesia tended to use the instant messengers as a means of communication due to the flexibility to send files, such as images, audio, contacts and documents. Meanwhile, the instant messenger applications offer the opportunities for users to record all their conversations for further review or archive.
3. The older adult users in Indonesia are likely to use trial and error when dealing with technology that they are not familiar with. Further, the older people from the Indonesian culture will not stop attempting tasks when they are facing difficulties. These users will seek assistance only when the device stops working entirely.
4. The elderly users in Indonesia tend to have one-on-one coaching from other people on how to operate the device to enable them to do their tasks in their own time. This active involvement of the researcher and older adult users in Indonesia will eventually educate the users with the technology. In this case, the use of UX/UI design method using the semi-structured interview for small group/individual was also utilized to investigate the

Indonesian older users' behaviour towards multiple smartphone technologies as well as giving necessary assistance when users needed it.

5. Older people in Indonesia did not offer any options to develop an emergency button as part of the smartphone navigation because these elderly people have in-house assistants (servants) to look after the entire house for cleaning and assisting the house owner when needed. Therefore, these assistants could also be utilised as personal assistants when there is an emergency situation in the house by making a call to the house owner's relatives or close friends.

4.4 Summary of Chapter 4

The overall results of the interviews and observation sessions with the participants in Indonesia showed that:

- More than half of the participants owned two or more phones due to different activities and different monthly data/calling rates
- Compared to the Australian participants, Indonesian participants had a reasonable understanding of how tasks could be performed in different ways once they engage with the device, depending on their experience
- Quick update of new communication technologies in Indonesia make these participants update their phones regularly
- One person (10%) of the representative users owns seven different phones using different telephone providers and used for various purposes.
- Five people (50%) of the representative users own three to four phones
- Meanwhile, four people (40%) of the representative users own only one phone
- Older people in Indonesia tendto send text messages, either using instant messengers or SMS, rather than talking on the phone (i.e., making a phone call).

4.4.1 How did the participants in Indonesia interact with their communication devices?

The interview and observation sessions provided insights from an elderly person's perspective on how they own and interact with their. The advice from the participants in Indonesia helped the researcher develop an understanding of how older adult users are attracted to this technology for the first time through to how they are able to operate it properly.

The observed sessions also analyzed when these users have issues during their interactions that affect how they engage with the technologies until they purchase a new device. Specifically, 60% of the respondents owned more than two phones and one participant owned seven mobile devices. Therefore, there are some specific capabilities from the participants in Indonesia in terms of how to deal with different technologies and platforms.

The collaborative sessions to share information on how to operate smartphones properly emerged as important as they are occasions where users might obtain knowledge from others. Therefore, these interview and observation sessions have been valuable for the researcher in gaining insight into the issues and ideas about older adults' engagement with phone technology in Indonesia. In this case, the data will then be utilized to propose and develop the future of smartphone user interface design. In some cases, the participants in Indonesia shared their knowledge with the researcherwho was able to learn new things.

Detailed analysis of the combined Indonesian and Australian data will be presented in Chapter 6: Discussion and Resolution.

CHAPTER 05:

Result Overview of the Participants in Australia

5.1 Introduction

This chapter presents detailed results of the interviews and observation sessions that were applied to the **Australian** participants. As with the Indonesian group of participants, the researcher asked the participants to fill out a consent form as part of an initial formal research process to ensure compliance with proper procedures in an Australian research context. The participants are identified by their initials to ensure anonymity and privacy.

Each participant was presented with the same task and questionnaire as the Indonesian group to maintain consistency of the expected results and the data for each interview. The tasks included making a phone call, sending a message through various messenger services and various tasks that relate to personal preferences. The data presented in this chapter illustrates how each participant has a unique combination of usage approaches to smartphone technology due to their work and social circumstances in the Australian cultural context.

There were ten Australian participants interviewed as listed in Chapter 3.

5.2 Participants

5.2.1 Participant 01 (FO)

5.2.1.1 Participant profile

Participant No. /Code	01 / FO	**Location**	Australia
Period of Interview	08 August 2018	**Education**	Law Degree
Age Range	70–75 (exact age is 70)	**Occupation**	Lawyer, Legal Advisor
Gender	Female	**Other info**	Government officer
Device used 1	iPhone 6S	**OS**	iOS

5.2.1.2 Participant biography

FO is a 70-year-old female who is currently working as a lawyer in a community legal service. She usually attends court when there is a court hearing. Every day, FO works approximately eight hours per day in a community legal service office. However, there are no specific times when FO has to attend a court hearing in the city of Perth as she will be contacted by the admin people in her office or other staff members in the court to arrange the schedules.

Regarding the smartphone, participant FO has used various mobile phone brands in the past before she purchased an iPhone device, but her current smartphone is the iPhone 6S.

FO considered herself as being up-to-date with technology as long as the technology does not keep changing. FO stated that whenever the phone technology changes, that changes her habits and lifestyles too.

5.2.1.3 Participant's overall comments for the selected models on the test board

According to FO she rarely saw the Japanese phone models in Australia and she thought that those models did not enter the Australia market. Phone model 1 on the test board looked similar to her current iPhone, but the display on model 1 looked smaller than her iPhone.

Meanwhile, phone model 1 on the test board had bigger (or maybe the biggest) navigation size than the other models, and this would make it easier for people to hit the buttons. FO thought

that a big and clear screen, including layout and navigation, would accommodate the needs of older adult people who may have low vision.

The coloured frame of the buttons on phone model 1 would make it easy for people to distinguish between the edge of the buttons and the background area. These elements are useful to avoid making mistakes while using the phone. FO thought that older people might click on something that is not clickable and that would frustrate them.

FO did not comment on the specific aspects of phone model 1, which has physical buttons on the device. FO understood the function of a button with a clear 'home icon' on it that will take her back to the page area. Other than that, FO thought that the navigation was clear, but she needed to interact with the device in order to get a better sense of the device.

5.2.1.4 Participant's opinion on the software and display design of the phone UI

During the interview sessions, FO addressed some issues on her iPhone that affected her interaction, such as:

The auto update of the iOS Operating System

FO mentioned that the software auto update was very frustrating because there was no notification that she needed to update the OS when an update was available. As FO updated the operating system, the overall configuration changed, and that impacted on her user experience. During the interview, FO stated that after struggling for a few months, ahe got assistance from the technical support team in a local Apple store to switch off her auto updates. One of her colleagues sometimes assisted FO on how to deal with her phone when it did not work as she expected. However, she relied on the Apple Store technical support people most of the time.

Unclear terminology

FO struggled when she found a sentence on the iPhone 6 saying "Adds Multitasking Gesture to the original …" during the auto update activation, which did not make any sense to her. FO thought that the auto update had nothing to do with the gesture, and it did not affect any of her interactions in the end.

Meanwhile, another sentence came onto the display “Download and Install”. FO got confused and was it difficult for FO to understand as she was not sure what to do at that time. Therefore, FO ignored the message until later on when she had better assistance from the Apple Store on what to do with the “Download and Install” message. The researcher asked her why she did not proceed and just saw what would happen if the instruction went ahead, and FO stated that she did not want to take the risk of doing something she did not understand.

Participant suggestions on the use of terminology

- FO suggested that the phone developer consider the mental model of the users, especially older adult ones. The use of terminology should be carefully selected to avoid confusion and misinterpretation. Otherwise, older adults will constantly seek assistance whenever a strange message appears.
- FO also suggested that older adults should have personal notes on how to utilize the phone in case any errors occurred in the future. This would also include general explanations of what terms meant and how to deal with them.

The visibility of the person’s photographs on the contact list

FO stated that a photograph should be attached in conjunction with the person’s name in the address book, which would be beneficial as callers could be easily recognised and identified. FO thought that this feature should be maintained and developed further because she had a lot of similar names in her contact list, such as John, James, Mary, and other popular names.

Participant’s suggestions on the contact pictures on the contact list

- A photograph should be attached to a person’s name that is being entered on the contact list. This will give the user the proper details of the person in the contact list by having the photograph. This development is to overcome the issue FO had of some similar names on the contact list. However, another issue might arise when older adults had to enter a new contact themselves and were required to attach a photograph of a person onto it. FO thought that assistance would be required to help older adult users determine how to setup a proper contact list, including attaching a photograph of a contact name.

- FO also suggested that the photos in the contact list on the iPhone 6 could be made bigger than they are now on her existing iPhone 6. FO stated that some people might have similar faces and she found it was hard to distinguish when she did not wear her glasses.

"I am a lawyer and have very limited knowledge about technology. When my phone volume was accidentally turned all the way up, it was very embarrassing to me as I did not know how to turn it down because I was panicking" (FO).

Clear and easy-to-understand error message

At some point, FO got some error messages on the phone and could not identify what the problem was through the message. There were always two options: OK and CANCEL. In this case, FO was not sure what would happen when either OK or CANCEL was clicked. FO became confused when this problem occurred as she did not want to take a risk and proceed if "Cancel" could also mean losing her previous information.

5.2.1.5 Participant's overall suggestions on the software and display design on the phone UI

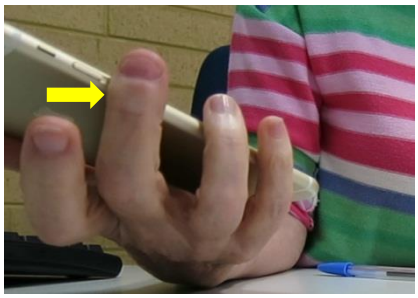
FO thought that older adults could not easily handle and solve errors in the technology themselves. Therefore, a friendly and clearly stated error message including a short but concise solution should be implemented to guide older adult users to recover from errors. The errors would simply happen when the user accidentally pressed a wrong button and the users would see some message to trigger their decision, such as Abort, Retry, Cancel. According to FO, incorrectly reacting to the message would make the phone stop working. The error message could be clear; however, the terminologies would not make it easy for her to understand what to do next.

5.2.1.6 Participant's opinion on the hardware and usability design on the phone device

Left-Handed User Interaction on the Volume Control

As a left-handed phone user, FO comfortably held the iPhone 6 devices in her left hand, until she found out that the volume buttons could be accidentally pressed when she was holding it. FO was frustrated when the phone volume would suddenly be turned all the way up during a

meeting and she got a phone call; or all the way down when she was awaiting an urgent call. FO felt that a loud ringtone volume might disrupt surrounding people or, in contrast, she could not hear an incoming call alert if the volume was turned all the way down.



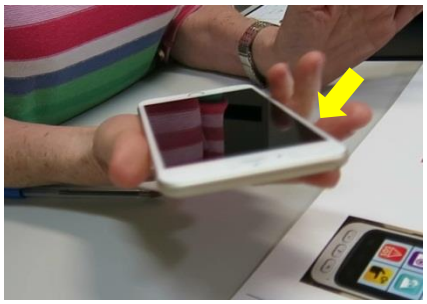


Figure 5.1 FO's hand-grip touching the volume buttons

Participant's suggestion on the hardware

FO suggested that the volume buttons on the hardware should be relocated to a higher or lower position from the index and middle fingers (see figure 5.1) as the current position causes issues. FO thought that male and female older adults might have different handgrips on a smartphone device. Therefore, a particular design for specific genders should be considered to accommodate specific needs regarding the volume buttons.

5.2.1.7 Overall participant suggestions

- The navigation on a smartphone device should be made as simple as possible and intuitive, and also clearly visible to accommodate the needs of older adult users who might be exposed to this type of technology for the first time.
- A more user-friendly diary could also be designed for older adults to help them remember appointments, as these people might be forgetful even of the most used application, such as the reminder application to take medicine.
- Assistance would be required in most circumstances in order to support these users when errors occurred, especially if the errors were related to the phone settings due to unclear

terminology. Therefore, the terminology should be 'translated' to an easier one to enable older adult users to understand and know how to react.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Searching for contact names	The list is in alphabetical order	Users cannot recognise similar or same names without photograph	Users should be prompted to take photos of the person or at least get a photograph of people in the contact list to distinguish between similar or identical names.
	Getting an error message	Giving users warnings	Non-intuitive messages would lead to confusion and uncertainty	• The error message should be equipped with additional information to let users know what was happening earlier and how to proceed with or discard the action.
	Volume control	Placed in the hardware	Accidentally pressed	• Placed in a more suitable position to avoid user pressing the buttons by mistakes. • Different materials could be used to differentiate the up/down volume buttons. • Should also consider left and right-handed users when carrying out the same task.
	Setting up a reminder	NA	Terminology and setup process were not intuitive	The design and structure, including the terminology, should be made more intuitive and have flexibility in the controls

5.2.2 Participant 02 (JO)

5.2.2.1 Participant profile

Participant No./Code	02 / JO	**Location**	Australia
Period of Interview	10 August 2018	**Education**	Not specified
Age Range	70–75 (exact age is 70)	**Occupation**	Community Service Admin
Gender	Female	**Other info**	
Device used 1	Galaxy Ace	**OS**	Android
Note	JO uses smartphone most of the time, takes turns with her husband once a while.		

5.2.2.2 Participant biography

JO is a 70-year-old retiree who lives in a retirement village. Both JO and her husband become leaders of the older adult community in the retirement village. However, JO and her husband do not want to be called 'leaders' because their role is just to help people with events carried out by the retirement village management. JO loves to help out; one of her passions is helping others. One of her children is a pastor in a church located in the city of Perth, whose duties include visiting people who are sick in hospitals and other designated places.

JO works from eight o'clock to five o'clock on selected weekdays in a refugee centre, which is located approximately 30 kilometres away from her house. JO's main activity at the community centre is as an administrator and one of her tasks is to help refugees from different countries. JO usually works a full day on Wednesdays and half-day on other days. Other than that, JO usually stays at home or gets together with the people in the community centre where she lives, or plays with her phone, i.e. accessing Facebook, YouTube, and also Instagram.

5.2.2.3 Participant's overall comments for selected models on the test board

When the researcher handed out the test board, JO did not point out specific models to be reviewed. In general, phone models 1 and 2 could be comparable to models4 and 8 in regards to the size of navigation buttons. However, Jo selected smartphone models 3, 5 and 6 due to the big touchscreen buttons. JO stated that she always mistypes words when sending messages

or was typing something up. Therefore, a smartphone with big navigation buttons and display could be beneficial for JO to avoid making typing mistakes.

5.2.2.4 Participant's opinion on the software and display design of the phone UI

Camera and photo gallery application to support JO's hobbies

According to JO, taking pictures is one of JO's hobbies in her free time, along with gardening. Therefore, JO utilises the camera phone to take photos of nice gardens and flowers. JO stated that she was familiar with the editing tools on the photo gallery, but was very slow to use the tools, as she wanted to edit a photo correctly before uploading it to social media. JO usually uploads the gardens or flowers photographs into Facebook.

Participant's comments on the camera and photo gallery applications

JO considered herself as a 'smartphone photographer' due to her hobby in taking photos using her smartphone. Therefore, JO requested a tool be developed that was designed for late adult users to be able to edit photos more easily and appropriately with flexibility and control, as in a real camera. JO stated when she could not perform editing on the spot it was normally due to her unfamiliarity with the tools in the settings. JO stated that someone's assistance who understood how to use the editing tools could be useful. Otherwise, the application would be uninstalled from the device due to its complexity and inflexibility of use.

"I like taking photos using my smartphone and put them up on Facebook so that I can share it with my sister. I normally take photos of flowers or gardens" (JO).

Facebook application interaction

JO stated that Facebook was one of her favourite applications. Generally, when JO finished taking some photographs, she used Facebook to upload and exchange pictures of gardens and flowers with her sisters who live out of town and overseas. JO thought she had no issue with Facebook because she accessed it daily whenever she wanted to upload photographs. JO stated that she has been using the application for approximately five years and is very happy with the navigation control, especially the image editing tools. JO also thought that the Facebook application was very useful for obtaining reviews of photographs she uploaded into her account

as people through the entire world who are connected to her account may have the same opportunity to view the photographs and give comments. Moreover, JO also likes giving comments to images that her friends upload to Facebook.

5.2.2.5 Participant's opinion of the hardware on the phone device

Phone hand grip compatibility

JO mentioned that she had an issue with the hand grip on her Galaxy Ace device, especially when taking a photograph. JO felt that the smartphone device was too light for her to grasp it correctly. Therefore, JO expected that she could take proper photographs when she had a better hand grip to the phone. Otherwise, the pictures may turn to be a bit blurry.

Participant's suggestion on the hand grip

JO suggested that if Samsung Galaxy Ace were to be used by older adult users, the hardware should be equipped with a supporting device or tools/mechanism to stabilise the hand grip for older adult users. This mechanism could be designed to help older adults hold the device steady with a proper hand grip model or design.

Bluetooth connection setup/configuration

First, JO was curious about how the Bluetooth earpiece could be connected to the smartphone or any other supporting device, such as the car audio system. JO wanted to use the Bluetooth earpiece to pick up calls when driving as she could not concentrate to do more than one thing at a time.

Participant's suggestion on the Bluetooth connection

JO told the researcher that she might not be able to perform the following tasks in regards to activating the Bluetooth connection:

- Configure the smartphone bluetooth setting and turn on the Bluetooth for the first time without assistance as JO could not understand the terminology.

- Turn the Bluetooth connection on and off and get connected in an easier way on a specific device using a shortcut. She would like to reconnect it after the connection gets disconnected.
- JO stated that a step-by-step guide would be helpful to direct her and keep her on track on how to use Bluetooth connection from the start.

Communication device as a resource in an emergency situation

JO observed the other older adults in the retirement village who did not own a telecommunication device such as a smartphone and saw these people might have difficult contacting other people in an emergency situation. JO also found that when people were about to make outgoing calls, they always requested assistance from the village staff members and the staff members would make the phone call for these elderly people. The retirement village staff usually utilizes the office wireless device to make outgoing calls so that the device could be used in some areas in the retirement village. Therefore, another means of communication should be provided by this village to support the communication needs of the older adults in order to make a simple outgoing call.

In this case, JO expected to be able to see a standalone 'SOS' or emergency button located as a shortcut to activate the emergency contacts. An easy-to-operate button with a direct shortcut to the family members should be designed for the older adult users in case of an emergency situation or just to carry out a one-way communication between user and family members. JO also stated that the function could not be applicable to people with special needs or require special assistance.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Upload photos to social media, i.e. Facebook	Currently, it allows direct upload to Facebook	Users have to follow multiple steps and sometimes users will lose track	More flexibility and control when uploading photographs into social media, such as Facebook, to minimise users cognitive load
	Taking and editing images	Users can edit the digital photo straight away	Some terminology might be difficult to understand. Too many editing tools are not necessary	Tools should be provided to adjust the photo quality with important editing operations put up on the editing screen.
	Calling relatives in an emergency	Emergency contacts should have been saved into the regular contact list and categorised using the phone system	At the moment, users have to find the names of the relatives	The SOS button should be linked up automatically with any emergency contacts The SOS shortcut button should always be available on the main screen.
	Listening to music using Bluetooth	Users can listen to music while driving	The setting process takes a lot of steps before Bluetooth connection can be activated	A shortcut with an automatic function should be made available to allow a user to turn on/off the Bluetooth connection easily and intuitively

5.2.3 Participant 03 (JH)

5.2.3.1 Participant profile

Participant No./Code	03 / JH	**Location**	Australia
Period of Interview	10 August 2018	**Education**	Engineer
Age Range	75–80 (exact age is 80)	**Occupation**	Retired
Gender	Male	**Other info**	Helping out his wife in the community centre
Device used 1	Galaxy Ace – owned by his wife	**OS**	Android
Note	JH takes turns on his wife's smartphone.		

5.2.3.2 Participant biography

JH was born in 1938 in the United Kingdom and has children who still live in the UK. JH sometimes visits his kids and other relatives in the UK during holiday seasons. JH is currently residing in a retirement village and is an active member in the community as one of the leaders of the village. JH also helps his wife who works as a volunteer in a same community centre for refugees.

JH explains that he has an issue with his hearing due to a light stroke he suffered a few years ago, but he is now fully recovered and getting better. Meanwhile, JH also stated that he has low vision and is not able to see something small on screen, such as tiny icons or images, but he prefers to see something digital or on-screen as long as he is not required to read something on the screen, such as online news.

5.2.3.3 Participant's overall comments for selected phone models on the test board

High contrast between background and foreground (navigation buttons)

During the test board review, JH stated his selection would be based on his feeling that a phone should have big buttons and a clear display, such as phone model 8 on the test board. According to JH, a phone with a white background would be JH's best preference because that

would make him easily distinguish between the icons and the background design. JH mentioned that this clear differentiation would enable users (him) to navigate through or click on the buttons easily. A clear separation between one button and another would also be significant to the design in order to ensure users are clicking the right icon.

Figure 5.2 Participant selection of the phone models on the Test Board

Participant's suggestions based on the test board review

However, during the interview session, JH commented that clear distinction between the buttons, icons, and images on the digital display screen should help a person navigate through the page accurately. As JH has low vision, he is required to use a phone with clear display where it is easy to distinguish between buttons and background colour/image. The visibility or clarity of those elements would increase JH's confidence in operating a smartphone device on his own. In an unlikely event, he might require assistance to advise him what to do in order to avoid errors in the future.

5.2.3.4 Participant's opinion on the software and display design of the phone UI

The visibility and clarity of background colour and detailed objects in the foreground

Regarding JH's observation, he personally had investigated how an individual elderly person would respond to a white background with a dark foreground on a smartphone display screen where people could change or modify the colours. His investigation involved some older adults in his age range. JH would like to explore further the reaction of older people when they saw this type of display colour combination. JH would also like to investigate further on what the

outcomes of the investigation would be, since he believed that a clear and distinctive colour would be valuable for people with low vision to have the ability to access the precise navigation in order to execute a function.

The use of instant messenger applications to chat

JH mentioned that a smartphone device with simple and clear screen layout and navigation would his preference. According to JH, a clearly designed indicator should be placed in the best position on the phone to allow users to navigate through the phone accurately and in a more flexible way. For example a shortcut to help users make a phone call needs to be clearly distinguished from the WhatsApp icon. A phone access could be placed as a shortcut which would be placed on the hardware. As JH has low vision, he would like the colour to be clearly differentiated to help him navigate the phone's functions accurately. For example, giving a clear outline on each button would help his to clearly differentiate the individual navigation on the display screen.

The size of side slider on the touchscreen panel

JH also mentioned that he had difficulties in scrolling up and down the pages on the screen to read the news on the smartphone,especially if the news contains more than one page. It was also due to the position of the up and down page slider, which is located on the side of the screen and the placement of the navigation would mostly be on the edge of the screen. However, according to JH, the problem was caused by the size of JH's finger tips, not due to any symptoms of arthritis. Therefore, JH always found it difficult to touch the buttons precisely and accurately.

"I have a low vision and I need to see things in contrast. So, the buttons and the background colour of the smartphone user interface should be absolutely clear" (JH).

Online newspapers application – page readability

JH only used his cell phone about four times a week when he needed it. He bought a local newspaper when he needed to get information or news. JH usually received updated

information from his friends in the community group infrequently. Therefore, JH felt that he should have the access to the online newspaper on his own to get the latest news update.

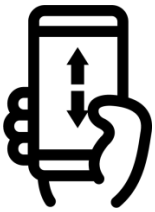
5.2.3.5 Participant's opinion on the hardware and usability design of the phone device

The readability on a personal computer

Approximately six years before the interview session was conducted, JH used to utilise his personal computer to read online news when he had no issue with his vision. JH just simply typed information into the web browser using the default keyboard and other equipment to have full control on the page. He was also able to read the news straight away from the screen of his personal computer. Nowadays, JH has to look at the monitor screen slowly and more carefully due to his low vision, in order to understand the full context of the page being read through. However, according to JH, reading from a digital device had a different feeling and experience as comparable to a printed material, such as the newspaper.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Navigate through using touchscreen buttons	Seamless experience on smartphone touchscreen panel	If the background and buttons colour are similar, users would not be able to distinguish the area of touch	Clearly distinguish between background and foreground colour to enhance the visitors' needs and capabilities
	Using messenger or phone call application		Users got mixed up between those two icons due to the similar colour scheme	Distinguish the icon designs to avoid being misinterpreted
	Slide the pages up/down or left/right	Users do not need to move the object	The size of page sliders are too small and the position is too close to the edge	Transparent sliders could be provided during reading and could be disappear within seconds. The slider control size should be big enough for users with fat fingers

	Reading online news using a digital device	The pages were laid out on a single display screen	Readability will decrease for elderly people with low vision	A shortcut should be available automatically for elderly users upon opening the online news application

5.2.4 Participant 04 (QQ)

5.2.4.1 Participant profile

Participant No./Code	04/QQ	**Location**	Australia
Period of Interview	30 September 2018	**Education**	Bachelor Degree
Age Range	65–70 (exact age is 67)	**Occupation**	Music Entertainer
Gender	Male	**Other info**	N/A
Device used 1	iPhone 6	**OS**	iOS

5.2.4.2 Participant biography

QQ is a 67-year-old musician, working in a restaurant as a music entertainer. QQ plays music in some places to entertain people, i.e. in community centres when there is an event, such as members gathering. Moreover, QQ also likes taking photographs of scenery and finding new places to take photographs of scenery during his spare time. Apart from being a music entertainer, QQ loves arts and design as a secondary interest.

QQ relies on his smartphone to do some research about his jobs and hobbies; he usually uses YouTube to learn new songs, and iTunes program on his iPad or CD/DVDs to learn new songs or download music scores. At home, QQ owns a home theatre audio unit, where he can listen to his favourite songs thru a decent sound system. QQ is also familiar with how to configure audio systems to get the best output for a specific genre. QQ personally thinks that a smartphone should be able to perform as a “wife”, but the only thing is a smartphone cannot cook. QQ illustrated a smartphone this way because QQ likes eating while listening to songs and he relies on his smartphone most of the time to entertain him.

5.2.4.3 Participant’s overall comments on selected phone models on the test board

During the interview session, QQ nominated his three preferred phone models on the test board.

His first choice was phone model 2 on the test board. According to QQ, model 2 had the most appropriate colour combination on the screen display for older adult users, where the colour on the navigation buttons looked robust and appealing. The buttons were nicely and

adequately separated to allow users to press the buttons more accurately compared to other models on the test board. QQ mentioned that he found some older adult users could press a wrong button due to their weak vision and unclear navigation information on the buttons; this had happened to QQ. The hardware shape on model 2 looked compact – neither too big nor too small.

Participant's suggestion for phone model 2 on the test board

Physical navigation could be more helpful for older adult users to navigate through the functions. The physical buttons could be placed along with the touchscreen as additional controls on this phone model.

According to QQ, his second choice on the test board was phone model 8 because this model looked common in the marketplace as a simple phone without having any intention to go online. QQ thought that this model would be perfect for older adult users if they were looking for a phone with a specific function to make a call or send an SMS. However, as far as he was concerned, model 8 has limited features compared to model 2 because model 8 is considered a standard and simple cellular phone, which has standard core functions of making calls and sending SMS. According to QQ, although model 8 is considered suitable for older adults, elderly users might get frustrated if they had to turn back to the old phone. These people need more time to change from one technology to others.

QQ's third choice was phone model 1. He thought that model 1 could be nominated as the most useful phone along with "smart" features clearly visible on the display. Although QQ was not familiar with the language, he could pick up the navigation functions from the icons or symbols. Also, QQ stated that model 1 had a more vibrant screen layout and sharper appearance of the navigation buttons. The navigation patterns also looked similar to general phone models in the market. This type of layout could help older adult users easily adapt to other similar devices and avoid making errors on the device, although these people may request help when they need it.

5.2.4.4 Participant's opinion on the software and display design of the phone UI

During the interview session, QQ demonstrated some functions on the personal smartphone to show functions he uses daily, and he stated the following items along with suggestions for improvements:

Use of the internet browser on the smartphone device

QQ used the default internet browser (Safari) to go online and search for digital music scores on the web. QQ usually downloaded digital music scores from a paid website to ensure reliability. QQ stated that a printed score was more comfortable to read than a digital one because he did not need to bring bulk paper for printing. Moreover, the hardcopy printouts could be problematic due to the number of scores QQ needed. Meanwhile, QQ usually plays the songs online before downloading the score to ensure the accuracy of the score and song. QQ is familiar with the sequence of the whole process to search for, listen to and purchase music scores through the internet as he has been doing this for years.

Smartphone and laptop connectivity

QQ used a laptop to download the songs and digital music score to do his job into the notebook. QQ usually used the laptop to review and learn the songs to be played beforehand. QQ mentioned that a smartphone could also function as a mini laptop, but a smartphone would be more frequently used to do other jobs over a laptop due to its display screen size.

Facebook application as a resource

QQ stated that Facebook could be used as one of his resources for finding digital music scores, but QQ was not a fan of Facebook as he did not have many friends connected on Facebook, although his wife did. QQ said that searching and browsing free music scores on Facebook could be a waste of his time. Therefore, QQ would rather find decent digital music scores through a trusted website, even though he had to pay.

sAlarm and reminder application

According to QQ, an alarm or reminder should be installed on the older adults' smartphones because they tend to forget appointments if they do not write their schedule down on paper. Older adults might have issues with short-term memory capability, and they might not recall schedules or appointments, i.e. a reminder to take medicines at certain time. According to QQ, the only problem older adults may be confronted with is the configuration process before they can get the alarm setup properly. Therefore, a shortcut could be provided to get into this process or, most obviously, assistance should be made available at any time to help this group of people understand the process and run it.

Contact details in phone book

QQ used to categorise his contact names to make it easier to find them, such as friends, work colleagues, and relatives. Otherwise, QQ might get the names mixed up, which could cause some confusion when he was about to make a phone call. QQ emphasized that the human brain could only hold or process a limited number of tasks at once. Therefore, a set of rule in categorization of either first names or surnames would be helpful for older adult users to distinguish certain names with similarities, such as John, Michael, or George. A picture associated with the person could also help the users recognize the contact details more properly and accurately.

Short message services (SMS) ethics consideration

QQ did not have any issues in sending an SMS out to others but had a concern around how young people replied to an SMS. QQ stated that some words he received on the reply did not make any sense to him, such as 'OK' or 'OKAY'. According to QQ, younger people should be better taught how to reply to a message appropriately and extend the message to present better message clarity to the recipient. Sometimes, QQ received a message that had a lot of typo errors and ended up being interpreted incorrectly. Therefore, QQ had to send another message to confirm the information he received earlier as he did not want to get the wrong

message across. Younger users should be reminded to consider ethics when sending messages out to avoid the message being misinterpreted.

Torch/flashlight application

According to QQ's daily experience and needs, a flashlight application is a useful tool at night when QQ is going to the bathroom. As he has a smartphone with the flashlight application installed, QQ stated that the application is considered more useful than any other applications such as games or Facebook. QQ suggested having a flashlight installed as a default application for the older adult's smartphone should be compulsory.

FM radio application

According to QQ, an FM radio application on his phone was considered as one popular application for an older adult user like him because these types of people (including QQ) generally liked to listen to "oldies" songs or news on the radio. QQ found that the FM Radio application could not be installed on the iPhone due to system restrictions. In addition to that, QQ lived near a radio station that played oldies songs 24/7 and sometimes he attended live events held by the statin.

Icons and symbols recognition

QQ thought that the icons and symbols on the smartphone device should be designed clearly and precisely for older adult users to understand the meanings. The icons or symbols on the navigation should not contain any fancy or unnecessary decorative items but should be adapted to older adult vision. A gear or wrench icon to indicate settings can sometimes be confusing to older adults as they did not understand the meaning of those two symbols. QQ stated that he spent a bit amount of time to figure out that particular icon on his smartphone, iPad and laptop. He thought that older adult users could be trained in what some of general icons mean to create initial understanding of the icons metaphor.

This process can be applied to both female and male users where fancy and decorative icons would be inappropriate for these users. Moreover, older adults users should be prevented from

misinterpreting icons. Based on personal experience, QQ stated that older adults would be confused by a cluttered smartphone interface layout that full of application icons.

Shortcut for emergency situations

Older adult users might need a shortcut to a contact name on the contact list or the phone book in case of an emergency, where they might be able to contact either relatives or emergency services without it being necessary to access the phone and go through steps to get into the relatives phone numbers. QQ suggested that the shortcut should be designed such that older adults or somebody else who might help the elderly person when in an emergency situation,could recognise the shortcut to the designated contacts.

The use of bright colour on the display

The use of colour on the display screen should be made adjustable in the system settings and be applicable to the overall/general screen display. However, older adults who might have been suffering from low vision can adjust how they want the color to appear on screen as comparable to a person with normal vision. Therefore, a screen display with high contrast could be useful in order to find the designated icon and to lead the users to the right path.

5.2.4.5 Participant's opinion on the hardware and usability design of the phone device

According to QQ, the size of his device's hardware was not an issue, especially for older adult users, given that these people could grip the phone properly and comfortably. QQ expected that the older adults' fingers could not only fit to the grip comfortably, but also navigate through the phone within their reach. QQ emphasized that people just need a smartphone with a big screen display to fulfil the requirements of their vision issues, as well as exercise control over the phone navigation.

QQ considered his iPhone to have significant storage capacity, which was useful for storing some song files and digital music scores to support his job, and some photographs. QQ used the smartphone camera to take photos when travelling and he stated that the phone storage was more than enough to store pictures for his 21 days of travelling.

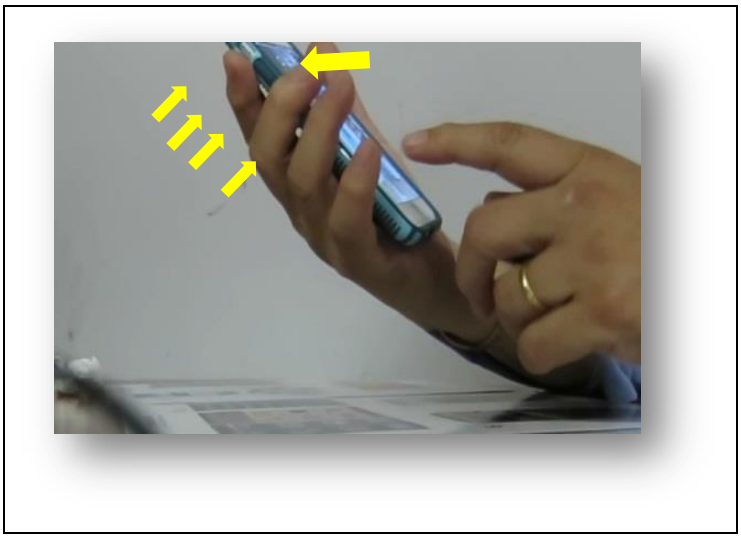


Figure 5.3 QQ's hand grip and finger control on the phone hardware

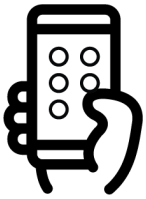
Furthermore, QQ also suggested that a new method should be developed to enable connectivity between a smartphone and a car-key device in the event of a person losing their car keys. Some older adult users think that this function is very useful to help them find their car keys simply by whistling or using a speech command on the phone to locate the keys. The 'whistling' method was used in the traditional models that exist in the market approximately 25 years ago. In the meantime, QQ experienced this himself and therefore, he expected to see further development of the smartphone function to cater this specific need.

In the end of the interview session, QQ also thought that one day, a smartphone could replace an ATM, where cash could be withdrawn via a smartphone device without being necessary to find and go to a nearest ATM in the area.

"Can you make a coffee using the smartphone? This would be a great feature as I need something to be real from a digital world" (QQ).

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Internet browser to do research	Could browse and try before purchasing	Rely on digital scores unless they got printed	Maintain the capability to play the songs online for trial purpose
	Connect Laptop and phone	Smartphone is used as a mini laptop	Smaller display screen than laptop	Enhance the quality of smartphone display screen
	Facebook application as a resource	Used as one of the resources	Just being a preview because they are mostly paid materials	NA
	Alarm and reminder application	Paper-based reminder not required	The initial setup will be problematic	Shortcut to reminder with an easy setup Direct and interactive assistance on the phone to setup the reminder or alarm
	Contact details in phone book	Very organised contacts	Similar names could be mixed up if no photo attached	Should implement direct photo upload into the phone book system to avoid having the same issues in the future.
	Short message services (SMS) ethics consideration	Short and concise message to deliver information	Ethical considerations	SMS application or any messengers should be equipped with ethics on how to write on digital environment.

	Torch/flashlight application	Assist the users when going to bathroom at night	NA	Should be maintained as a default application
	FM radio application	Utilising this application due to habit	NA	The application should be maintained because most older adults liked to listen to oldies song on the radio (not the digital version)
	Icons and symbols recognition	Shorten the navigation name/button	Confused of the gear icons	Some icons should have a bit explanation of the real meaning
	Shortcut for emergency situations	Helping people when in emergency	Not available on the current phone models	• Should always be available on the screen. • Initial setup should be easy to do
	The use of bright colour on the display	Present high contrast for people with low vision	If users need to setup which will make the screen become unclear for the first time	The display should be auto-adjust for elderly people with low vision

5.2.5 Participant 05 (CW)

5.2.5.1 Participant profile

Participant No./Code	05/CW	**Location**	Australia
Period of Interview	03 October 2018	**Education**	Not specified
Age Range	70–75 (exact age is 72)	**Occupation**	Retired, traveller, entertainer
Gender	Male	**Other info**	Work as a freelance tour guide
Device used 1	iPhone 5	**OS**	iOS
Device used 2	iPhone 6S+	**OS**	iOS

5.2.5.2 Participant biography

CW is a 72-year-old retiree, working as a freelance courier service driver and a local tour guide. CW was born in England during the Second World War. He used to work as a social worker in the United Kingdom and considers himself knowledgeable on the history of Great Britain, including the involvement of some organizations or community services during the war. CW stated that a book called "Empty Cradles (Oranges and Sunshine)" was his favourite book, which told the story of the war.

CW considers himself very up-to-date with technology, especially communications technology. CW also claims that 90% of the functions on his iPhone 5 and 6 have been utilized well, but not all of them are useful for his daily life. However, CW likes to update himself on technology developments and always keeps track of any updates.

5.2.5.3 Participant's overall comments on selected models on the test board

Participant's preferred choices

Regarding smartphone choice, CW selected phone models 1 and 3 on the test board as the preferred smartphones because they looked simple and easy to understand and operate due to the clear and clean navigation display.

When CW looked at phone model n1, he explained that it was easy to perform tasks on phone model number 1 by pressing the navigation on display. CW showed that the "sun" icon and the

temperature indicator on the top-left corner could be used to display the current weather condition in that specific location. Overall, CW understands how to fully operate that particular model.

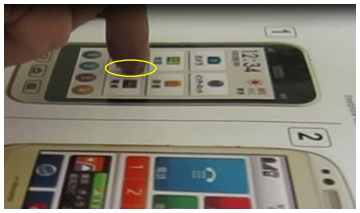
	
Model no. 1	**Model no. 3**

Figure 5.4 CF's selection on the test board (model 1 and 3)

Meanwhile, CW thought that phone model number 3 had a more vivid colour display and clear navigation edges. Therefore, the navigation buttons were still very easy to visually perceive and distinguish. CW stated that model number 3 had a clearer icon to indicate the "settings" than model no. 1. CW could allocate the 'setting' icon which is located on the bottom right corner of the smartphone display.

Participant's least preferred choices

CW thought that the interface designs of models 5A and 5B were not suitable due to the small size of the navigation buttons.

CW stated that phone model number 8 was not one of his favourites as the phone looked old. However, CW pointed out the red and green buttons, which were common to most mobile phone devices to indicate phone pick up and hang up. Meanwhile, the "Menu" button should take users to the submenu selection page and the "names" should take users to the "contacts" list. Moreover, CW also commented on an icon that indicated "signal" on the top left corner that could be confusing to older adults due to a mixed up with the "Wi-Fi connection" symbol.

Apart from those issues, CW stated that he liked the arrows buttons located in the middle of the device which clearly indicated scroll up and down when the users need to scroll to multiple

pages. CW also thought that the keypad buttons on phone model no. 8 looked similar to number 4, 6 and 7 for an easy access. However, as CW has purchased 2 (two) smartphones, he thought that those model would still be relevant to older adult users.

Participant suggestions based on the models on the test board

CW made a few suggestions to the researcher based on his selected models and the observation of the other models on the test board, as follows:

- The icons on the navigation should be made clear and easily differentiated by older adult users, i.e. model no. 4, 6, 8 with a more reasonable contrast between foreground and background. Late adult users would not be familiar with the icons meaning and also to navigate around by looking at digital icons on the smartphone display screen.
- The colour combination should be better distinguished between background and foreground and used appropriately, the page should use vivid colours, and be obvious for older adult eyesight, especially if they have low vision.
- The use of some similar icons or symbols on mobile phones and smartphone could be minimised to avoid confusion; for example, the icon of “signal reception” and the “Wi-Fi connection” should be properly differentiated as on phone model no. 8. The older adult users should be taught in understanding the metaphor of the icons on the buttons.
- A simple manual or instruction guide should also be provided to older adult users if they are operating different phone models, such as between phone models number 1 & 3 and 4, 6, 7, 8, which determine the latest smartphone models and older ones, included those models have different mechanisms and interactivity. According to CW, he did not require a manual, as he liked to use trial and error with any new technologies. CW did not worry when errors occurred on his phone as he knew how to fix that and be fully recovered. Otherwise, CW will visit the Apple Store to ask for assistance.

5.2.5.4 Participant opinion on the software and display design of the phone UI

During the interview and observation, CW demonstrated his skills to interact with most of the features that he played regularly and frequently on both the iPhone 5 and 6, as follows:

“I know most of the things in my two smartphones. I am very good in navigating around the phone for any purposes and I can demonstrate all of the functions that I know so far”

The general functions/features of the iPhone devices:

According to CW, there were some applications he used frequently and others that would be used as necessary, as follows:

Icons control by moving the icons around the page

CW showed the ability to move the icons around the page using the drag and drop motion. Therefore, CW could move the icons up - down and left - right without having any issues. Moreover, CW demonstrated that he could also move the icons to the recycle bin by clicking on and dragging an unwanted icon to the bin. CW told the researcher that he learned to understand the meaning of each icon from the PC that he had at home. Although he seemed familiar with the icons, CW thought that the ‘setting’ icon might be challenging for older adult users to properly understand the function without doing the tasks frequently and repeatedly.

However, CW found some difficulties in performing these drag-and-drop actions in the beginning, and the Apple Store staff members assisted him accordingly. CW thought that regular practice was required to get him used to carrying out the tasks and to minimise errors.

Figure 5.5 Participant’s iPhone 6 device: icons display and control

The voice command function using Siri voice command function

CW utilised the voice command using Siri to perform most of the tasks on the smartphone device, such as browsing the internet and entering the keywords, sending text messages using SMS or instant messengers and opening an application. CW used Siri most of the time to avoid misspelling and to speed up sending out text messages without having to type any of the letters or words using the phone keyboard.

Figure 5.6 Participant's device: iPhone 6 demonstration of Siri function

Meanwhile, CW also demonstrated the ability to use the following applications on the iPhone to proof his capability to do most of the things using the iPhone device:

Online browsing using Google Chrome application

CW used Google Chrome to find information on the internet, such as one of his favourite was finding pictures of Australian marsupials as one of CW's interest. Other than that, CW also used Google Chrome to search for some TV programs, current movies, or online newspapers. He demonstrated his skill to read the online news without having any issues as he could also show his ability to use the page slider to scroll into different pages on the news page. Technically, CW stated that Google Chrome had better interactivity and usability compared to Safari on the iPhone where Chrome has more flexibility and simple control for the users. The application

control may become an issue for older adult users if that was not properly designed to cater the older adult users' needs.

The alarm and reminder application

CW used the alarm application to alert him of some events or instances, such as for wake-up calls or reminders for use as a timer or parking reminder.

Apart from those functions, CW never used the alarm function for anything else. However, CW claimed that the alarm was easy to setup and operate (CW demonstrated how he could set up the timer for the desired hour, minute, and second; and turn the alarm on and off without any issues).

The translator application

As a freelance local guide, CW works independently for a Chinese travel agent. Therefore, he has to be able to communicate with the tour members who happened to be the Chinese group of people and also the tour leader. As a native English speaker, he could only understand some easy words, such as "how are you" or "good morning, afternoon, and evening". Apart from those words, he relied heavily on the translator when talking to the tour members. Although the translator could not give him the best translation results regardless the grammar, CW used the app to explain or describe some difficult words or meanings from English into Chinese. CW operated the translator app using voice command and had been able to select several languages during the demonstration session on the interview.

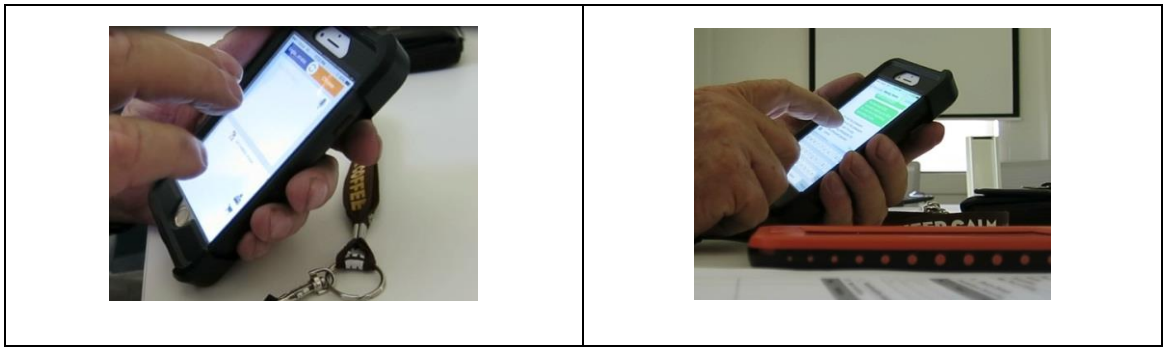


Figure 5.7 Participant's device: iPhone 5 with the text translator

However, CW stated that he had to change the language selection into Australian English to enable the application to work properly. Otherwise, the application could make an error in capturing words or sentences, including unexpected results. CW stated that hardware wise, Siri voice command on iPhone 6+ could pick up the words better than on the iPhone 5 devices. CW thought that iPhone 6+ might have a better capability to pick up and understand spoken words or sentences than iPhone 5. The features included switching over between female and male voices. Apart from those issues, CW suggested that the hole on the microphone should be made bigger to pick up gently spoken words. Otherwise, he had to speak closer to the microphone to let the device pick up his words properly and accurately.

The favourite games applications

CW explained that he normally played games for fun, such as Bejewelled. CW also showed that his friends had better ability to play that game because CW's rank was always placed at the bottom of the tally board. Therefore, during the interview, CW demonstrated his ability to adjust the volume level just using the control buttons on the hardware and in the application; and also turn the background music on and off. Sometimes, CW did not realise that the phone ringtone was also turned off and had to figure out how to turn that back on.

Figure 5.8 Participant's favorite game on the iPhone 5

The camera application

CW stated that he had issues in producing a good picture with excellent composition using the camera phone. However, CW learned how to take good pictures from YouTube to improve his photography skills. CW stated that he had to keep practising on what he learned to produce better photo results. CW had taught some of his friends on how to take good pictures using a

smartphone camera because he loved doing that. However, there were some other tasks that CW could also perform using the camera application included:

- Adjusting the brightness and contrast of the photo results to obtain the right picture appearance.
- Fixing up the white balance to get the correct colour temperature.
- Zooming in/out to observe the detailed of the objects on the image.
- Turning the pictures into different photo presets, such as black and white or sepia.
- For settings other than those stated above, CW stated that he had to watch tutorials on YouTube in order to obtain better knowledge and skills.

The CCTV camera connection with the smartphone

During the interview, CW stated that he would install three CCTV cameras at his home and connected to the smartphone via the internet. CW experienced someone had broken into the house a few months back and he had lost most of his valuables. As he had been familiar with the phone technology, he would use that to improve the safety and security in his house using the CCTV technology.

However, CW suggested some additional items for the camera application, as follows:

- The camera and video icons should be clearly differentiated as CW experienced that he had pressed the video button to take a picture, but did not realise the situation until he saw the recording light lit up on the display to indicate the device is currently recording.
- The camera setting should use a more non-technical language to help users on his age understand the terminology in order to operate the application or adjust the setting easily. For example when CW nrequired to adjust the white balance and exposure of an image using the configuration button. CW stated that the terms would only make sense to people who had technical experience in using a real camera. Some presets could be provided to help older adult users modify the pictures more comfortably without having to fiddle around the buttons and making mistakes.

The photo gallery application

CW explained that he could perform some tasks using the photo gallery application, instead of just previewing pictures, such as:

- Viewing the photographs and flicking through each picture.
- Zooming in/out, rotating and confirming the changes made.
- Jumping from one album to another.
- Editing a picture's brightness and contrast, white balance and cropping the image.
- Sorting the pictures by months or years.
- Transferring the images to the PC to free some space on the smartphone.

For the photo gallery application, CW suggested that the main terminologies on the settings should be made simpler and easier to operate, especially for older adult users. Representative icons or symbols could be utilised to avoid using much text in navigation. CW also mentioned that older adults should be assisted when using smartphone camera technology for the first time to familiarise themselves with the phone configuration and terminologies. The initial training should be carried out due to differences between a real digital camera and the smartphone camera. Once the older adult users get familiar with the functions and they use those frequently, it is expected that they could adapt to each device individually.

The stock exchange application

CW demonstrated how to monitor the rise and fall of Australian or overseas stock market in real time. CW could also understand the annotations and be able to distinguish the colour coordination that represents the stock movement periodically. In this case, CW was not necessary to check the numbers against the legend to know what is happening to the stock 'movement' as the detail has been indicated by the icons or symbols showing the changes.

The calculator application

During the interview session, CW demonstrated his skills in using the basic calculator application on his iPhone device. CW stated that he used a calculator for the first time when he was working for a shipping company in Hong Kong and considered himself good at simple

mathematical calculations without being necessary to use calculator. According to CW, the calculator would only be used to work out complex mathematics equations, such as scientific ones. CW believed that one day, a computer could be the size of a calculator or a sugar cube with the complex mechanism inside.

iTunes application

CW used iTunes to listen to his music collections or to stream an online radio. CW suggested the manufacturer, (such as Apple) maintain this application as the default application as this would be required by most older adult users to listen to free music on their own time.

YouTube application

One of CW's favourite hobbies during his spare time was watching videos on YouTube, such as watching prank videos and comedy clips. CW also stated that he usually shared video links with other people who have same interest via email using the Gmail application on the iPhone. According to CW, the icons on the YouTube were easy to understand as they were similar to a home video/audio player navigation buttons, i.e. the play and pause buttons.

The phone tracker application

CW had experienced his phone being stolen, and the person tried to sell it in a black-market, but CW noticed the location by using the phone locator on the iPhone. Luckily, CW set a password on the device and the person who stole the phone could not do anything on it. Therefore, CW suggested two things regarding the phone tracker function:

- Users should install a phone tracker, in case the device is stolen or the tracker should be available by default from the manufacturer
- Users should be able to set a password on the device, activate the password and memorise it to avoid other people accessing the device if that stolen.

Touchscreen control flexibility

CW demonstrated how to relocate unnecessary icons to other spots or locations on the smartphone page, including removing unnecessary icons to the bin. According to CW, he could perform two different functions to get two separate results, as follows:

- A light touch would be used to move the icon to another location, or to select multiple icons.
- A hard touch would be used to remove the icon and send it to the recycling bin.

CW emphasised that assistance would still be required to be able to accomplish these actions, in particular for new smartphone users who elderly phone users.

The following applications stated below were rarely used, but CW stated that he knew how to navigate those functions very well, i.e. the magnifier, compass, FM radio, Internet banking, and Bluetooth connection. However, as he did not need these applications regularly and might not utilise them frequently, CW might need assistance on how to operate some other applications. In some cases, CW did not require assistance for some common applications, such as the compass and FM radio applications. During the interview session, CW demonstrated some of the functions on the following applications very briefly, although he asked some questions to the researcher to carry out some configuration. The detailed explanation is as follows:

The magnifier application

CW used the magnifier application to read a newspaper or small text on other printed materials. However, CW rarely bought a newspaper because the online version had more detailed information.

The compass

CW demonstrated how the compass worked to find the direction. During the interview, the researcher showed CW how to calibrate his compass application as it did not show accurate direction. Once the calibration had been carried out, the compass worked properly as expected.

FM radio

CW showed his ability to change the station frequency on the FM Radio application, including storing his favourite radio stations into the memory presets. His demonstration also included adjusting the volume control on the application display or from the hardware control.

Internet banking application

CW used an internet banking application to transfer funds to other people or just simply check the account balance on his accounts. Apart from these functions, CW rarely accessed internet banking due to being uncertain of its security and safety. He preferred to go to the ATM or bank to withdraw money rather than using the app.

Bluetooth connection

The last demonstration from CW was showing his ability to set up the Bluetooth earphone and get it connected to to the iPhone connection. CW used Bluetooth to connect the earphones with the radio player in his car to listen to radio

5.2.5.5 Participant's opinion on the hardware and usability design of the phone device

During the interview session, CW made some comments on the hardware as follows:

Phone storage and speed of its processor

A large amount of storage on a smartphone device is critical for CW as he likes taking photos and videos. CW considered the price of a smartphone in the market with a large storage capacity was still too high for him. However, CW would normally transfer the files (photographs and videos) into his PC to free up some space as he has a lot of storage on his PC and laptop. CW also thought that the remaining space could affect the speed of the smartphone to do data and application processing.

The position of volume controllers on the hardware

CW expected that the volume control buttons on the hardware could be modified accordingly so that they could be placed in a position to avoid accidental contact or be adjusted by the fingers. The buttons could be accidentally pressed when the users did not realise that the

fingers actually touched the buttons. This incident would affect surrounding people if the buttons are pressed all the way up and the ringtone turns out to be deafening. CW did not expect the buttons were accidentally pressed all the way down, users could not hear any incoming alerts, such as incoming calls and messages.

Participant suggestion on the volume controllers

CW suggested the iPhone manufacturer place the buttons in another spot to avoid mistaken contact with the fingers.

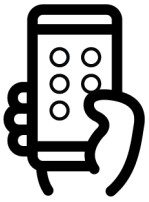
The Apple TV Technology connectivity

CW had recently bought an Apple TV but had no idea how to get the device connected to the smartphone (iPhone). CW finally found that an HDMI cable was needed to connect the Apple TV box and the television after getting assistance from the Apple Store. However, CW required assistance from the technician to carry out initial setup or configuration. Otherwise, that process would take a long time for CW to do.

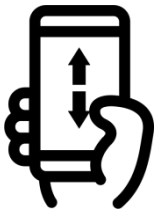
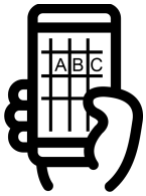
Participant's suggestion on the Apple TV technology

CW recommended that older adult users should be accompanied or given simple basic training whenever they purchased or owned a new technology in order to familiarise themselves with its configuration. A manual could also be provided as an alternative, along with practical instructions as a handout. In general, verbal and face-to-face assistance could make it easier for elderly people to understand the instructions.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Icons control by moving the icons around the page	Flexible control using the 'snap' to grid mechanism	User can miss the target	Maintain the 'snap-to-grid' to avoid meshing up the icons movement

	The voice command function using Siri	Freehand operation to text and activate application	Siri could not recognise the voice properly when the silicone case is on	Increase sensitivity to Siri reception to take any incoming instructions or messages
	Online browsing using Google Chrome application	Helping to find information online, such as images of marsupials	Small sliders could be problematic for some older users	The page sliders could be developed to ease the operations for older adult users, especially those who have tactile issues.
	The alarm and reminder application	Good to be used as a digital wakeup call	The intial setup is problematic.	Initial setup could be problematic as elderly users may need assistance
	The translator application	Supports the user's job most of the time as a local guide	Spoken words could not be recognised at times.	The recognition of users' pronounciation should be made more various to pick up any different accents.
	Favourite games applications	Good for relaxing	Some games could not be played due to complexity in games control, such as volume	Provide some easy and relaxing games with flexibile controls, specifically for the older adult users in their leisure time.
	The camera application	It is equipped with features for professional photography	It was not easy to get the right composition due to the differences in the phone handgrip compared to a real camera	The handgrip could be better adjusted for older adult users to be able to hold the camera properly. This includes setting up the flash on the smartphone device
	The CCTV camera connection with the smartphone	Flexibility to protect the property using smartphone	Assistance is required to activate or troubleshoot	Step-by-step guide should be provided to older adult users to get the equipment setup and operated using the Internet connection

	The photo gallery application	The application operates as a desktop app with full functions	It uses some complicated terminology	Maintain the operations as if users use the desktop application. User must adapt to the use of functionality as in the desktop by operating the application more frequently
	The stock exchange application	User understands the graphic representation on the application	Users might not understand if the application is updated and there are some changes in the icons or symbols in the application	Anootated icons could be helpful for first time user, specifically the graphical representation and icons on the graphic.
	The calculator application	Nice to have this installed by default on a smartphone device	It is not easy to access a scientific calculator	The functions could be adjusted to specific users, whether they only require operating a traditional calculator or a scientific one.
	iTunes application	Users could listen to new songs using streaming modes	Some applications, i.e. iTunes or Spotify would ask for trial or payment.	Users might not understand how to skip the request by continuing the 'free-trial' although the ads would be disruptive.
	YouTube application	Functionality is similar to traditional audio or CD/DVD player	NA	The functions should be maintained
	The phone tracker application	If the phone gets stolen	Had no idea how to activate the function	Older adult users should be given guides

	Touchscreen control flexibility	User had the flexibility to control the icons, i.e.moving the icons around the page	New older adult users would not be familiar with the function	New older adult users should be introduced with the operations.
	The magnifier application	No more magnifying glass to read small text	Users are required to identify the symbols of magnifier versus search	Symbols/icons should be easily recognized to avoid being mistaken
	The compass application	Minimise need to carry a real compass	Users might not know how to calibrate	The calibration could be carried out automatically by the device for certain period of time.
	FM radio	The radio stations can now be played on the phone	Finding the radio stations on digital environment could be problematic	• Step-by-step guide should be provided • Icons and symbols representation should be made sjmilar to the existing or analogue system or control

5.2.6 Participant 06 (GO)

5.2.6.1 Participant profile

Participant No. /Code	06/GO	**Location**	Australia
Period of Interview	12 September 2018	**Education**	Not specified
Age Range	70–75 (exact age is 72)	**Occupation**	Retired – in a retirement village
Gender	Female (represented by her nephew)	**Other info**	N/A
Device used 1	Samsung Galaxy S6	**OS**	Android
Note	Representing auntie		

5.2.6.2 Participant biography

GO was representing his auntie and informed the researcher that he had observed and assisted his parents and aunt regarding their regular use of phone technology. GO stated that technology is a must-have for these people, serving as an entertainment tool in their spare time or as a therapy instrument. For the time being, GO's parents and aunt live in a retirement village and both of them rarely have any interaction with their neighbours due to health issues. Therefore, GO's parents and aunt only use their smartphone or tablet when they are in the bedroom.

When GO's parents and aunt need to travel to their friends or relatives, they never have the phone with them, as they do not need entertainment outside the house or bedroom. GO is very familiar with the technology because he used to work as a mechanical engineer. Therefore, he had the ability to teach other people, such as his aunt, about how to use technology without issues. However, GO has to keep repeating the steps of a specific task whenever he asked his aunt to complete one job, i.e. making a phone call to GO. GO thought that they might have forgotten of the steps and sequences that should be undertaken. The other issue was that his parents and aunt are not able to write on paper due to their health issues. That is the one of the reasons why they keep asking GO to re-explain the steps on how to do a task using their smartphone, although it may be considered a simple task.

5.2.6.3 Participant's overall comments on the selected phone models on the test board

The researcher handed over the test board to GO to select the phone models, but GO utilized the printed materials to observe the fingertips when pressing the buttons on the paper-based models. GO pointed out that his fingers could be much bigger than someone from an Asian background. Apart from that, GO mentioned that male fingers could be bigger than female fingers. GO attempted to place his fingers on models 1, 3 and 5 to identify the navigation button size against his fingertips. Moreover, GO stated that his aunt and parents also had big fingers, which might bring up the same issues as him. However, GO's relatives would possibly be able to observe the difference between each button separately.

5.2.6.4 Participant's opinion on the software and display design of the phone UI

The use of physical buttons as a better navigation

According to GO, some older adults were more familiar with using a mobile phone with physical buttons than a touchscreen. In earlier days, these people used an old-style phone keypad to dial numbers by pressing the physical buttons that came out from the phone and they could probably operate the phone using one hand. GO stated that the older generation have struggled a lot when operating a smartphone device for the first time.

However, GO mentioned that some of his relatives in various age ranges had different preferences and experience interacting with mobile phone models. GO also stated that the phone background colour on the smartphone device has been transformed into a solid and dark colour in order to allow his relatives to interact with the phone properly.

"I have fat fingers and it's always difficult to press the buttons correctly. Sometimes, I give up!" (GO).

Most commonly, issues happen when GO's relatives have to recognise the individual icons, as they are uncertain of what each icon could do. The animated theme was also an issue, as the moving images or elements could be very disruptive and take users' focus from their task to the animated elements. Therefore, these users would possibly click on the animated objects rather than properly navigate using the designated button.

5.2.6.5 Participant's opinion on the hardware and usability design on the phone device

GO described that the differences in the phone sizes would become a challenge for male and female users. There were individual preferences on how each person would hold a mobile or smartphone device. According to GO, smartphone manufacturers would have an impact on how well the smartphone hardware was designed and produced.

The earphone port

Go said that his aunt loved listening to FM radio when she was still at home. However, her habits had changed to utilize the phone FM radio application to listen to radio stations. GO stated that his aunt was pleased to listen to radio stations via a smartphone due to the size of the device, which she can carry around. However, he suggested that the port could be set in a more accessible proper spot to enable older adult users plugged in the connector themselves without any problems.

The button to turn off the alarm

There is a big issue when GO's aunt has to setup the alarm to wake her up or even just to use it as a reminder. GO stated that his aunt could not set up the alarm, including assigning the specific music when the alert is on. Therefore, his aunt always seeks assistance to set up the alarm for a certain time. However, she could snooze the alarm as that is an easy task for her.

Individual preference of specific interaction

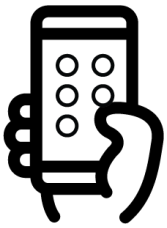
According to GO, an interaction on a phone would depend on individual preferences. This situation would then impact on what and how users would experience and overcome issues on the device, if any. Minor or major changes from the phone manufacturer would also impact on the users' performance, especially older users.

According to GO, older people like his aunt and parents could be considered as having their own preferences to operate the technology based on their previous experience. Simple modification, such as the placement of an audio jack port should be made clearer when the manufacturer relocated of the port. Otherwise, older adult users might not be able to find the info easily. These types of people would not easily have the proficiency to find the new element

of technology without assistance or to adapt to a new environment in a short period of time. GO also mentioned that a traditional house phone or a TV remote control was designed specifically to be made universal for all people across different genders, ages, and nationalities.

Figure 5.9 Participant's (GO's) interaction with the paper-based smartphone device

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Navigating around on non-touchscreen device	The use of physical buttons are more effective	Looks less technical than the touchscreen panel	User suggested to apply vibration upon the touch to feel like physical buttons.
	Finding a specific navigation with an animated theme installed	NA	Animated images could be disruptive	Minimize animation on the theme and maintain clean and clear display
	Setting up alarm	Useful as reminder on a particular time	Users could not setup the configuration	Simple setup process must be provided for elderly users

	Plugging in audio port	If assisted	If not assisted, especially on the first attempt	Clearer indicator on the hardware, such as icons/symbols next to the port

5.2.7 Participant 07 (AN)

5.2.7.1 Participant profile

Participant No. /Code	07/AN	**Location**	Australia
Period of Interview	12 September 2018	**Education**	Not specified
Age Range	75–80 (exact age is 80)	**Occupation**	Retired
Gender	Female	**Other info**	
Device used 1	Samsung Galaxy S6	**OS**	Android
Note	This user is acting on behalf of his relatives (parents and auntie)		

5.2.7.2 Participant biography

Participant 07 (AN) was interviewed to represent his parents, who were retired, and one of his aunties, who was 80 years old. Even though AN's auntie is 80 years old, she still can play games on the smartphone. According to AN, his auntie likes playing games that would be better to play something and finds it therapeutic, such as the Candy Crush Saga, but she has difficulty touching the exact buttons due to size.

In her daily life, AN's mom never made a call to other people herself, without somebody who is kind enough to help her make a phone call.

5.2.7.3 Participant's overall comments for selected phone models on the test board

Assistance to initially setup the phone is required

AN stated that his Samsung Galaxy S6 phone screen layout and design were too complex for older adult users – in this case, the phone is being used by AN's relatives. This complexity was discovered when the relatives were trying to carry out daily routine tasks, but they could not make the full use of the smartphone device. AN thought that assistance was required to get the phone properly set up. Other than that, the setting would be the least navigation control for users to operate due to its complexity unless it is very significant. In general, problems might have occurred in the display and navigation, which were not perfectly suited to the older adult users.

5.2.7.4 Participant's opinion on the software and display design of the phone UI

The GPS tracker function as oppose to Location Service

AN mentioned that he saw some people equipped with a GPS locator/device or tracker to map walking movements or path/direction, where this type of locator could possibly be embedded inside a smartphone device or utilized with another external device such as a smartwatch or necklace. AN also stated that one of his friends has a son who had a mental health problem. Therefore, his parents put a GPS locator/tracker on his shoes to track the child's movements. His friend had an experience where the son left home without any permission from the parents and that created a serious issue due to the health problems experienced by the boy. Therefore, AN was hoping that this technology could also be adapted and implemented for older users, especially people with dementia. The device could also be linked and used with a smartphone application for tracking purpose. The GPS tracker could also be expected to perform as a location direction finder in case an older person could not find their way home. According to AN, this method would be beneficial to older people and their family members.

Memorizing Passwords

According to AN, his aunt had difficulties memorizing passwords or pin numbers, especially for internet banking. Therefore, his aunt could not perform any internet banking transactions; for example, transfering funds from one account to another. She needed to carry out transactions at a local bank branch or via ATM. This is one of the reasons why she would never setup an email address, because it might be problematic to her. Furthermore, there would be significant issues when a password was initially created due to the secure processes that a user needs to go through.

"It is very challenging to memorize passwords on top of my head. It is going to be easier if I put the password on a piece of paper" (AN's aunt).

AN thought that password using pattern on the Android would be the least likely to be used due to the weakness of elderly users in memorizing the patterns and having a tactile interaction with the phone. AN suggested developing a password using a fingerprint to access the phone

applications as this method would be so much easier than memorizing patterns or numbers. This fingerprint method may be expected to solve the password issue when a number or pattern passcodes could not be retrieved. However, the password setup mechanism should be created in a way that differs from the existing process to allow older adult users to set up their own password in an way that they find easier to understand.

5.2.7.5 Participant's opinion on the hardware and usability design on the phone device

Reasonable size of navigation buttons

AN was concerned about the size of the smartphone navigation/buttons because he had been observing his parents, who had big fingers and that hindered them from accessing the phone navigation properly. AN stated that his mum also had quite big fingers and his auntie did too. AN also mentioned that in further development, a better and bigger grid size that is spacious enough should be considered to accommodate the needs of people with larger fingers tips.

There were concerns for some Australian individuals who may have large finger size, where the differences could also extend not only on the size, but also shape and pressure. Finger pressure might depend on a person's activities or work during the day. According to AN, an on-field engineer might have different finger pressure from an admin staff member where these people have to perform a different set of activities.

GPS Tracker system

AN stated that the GPS Tracker device would be beneficial for specific users to send a signal in case a person fainted or fell down. Meanwhile, a person who was helping that person should have access to the smartphone to contact the relatives of that particular person.

Therefore, AN thought that a fingerprint from the phone owner would still be important and crucial to obtaining access to the phone in the case of an emergency.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Initially setup the phone configuration	Adjustable to specific user	Not ideal for older adult users	Step-by-step manual should be provided
	The GPS tracker function as oppose to Location Service	Can track missing people if the device is taken with the person	The user should be assisted	Initial setup could be made more simple
	Memorizing Password	Security purpose	Unable to easily memorize numbers	Another method should be used to implement password utilisation
	Reasonable size of navigation buttons	NA	The size did not fit the users' fingertips	Adjustable navigation size is more significant to allow easier users interaction
	GPS Tracker system	Tracking elderly users with dementia	Initial setup and turning it on and off	Easy to setup GPS Tracker should be provided

5.2.8 Participant 08 (SL)

5.2.8.1 Participant profile

Participant No./Code	08/SL	**Location**	Australia
Period of Interview	31 August 2018	**Education**	Not specified
Age Range	70–75 (exact age is 71) 75–80 (exact age is 80)	**Occupation**	Retired, but living at home
Gender	Female	**Other info**	
Device used 1	Samsung Galaxy (model is N/A)	**OS**	Android
Note	This user is acting on behalf of parents and auntie.		

5.2.8.2 Participant biography

SL reported for his 71-year-old auntie and 80-year-old mother on this observation with his mother and auntie. Both of them were considered as retirees and obtained a smartphone from their children as a second-hand device. They are of Asian ethnic origin, and were born in Malaysia, but have lived most of their life in Australia as Australian Citizens. They mainly used the smartphone device at home as they usually forgot to take the phone with them when they were outside the house. Therefore, both SL's parents and auntie argued that they were not required to bring a phone device if they were only going out to meet someone for a short period of time. Therefore, they always left the phone at home intentionally. However, SL also argued that if there was an urgent matter, the phone could be used to call the relatives and ask for help. SL insisted that these older adults should always bring the phone whenever they went out of the house.

5.2.8.3 Participant's overall comments for the selected models on the test board

During the interview session, SL ranked model 4 as the first- and 6 as the the second-most usable models if he were to purchase the phones. SL observed that those models (4 and 6) looked similar to the auntie's old phone devices, which had big buttons and screen display, including text and numbers on the keypad. SL thought that these models were standard in the early days when phone companies produced mobile phones for the first time.

5.2.8.4 Participant's opinion on the software and display design of the phone UI

Navigating around on less than three-clicks away

Based on SL's observation on older adult users (his parents and relatives), they would not be able to accomplish an activity where they require to navigate further than one screen away. For example, these people would find it easier to make a phone from the 'call history' as comparable to digging into the phone book, finding a name, and then placeing the call. These people were not expected to navigate through a series of screens and perform several clicks in depth (SL stated it is important to have maximum of three-click away for ordinary users, or even just one click away for older adult users in order to get the best from interactions, especially on a mobile phone device).

Three-colour combination to enhance clear visibility for older adult users

SL suggested an alternative solution for the smartphone user interface design specifically for older adults with a minimum colour combination, such as implementing a three-colour combination. It is also important to keep the layout design free from unnecessary fancy elements or decorative objects, such as adding flowers or butterflies on the icons as the default image, unless those elements were modified by the users. SL stated that a smartphone screen layout should be clearly designed and implemented a formal and plain layout to accommodate the older adults' needs to operate the smartphone device properly. A clear, formal and plain layout would be useful for older adults to take them around the screen without necessarily being inconvenient to travel around their own smartphone device.

"The colours on the traffic light are suitable for eyes of people in my age. The combination of red, yellow and green works well" (SL).

SL also explained that a three-colour design could be utilised to enhance the visual clarity of some navigation buttons, such as the emergency, family contact and hospital icons. According to SL, the three-colour combination could also be adapted and extended from the existing

utilisation of traffic light colours (red, yellow, and green) to avoid older adult users being disoriented, especially people with colour blindness.

Address book application development

According to SL, big photos with flashing text to indicate the names would enable user to recognise and identify the caller more clearly. In some cases, some similar names might appear on the contact list due to common names. This implementation could also be considered in the next smartphone iteration or development.

One to three-click depth to avoid getting disoriented

In the event of phone interaction, an older adult might get lost and not be able to get to the exact page they wanted to do on their phone. Older people may find the process to memorize icons or symbols easy because they do not make sense to the old people. For example, the symbol of a mechanical gear to represent settings was meaningless to the elderly until someone explained the meaning to them. According to SL, the older adults were familiar and would be able to recognise the symbols of “make a phone call” and “hang up the call” due to their prior experience and familiarity with those symbols on their older phone models.

5.2.8.5 Participant’s opinion on the hardware and usability design of the phone device

A monitoring system for the older adult with dementia

SL also thought that a monitoring watch could be worn by the older adult people, especially if these people had dementia. The watch could then be synchronised with an auto-update system from the cloud. This system could be beneficial for the older adult whose relatives might be geographically distant. The older adult person could be monitored online through the internet. Therefore, a high-security system should be implemented together with the watch.

As an alternative design suggestion from SL, flashing icons might alert older adults to incoming calls or messages. According to SL, the flashing object could become an important feature because generally, older adults might have very poor vision and they might get confused by having too many colours on one screen. The older adult would notice as soon as a flashing object appeared on the smartphone screen.

The screen lock system to avoid unexpected operation

SL found someone who kept calling him accidentally using a smartphone. SL suspected that this person had put the smartphone in his pocket and left the device unlocked – and SL assumed that this person did not know how to lock the phone. This unfamiliarity with the phone lock/unlock functions would become a problem for a person who always put the device in their pocket. According to SL's experience, the lock function would also be problematic when the phone owner required emergency assistance and somebody else needed to access to the phone immediately. On the other hand, in some events, the call might be considered as invalid due to multiple unexpected calls made by the person.

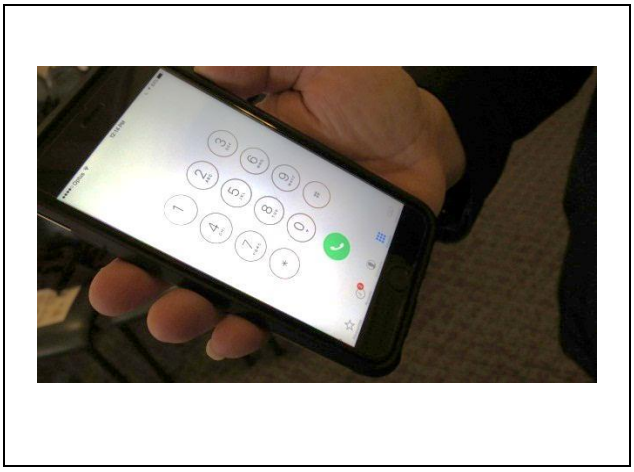


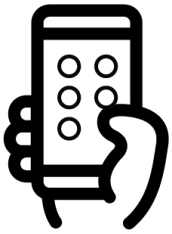
Figure 5.10 Participant's phone with numbered password lock system

Therefore SL suggested a system that locks the device automatically, but there should be a process where the user could bypass the password in case they could not recall the password. SL referred to his parents' friends who have a problem with dementia where the husband had left the house without anyone knowing. SL stated that his friend and the other family members were so lucky to find the husband just nearby. However, it was a very stressful situation where those people had to find the man in the darkness. That was the main reason for the family members to decide to place a GPS tracker placed on his neck to track the person when needed.

Special navigation models for emergency situations

SL emphasised that an application called the ICE (In Case of Emergency) should be installed as compulsory items on older adults' smartphone devices by default, in order to help them in the case of emergency. The application should also be stored in the contacts or address book, or as a uniquely created shortcut, and the icon should be made extra clear and visbile to the smartphone owners. SL stated that ICE should be compulsory to be kept in the address book and this should be mandatory in Australia. In addition to the ICE application, SL also suggested having a "panic" device hung for examplearound the neck of an older adult. Moreover, that device should also be linked to the iPhone or the relatives to automatically activate or transmit an emergency call to the contacts who have been categorized as important people or people who should be contacted in emergency.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Finding a specific application quickly	NA	Some decorative wallpaper could distract users from finding the application/buttons easily and accurately	• Unnecessary decorative elements should be reduced (if not removed) from the overall design to avoid further distraction. • The removal could also enhance the users' navigation speed.
	Accessing address book	Well organised on alphabetical order	No photographs would confuse users	Some contacts require photographs to easily identify some common names
	Navigating through more than 3-page away	Could gain more information	Users would not be able to recognise where they are. Users could not go back to the main page easily	• The page depth should be reduced to allow older adult users having more straightforward access. • 'Back to main page' control should be clearly implemented in every page to allow users have

				the flexibility to go back to the main page
	Monitoring an elderly with dementia	Older adult users could monitor other people in the same age	NA	Monitoring system can be implemented with a bit of training or assistance during setting up process as well as the operational procedures.
	Screen lock to avoid unexpected operation	NA	Some applications could automatically be uninstalled without notice	Screen-lock should be considered as an important tool to avoid unexpected touch. This could be combined with an easy-to-setup process or auto-setup system
	Calling relatives in an emergency situation	Using the ICE (In-Case of Emergency) access	Users would not how to setup	The phone store should assist new users to setup the phone as well as the emergency access before they can use it.

5.2.9 Participant 09 (LE)

5.2.9.1 Participant profile

Participant No. /Code	09/LE	**Location**	Australia
Period of Interview	02 October 2018	**Education**	Engineer
Age Range	70–75 (exact age is 71)	**Occupation**	Freelance consultant
Gender	Male	**Other info**	Works 2 days a week – Wednesday, Thursday
Device used 1	Huawei	**OS**	Android
Device used 2	iPad	**OS**	Apple iOS

5.2.9.2 Participant biography

LE is a 71-year-old retiree but works voluntarily in a community centre as a consulting staff member. His job is to consult elderly members in the community on how to deal with difficult situations, or just to be a friend to the members. The researcher picked LE as one of the participants as he recently had a heart attack at his house and, luckily, he has fully recovered. LE seems to be fine to be able to go back to work. When he had the experience his wife could not do anything to save his life at that time, i.e. call an ambulance or at least their neighbour. According to LE, his wife had no idea on how to use a smartphone. LE stated that there was a neighbour who walked past their home when the incident happened and LE's wife asked for help from this gentleman. Otherwise, LE's life could not be saved. In fact, LE's wife did not have any personal phone and did not even know how to turn on a mobile phone at that time.

"I had a heart attack at home and my wife could not do anything because she could not operate my phone to call the ambulance" (LE).

LE is considered himself more skillful in using a smartphone than his wife. During the interview, LE demonstrated that he could perform well on the phone although it seemed a bit slower than average.

5.2.9.3 Participant's overall comments on selected model on the test board

Emergency button on a static block of the navigation panel

During the interview, the researcher showed the test board to LE and he thought that he had never used any of those models before. LE thought that the model with a 4-main-control area always visible at the bottom of the phone (model 1 and 2) would be useful for older adults to give direct access to certain contacts in an emergency. LE emphasized that the SOS button that is located on the bottom part of one of the designs (phone model 3) would also be helpful if an older adult person was in an emergency situation like LE had experienced. LE considered himself as a person with normal eyesight. Therefore, LE believed that clear and easy-to-distinguish navigation, such as clear and visible shapes and colours, would be beneficial for older people's eyes to get used to the individual functions, except if a person was colour-blind. The SOS emergency button should be designed using clearly contrasting colour on a static navigation panel to allow users to interact with the buttons during any emergency situation.

5.2.9.4 Participant's opinion on the software and display design of the phone UI

Auto-adjust reading clarity by adjusting reading distance

According to LE, the display clarity of his smartphone was suitable for his eyes and his reading capabilities. LE thought that clearly visible navigation objects were important for someone who was wearing reading glasses. LE demonstrated the way he pushed the phone device away from him when he was reading on the phone screen to get better reading distance. LE stated that he would rather adjust the phone position to get the best reading distance than change the font size on the phone. LE knew that some people might have changed the screen size, resolution or even the text size to be able to read properly. In his case, LE would move the phone further away from or closer to his eyes to adjust the readability.

Auto-zoom in or out on the display screen when watching videos

However, LE would only require adjusting the phone font size when he needed a better wxperience while reading or watching videos. Otherwise, LE liked playing videos on YouTube or doing video calls using the instant messenger or Skype applications to chat to friends, both locally and overseas.

5.2.9.5 Participant's opinion on the hardware and usability design on the phone device

User control and freedom over the silicone phone case

LE did not have any issues with the smartphone device so far. However, he did feel uncomfortable with a smartphone or mobile phone covered with a silicone case or some similar materials as it may reduce his hand grip capability. LE mentioned that having a silicone material wrapped around the phone body require him to readjust his handgrip to experience the phone shape and touch. LE found that a phone cover made of silicone might get oily when a person was holding the device for a period of time. However, overall, LE has no issues with the hardware size of the phone.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Accessing contacts when in emergency	Emergency access is not available in the current phone	Emergency access is not available in the current phone	The button should be designed by default and in an obvious location. Static panel should be incorporated with the button design.
	Reading digital news on news applications of Facebook	Adjustable brightness to enhance reading clarity	Manual adjustment on text size	• There should be mechanics to automatically detect the eye's distance to adjust the reading distance. • This includes auto-adjust on the brightness/contrast and auto-zoom in/out when watching on a non-text medium
	Handgrip on the phone hardware with a silicone cover	Phone body protection	Make the device have bigger grip Different handgrip and control to some external buttons	• Hardware materials could be adjusted to older people's handgrip that might be weaker • Device controls should be more accessible through a silicone cover

5.2.10 Participant 10 (KI)

5.2.10.1 Participant profile

Participant No. /Code	10/KI	**Location**	Australia
Period of Interview	16 September 2018	**Education**	Economics/accounting
Age Range	70–75 (exact age is 74)	**Occupation**	Retired
Gender	Male	**Other info**	Born in Hong Kong, Citizen of Australia.
Device used 1	iPhone 5	**OS**	iOS

5.2.10.2 Participant biography

KI is a 74-year-old retired businessman, an Australian citizen born in Hong Kong. He has been in Australia for more than 35 years and has been an Australian Citizen for approximately 20 years. KI has been running businesses in Australia for 5–7 years and he usually drives his car to meet his clients. KI usually utilizes his smartphone to make calls and send SMS only. KI stated that he is very reluctant to use new technology, but at present, KI thought that he should keep up with it and technology should be embraced. KI stated that he is considered as having fat fingers for an Asian male and finds it difficult to precisely navigate around the smartphone buttons.

5.2.10.3 Participant's overall comments on the selected phone models on the test board

According to KI, the phone model that was most attractive to him on the test board was phone model 8 due to the hardware size. KI stated that he does not normally use the smartphone for anything other than making phone calls and sending SMS. Therefore, the smartphone functions would not significantly affect the interaction, but the handgrip would.

Physical touch on the hardware

During the evaluation on the test board, KI stated that a mobile phone with big physical touch on the hardware as well as the buttons could be considered as KI's preferred phone rather than a touchscreen one. During the interview session, KI mentioned that he had an issue with his vision and hearing. Therefore, according to KL, his touch sense was greater than his vision; therefore, he could sense the buttons on the phone and recognise the numbers, but he could not see the numbers properly and accurately. When the researcher asked about the use of Siri,

KI stated that he was not interested in using Siri due to unfamiliarity with it which he felt would cause him to make some errors sooner or later.

5.2.10.4 Participant's opinion on the software and display design on the phone UI

Fat fingertips to interact with the phone navigation

KI mentioned that he was very reluctant to use technology, especially as a communication tool, due to his low vision. KI would rather use the house phone than a cellular phone or a smartphone to make calls to his friends unless he could sense the buttons on his fingers and fingertips. KI stated that his fingers were considered bigger than normal Asian males which impactedhis experience interacting with a smartphone display screen, except on an iPad device.

KI tried to demonstrate one of the most frustrating interactions for him: finding a name on the phone contact list. KI felt that this task was a difficult task to carry out as he could not press the page slider accurately to find the names on the contact list.

"I need to be able to feel the 'vibration' when I touch the button. Otherwise, I am not sure whether I have already pressed it or not" (KI).

KI stated that the main reason why KI never sent any short text messages (SMS) using the phone was due to the fingers and fingertips issue. He would always make typing errors whenever he typed on the touchscreen keyboard. KI demonstrated his approach to sending an SMS which took approximately 5–7 minutes for a sentence containing 8–10 words.

Figure 5.11 KI's finger size on the smartphone has a significant impact on the interaction

Navigation buttons and gaps

During the interview and observation session, KI attempted to interact with his phone by putting his thumb on one of the navigational buttons. KI stated that performing a task on a phone could be difficult for him because he always missed the target (button). KI could perform the task very well when the gap between one button and the other was spacious enough. However, the actual navigation size, including the gap, on a smartphone might not be suitable for his fingers, and KI struggled to get the touch right unless he did it very slowly and carefully, although he still made some slips.

5.2.10.5 Participant's opinion on the hardware and usability design on the phone device

The phone auto-lock system

KI used to put his phone in his pocket to get quick access to it when there was a phone call or he wanted to make one. KI mentioned that several people got a call from him at times where he was unaware he was making the calls. Some people found it a bit strange because he made a phone call but he did not respond to them.

KI acknowledged the fact that his smartphone could make an unexpected call to other people while the phone was in his pocket. It happened due to the phone being unlocked, making the 'answer' button easily pressed leading to accidental calls.

Inability to set up the auto-lock system on the phone

Initially, KI thought that his phone was supposed to have been locked up before it was placed in his pocket. In this situation, KI said that he did not know that the phone was not locked and he did not know how to set the auto-lock on the smartphone to come on once the phone has been idle for a certain period of time. As a result, KI's phone would accidentally make a call people from his address book list or from the last called person. KI was surprised when people told him about the incidents.

Issues and ideas from participant

	Tasks	Good	Bad	Ideas for improvement
	Sliding page up and down to find names on contact list	NA	The sliders are considered too small to operate	Use transparent slider or increase the size of the slider with the consideration of setting up the transparent level on the buttons.
	Pressing individual button correctly	NA	Buttons are too close one another, making it difficult to press them accurately	Adding more gaps between buttons make it easier to use and provide more precise access on the individual buttons
	Phone lock access	To avoid making accidental calls	User could not setup the auto-lock system	Screen auto-lock system should be activated immediately after being idle. There should be a way to configure the auto-lock setup.

5.3 Key research insights from Australian Participants

The researcher gained a better understanding of how the participants from Australia utilise and interact with their personal mobile devices from the Australian older adult perspectives. Using UX/UI Design research methods, the researcher was allowed to explore more in depth into the participants' daily activities and habits as needed.

Some of the key aspects of the research findings during the observation sessions in Australia are as follows:

1. Compared with the Indonesian users, participants in Australia generally have one phone only. Based on the interview sessions, only one participant had two smartphones and was very capable of operating the device. The UX/UI Design research methods were also used with the Australian participants to investigate the dynamics of Australian people within their community, in terms of how they interact with other people using communication technology.

2. The older adult participants in Australia tended to make a phone call to their colleagues, friends, or relatives rather than sending text messages. Four people used messengers from various platforms to send and receive messages, while the other six people tended to make phone calls to communicate with others.

3. Older adult users in Australia demonstrated less operational control than the elderly people in Indonesia due to their preference for having direct communication rather than sending out text messages. Only one elderly person in Australia proved his ability during the interview session to be capable of most of the smartphone operation.

4. The older adult users in Indonesia are more likely to visit the offline technical support when dealing with operations that they are not familiar with.

5. Elderly users in both Indonesia and Australia tend to have one-on-one coaching from other people who might be more familiar with phone technology to assist them to operate the smartphone device and to enable them to do their tasks in their own time. This active involvement of the researcher and other people with older adult users in Australia will

eventually educate the elderly people with the technology. In this case, the UX/UI Design research method using small group/individual interviews was proven to be a suitable method to investigate the Australian older users' needs and desires, including the behaviour towards multiple smartphone technologies as well as giving necessary assistance when users needed it.

5.4 Summary of Chapter 5

The results of the overall interview and observation with the participants in Australia showed that:

- Nine people (90%) of the representative users own one smartphone only and stick to one telecommunication provider. Meanwhile, these people (90%) of the respondents have owned the smartphone models more than 3–5 years
- One person (10%) of the representative users owns two smartphones
- All users in Australia had a tendency hold on to their device rather than purchase a new phone unless their existing device was fully non-operation
- Users in Australia tended to seek assistance from the offline smartphone store to avoid unexpected operations error.
- All users in Australia have the tendency to make a call rather than text to communicate.
- One (10%) of the participants was familiar with the Facebook application to exchange pictures, and used the application to communicate with others.

5.4.1 How did the participants in Australia interact with their communication devices?

Using a UX/UI Design research method, the interview and observation sessions provided insight from the elderly perspective on how they own and interact with their phones. The suggestions from the participants in Australia have helped the researcher develop an understanding of how the older adult users were attracted to the smartphone technology. One of the reasons was these users could own just one device until the phone breaks down.

The researcher also found one user with more significant skills to operate the smartphone device as they had prior experience and knowledge in operating similar technologies and platforms.

In this case, the data will then be utilized to propose and develop the future of smartphone user interface design based on this experience. At some points, the researcher also obtained new ideas from the participants' overview.

Detailed analysis of the combined Indonesian and Australian data will be presented in Chapter Six: Discussion and Resolution.

CHAPTER 6:

Discussion and Resolution

6.1 Introduction

This chapter will discuss the results of employing a User Experience (UX)/User Interface (UI) Design research method using semi-structured interviews with small groups/individuals and other data collection outlined in Chapters 4 and 5, in which the data was recorded with the Indonesian and Australian participants to identify significant issues that exist for older adult users during the utilization of their smartphone. To achieve this, the interview was broken down into two sessions using a UX/UI research method using semi-structured interviews with small group/individual participants as discussed in Chapter 3.

This chapter will discuss the results of the first interview session, which focused on providing the preliminary research data to obtain initial findings in regard to the reasons why and where older adult users from the two countries (Australia and Indonesia) experience difficulties in navigating smartphones, including their features and functions.

These results are then analyzed further as the items that the participants like and dislike in the older model and current smartphone technology are also investigated and implemented in the phase one interview and observation session to develop a design framework (see Figure 6.1). The new design includes features, functions, and other design elements identified by participants to fit the smartphone interface design and their interaction to fulfil their needs.

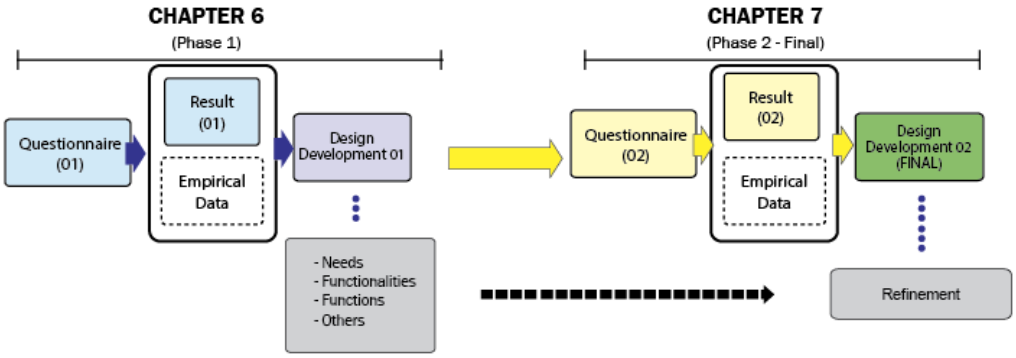


Figure 6.1 Phase one and two of the results analysis and design development

Phase **one** of the interview session was conducted as follows:

This first interview session was conducted to obtain initial responses, feedback and suggestions on the current phone models in the market of each country.

Phase **two** of the interview session was conducted as follows:

The second phase of the interview was conducted to confirm a new smartphone user interface design using the frameworks and prototype design based on the items proposed by representative users in the first interview session. This interview session was also conducted to confirm the design changes and implementation of cognitive frameworks that are addressed on the next chapter (Chapter 7).

6.2 The Question Categories

The observation and interview results will be discussed below regarding how the participants/users connect to the topic of the investigation of smartphone user interface design interaction. The discussion also included how the older adult users could participate in the design development of new proposed smartphone user interface design. The discussions are split up into 4 main sections, as follows:

1. Demographic identification
2. Smartphone Identification

3. Usability Issues

4. Cognitive Ergonomics

6.2.1 Demographic identification of Indonesian and Australian Participants

The following group of questions indicate the demographic details of the Indonesian and Australian users, including their daily activities related to smartphone use.

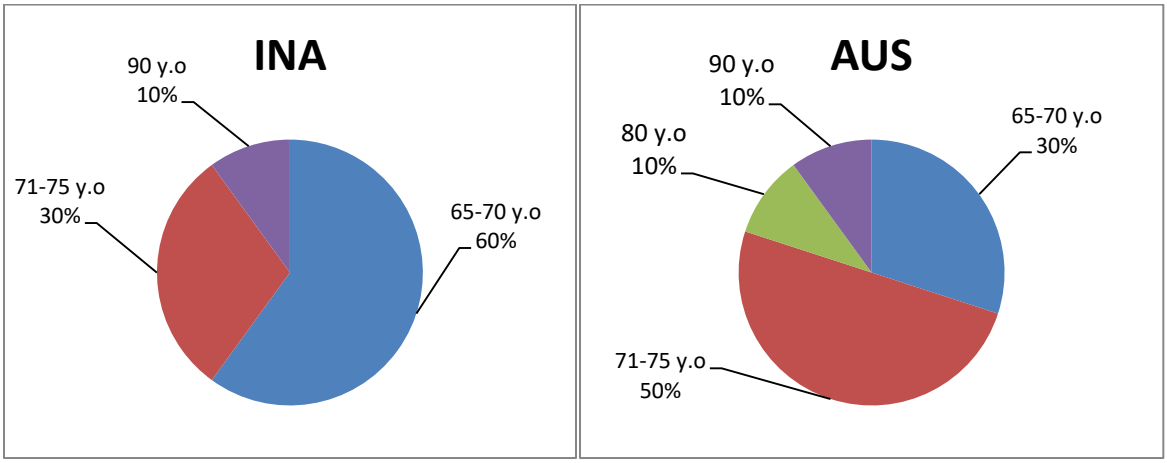


Figure 6.2 The older adult participants in Indonesia and Australia

The researcher had identified a broad spread of participant age range to obtain a better understanding on a wider spread of smartphone users in Indonesia and Australia. The range included older adult participants who were aged from 65 into their 90s who still have the ability to operate a smartphone device to carry out daily activities.

The researcher undertook interviews within the equal numbers of working and retired people to allow proportional distribution of the participants in Indonesia and Australia (see figure 6.2a). Meanwhile, the male and female participants were 60%:40% in Indonesia and 50%:50% in Australia (see figure 6.2b). However, there is a significant different between the number of retired people in Indonesia and Australia as it is difficult to retire in Indonesia as the government does not provide any superannuation, as it does in the Australian culture (Australian Taxation Office, 2013). Older adults in Indonesia have to financially support themselves as they are getting older.

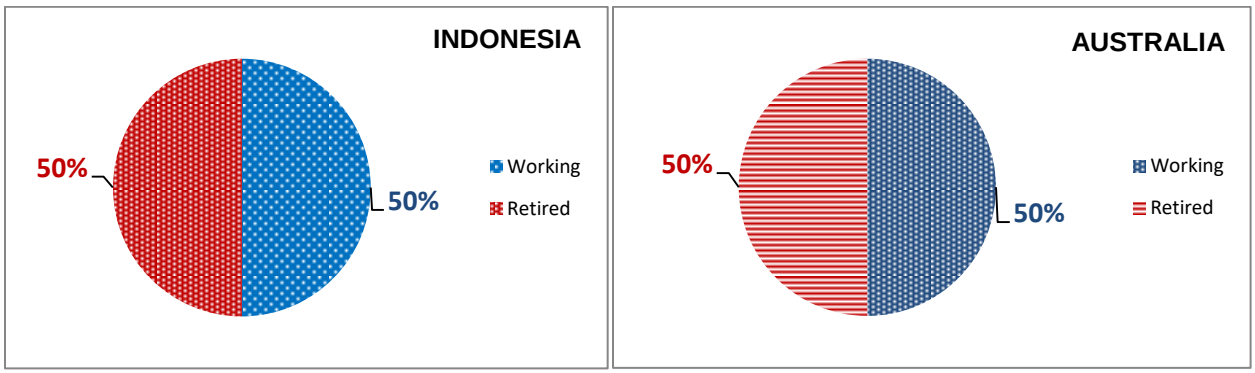


Figure 6.2a The working and retired participants in Indonesia and Australia

Meanwhile, the composition of male and female participants can be seen in figure 6.2b, with 60% (6 people) of male and 40% (4 people) of female respondents in Indonesia. Meanwhile, an equal number of male and female participants in Australia were interviewed. (See Figure 6.2b)

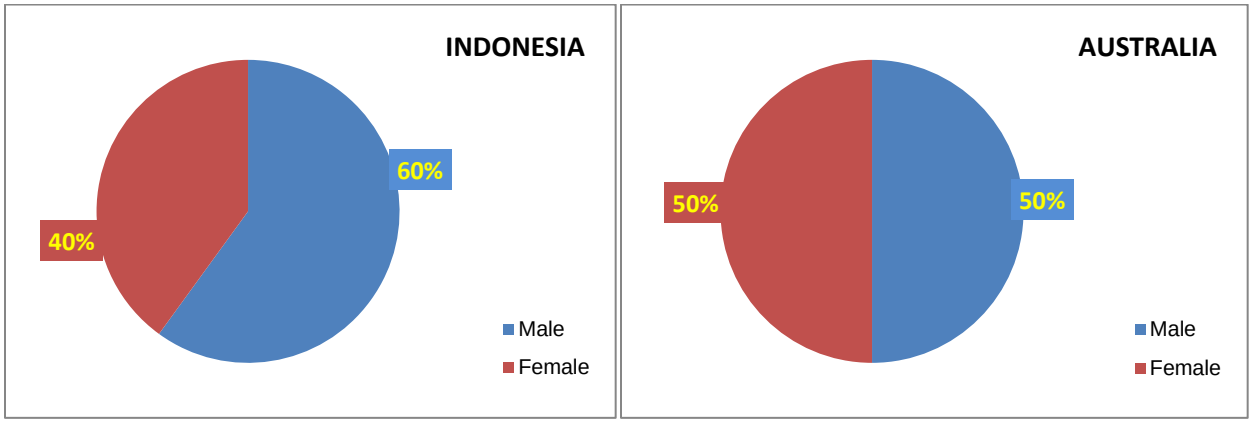


Figure 6.2b The male and female participants in Indonesia and Australia

6.2.1.1 The activities of the older adults in Indonesia and Australia

The Indonesian group had been identified as they were still actively working as entrepreneurs or businesspeople, and also involved in many different activities in the community or organizations. Therefore, this type of user used their phones for various activities – mainly to communicate with other entrepreneurs or fellow business traders (e.g., suppliers, distributors, and customers, both local and overseas). These groups of people also make a connection with their friends or relatives using the same means of communication. This group of Indonesian

participants was more likely to utilize various communication means or messenger applications to carry out more various tasks, such as sending out a picture while chatting through instant messenger, sending out an audio messenger while broadcasting messages in a group of people using instant messenger or making a video call at the same time. These actions had distinctive functions and results; e.g., sending a copy of a document via an instant messenger was quicker than via post mail.

Meanwhile, 50% of the participants in Australia had entered the retirement period and their main activities were considered to be more relaxing and leisurely. They tended to be involved in community services or non-profit organizations during their retirement period. Meanwhile, only two people from the Australian respondents were still employed full-time. One participant was employed as a salaried lawyer and another as a part-time entertainer (musician) while the rest of the participants in Australia were actively involved in community services or organisations.

6.2.1.2 Phone device ownership

The Australian participants owned only one phone each, which they used for all activities. Moreover, they were more likely to communicate by speaking on the phone, rather than sending text messages via SMS or instant messengers.

Meanwhile, the Indonesian participants owned more than two phones that they normally used at the same time, and a few had only two phones only. During the interview sessions, it was found that there only one person owned one old phone model. This happened due to different telecommunication providers in Indonesia with various phone rates and packages for a specific period of time that attracted users in different ways and for different purposes. In Indonesia, the telecommunications industry is more competitive than in Australia, where all the Australian companies offer similar plan rates to customers. Moreover, more effective rates for various users with specific needs can easily be attained in Indonesia by selecting the most appropriate phone rates as necessary; e.g., students were able to subscribe to a significantly lower rate compared with regular customers via a postpaid subscription.

Phone device ownership – Indonesia

The participants' occupations revealed that the participants in Indonesia organized and operated their own businesses although they were in the retirement age. Among the ten participants in Indonesia, there was a significant rate of phone ownerships, as follows:

- One person (n=1, 10%) of the ten participants owned more than five phones
- Seven people (n=7, 70%) of the ten participants owned more than two phones.
- Two people (n=2, 20%) of the ten participants owned just one phone.

Overall, 70% of the respondents in Indonesia owned more than two phones to allow them to make contact with their friends or colleagues more easily and comfortably using preferred phone data services. Meanwhile, the other phone devices can be used to carry out different tasks, such as browsing, or can be used as a backup device (see Figure 6.3).

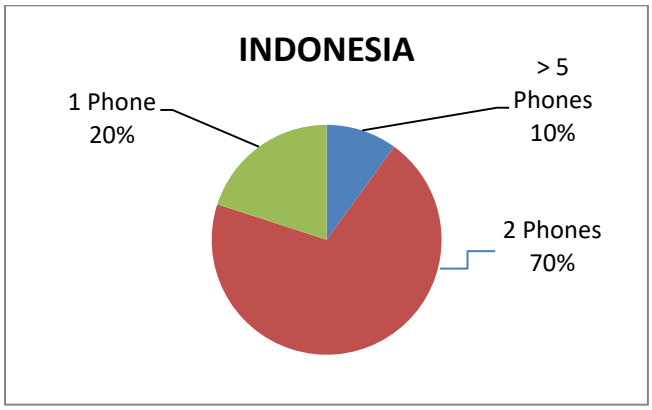


Figure 6.3 Smartphone ownership in Indonesia

The most commonly used technologies among the Indonesian participants who are actively working were more advanced and complex in operating technological devices; for example, one of the participants could operate digital medical equipment as a TCM practitioner, and one participant is a dentist (total n=2, 20%). These two participants reported regularly using advanced technology to support their job, such as acupuncture machineries for the TCM to help cure the patients and dental X-Ray machine for the dentist to take an X-Ray photographs of teeth structure. Moreover, the participants were also required to carry out administrative tasks

as part of their work, such as creating a report document using one of Microsoft Office programs. These two respondents reported using those two types of technology at a medium level of complexity.

One older adult participant (n=1, 10%) was considered as the oldest participant, being 93 years old at the time of interview. This participant was selected due to the age and the exceptional capability in operating the basic functions of the smartphone device at that particular age.

Meanwhile, among the 10 participants in Indonesia, four people (n=4, 40%) owned a personal computer or a laptop to support their work. However, the rest of the participants (n=6, 60%) stated they had never used a computer or a laptop in their life and a phone device was the first technology they had explored and utilized.

The main motivation of the ten Indonesian participants for having a smartphone (n=10; 100%) was to communicate with other people, for example using the phone device application, send short message services (or instant messengers) and also to conduct a video conference using the webcam application. The second motivation was to obtain information on the internet using an internet browser application such as Google Chrome (n=7, 70%). Only three people (n=3, 30%) never used the browsers because they did not need to find anything online or even surf the internet as these participants would rather use an application to read online news, such as online news application.

Phone Device Ownership – Australia

Meanwhile, data on the participants in Australia showed that nine people (n=9; 90%) had one phone on hand as their one and only communication device, while only one person (n=1; 10%) had two smartphones to be used interchangeably if the other smartphone goes wrong (See figure 6.4). None of the participants had an old-style phone due to discomfort and unpredictable phone utilization behaviour, such as the incapacity to run certain program and issues with battery stability. Four people within the Australian participants (n=4; 40%) used Android-based Operating Systems, while the other six people (n=6; 60%) used an Apple phone product, such as iPhone 5, 6 and 6S. Only one participant was at the age of 90, while the others

ranged from 65–70 (three people, n=3; 30%), 71–75 (five people, n=5; 50%), and one person (n=1; 10%) was aged 80.

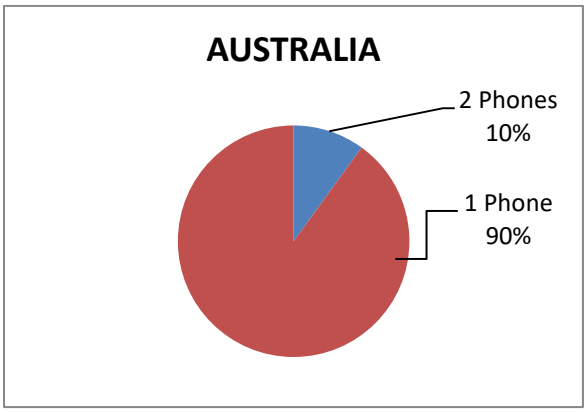


Figure 6.4 Smartphone ownership in Australia

One person (n=1; 10%) was very familiar with voice command (Siri) and utilized this function to activate most of the applications on the device, including making a phone call and sending short message services. Meanwhile, the other respondents used the normal application to carry out the tasks around the applications.

6.2.1.3 Identification of phone ownership and utilization by participants

In this research project, the participants were selected from Indonesian and Australian older adults who are still working or have retired. Because this research project is aimed at older adults, the researcher anticipated some repetition of issues and problems, and a slow process during the interview and observation sessions. The researcher needed to obtain more findings by asking the participants more in-depth questions to get deeper information when the participants could not recognize certain experiences or ideas.

Due to the nature of the interview and observation sessions when the participants addressed the issues on the older adults smartphone device through a set of questions (see Appendix), the researcher sometimes had to repeat the questions more than twice to get the right message across to the participants in order to obtain the apropriate response. Participants could lose the

interest in responding to the enquiries at times, and the researcher had to direct them back to the original enquiry. One of the participants from Indonesia (n=1; 10% of the Indonesian participants) wrote their comments and suggestions on a piece of paper to prevent them forgetting the questions asked and handed over the answer to the researcher at the end of the session .

Meanwhile, one participant from Australia (n=1; 10% of the Australian participants) took two phones to the interview and observation session to show the differences and similarities in functions between the two phone models. Unexpectedly, one participant (n=1; 10%) from Indonesia brought five out of his seven phone models to show that there were significant differences among the various phone functions, including the participant's preferred models among his seven phones. The participant had left two models at home due to their functioning only as backup devices.

Data shows that eight participants in Indonesia (n=8; 80%) utilized only instant messengers on the daily basis to communicate with other people rather than using the phone application to make a call or sending short message services (SMS). This utilization included creating groups in messenger apps for different groups of people. Meanwhile, only one participant (n=1; 10%) in Australia utilized instant messenger (WhatsApp) to communicate with other people, while the other nine people (n=9; 90%) utilized the phone and SMS functions to communicate with others.

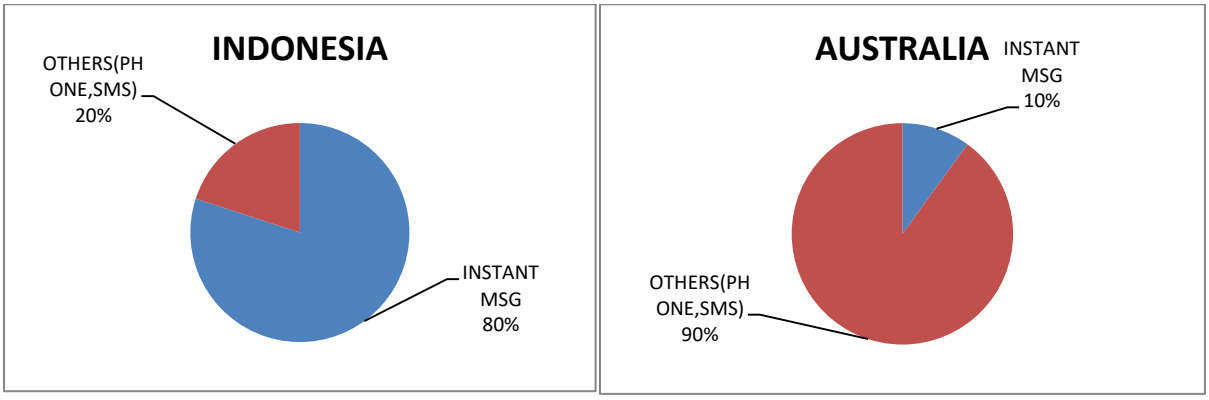


Figure 6.5 The most frequently used applications for the Indonesian and Australian participants

6.2.2 Smartphone usability identification

This category of questions identified the smartphone ownership and functionalities of each user group, initialized by the following question: “What applications or features do you use on your smartphone daily?”

Discussion

The Indonesian group was most likely to use Instant Messengers, such as WhatsApp and Line Messengers as communication applications. Meanwhile, the Australian participants used the short message service (SMS) to text other people or made a phone call to the other party. People in Indonesia preferred to talk via text messengers, compared to the Australian participants, where talking directly to their friends or relatives was the preferred method of daily communication. Moreover, the Indonesian participants were also likely to send pictures or videos to their friends, colleagues or relatives – including emoticons – during their conversations on instant messengers to indirectly express their feeling using symbols.

6.2.3 Usability issues identification

This category of questions identified the usability issues on the participants’ smartphone user interface design from the user group in Indonesia and Australia. The questions were based on the ten Usability Heuristics by Jacob Nielsen (Nielsen and Molich, 1989).

There are two questions on the Usability Issues: “How easily do you distinguish the following icons for an operation?” (i.e. “OK” and “Cancel” ; Tick ☑ and Cross ☒ icons; “Yes” and “No” text); and “How easily do you operate the following” (i.e. the operation of slide “left–right” and scroll “up and down” to slide and scroll the page).

“How easily do you distinguish the following icons for an operation?”:Discussion

Both the Indonesian and Australian groups preferred to identify an action-based button by looking at the text. In the examples, the use of “OK” and “CANCEL” could better appear to the older adult participants who had low eyesight. Moreover, the icons ☑ or ☒ could be unclear to the users as they thought that ☑ is to represent a correct answer rather than ‘OK’ and xx to

represent incorrect or wrong answer rather than 'CANCEL' to terminate the action, especially when the screen brightness and contrast were not properly adjusted. An incorrect action was likely to happen when users misinterpreted the icons or symbols to proceed to the next step or confirm, as represented by the 'OK' button and 'CANCEL' to terminate the action respectively.

Design suggestion on the shapes of icons/symbols

The shape of icons and symbols is expected to implement consistent or similar basic shapes following the buttons.

The use of icons and symbols with similar shape should be recognisable on the decision-based buttons unless the difference is significant. The eyesight of the older adult might be too limited to see the difference in shape of the ☑ and ☒ icons. Therefore, the development could be carried out as follows:

- The buttons or navigations should be made clear and easy to distinguish by users with low vision by giving colour to the buttons to indicate the 'YES' to represent 'good to proceed', or 'NO' to represent 'not good to proceed'.
- The text could be incorporated and placed below each icon or symbol to clarify its meaning.
- A three-dimensional object or shape could be interpreted better by elderly eyesight, such as giving a bevelled button or shadows underneath the buttons.
- The buttons can be distinguished using different colour representation, where green colour on ☑ or 'OK' indicates proceed; and red on ☒ or 'CANCEL' indicates revoking the operation.

"How easily do you operate the following": Discussion

The page should have clear indication of the 'Left–Right' and 'Up–Down' arrow to notify users how the page can be controlled and directions should be clear and refer to the operation each arrow performs. The indicators could possibly be hidden before the user activated the screen to make the bars appear. Therefore, there seemed to be an invisible slider or one that did not exist on the screen.

Design suggestion of suitable size on navigation control

Clear and consistent direction signs should be implemented to allow a more direct and intuitive method of user interaction. Figure 6.6 shows how different arrows to indicate directions are placed in proper spots to reduce human mental load. Meanwhile, figure 6.7 shows different icons or symbols to represent directions as stated by the participants.

The participants in Indonesia and Australia preferred to have the control of the "swipe" and "slide" using clear pointer direction, including clearly visible button with reasonably large buttons that fit their fingertips. For example, the use of directional arrow buttons with a reasonably large area for fingertips might help the users to understand the direction and they could click the button properly. The participants suggested that the buttons' placement should also be clear to match the users' mental model, such as this arrow is to indicate right and this arrow is to indicate left direction. Moreover, the left arrow should be placed on the left side to indicate the control to the left side as well as the right arrow (see Figure 6.6).

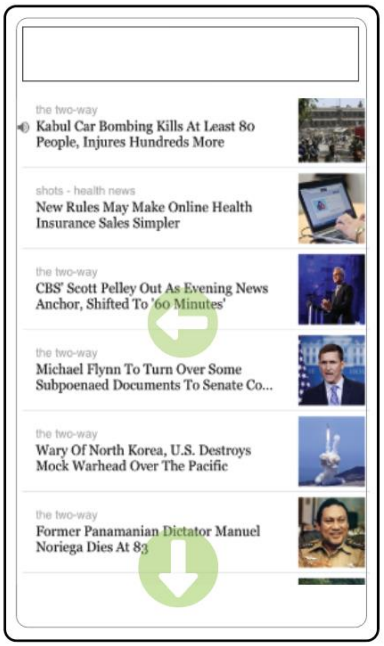


Figure 6.6 The recommended operational/directional control to slide down or across the screen to show different topics on the online news page (Designed by Yahya, A., 2019)

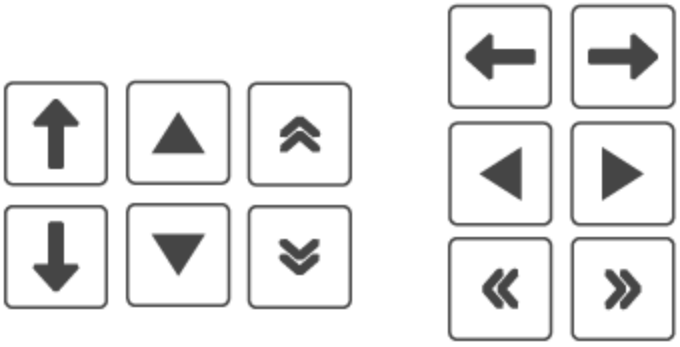


Figure 6.7 Suggested clear pointers designs to indicate directions (Designed by Yahya, A., 2019)

Participants found that touch-and-slide mechanism very easy to discern and operate, like flipping a hardcopy magazine or newspaper when they have to move their fingers from one side to the other side of the screen.

"Have you ever or never changed your language setting to other languages than what you understand? And why?" (i.e. Changing from Bahasa to English and English to Mandarin and vice versa): Discussion

The Indonesian group had the ability to speak in some different languages, such as Mandarin, Dutch, Korean and Japanese. Therefore, the Indonesian group was more likely to purchase a phone on in which they could select different language options. This situation was different for the Australian participants, who all had to use only one language, which was English, to operate the overall systems. This situation was very likely to happen due to the ability of the majority of people in Indonesia to speak more than languages, with many communities speaking in their own 'mother tongue' language. Meanwhile, in Australia, most people speak English as their main language to communicate and it is also part of the default system design on the smartphone device.

Design suggestion on language selection

This feature is important to the users in both countries to allow user flexibility to switch the language from one to the other for better understanding. The following would be recommended to the language selection:

- Users should be given the flexibility to easily switch from one language to other languages on the phone device, such as from English to Bahasa or Mandarin and vice versa.

Alternatively, users can select or be given options on the top five languages, such as English, Chinese, Japanese, Korean, or Spanish, to be applied to the phone systems. These languages can be provided by default in the country where the phone was sold manufactured. The language switch button/shortcut should be placed on the main system control, along with the other main setting preferences, for easy access.

"What would you do if an error happened while you were interacting with the phone?" and "How important is assistance or guidance to operate the smartphone's basic functions?" (i.e., this is to identify the level of difficulties the users may have when there is an error on the phone until assistance is required): Discussion

The Indonesian participants were more likely to fix errors on their smartphone themselves by using trial and error due to the number of phones owned by this group of participants. This group of people normally figure out themselves how to find the error and recover. Alternatively, the participants will contact their friends or relatives for assistance.

Moreover, different phone models had different service centres, and most of the old phone models no longer had an authorised service centre in Indonesia. Meanwhile, in Australia, the participants always stay updated with the latest technology, as well as using a service centre and going to the authorised service centre so errors could be fixed up more efficiently, i.e. for Apple products, where this brand offers after-sales service in the all Apple Stores in the whoe of Australia and also worldwide. Mac users find this is very beneficial as they do not have to pay extra for the support service.

The participants experienced the most difficult situation when they forgot to switch between wifi and data connection in the system setting. The participants did not realize the situation until they could not receive a message on their instant messenger application or browse the internet. Meanwhile, users did not recognize that the wifi or data connection symbol did not indicate the signal transmission. The participants could not properly identify and recognise the

symbol due to unfamiliarity. Therefore, there seemed to be an error from the smartphone system, but it was actually the connectivity.

Design suggestion on how to deal with errors on the phone

Older adult users often do not know what to do when they receive error messages on the phone screen. This can reduce their confidence in using smartphones, including fear of making further errors. Simple warning messages can easily distract older adult users. Therefore, the users recommended the following to allow users to identify the problems with their phones:

Proposed design solution for users in Indonesia:

- For the Indonesian participants, a clear message to solve the error should be displayed on the screen at the time the error occurs. The message should contain a step-by-step solution or possible ways to resolve the issues, specifically how to recover from the error at present. The errors could be presented in users' default language or using icons/ images to represent the solution. The use of technical terminology should also be avoided.
- For example, users experienced the "no internet connection" problem during browsing where they did not realise the wifi or data connection indicator was off or not connected.
- Therefore, an indicator of internet connectivity should be made clear to distinguish that the phone was connected to the internet or not, i.e. using flashing icons to indicate connected and static icons to indicate no connection.

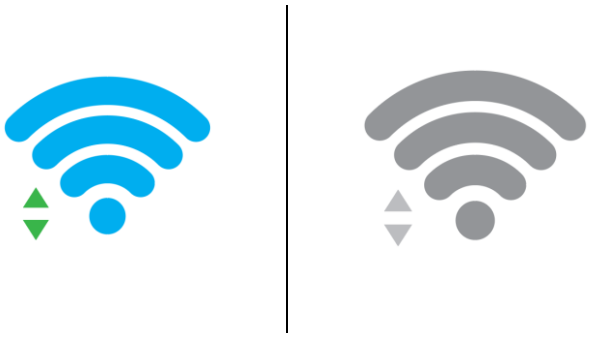


Figure 6.7a (Left) Illustration of connected wifi with flashing arrows and (right) no wifi connection

Proposed desgn solution for users in Australia:

- For Australian users, participants would normally visit authorised service centres when errors occur on their phone regardless of the issues.
- The users expected the staff members should always be readily available to help them when errors occur on their phones as part of their services. The users would visit authorized service centres which are located in some strategic places in big cities.
- Assistance from authorized service centres should be readily available most of the time, offline or online. A list of nearby authorized stores or service centres should also be placed on the main page as one of the main features to indicate nearby stores, e.g. within five kilometres from their current location.
- On the other hand, the users could also get a tutorial on YouTube to obtain online support.

Figure 6.8 An offline customer service centre for iPhone users

The error information and solution were recommended to be distinguished between the Indonesian and Australian users to match the system language they are operating.

"What errors do you usually make when interacting with the smartphone? And why?" (i.e., when adding detailed features using the application navigation buttons, such as emoticons): Discussion

The participants in Indonesia were used to interacting up to three pages deep on a selected application and tended to generate failures when they had to go deeper than three pages. For example, when the participants attempted to send instant messages and needed to perform subsequent actions, such as attaching multiple pictures or documents into the messenger and also emoticons on the chat windows, including copying and pasting text messages to the person in one sequential action. The Indonesian group of users usually got confused when caryring out multiple tasks on their phone during the interaction; for example, the users would normally edit the photographs they would send to other people, i.e. rotating and resizing the image before sending them to people in their instant messenger contact list. It is very unlikely these people would send the picture as it was originally taken.

This could possibly generate errors during the interaction due to the depth and different interactions that users have to carry out. The older adult users could sometimes lose track and direction and did not know what to do next. Moreover, the participants stated that they would come across a problem when they tried to attempt multiple actions sequentially on a page which is deeper than three levels down.

Most users could not go back to the previous page and they did not know where they were at the current stage. Therefore, they tended to go back to the home or main screen by pressing the ‘home’ button. That is one of the ways to handle the error: by going back to the ‘normal’ state in which an older adult user would be able to identify where to go next.

Meanwhile, the participants in Australia would be notified when there was an error on the phone by having a message came up on the screen to indicate the error on the previous action; for example, if a user accidentally pressed the volume button all the way up they would end up getting a deafening audio level, the smartphone device would give an indicator of the maximum audio level the user has already reached and warn the user through a pop-up message before the action could be executed. In this case, at least one participant had already experienced this when the phone ringtone volume was suddenly too loud.

When the error occurred, the Australian participants found it rather easier to overcome the situation because they only interacted with one phone that they ewere very familiar with. However, the Australian participants would normally have issues with hardware rather than software or applications.

Design suggestion on allowing users to recover from errors

Navigating through more than three pages deep on the vertical navigation should be avoided to allow users to recognise their current position and be able to go back to the previous page.

Overall, the participants in Indonesia and Australia needed regular practice to get familiar with their phone and get into the routine of operating their phones. A clear 'on-screen' indicator should also be provided to allow older adult users to discover the current position themselves when interacting on an app, especially when they do not know where they are or understand how to go back.

Moreover, the phone could be designed with an interaction three screens deep at most to get into the final point to enhance their interaction skills and make the participants more confident to interact with the smartphone device.

The page depth could be deeper than three steps, but the participants were expected to know clearly their position or be given a guided instruction using pictures or images to illustrate the necessary steps to be undertaken when they are lost. Meanwhile, the integration between applications and hardware could be improved to avoid multiple errors and enhance usability for the participants.

"Does changing style (i.e. theme/font type) make you confused when operating your Smartphone due to system updates?" (i.e. changes of font type would cause issues and confusion): Discussion

The participants in both countries were more likely to interact with the default user interface (UI) style without making any additional changes on the display. In addition, the participants in both groups were also more confident to navigate around the page when the layout was consistent or similar to the style or theme on older phone models they used to operate.

Moreover, the older adult participants used to operate their phones with black and white systems, while 60% of the participants still keep their older phone devices.

The participants were concerned when the operating system was updated, which may affect the overall phone styles, such as:

- The smartphone style or theme would change according to the new system and needed some adjustments on the layout and grid functions.
- The font type and size were also updated to match the new Operating System updates.
- The position or location of the navigation button would be moved to match the latest version of the Operating System.

The older adult participants may lose track of how they navigate around the phone as they were used to the user interface design layout before the OS was updated.

Design suggestion on the phone text style

This suggestion is addressed to help user better recognise and understand the icons set to a particular style.

"Can I turn off the auto-update on my phone? It changes the whole phone style"

The navigation design for older adults should not be updated or renewed regularly even when the system needs to be updated. Confusion may be caused among older adults by the processing of memory load to analyse new artefacts and operational pattern. However, detailed instruction for the new system could be provided to help support older adults. Fig 6.9 shows different styles may be present when a system has been updated.

		
Style A	Style B	Style C
Main navigation using different styles upon system update *From left-to-right: Play Store, Google Chrome, Google Assistance, Google Mail, Google Hangouts*		

Figure 6.9 The effect of system updates on the navigation style appearance.

The participants suggested that the system should be able to adapt to the older adult user although the updates are more likely to be applied regularly, i.e. the user interface colour scheme and button colour should be kept consistent and taken from the previous version with minor changes. The older adult users were concerned about the speed of access to recognize the icons on their phones rather than having a decent look and feel for the inteface design.

"What do you think of the overall visual aesthetics on your Smartphone compared with other devices you have used?" (i.e., icon set for main basic functions, tools, utilities background design, including the clarity of elements, such as icons, text, colour and details): Discussion

The participants in Indonesia were concerned about the functions on the phone rather than the visual aesthetics of the display. Their main concern was about the navigation clarity and accuracy when interacting with the phones which were considered as "aesthetics" for those users.

"I don't need fancy interface design on my phone, I need the functions"

The aesthethics on the phone should lead to the navigational model that will drive the user to easily operate the functions. For example, one participant would memorize the colour of an application, such as green for the phone where WhatsApp instant messenger also uses the green colour for the icon. Therefore, the participant expected to visually spot the difference between those two applications although both of the icons were visually clear and pleasing.

Moreover, the participants from Australia were keen to change the wallpaper design of the main page of the smartphone interface. This is likely to happen because the participants were interested in getting a new atmosphere on the layout regularly. It is expected that these changes would not affect the overall phone functions against the aesthetics.

Design suggestion on the phone visual aesthetics

Visual aesthetics are welcomed to enhance the phone interface appearance. However, fancy and crowded design could lead to disorientation of older adult users in both countries. Some aspects of a mobile phone device should be kept consistent although the system gets updated.

Indonesian participants suggested that there should be a distinct contrast between background or wallpaper (aesthetics) and the buttons (functions) to give better distinction between those two elements. The interface design was also suggested to be aesthetically pleasing rather than being busy and crowded. Older adult users should be given direct access to the system settings to change the UI aesthetics as preferred, as long as the changes did not affect the main operation or experience in using the smartphone. It is also recommended to add text underneath the icons as an additional element to clearly differentiate among a number of applications.

Meanwhile, a solution to provide a guide on how to modify the user interface aesthetics will only be appropriate for the participants in Australia, for example to change the UI background in a more efficient and quick way. A feature that contains a guide could be placed on the system settings to enable quick access to the display setting when the user wants to change the wallpaper.

The participants from Australia also suggested a special setting for older people who need to change the wallpaper design. This is to allow the users to apply a distinct contrast between background and buttons to enable them to operate the phones properly. Button shadows could possibly be applied to the navigation button to enhance the contrast between the background of the buttons and the text colour (see figure 6.10).

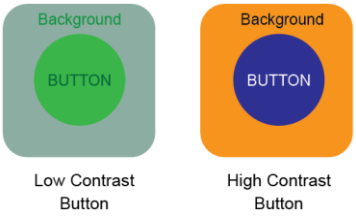


Figure 6.10 A low and high contrast between background and buttons

6.2.4 Cognitive ergonomics identification

These questions aimed to pinpoint the cognitive ergonomics factors of the older adult users' interaction with the smartphone device. The questions included the identification of button size, the use of effective icons or symbols as objects, navigation accessibility, individual action assessment on the navigation, and device interconnection. The questions were merely assessing the level of interactivity between users' needs and smartphone function availability.

The group of questions below have already summarized the cognitive ergonomics of the smartphone functions from a participant's point of view. The points included the following items being classified:

- the design of the navigation buttons
- difficulties in finding particular navigation
- "HOME" buttons as the main access to and from other apps
- experience in using the physical or seamless HOME button
- object, action and option visibility on the smartphone
- the placement of core apps or features on the smartphone main page
- the experience of using another communication device compared to smartphone
- the connectivity of smartphones and PC
- assistive learning on smartphone technology to keep up with the updates
- smartphone application and display customization
- level of skills, comfort, privacy and satisfaction on the current smartphone device
- interest in using a smartphone over other devices

The description, analysis and proposed design solutions for these items are explained below.

“What do you think of the navigation button size/design on your Smartphone?”: Discussion

“*The bigger the buttons, the easier to interact with the phone”.*

The participants group in Indonesia did not have any issues with the smartphone button size. The situation was different from the Australian group where these older adult users experience difficulties interacting with the buttons. That happened when the participants pressed a particular button on the phone due to their larger fingers. These participants stated that they accidently pressed the wrong buttons at the same time frequently.

Design solution

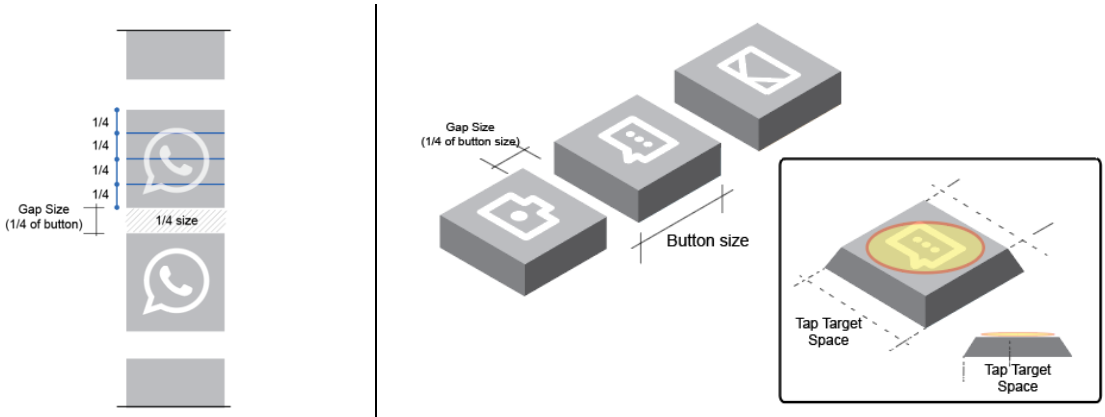
Participants recommended that a navigation button should not be smaller than their fingertips to allow them to tap on the target accurately. It also allows users to distinguish each icon as navigation individually.

The tap target button should be designed at the minimum of ¼ of the button size to allow the users’ eyes to differentiate each button individually in order to make the user proplerly click on the target.

Both the Indonesian and Australian group of older adults would be more likely to navigate on apps that allow users to adjust the icon grid and size to fit their fingertips to tap the target button. However, the Australian participants suggested that the new user interface design could have bigger buttons as they have bigger fingertips than the Indonesian participants, such as their index fingers and thumbs.

These groups also needed to have larger gaps between the buttons to be able to see the icons accurately. Moreover, the placement of the functions they accessed the most should be placed and laid out on the main screen to help them access the navigation buttons more easily. A spacious gap could also be designed around each button using bevel (see figure 6.11: Right) to add spaces or gaps to the button and allow users to distinguish each button individually. The gap could also be given a darker colour to separate the visuals from the main button.

Figure 6.11 shows the size of gap = ¼ of button to give better view and more precise tap on the button. This is due to the weakening of older adults' eyesight making it hard for them to distinguish objects accurately and interact with the buttons precisely. When the gap between buttons is not clear, users would have the tendency to tap not on the target button.



Left: Top Elevation view

Right: Perpective View

Figure 6.11 Button shape and gaps on the UI buttons

"How easily do you find an application by recognizing the buttons on your smartphone?" (i.e. This is to identify the difference between an icon by itself with an icon with a text underneath or embedded on the icon): Discussion

"Applications with similar or the same colour are difficult to distinguish. The text solved it"

Both the Indonesian and Australian participants needed to guess the functions or applications when there was no text following the app's icon or symbols. This is likely to happen when some icons had similar shape and colours on the apps list, such as the Phone app and WhatsApp instant messenger. Meanwhile, the older adult eyesight was weakening as they got older and this group of people needed a longer time to distinguish the application they were looking for.

Design solution on icons with similar appearance (shape, colour, and icon)

Some applications' icons may have similar shape and colour, which confused older adult users and made it hard for them to select the application they were looking for. The participants sometimes make mistakes by clicking on the wrong application that has similar icons and

colours, such as phone and WhatsApp instant messenger. Separate text placed outside the icon is a useful element to indicate the app.

A different button shape or element that distinguish one application from the other should be created to avoid confusion. Alternatively, text could be placed underneath the icon to label the app and clearly differentiate applications that have similar shape and colour (see figure 6.12).

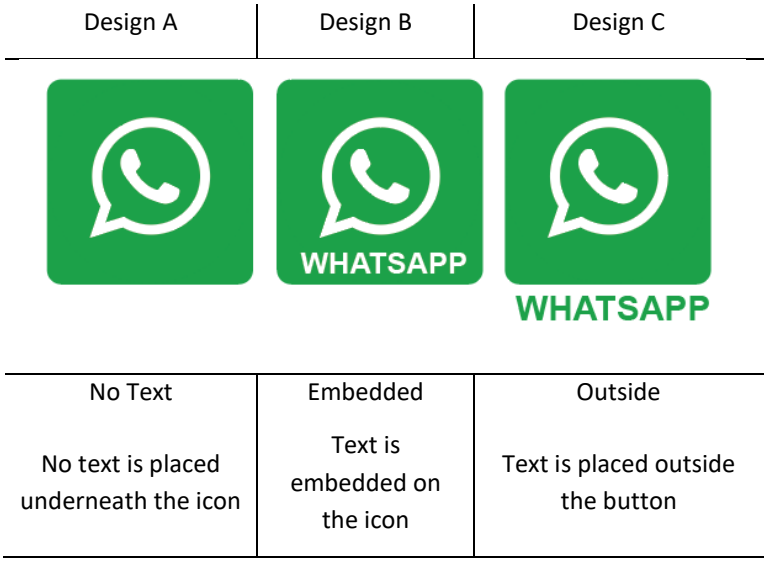


Figure 6.12 Navigation buttons and labels attached to them make the app easier to find

"How is your experience using the HOME button on your smartphone?" (i.e. a HOME button is designed as a touchscreen control or a physical button where the touch might give the tactile cue of the interaction): Discussion

The "HOME" button was considered as critical navigation for the users from both countries to take them back to the first page when an error happens on the screen or they were having an unexpected issue. Therefore, easy and quick access to the home or main page should be clearly designed as a shortcut.

"If I lose my way, I'll hit the 'home' button and start again"

The participants could have been anxious when there is an error in the system if they are not familiar with their phone technology. As a result, the participant would like to recover from the error immediately or they would exit the application. However, the easiest way to resolve any issues on the phone is to hit the 'home' button whenever the participants come across any errors or malfunctions. Alternatively they would turn off and restart the phone by using the power button. However, the second action is least likely to happen in both Indonesian and Australian user groups unless there is no other solution, such as when the phone freezes.

Design suggestion on an effective and efficient 'home' button

The suggestion is to keep the 'home' button on the phone as a so-called "emergency exit "navigation. Moreover, tactile interaction is necessary for the older adult users to interact with the home button efficiently to take them back to the original page.

The Indonesian group suggested that they preferred to have the physical 'home' buttons in order to feel the touch when having issues with the phone. The feeling included being accurately and precisely tapping on the 'home' button. Meanwhile, the Australian participants preferred to have a physical touch of the 'home' button that is as big as the size of their fingertips (see figure 6.13). Moreover, a 'home' button with a physical touch should be designed to enhance the accuracy of a user's interaction. This button should be easily and quickly accessible when users could not find their way around the application or when the users are experiencing errors on the phone. Users may find it easier to start the tasks again from the beginning.

Figure 6.13 A physical 'home' button [left] to obtain the tactile experience is recommended as being used on older phone models as comparative to the non-physical 'home' button [right]

"How do you find the clarity of page controller on your smartphone? And, how do you recognise those items or objects?" (i.e. direction navigation using text or labels, the use of icon "<" to indicate left direction and ">" to indicate right direction, and recognition of active/inactive menu states): Discussion

"I can't see the difference until I interact with the button"

The combined elements of object, icons and option visibility and clarity determine how the participants reacted to the navigations. Some of the Indonesian participants had difficulties to distinguish the "active" and "inactive" menu options as they did not know the differences between those two stages. The Indonesian participants would only interact with a navigation or pointer that was clear to them, such as a clear inidicator of an active or inactive navigation. The use of arrows that indicate direction should represent a proper directional pointer, such as a triangle.

Design suggestion on differentiating active and inactive icons

The integration between object and action visibility should be made clear to make the interaction more efficient and to avoid people trying something that does not work.

Moreover, the majority of the Australian group of users had no issue in understanding the object, icons and option visibility in the submenu headings. According to the participants in Australia, the arrow indicates a direction which is indicated by the icons or symbols. The icon '▶' will indicate 'available' or '▷' to indicate 'unavailable'. (see figure 6.13a)

Figure 6.13a the active and inactive buttons to indicate availability and unavailability

Therefore, this group of older adult participants will use trial and error whether the buttons are currently active or inactive, then they will learn from there. An active stage button could also be

combined with animated elements to differentiate the “active” and “inactive” stage of the buttons, such as a flashing icon with high-contrast colour to indicate the active or available content. The animated elements will be helpful for participants with vision impairment. This will help users identify the menus and also the existence of submenu options.

“How familiar are you with the general (main) functions of the smartphone, such as making a call and sending SMS, comparative to your older phone device?” (i.e. comparing the main functions of the smartphone and old style phone, such as making a Phone Call, SMS, Turn the Power ON/OFF, Game, or OTHERS): Discussion

The participants in Indonesia were more able to recognize that there were clear differences between the red and green buttons to indicate making a call and cancelling a call respectively, including redialling previous numbers. The participants did not need to memorize the intended meaning of the red and green coloured buttons, as these have come into their daily routines with the older phones, both on touchscreens and phones with physical buttons.

Meanwhile, the participants in Australia were also famililar with the smartphone icon colour and functions but the only concern was the button size. Participants in Australia understood the function of red and green button; however, these groups of people would normally fail to precisely tap on the target due to their large finger size.

Design suggestion to allow users to understand the icons and interact properly

- The clarity of design paradigm should be maintained on the smartphone, for example, the use of default red and green colour buttons to indicate phone call controls should be retained as the main phone function for users in Indonesia and Australia.
- Users from Australia recommended a larger button design to fully operate the function as well as understand the meaning of the icons.
- A touch vibration needs to be activated by default to give users feedback via the touch on all navigations, especially the main ones.

“Have you ever used any other Smartphone devices as a means of communication?” (if not, go to the next question) (i.e. if users have ever switched from one communication device

with a specific operating system to another phone which has different operating system (For example switching from Android to iPhone and vice versa): Discussion

"I use iPhone to make a phone call and I also use iPad to play games"

The users in Indonesia had utilized multiple phones to support their daily activities; for example, the CDMA-based phones with cheaper phone rates were normally used to carry out free talk in the nighttime or used with unlimited data packages.

Meanwhile, this group of participants also had other phones that would be used as a backup if their main phone was broken. In other words, the participants in Indonesia utilized more than one device with different functions than just to communicate. Moreover, the older adult participants in Indonesia tended to use the older phone models to only make phone calls. Therefore, the older phone models had already fulfilled the participants' main needs from communication technology.

This is likely to happen because the older adults users in Indonesia tend to keep old phones for a longer period compared to Australian participants, for many different purposes. Meanwhile, in Australia, phone models keep changing every year, and therefore, new phone plans were renewed regularly with a reasonable price and call rate. Therefore, it was unnecessary for the Australian participants to learn how to make a cheap call using older phone models, while the Indonesian participants had to maintain the ability to operate the older phones in order to switch to the older models when the other model is experiencing an issue.

However, the people in these two countries used bigger devices such, as iPads, to play games, operate Facetime applications to do video calls, or watch videos on YouTube. Overall, the participants in Australia preferred to own one device at a time.

Design solution to be familiar with different devices

A smartphone or other similar communication device should be adaptable to the users in fulfilling the users' needs in each country where different users may require different communication devices. The participants are motivated by the ease of access to the information on the phone. The participants recommended that the designer should make the

experience more enjoyable and adaptable for the older adult users in order to familiarize the devices. It may take sometime for the older adults to learn new things.

"Have you ever used PC or Laptops to connect to the Smartphone? How do you rate the experience in operating the functions?" (If NOT, go to next question) (i.e., transferring files from the phone to the PC): Discussion

The participants in both countries were unlikely to connect their smartphone to their PC . This function was considered as not significant in this research project due to the complexity of the scope of the observation and identification. However, there was only one participant in Indonesia and one participant in Australia who had used a personal computer to transfer files when their phone storage was full, such as when the storage was filled up with pictures. In addition to that, the other older adult in these two groups had never been presented with this technology (i.e. a PC or a laptop) before.

Furthermore, there was only one participant in Indonesia and one in Australia who had worked with a desktop computer extensively and developed routines to access the smartphone through the desktop computer. The remainder of the participants found it hard and were not so motivated owing to the trouble when connecting the computer and the phone without any assistance or supervision from other people, such as friends or relatives. Therefore, these people usually deleted files, such as photographs on the phone, to free up space.

Design suggestion to enable easy connection between technologies

The participants in both countries could be provided with a shortcut to access and connect the phone and PC easily and automatically. The structure of the connectivity could be carried out as follows:

- The PC and phone OS (Operating System) will have to communicate with each other automatically when the users plug-in the data cable. This task should be carried out using a single click. If the application to connect the phone and PC has not been installed, the operating system on the PC would install it automatically upon its connection.

- A shortcut to activate the connectivity program should automatically pop up and be listed as a shortcut icon on the main page to enable the connection between the PC and the smartphone when the phone is connected to the PC.
- In future uses, this system should be made active and ready to go when the smartphone connects to the PC. This will make phone operations with external tools easily executed and the indicator is clear (see figure 6.14).

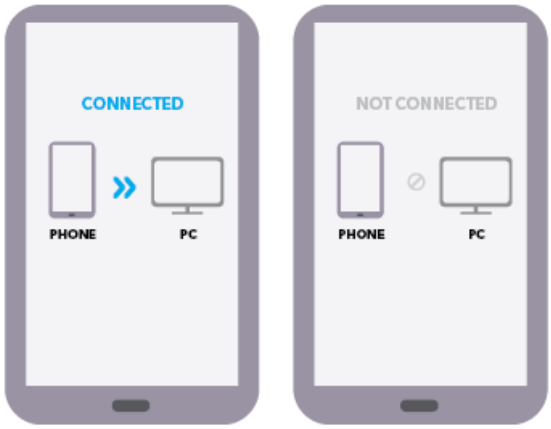


Figure 6.14 Smartphone-to-PC connection indicator made clear and set to automatic (designed by Yahya, A., 2017)

The Indonesian group was more likely to get assistance from close relatives or friends before obtaining support from an authorized service centre or customer service to carry out this task (i.e. connecting the phone to laptop). On the other hand, the Australian user groups may require assistance from authorized service centeres to solve the phone-to-laptop connection issue.

"How do you find the experience of customising your smartphone for personal use?" (i.e. changing the smartphone themes, icon set, ringtone, or any other personal elements): Discussion

The participants in Indonesia were unlikely to modify the main display theme, such as changing the the screen background of the smartphone user interface design frequenly. The Indonesian

participants were more concerned about the functions than customizing any other parts of the device because they were unfamiliar with the theme system.

This group of participants was more likely to customise the instant messenger apps to fit their personal needs in communicating or managing a business, such as changing profile pictures to differentiate a particular group or to be used as a promotion. These participants generally differentiate each group as groups of business people, group of relatives or group of ordinary friends.

Meanwhile, the Australian user group tended to modify their ringtone to fit their musical mood or feel. One person among the participants had the ability to change and play around with the display and theme setting on the smartphone interface, such as placing favourite photographs of their family members or photographs of their past activities as the wallpaper. The rest of the participants used profile pictures since they set up the phone for the first time. This was due to their unfamiliarity with the setting preferences on the smartphone device. Other than those interactivity issues, people from both countries kept the display as the default to avoid mistakenly changing the whole system, unless the technical people teach them how to do it.

Design suggestion with custom settings

The phone's functions should be customized to enhance interactivity rather than being attractive. The system settings should be able to assist the users to modify those items more easily in order to improve user interaction and capability based on personal preferences. The participants recommended that they need to be encouraged to become more confident in making changes to the system setting. Any issues can be solved if the participants were given an icon set of the functions or shortcuts to the system modification. On the other hand, the participants may have been trying to expand their knowledge from changing a simple element on their smartphone device, such as the phone ringtone, to a more complex one, such as changing the overall phone theme and its layout configuration. However, they need practice to get familiar with those.

"How do you rate the overall navigations when operating your smartphone device to support your daily activities?" (i.e. this is to value the skills, comfort, privacy and satisfactory level on how to function the smartphone daily): Discussion

The participants in Indonesia were predominantly using Android Smartphones or tablets, which rarely have authorized service centres in the country. In addition to this, the Indonesian group was more likely to own more than one phone device, which would motivate the users to be able to be skilful in operating different devices individually. The longer the participants used the different phone models, the better the skills they had, and they would feel more comfortable using various phones. This would also impact on their comfort and satisfaction in using different types of phone technology. The participants also believed that improvements in technology would be parallel with the development of device convenience level for the users.

Meanwhile, the Australian group were more likely to be using an iPad due to the similarity of the functions with the iPhone, as both of them were made by Apple. However, this group of people were still concerned about device security. Once the older adult users were confident in using the device, they were certainly adaptable to any changes. As Apple has dominated the market in Australia, the participants had bought at least one iPad tablet for entertainment purposes, compared to the Android tablet.

Design suggestion to familiarize users with different devices.

The skills of the older adult in each country may vary, depending on the device being used. The following items represent the needs for improvement in participants' experience:

- **Comfort** – the level of user comfort increases when the operating system is not regularly updated as this affected the users' comfort when utilization had become a habit.
- **Privacy** – the feel of security increases when the users feel that the phone has already protected their privacy by ensuring that the phone has been guarded with the latest security technology on the software or hardware.
- **Satisfaction** – this occurs when the users have met the skills standards to function their smartphone properly.

Participants stated that once they are satisfied with a product or device, they would normally spread the news to their friends to indicate they are capable of using one particular technology and asked others to purchase similar products.

"How do you rate your smartphone utilisation comparable to any other communication devices for daily use?" (i.e. comparing the smartphone with the house phone or any other devices, such as iPad with the Facetime application for communication purpose): Discussion

The Indonesian group was more likely to operate a phone that had large navigation buttons on the device to tap on the target precisely. This preference crossed their mind due to the habit of the older adults in Indonesia who still own and use the house phone, which has reasonably large buttons. In contrast, the participants in Australia had switched to the digital phone models a few years ahead of the Indonesian ones and they have been more familiar with the digital touch for a longer period than the Indonesian participants. However, the participants in both countries preferred to use a device with a larger screen than the smartphones for daily use, such as the seven-inch tablets or the iPad, which were preferable to the participants. The participants lacked the confidence to operate a new technology properly, especially to communicate with other people in an easy way.

Design suggestion of brand recognition and familiarity

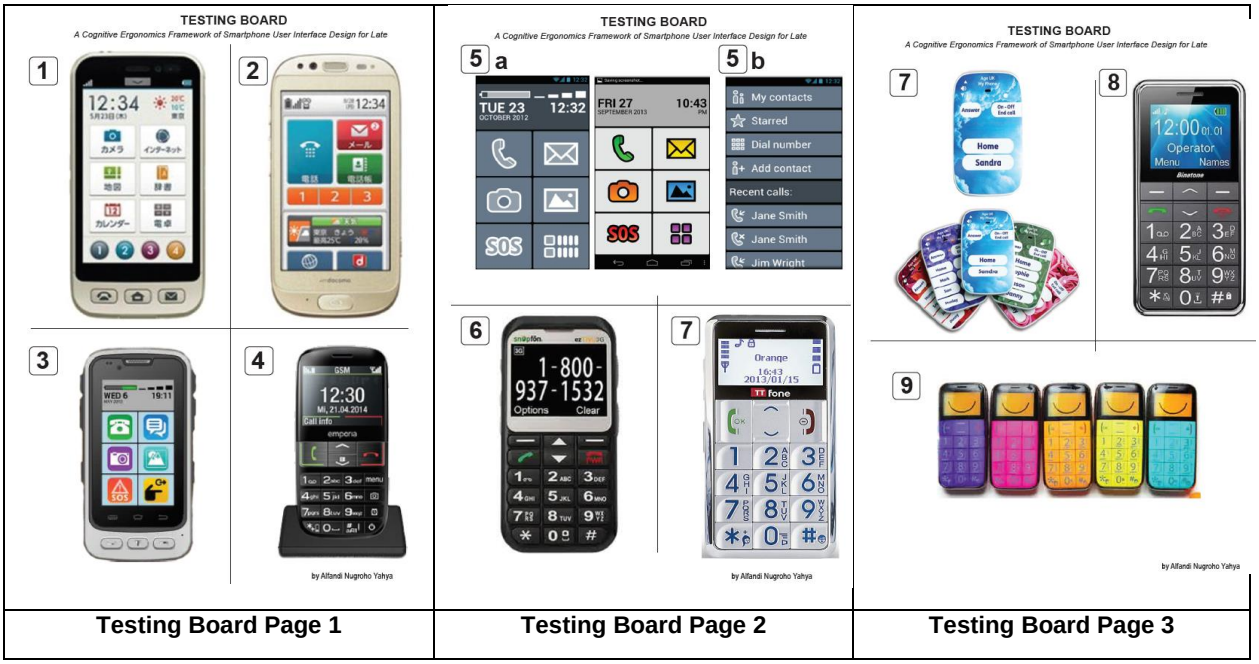
Different devices should offer different function and utilization. In Indonesia, this type of group was more interested using a device with a larger display for making video calls or watching videos. In addition to this, the Indonesian market for tablet products is considered more competitive than Australia, with various different brands in the market. As compared to the Australian market, the iPhone device holds the top position due to its famous brand, even compared with the iPad device for daily use. The Australian participants mainly use the iPad for entertainment purposes, such as watching YouTube videos, apart from using Facetime application to communicate using video streaming.

6.3 Reflective Identification on Smartphone Utilization Based on the Test Board Review

During the interview and observation sessions, ten phone devices, along with different interface designs, were presented to the potential users in the form of a test board in which the phones were from the devices offered in the market based on initial selection and filtered from the users feedback (see figure 6.16) . Participants in Indonesia and Australia were given a test board that was premade based on the initial/pre-survey session to identify the older adult users phone preferences.

Figure 6.16 Various mobile phones in the market – Indonesia and Australia

It was not surprising to discover that the older adults users selected the phones that were closest to their older phone models (n=10; 100%). The same situation occurred in both countries that were being analyzed. The older adults' older phone models influenced how they looked at the models during the interview sessions on the testing board with selected phone models (see figure 6.16a). The selection will then be narrowed down based on users' initial selection.



Testing Board Page 1	Testing Board Page 2	Testing Board Page 3

Figure 6.16a Testing board to investigate the users' previous device and identify various interface designs

The participants mainly chose the models based on prior experiences or models that they had used in the past, either on similar or different devices. Meanwhile, the categories of participants' selection were:

- Participants have chosen a model based on an older model they previously had
- Participants have chosen a model due to its similarities to other technologies, such as the TV remote control
- Participants have chosen a model because it was considered a new design to them

Figure 6.17 shows that older adults tend to use a phone that shows a clear navigation (model 1–8) and avoid fancy phones (model 7 and 9 – although some people selected these models on the initial observation and investigation based on the market research). In addition, overall data on figure 6.17 shows participants in both countries did not prefer models 7 or 9 due to the unfit and unsuitable compatibility of these selected user groups with the phone models. Then, the users would only need to purchase models 7 or 9 when they would give them as a present to their grandchildren or someone much younger than the participants,but not for their own personal use.

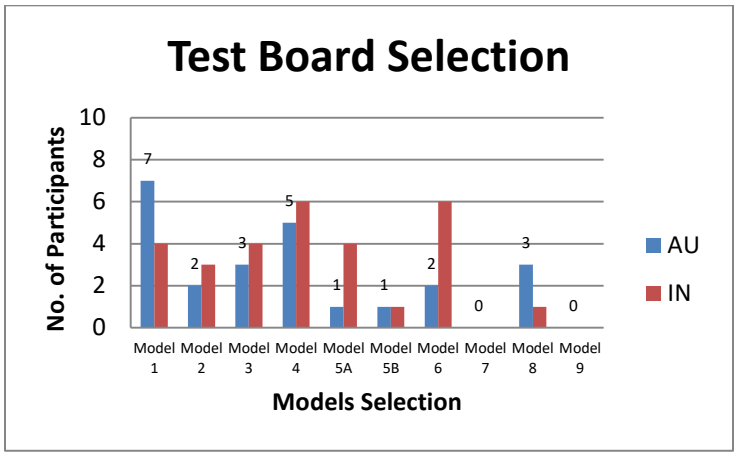


Figure 6.17 Phone model selection on the test board (see test board in Figure 6.16)

The summary below presents the information based on table 6.17 broken down into two different cultural background, as follows;

Participants in Indonesia

The phone models preferences of the participant in Indonesia as shown in Figure 6.17 indicated that more than half of the participants selected models 4 and 6 as their preferred phone styles and only one participant selected model 8. This was due to the ownership of older phone models by the Indonesian participants prior to owning the smartphone device and they utilized these models by subscribing to different phone plans. The multiple devices (more than two) were also used as a backup when errors occurred on their main phone. Meanwhile,

models 4 and 6 were selected because these have larger text displays, and model 8 had a coloured background but a slightly smaller font size appeared on screen. Overall, phone models with large buttons were important on these models as well as the functions.

Participants in Australia

The phone model preferences of the participants in Australia as shown in Figure 6.17 show that more than half of the participants in Australia (n=7; 70%;) were interested in phone model 1 on the Testing Board (see Figure 6.16). Meanwhile, only one participant (n=1;10%) had selected model 5 as their preferred model. However, most of the Australian participants selected model 1 due to its close similarity to their current smartphone device.

Moreover, none of the participants in either country selected models 7 or 9 due to the design of the device, which did not represent the older adult personality, although these models also appeared in the market. Also, these two models were considered to be too colourful for the elderly users. However, the screen display is considered suitable and large to enhance the readability for the older adult users. All participants stated that models 7 and 9 were only suitable for younger users: although both models have larger screens and buttons, they were "too colourful", as stated by 7 participants. On the other hand, the phone manufacturers can use models number 7 and 9 as a reference for the older adults phone design in terms of compact hardware with a big display screen that would fit older adult people's hand grip.

6.4 Stage Two Interview Confirming the New Design Development Phase One

The preliminary research showed that the smartphone user interface design proposed in this research project should be developed to meet the needs of the participants from both countries. The proposed changes included giving more space in between buttons to enhance precision, adding buttons for emergency situations, maintaining the torch application access as a compulsory feature, and a recommendation to have emergency contacts that always appear on the home screen. This series of important changes has been applied in Design Development Phase 1.

The researcher included these main functions to meet the participants' requirements based on the stage 1 interview and observation session. The stage 2 interview and observation session was intended to confirm and ensure that the development of the user interface design and the proposed new items had reached a satisfactory level according to the participants gathered in phase 1 of the interview session to build the design frameworks. The detail of the findings will be explained in Chapter 7.

Figure 6.18 shows the overall flow of stage 1 of the interview session that has been carried out and explained in this chapter. Meanwhile, stage 2 of the interview sessions was carried out to confirm the participants' suggestions and apply the new design frameworks regarding the new smartphone user interface design improvement. The stage 1 interview was considered as a preliminary research data-gathering stage to obtain feedback and comments on the proposed items to improve the user interface design using UI/UX method.

At this stage, the researcher had already gathered as much information as possible to help produce a new design framework that will be implemented on smartphone user interface design to meet the older adults' requirements. Meanwhile, the stage 2 interview session was the verification phase prior to finalizing the new design frameworks of the smartphone user interface design for the older adult users.

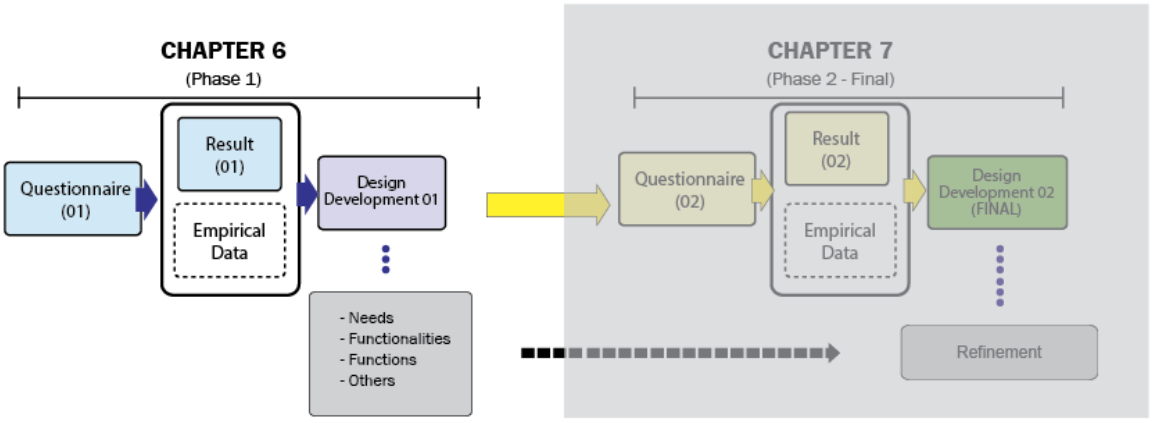


Figure 6.18 The development of the proposed User Interface Design in two phases

As mentioned in Chapter 3, participants were given a set of new smartphone user interface designs on a test board to verify the issues raised in the first interview session. In the stage of confirming the design development, it was important to verify the new design and ensure that the main items are on the phone, as well as how the improved UI has been designed as part of the stage 1 interview session.

From the total of twenty participants across both countries that were interviewed and observed, ten participants from Indonesia (n=10, 100%) confirmed and verified the design changes based on the first series of the questions. Meanwhile, only seven participants from the total of ten people from Australia (n=7, 70%) were able to be interviewed face-to-face in stage 2 to verify the new design development. This is due to some of the participants moveing overseas so the researcher was unable to meet up in person.

However, the proposed interface design was then delivered to the participants who were unable to be present in session two using email to obtain quick responses from them. The most important change for one participant out of five people from Australia was that the phone should be equipped with a direct access to an emergency button to cater for his needs based on his personal experience of having a heart attack (n=1, 10%). Moreover, this participant also made further suggestions that a phone design should cater specifically for female users to enable female users to navigate through the phone's features more easily, such as his wife who had difficulties in operating a phone when in an emergency due to the unfamiliarity of the smartphone technology. The researcher then suggested that the emergency button could be designed and placed on the device hardware or implemented using a contrasting colour with a special effect embedded into the design.

6.5 Comparison of Usability Data and Analysis

The research findings showed that there were both differences and similarities between the Indonesian and Australian older adult users due to cultural and location differences. Specifically, these findings are related to the interaction of older adult users and the

smartphone interface design. The results show that the key findings coming from this study on the investigation of interview results phase one are:

1. The Indonesian and Australian users owned a different number of smartphones. Most participants in Indonesia had more than one device (n=9; 90%), and one person has seven devices. Meanwhile, only one participant in Australia had two phone devices on hand, but the participants used only one phone as the main device most of the time. Therefore, they need to adapt or be more adaptive to various user interface design from various UI design as they have built the habit on one device only.
2. The interactivities between Indonesian and Australian users seemed to be different, where (n=9; 90%) of the Indonesian older adult users tended to utilize instant messangers most of the time for regular communication purposes, while the Australian participants used the phone application to make a call to the person to maintain communication with other people.
3. A UI/UX method was carried out during the direct observation and interview session with the older adults users who were engaged by the researcher to gather the rigorous data. The participants were positively and actively contributing to the design development using the UX/UI research method to obtain detailed information about the older adults' needs both in Indonesia and Australia, in terms of an improved smartphone user interface design to cater for their needs.
4. A design or design criteria for a possible new smartphone user interface design or design frameworks was proposed by both the Indonesian and Australian participants to fulfill their needs in using smartphone technology. This considered the cultural differences and included the usability and user experience performance from each cultural background. For example, the findings in the research project reveal that the Australian participants used the smartphone mostly to make a phone call, while the Indonesian ones preferred to use the phone to send text messages using instant messengers to communicate and send files to others. Therefore, direct access to these applications should be clearly

distinguished and visibly accessible in order to fulfil the needs of users from each cultural background.

6.6 Summary of Chapter 6

In this chapter, the analysis and discussion of the older adult participants showed that the UX/UI method and smartphone user interface design development for the older adult users should be developed to enhance better interaction between smartphone technology and senior users. Specifically, cultural differences should also be taken into account to obtain the most efficient interactivity and fulfill the cognitive ergonomics frameworks in utilizing the smartphone device.

Results show that users had various issues with the smartphone interface design based on their cultural background, experience, and requirements. The analysis and discussion of the users' needs and development identified in this chapter will support the researcher in the following chapter (Chapter 7) to generate the new design frameworks of smartphone interface design for older adult users. The elements developed in the improved user interface design should focus on the older adults' needs rather than the designers' needs. This objective is to fulfill how the smartphone user interface design for older adult users should be framed.

CHAPTER 07:

New Smartphone Design Frameworks for Older Adult Users

7.1 Introduction

Chapter seven presents a new design framework to fulfill the participants' enquiries about how a new design framework would be implemented using a step-by-step process to be used as guidelines for designers and implemented to elderly users.

Based on the previous chapters, the need for an improved smartphone user interface design for older adult users was discussed and shown to be significant. The data was collected, compared and analyzed to show the needs of older adults users from both cultural backgrounds to implement new design frameworks. Meanwhile, other requirements were also influenced by cultural circumstances in Indonesia and Australia. Therefore, this chapter aims to confirm the improved design that has been refined and finalized to fit the participants' necessities as a new design framework.

7.2 New Experience Design Enhancement for Older Adult Users

Analysis of interview data on cognitive ergonomics using UX/UI design research method found that the smartphone user interface design redevelopment for older adult users should be able to empower this group of users to fully operate and fulfill their intended experiences on the smartphone device. Based on the findings, the researcher has categorised the Heuristic Principles by Nielsen (1994) into the three main points of user-centered experience design by Shedroff (2001) to generate the 18-point framework to determine new guidelines of smartphone interface design for older adult users.

Based on Shedroff (2001), there are three elements that are used as the foundation of user experience design: attraction, engagement, and conclusion. Moreover, based on the contextual

information, the extraction of older adults' requirements from Indonesia and Australia towards an improved smartphone user interface design could be categorised accordingly (see figure 7.1):

Attraction consists of the following points:

1. Visible
2. Accessible
3. Ordering Items

Engagement consists of the following points:

1. Reachable
2. Practicable
3. Functional
4. Applicable
5. Expandable
6. Support/Help

Conclusion consists of the following points:

1. Achieveable
2. Adaptable
3. Advantegous/Beneficial
4. Comfortable/Convenient
5. Favourable
6. Securable
7. Recommendable
8. Satisfaction
9. Becoming Capable

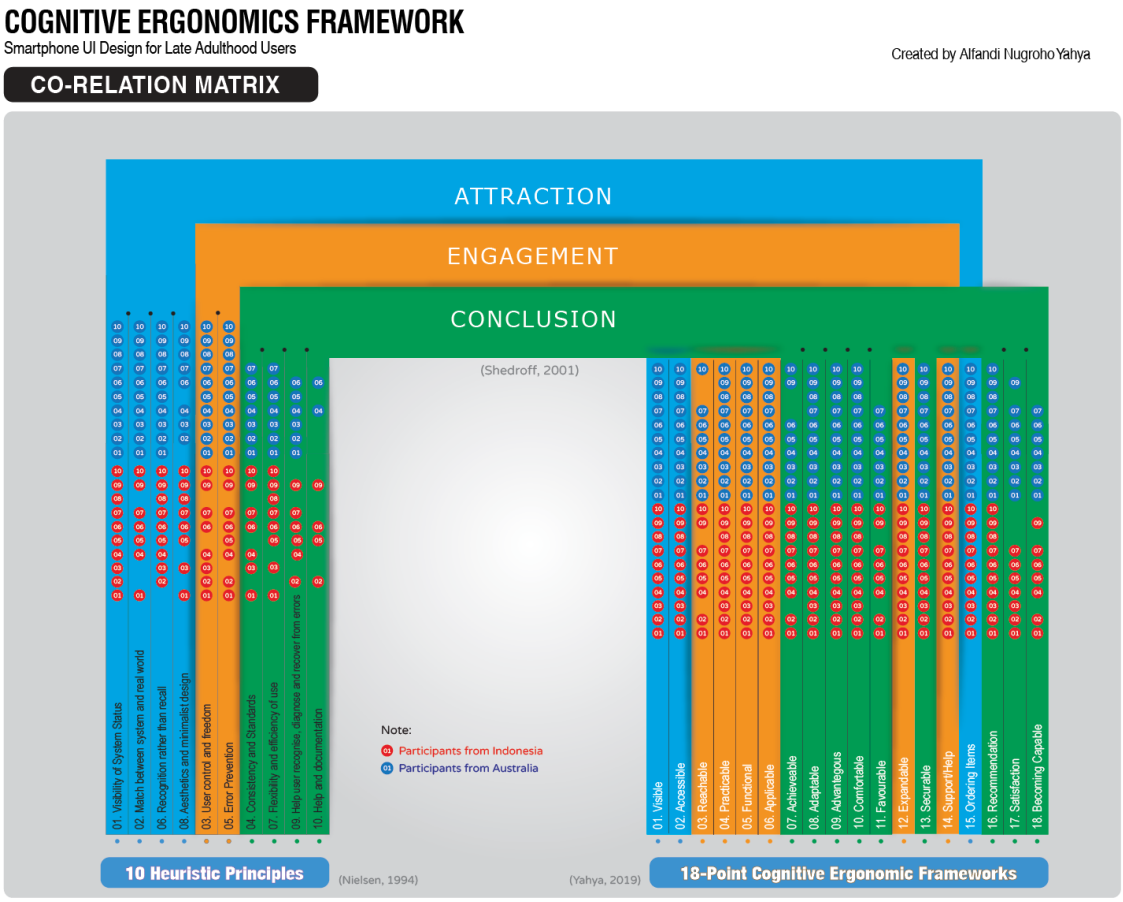


Figure 7.1 The researcher's correlation matrix as to capture the relation of Heuristic Principles (Nielsen, 1994), User-Centred Design/User Experience (Shedroff, 2001) and 18-point New Cognitive Ergonomics Framework (Yahya, 2019)

Moreover, the improved design framework (see figure 7.2) is categorised by the level of importance on the points which would be implemented. Below are the 18 points of the new Cognitive Design Frameworks that will be used as guidelines to produce a better smartphone user interface design for older adults users, as categorized based on the level of importance:

1. Visible
2. Accessible
3. Reachable
4. Practicable
5. Functional
6. Applicable

7. Achievable
8. Adaptable
9. Advantageous/Beneficial
10. Comfortable/Convenient
11. Favourable
12. Expandable
13. Securable
14. Support/Help
15. Ordering Items
16. Recommendable
17. Satisfaction
18. Becoming Capable

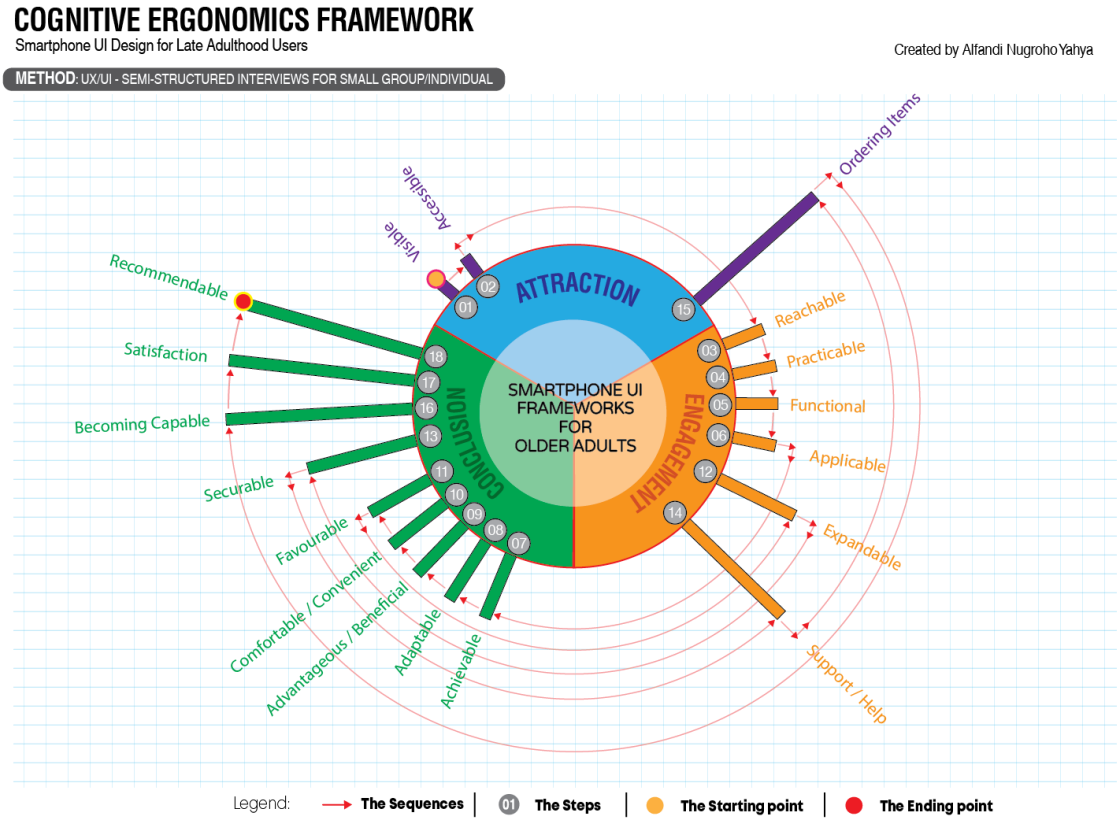


Figure 7.2 New cognitive ergonomics framework to enhance older adults' smartphone interaction

In Figure 7.2, users should start at the yellow ‘starting point’, then use the red arrows to follow points 1-18 back and forth through the three overarching categories (‘attraction’, ‘engagement’ and ‘conclusion’) as they cycle outwards from most to least important to the red 'ending point'.

The research project is user-interface/experience based. The participants performed smartphone user-interface design testing activities, including identifying problems and giving recommendations to the researcher. In order to carry out the user-interface design investigation effectively, the participants in two countries discussed the issues that occurred on their individual smartphone device. In Figure 7.1, the correlation matrix diagram, the Indonesian participants are indicated by a red circle ● and the Australian participants are indicated by a blue circle ●. The numbers of the participants involved in the observation are shown by the number inside the blue and red circles.

In order to obtain the investigation’s desired result of a smartphone user-interface design for older adult users, the UI/UX methods were derived from ten Usability Heuristic Principles of User-Interface Design (Nielsen & Molich, 1999) and User-Centred Design and User Experience (Shedroff, 2001) which are design processes that focus on user experience and requirements. Shedroff’s (2001) method also aims specifically to develop an understanding of user needs. The process includes a combination of investigation, creation and design confirmation.

The issues were then classified into 10 Usability Heuristic Principles (Nielsen & Molich, 1999) to categorise them more specifically, based on the following:

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use

8. Aesthetic and minimalist design

9. Help users recognize, diagnose, and recover from errors

10. Help and documentation

7.3 Discussion and background of the New Cognitive Ergonomics Framework

As shown in Figure 7.2, the first stage of the test results has been categorised into the three elements of user-centred design and user experience (Shedroff, 2001): attraction, engagement and conclusion.

The significant requirements related to the question groups and issues that guided the participants' interview and live demonstration on their smartphone device were divided according to their level of importance (based on 10 Heuristic Usability Principles):

The most important requirements related to the level of 'attractiveness', to visually observe the user interface elements as follows:

- #1. The visibility of interface icons or navigation object.
- #2. Make sense of the object or navigation
- #6. Icon should be recognisable to reduce memory load
- #8. The aesthetic must support the level of comfort of the users

Moderately important requirements related to the level of 'engagement' via the operation of the user interface design elements as follows:

- #3. The user has freedom to control the navigation in various ways
- #5. Any errors should be anticipated and prevented beforehand

The requirements and problems areas that were less important were as follows:

- #4. The expansion of device utilization via the combination of various tasks with ease
- #7. User has the flexibility to use various methods to operate a single function
- #9. The device should be able to diagnose and inform the users of errors, including how to resolve issues
- #10. A manual should be provided as a last resort to resolve errors.

To conclude, this research project proposes the 18-Point Cognitive Ergonomics Framework that was derived from two stages of testing. Testing was carried out to obtain initial data from participants in Indonesia and Australia regarding the usability issues they experienced on their personal smartphone device(s), and to confirm the design changes that will be applied on the new smartphone user-interface using a UX/UI design method.

The flow of the design process development incorporates the needs and requirements of the older adult users into the smartphone user interface design process. In this research project, the New Cognitive Ergonomics Framework helped to achieve a better smartphone UI design for older adult users to accurately incorporate their contribution into the design process. The 18-point cognitive ergonomics framework will allow designers to build better smartphone user interface design for older adult users, specifically in Indonesia and Australia. Moreover, the UX/UI method has been proven to show the level of engagement from older adult users during the usability testing session, and the 18-points of the design framework have proven to be a potential source for designers that should be explored further. This research project only involved the conceptual frameworks of the design process and this should be utilized as a means for further development of the design process, such as creating icons or buttons for older adult users with special needs or requirements (i.e. older adults with dementia).

Each of the 18 points of the New Cognitive Ergonomics Framework will be explained below:

Visible/Visibility:

Objects (navigations or apps) should be clearly visible on the screen.

In order to start the interaction on a smartphone device, older adults need to ensure they are able to clearly see the buttons (control, applications and input) and the buttons should be clearly visible on the screen before they can start navigating around. However, additional information should also be visible along with the buttons to help them oriented and direct them into the right direction (navigation). This includes the placement of text and numbers

underneath the buttons, which should be clearly visible and easy to find. When older adults need to activate the voice command, the buttons indicating the “voice command” should also be clearly visible and available for use. Lee (2007) stated that older adult users need bigger buttons on the devices, including the proper placement of text or numbers underneath the buttons to enhance the visibility as well as the ease of use. Better brightness and contrast of the background and buttons should also be considered as part of the users’ requirement on the device UI to enable the older adult users to clearly and easily distinguish the the application individually.

The results of the interview also confirmed that the respondents tended to navigate more easily around the device when the buttons were clearly visible and gave the participants a proper control to find. The results also mentioned consideration of physical characteristics to fit the physical level and needs of the group of users, for example taking the deterioration of older adult vision into account.

Accessible

The buttons of the main functions should always be visible on the main screen and be easily accessible by older adult users, especially elderly people with low vision and/or hearing impairment.

Main smartphone navigation buttons should be easily accessible for older adults, especially older people with low vision and hearing impairment. The buttons should also be integrated with other indicative elements, such as audio/sound, highlights, and vibration. Below (figure 7.3) are two examples of buttons that should appear on screen and be easily accessible to enhance interactivity when the users are unable to type on the screen. For example, emergency contacts that link to relative’s contact numbers should be located in a strategic position and easily accessible when in an emergency situation. The phone magnifier to enlarge the text size should also be provided via a shortcut on the main page. Meanwhile, for elderly people with a vision impairment, a microphone should be accessible and active when the on-screen keyboard is no longer usable. (see figure 7.3) Moreover, the functions in figure 7.3 would be expected to

increase the smartphone accessibility for older adult users with vision or hearing impairment. Voice command could be activated when older adult users have the need to type a message or launch an application using voice command, and the magnifier could be used to increase readability on the phone screen.

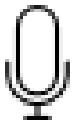
Icons		
Functions	Microphone icon is to activate voice command	This tool to enlarge the text

Figure 7.3 Clear icon representation to enhance application recognition for older adults

Reachable:

Navigation buttons should be within the range of users' finger reach and movement.

The findings reported that due to the weakening of older adults' tactile skills, they would like navigation buttons within the range of their main "control" fingers, such as the thumb and index finger. Users should be able to reach the buttons that are located at the far top and bottom of the page, from left to right, using their finger (index finger or thumb) without moving their whole hands. As aging occurs, older adult users are more interested in navigating straight to their desired destination point rather than having to move around to find their way. Below (figure 7.4) is an example of expected thumb movement of a user using the one hand and forefinger would be used on two-hand interaction. The example in Figure 7.4 shows a user's finger movement. The figure shows thumb movement when a user is reading news on a browser and the user needs to scroll up and down to go through the pages using one hand (Figure 7.4 - A1 and A2). Meanwhile, users would also control the page using the forefinger of the other hand to click on a link when the user is unable to reach the controller or navigation using the thumb (Figure 7.4 - B1: left-handed user, B2: right-handed user). A middle point on the smartphone interface should be made apparent to put the navigation within the range of the thumb.

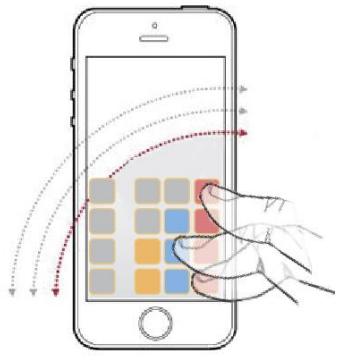
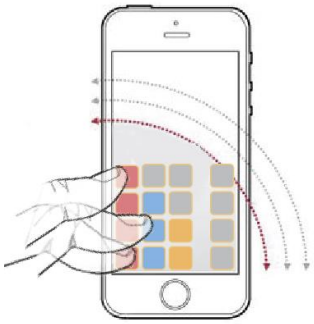
<table>
<tr><td colspan="2">A1
  </td><td colspan="2">A2
  </td></tr>
<tr><td>Area Point 1</td><td>Area Point 1</td><td>Area Point 1</td><td>Area Point 1</td></tr>
<tr><td colspan="4">Level of Accessibility using one hand</td></tr>
<tr><td>High Access</td><td>Medium Access</td><td>Low Access</td><td>Access using other hand</td></tr>
<tr><td colspan="2">B1
  </td><td colspan="2">B2
  </td></tr>
<tr><td colspan="2">Left Handed User</td><td colspan="2">Right Handed User</td></tr>
</table>

Figure 7.4 Users' reachability range and level of importance on the smartphone interface

Practicable:

The device should support users' practice to enable quicker and more efficient interaction on individual navigation, as well as the overall device.

A number of attempts at particular navigations or buttons force the older adult to carry out frequent practices on their fingers and hand movements to gain familiarity with a certain position and movement on the smartphone UI. In some cases, the buttons should be accessible

without having to practice, i.e. the emergency button. The older adult users are expected to access the emergency buttons without any difficulties when needed, in an emergency situation.

Therefore, older adult users may not be required to remember and find the position of the button in an emergency situation; for example, the emergency icon should always be located on the bottom left corner of the device which has the easiest and closest reach of the users' thumb. It would be important for this button to be accessed quickly in an emergency situation. An SOS button with red colour should also be placed in the same area to reduce the users' cognitive load in finding the button.

Functional

The buttons should function properly as required.

Users should be able to navigate and operate the buttons as expected on the smartphone interface design. Moreover, the buttons should carry out the assigned tasks as the users may have expected. A "back" button should also be functional to bring users back to the previous position when they get lost. For example, based on the participants opinion, a digital flashlight application should be accessed or operated in a similar way to an analog one when the on/off button is being activated where a flashlight is considered to be the most significant tool when in the dark.

Figure 7.5 below is an example of how a digital flashlight application should function the same as the analog one.

Name	**Digital Flashlight**	**Real Flashlight**

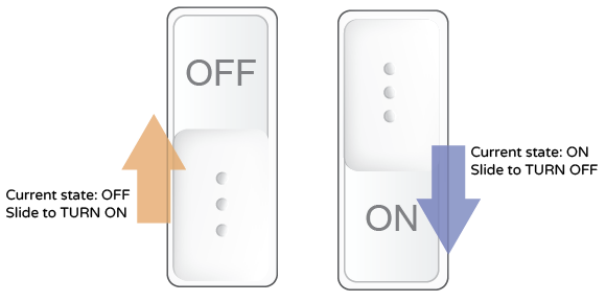
Apps Vs **Real**		 Slide to turn on/off

Figure 7.5 User's mental model for operating digital and analog torch

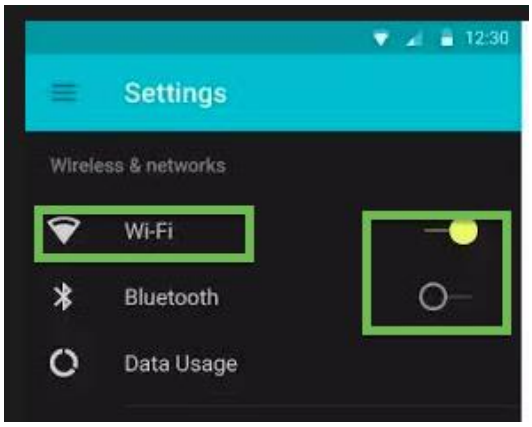
Applicable:

Users should be able to apply the basic operational method on all application or functions they use on the smartphone.

The smartphone applications that have been installed on the device should have consistent methods of operation to generate interactive habits on the device. Understanding a consistent mechanism will assist older adults to interact with the smartphone device easily and accurately, included minimizing the cognitive load. In this research project, the older adult users should understand the basic mechanism from the prior knowledge to be able to apply similar or the same interactivity throughout the functions on each application. For example, the up and down slider of an ON/OFF switch should consistently be applied on the Wi-Fi connection switcher. See the below illustration in Figure 7.6 for an example.



Toggle Turn ON/OFF on the torch



Toggle Turn ON/OFF on Wi-Fi Connection

Figure 7.6 Suggested easy-to-operate on/off switch using sliders

Achievable:

Practice makes goals better achieveable.

Users should be rewarded for being able to achieve a task successfully. This success can be measured when users have successfully completed a task in a proper way a within certain period of time. As stated by the participants, older adults would need to complete a task to achieve a sense of satisfaction and to indicate there was no error within the completion. The findings also reported that each older adult user has a particular goal when interacting with the smartphone device. Once the goal has been achieved, then it is considered that the task has been completed. This applies to participants in both Indonesia and Australia.

However, the Australian user group tended to stop at the point when one task had been completely achieved (for example, the user had to make a phone call, they talked to the person on the phone and then hung up, to indicate the phone call has been completed). Meanwhile, the Indonesian user groups attempted different methods to communicate using the smartphone device. As mentioned in Chapter 2, research showed that Indonesia has various data plans available to communicate more cheaply using other means of communication such as messengers that will allow them to send files (i.e. photographs, videos, or other files) in more convenient ways.

The older adult group in Indonesia considered a task as being, for example, when they can send a file (photographs, videos and others) using the instant messenger such as WhatsApp. That indicates they have completed the whole process of communication.

To start making a phone call, a clear name and photograph of the person should be properly visible and placed on the contact list. A formal font should be used to avoid mistakes in reading their full name. Then user can start dialing the assigned number. The complete sequence of this task (getting the person's name and making a phone call) is as follows:

Main > Phone > History > [*pick a name*] "JOHN SMITH" > *[confirm the name & picture*] > Call > [*when finished*] Hang up > [*Call is completed*].

Adaptable:

Late adult users should be adaptive to the applied practice processes.

Users are expected to adapt to an existing application to familiarise themselves with other applications that have similar or even the same interactivity process to they can completely achieve when they get used to them. In this case, these people may have adapted to the sequences in completing the tasks using the specific proceses

In addition to this, their brain may have adapted to the icons or symbols used, including the sequences. For example, when an older adult person can make a normal phone call from their contact list, the sequence of making a phone call would be similar to the instant messenger free-call service using the WhatsApp application. Therefore, older adults should then be able to make a phone call using the same method using a different application.

Users from an Indonesian cultural background may adapt to an app as long as the language on the system is consistent. For some users, the system language has to be changed to Bahasa to ease their understanding during the interaction, but some other participants stated that they could accept and understand the system in English. Meanwhile, the Australian users may not find it necessary to change the system language as they have used English as their default language in their daily life. However, the language would need to be meaningful of its functions as daily language could be different from the understanding of technological terms.

Advantageous/Beneficial:

The completion of initial processes could be advantageous when operated frequently and repeatedly.

The older adult users felt that the process of interacting with the smartphone device could be more useful when carried out properly and frequenly. For older adult users, frequent attempts on an application are considered beneficial, as they would be able to access important items as needed, such as finding their relatives' phone numbers. The improved design would be beneficial when they feel that the app can fulfil their requirements effectively and they can access it in a short period of time, such as in an emergency situation. Older adult users should be able to associate the main and critical navigation system on the smartphone device and make minimum effort to engage with the navigation to successfully complete a specific task. For example, the digital flashlight would be more beneficial to carry than a real flashlight as it is easier and more handy. The same level of importance and necessity are applied to both the real and digital items in which a digital flashlight may be less important or less necessary than a real one, but it may be more convenient to carry a phone with flashlight application installed on it.

Research findings showed that once the older adult participants found an app to be beneficial to supporting their daily activities, they are reluctant to change to other apps, such as the WhatsApp application comparable to Line messnger. Findings from this research project also showed that when an app is no longer beneficial for them, the older adult users may think of changing it to a "traditional" one. Data showed that 75% users of the Australians participants in this research project found that a flashlight application was more beneficial and easier to operate than the real one. Therefore, these participants would prefer to carry a smartphone device with a flashlight application installed, rather than an actual flashlight. In contrast, once the older adult users found it no longer beneficial (i.e., the app takes longer to start or has a lot of sophisticated controls on it), the older adult users may switch back to an analog flashlight.

Meanwhile, the Indonesian users in this research project had the tendency to try to install another flashlight application before they decided to switch back and choose an analog flashlight.

Comfortable/Convenient:

Older adult users may feel much more comfortable to interact on an application when they can repeat the task without any issues.

Once the older adult users feel the benefit of completing a task successfully and conveniently, they would feel the engagement of interacting with the apps makes them feel more comfortable, as stated by all participants in both countries. This feeling would be generated by how easily the users recognize the apps and use them effortlessly. For example, female users might use the camera as a mirror so they do not need to carry a real mirror.

Older adults will keep using an app on the smartphone when they experience the benefits of the interaction. Along the way, they would also feel comfortable to use a particular application for a longer period of time repeatedly and more frequently. Findings showed that the Indonesian older adult users were more likely to use the instant messengers than any other messaging applications due to the nature of Indonesian culture, where it is more convenient to communicate using text than talking on the phone. Therefore, the use of instant messenger would make it more convenient for the participants to deliver messages including files to other people.

Meanwhile, in Australia, the older adults were found to have a larger finger size than the Indonesian older adults. Therefore, they were more reluctant to use instant messenger or type messages using the smartphone keyboard. They would feel more comfortable to call the person they want to talk to. Data also revealed that the older adults in Australia felt more comfortable to talk on the phone directly as it is clearer than sending text messages.

Favourable:

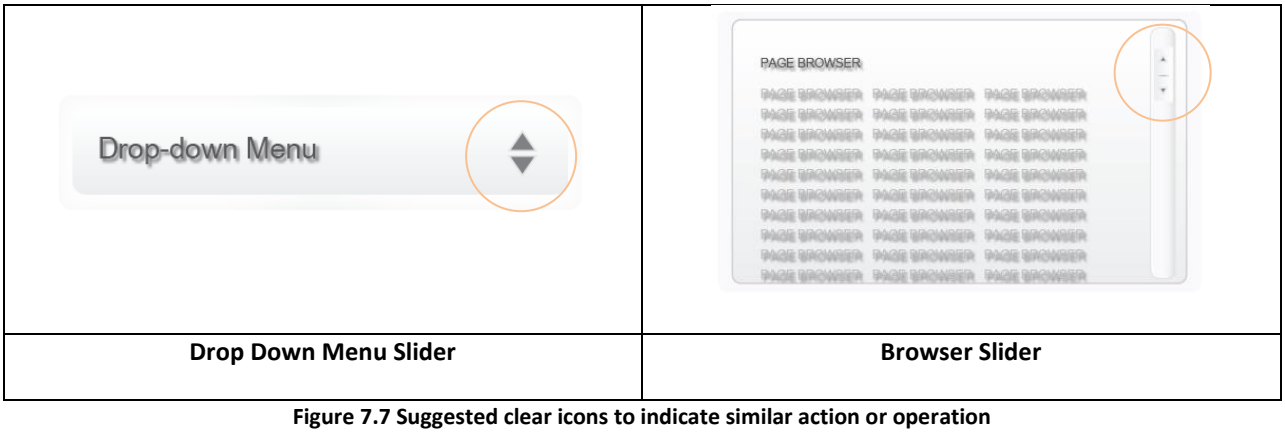
Favourite applications are nominated as a result of users being comfortable with those.

Smartphone users might access some apps without difficulty, while other apps might present issues. Therefore, users might favour one app after finding that a particular application is much easier to operate than others. Users might place their favorite apps in a specific folder or location. For example, older adults in both countries have found WhatsApp free call is more beneficial than a regular phone call due to its cheaper calling rate using the internet connection. Favourite applications are considered as the results of being accessed more easily and comfortably. As stated by the participants, older adult users may have difficulties learning something new all the time. Therefore, once these older adult users are much more familiar and feel comfortable with an application, the application would become a favourite one.

Expandable:

Expansion of interaction on different applications with the same methods.

Older users might expand their skills to carry out similar interaction on different applications or navigation buttons when they have grasped the basic concept. The users would try to operate similar interactivity methods on different applications or systems. For example, if users have been able to identify that a 'triangle' icon implies "directions", they would be able to activate other menus which have the 'triangle' icon, such as drop-down menus or the page slider to move the page up and down (see figure 7.7).



Drop Down Menu Slider	Browser Slider

Figure 7.7 Suggested clear icons to indicate similar action or operation

Users' comfort should be taken into account before they perform the next step, which is expanding and applying their skills to other things, such as experimentation on other apps using the same methods. Research findings in both cultures showed that older adult participants are not reluctant to expand their knowledge and skills in the use of smartphone technology as they want to be in parallel with the skills of the younger generations. For example, once the older adult users are able to use and feel comfortable on how to operate the page slider on a web browser, they would certainly be able to perform the same action or operation on other application, such as the slider in an instant messenger or phone book. Therefore, their skills are expanded from being able to operate the page slider on a web browser into an operation in an instant messenger application.

Securable:

Security is critical when performing online transactions as personal information of the older adult users should be kept secure and safe.

In more advanced tasks, such as online transactions, older users users need to feel secure when performing an online transaction; for example, when making a payment online for plane tickets or a hotel booking. Older adult users may not be familiar with the security systems in the online environement; however, the system should be able to notify the user and give proper explanation about their website safety and security; i.e., encryption for the online transaction. The older adult participants stated that they would make online payments using a credit card as this could be problematic for them due to the complexity of the payment processes and the credential details they have to enter into an online system. Apart from that, these people would never know how the security system works to secure the online transaction. Therefore, a "padlock" icon indicating a secure page should be better incorporated and a brief but clear explanation about the security system should also be made clear and significant on the website when the online transaction occurs.

As mentioned in chapter 2, the total transaction value of digital payments in Indonesia reached an amount of up to US$18 million in 2017 (Statista.com, 2017). This figure is expected to increase by 100% over four years, resulting in a total amount of approximately US$36 million in 2021. Meanwhile, in Australia the total transaction value using digital payments was US$24.796 million in 2017 and expected to grow by 83% to 2021, which results in a total amount of approximately US$44 million (Statista.com, 2017). Therefore, online transactions hold big value and financial flow for a specific region.

In summary, data showed that online transactions play a significant role in the national financial flow and older adult users could be classified as part of the users. Therefore, the security systems for online transactions should be made clear and obvious to assure the users security, especially older adult people, to allow them to carry out online transaction securely and conveniently.

Support/Help:

Direct support should be given to the older adult users to avoid unsolved issues in advance.

If older adult users encounter a complex situation before carrying out a task, they are more likely to ask for assistance before they make mistakes that will end up in errors. Older adults are scared to make any small mistakes when dealing with technology. Therefore, digital assistance could be considered as one of the features that could make older adult users feel more confident to try new things on their device when clicking on the app (see figure 7.8). For example, users might need to relearn the interaction when the operating system on an app has been updated as this might affect the overall layout; i.e., these users need assistance to setup the clock or alarm when the operating system has been updated as the interface may be unlike the older one.

Figure 7.8 The design of "HELP" functions which is operated as a layer system

In chapter 2, research data showed that in 2013, the total number of Android users in Indonesia was only 21.45% and iOS 2.25%. However, data in July 2017 revealed that Android use in Indonesia has grown to 84% of overall smartphone use (Statista, 2017). Meanwhile, iOS users in Indonesia are up to 3% in the same period. Therefore, there is a significant growth of Indonesian's Android users in the past four years. In Australia, data in 2013 showed Android users are 57.9% and iOS users are 36% of overall smartphone users. In 2017, the number of smartphone users using the Android operating systems went up to 64.7% and iOS users decreased to 35%.

In summary, based on the findings from both cultural backgrounds, the users in Indonesia utilize Android operating systems more than iOS (84% and 3% respectively). However, in

Australia, the gap between Android and iOS users is not as significant (64.7% and 35% respectively).

Therefore, smartphone users in Indonesia are expected to obtain more and better support specifically for the Android OS users due to the number of people having Android phones as comparable to the iOS ones. Meanwhile, the older adult users required more support from the help centres to help them find a better solution using face-to-face when they are experiencing some issues. Therefore, in the Australian society, iOS users expected to get more assistance than the Android ones.

Ordering of items:

Applications in alphabetical order are easily discoverable.

As stated during the interview sessions, older adult participants would need to write down the order of how to troubleshoot any operations when having issues on their own. The process should be put in an organized order that would make it easier for the users to find the issues and solve them.

The participants stated if they wanted to find an application in a folder, the system should organise the apps in alphabetical order to make users find the apps easily. For example, the Line messenger (app starts with “M”) should appear before the WhatsApp messenger (app starts with “W), where Maps (app starts with M) should be placed before Waze application (app starts with “W”)

Based on the results, it was found that participants from both cultural backgrounds had been familiar with how to organise items or objects (i.e. application) in an systematical order (see figure 7.9). However, in the Indonesian culture where Bahasa is applied on the smartphone language system, some terminologies would be different from English. For example, system Setting in English (the word starts with “S”) would be different from Pengaturan (the word starts with “P”) in Bahasa.

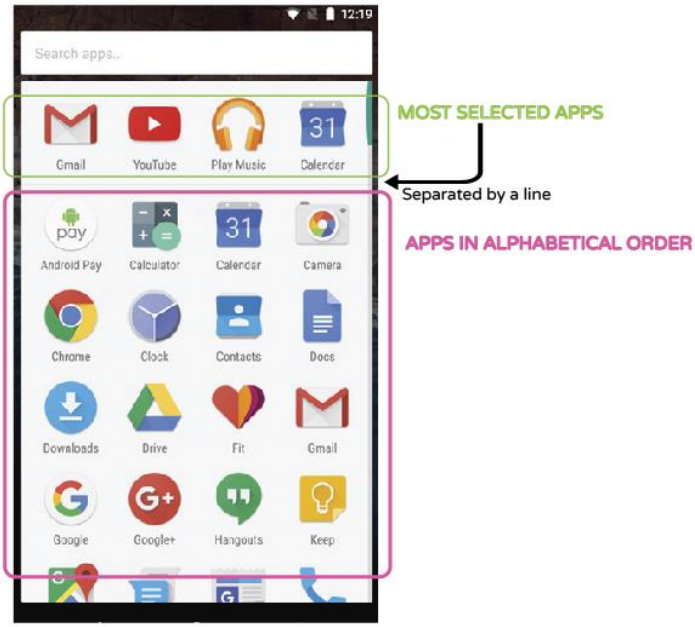


Figure 7.9 The navigation organized in alphabetical order

Recommendable:

Other people should comprehend how older adult users feel about how they are getting used to a smartphone technology.

In terms of interaction, as stated by the participants, older adult users would find it fun to interact with technology to maintain the relation with other people around their society using smartphone technology. Once they have already had the fun part, these users would be more likely to recommend the applications they used to other older people and convey their experiences to them. On the other hand, these people would convince other people to use the same or at least similar technology in order to make two-way communication between them using a smartphone. Once they are familiar with the general functions, such as making a phone call, the older adult users could start having conversations using instant messengers if they wish.

Data from the respondents showed that once the older adult users were likely to operate or interact with the smartphone device or a specific application, they could possibly make a recommendation to other older adults and make a "digital community" among themselves.

In this case, these older adult people would have the opportunity to exchange information and knowledge on how to excel in technology. In other words, a recommendation would be presented to other older adults and to encourage the same generation to become expert in the utilization of smartphone technology for communication to enhance their quality of life.

Satisfaction:

Satisfaction through perfection and effectiveness.

The older adult users would be satisfied when they could complete a task properly and effectively. The users' satisfaction would be determined by how efficiently and effectively the tasks can be accomplished in a short period of time. These older adults users might also need to create a knowledge and skill-based experience to allow them to revisit the tasks in their own time.

Data from the participants from both cultural backgrounds showed that, apart from being comfortable and satisfied in interacting with a smartphone device, older adult users should be satisfied with the outcomes of their experience as towards the technology. Each cultural background – Indonesia or Australia – might have a different level of satisfaction when a particular task has been completed. However, the satisfaction has led them into a concluded level of interactivity.

Becoming capable:

Capability comes from frequent practice, and trial and error.

Users might find themselves capable of operating the smartphone device when all the above steps have been performed and succefully achieved. At the beginning, the older users might find those steps are difficult to carry out due to some factors. The more frequently the older adult users perform the tasks, the better and quicker they will become capable of carrying out

the same tasks repeatedly. Therefore, older adult users might also find themselves capable of the following skills:

- Recognizing more complicated system and navigation of their smartphone device
- Navigating through the user interface system more effectively without any errors
- Solving erorrs, issues or problems on their own without being dependant on any other people.

The above-mentioned capabilities are considered as a common or basic states where users should be kept being familiar and becoming an expert in its operations. Data showed that the older adult users had to carry out several attempts before they could interact with the phone properly and effectively without having any issues. Once they have achieved that, the older adult users would feel the following point – achieving user satisfaction.

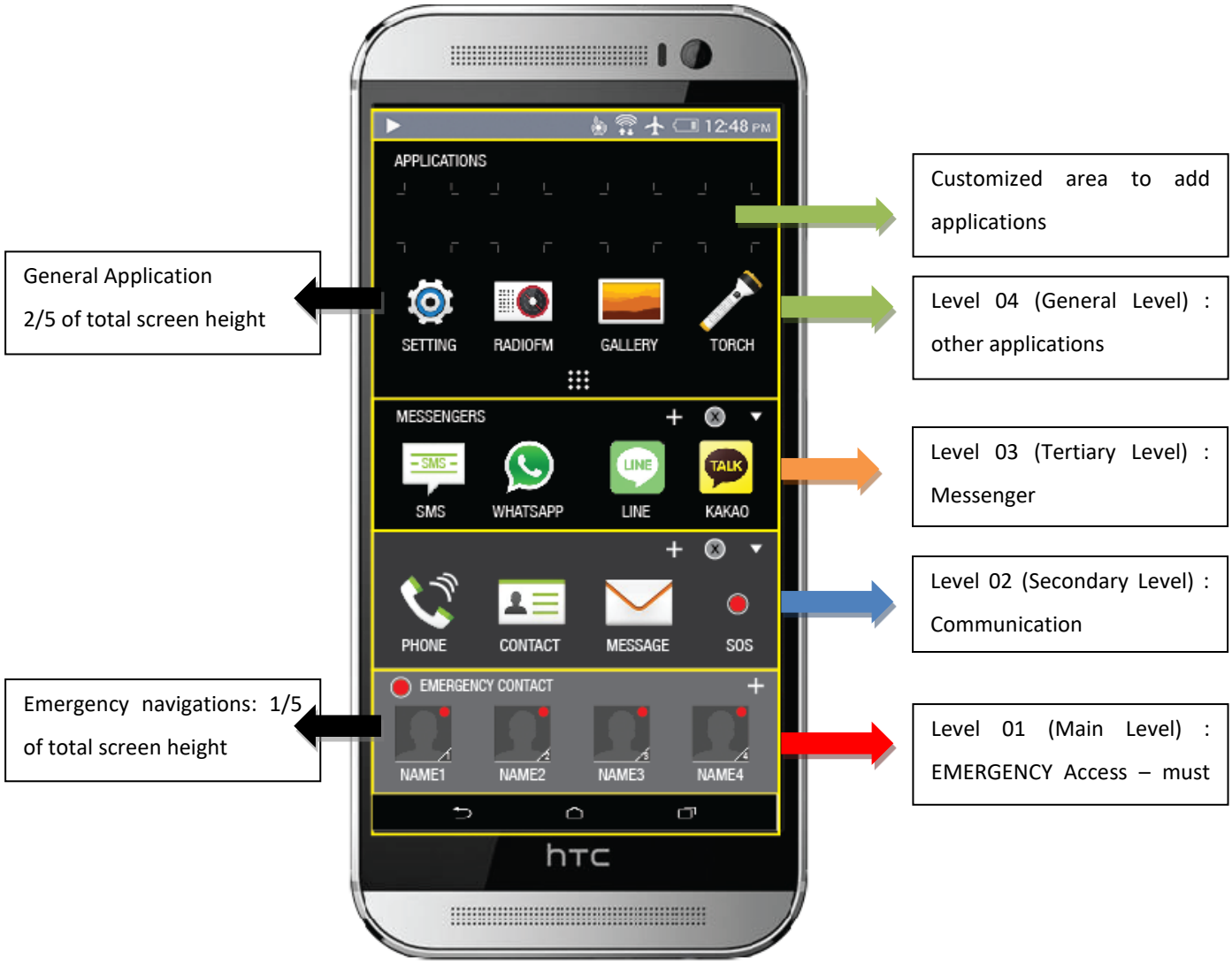


Figure 7.10 New frameworks of UI development

7.4 Summary of Chapter 7

This chapter presented the breakdown and deeper development of an 18-point cognitive ergonomics framework based on the three elements of user experience design of Shedroff (2001) to enhance the capability of older adults users to interact with the smartphone device in a more effective way. Thus, this 18-point framework was designed and built on the researcher's techniques to extend the user-centered experience and be applicable as the basis framework of smartphone user interface design development in two different cultures – Indonesian and Australian. The frameworks could also be used to distinguish the uniqueness of each individual

culture, where cultural differences support the creation and development of the new and improved cognitive ergonomics framework into a smartphone user interface design development.

The most important aspect of how a new user interface design frameworks should be designed was the visibility of specific elements or navigation to the users before they could perform further actions on the smartphone device. Research findings showed that older adults in both countries would prefer an object rather than text (such as the presence of an icon or symbol) which has to be visible before they start to interact with the phone,

If the element or object in which the participants would like to interact could not be found, the users would not be able to carry on to the interaction. In other words, their interaction would stop even before they carry out the task. The sample prototype based on the particular scenario of new design development can be found on this portal: https://marvelapp.com/72c4hi7/screen/34711241.

This research project could provide better and more valuable foundations for combining smartphone user interface design ideas and older adult user requirements to create better smartphone interaction on an improved user interface design for them. It could be argued that new prototype designs do not go far enough to address the range of needs of older adult generation in an increasing population of this group in using smartphone technology.

The example of basic interactive prototype development used as the basis of the whole frameworks can be found here https://marvelapp.com/1180je06/screen/34726453.

CHAPTER 08:

Conclusion

This final chapter summarizes the overall results based on the observations and interviews undertaken with the older adult smartphone users, regarding their needs for improved experiences in their interaction with their smartphone based on a User Experience (UX)/User Interface (UI) Design method using semi-structured, small group/individual interviews (Mortensen, 2019). This research project is expected to fulfil the needs of older adult users as stated by Demirbilek (2004) where elderly people require equal accommodations and compensation in late life. That also includes filling the gap in the existing literature, adding to the knowledge of how a new framework will give better guidance and more effectively improve the interaction with smartphone for older adult users.

The approach has followed the principles of ergonomics, such as easy operation, less memory load, and efficiency to create the design (Zhang et al., 2007) and also six points of smartphone heuristics (Hawthorn, 2000). As Leung (2011) described, there is an issue for people lacking technological literacy and this has become more pressing as technology has increasingly become a necessity (Leung, 2011).

In this research project, the detailed experiences of late adult smartphone users were examined by carrying out contextual enquiry that focused on how the older adults utilized a smartphone in their daily life. The semi-structured interviews were conducted in two countries (Indonesia and Australia) using Bahasa and English respectively. The results of the analysis included the investigation into how older adult users perceived and used a smartphone to enhance their daily activities. The interview sessions were carried out using using UX/UI design method in Bahasa for the Indonesian users and English for the Australian users. The sessions involved a process of creating a new design (including layout and buttons/icons) using paper-based prototypes and digital phone models to confirm the new frameworks have fulfilled the needs of older adult users to own a smartphone that is fully functional. And also, it is expected

to show the increase in confidence level on an improved smartphone user interface design using the 18-point guidelines.

The investigation was conducted using UX/UI design research methods, employing semi-structured, small group/individual interviews to study the contextual information and behaviour explanation to discover the detailed characteristics of each older adult participant in the two countries in terms of using smartphone devices in their daily life. This method was used in this research project to allow the researcher to obtain much refined information that could inform a detailed understanding of older adults' preferences in using a smartphone for day-to-day purposes. This research project also considered the cultural differences that affected the research and decision-making processes. Therefore, some adjustments were made to enhance the overall research practice for the two cultural contexts.

The theories of Shedroff (2001) on user-centred experience were adopted and linked to the initial heuristic principles of Nielsen (1994) to build the map of the expanded version of the experience, based on the data in chapters 4 and 5 that has been categorized according to what the users think and need on their smartphone. In the final stage of the research project, the researcher utilized and applied the theory of Nielsen (1994) and expanded the theory of Shedroff (2001), generating the 18-point of cognitive ergonomic framework as well as applying the improved version of the final design.

Ten Heuristic Principles and three variables of experiences – attraction, engagement, and conclusion – were then expanded to produce an 18-point cognitive ergonomics framework for late adult users to give designers and older adult users the step-by-step guidelines on how to create and utilize the smartphone in an effective way.

The researcher has outlined the significance of this research project: using User Experience Design research methods with semi-structured interviews for small group/individual users to investigate how older adult users in Indonesia and Australia perceive and use smartphones to do their daily activities. This research project was initialized by carrying out data gathering to investigate the perpectives as well as preliminary needs of late adult users of their phones.

Furthermore, a comparative analysis was performed between the older adults in Indonesia and Australia, in which similarities and differences were drawn out, including the cultural difference in using smartphone technology. The observation and interviews were carried out from multi-dimensional perspectives, such as organizations and communities, to obtain the most sufficient and suitable information from the older adult users. Small groups of older adult users were formed in both Indonesia and Australia, to discover the needs of these two user groups in terms of smartphone ownership. The overview and analysis of population data was carried out by splitting the respondents into groups or clusters. Group one contained ten people from Indonesia and the second group contained ten people from Australia, divided into working and retired people to convey the actual representation of the older adult users demographic in both countries.

A Detailed draft of an improved smartphone user interface design was then developed along with the interviews using paper-based prototypes and then confirmed using digital prototypes. This method was found to be a proper combination for the discovery of what frameworks can be utilized to produce new smartphone interface design for the elderly and the users' expectation from the new design. In addition, the researcher converted Shedroff's (2001) techniques of user-centred experience to expand the cognitive ergonomic frameworks for this research project.

The researcher has expanded the 10-point Heuristic Principles and three variables of Shedroff's User Centered Design and User Experience Design into an 18-point cognitive ergonomic framework to assist in the smartphone design development to generate better user interface design configuration for that specific user groups. The 18-point cognitive ergonomic framework was applied to how a new smartphone should be designed for older adult users, hoping to accommodate the user experience and needs of elderly users' smartphone interaction. The researcher also found that the 18-point framework would contribute to new knowledge by filling the gap about smartphone design that would construct a new behavior among older adults in using smartphone technology and stimulate an impact on their community.

The approach of this research project can be further progressed by following the practice of data collection methods using the user experience (UX)/user interface (UI) research design method to contextualize the interview process of potential smartphone users using semi-structured interviews in a small group/individual, industry representatives, and other researchers in the future.

This future research project could dedicate to present benefits of the current and future trends of mobile/smartphone technology evolution and its relation to its specific users. Positive performance will also be challenging to ascertain the future innovation in smartphone technology and the development of its cognitive ergonomics frameworks to enhance human life, especially for older adult users.

In a broader research project of smartphone user interface design, the investigation of smartphone technology and user interface design for older adult users are confronted with challenges that have still not been fully researched, such as:

- How older adults with physical impairments can benefit from the future of technology development
- How Artificial Intelligence can track the human (older adult) behavior of recognized interaction to create default mechanisms for specific users with or without special needs
- How digital innovation might be advantageous for toddlers to recognize and train their behaviour by using a smartphone device
- How smartphones and an Internet of Things (IoT) could work together to enhance the quality of life, especially the older adults
- How global smartphone industries are incorporated into the development of a research project into larger-sized devices for older adult users, such as an iPad.

Moreover, to show how this research project is significant, especially for the older adult generations in interacting with their smartphone device, the 18-point cognitive ergonomic framework should fill the gap in giving the stages on how to initiate smartphone user interface design development that is applicable to improve the quality of users' interactions on a hand-

held device. The overall opportunity is to guide and enhance the older adults' experiences in improving the utilization of smartphone technology.

This research project also suggests directions for further research, such as how could the improved design guidelines generate a market in existing smartphone layouts and brands?

Bibliography

Adler, P., & Winograd, T. 1992. The Usability Challenge. In P. Adler & T. Winograd (Eds.), Usability: Turning Technologies Into Tools (pp. 3–14). New York: Oxford University Press.

Adler, P.A., & Adler, P. 1998. Observational Techniques. In N. K. Densin & Y. A. Lincoln (Eds.), Collecting and Interpreting Qualitative Materials (pp. 79-109). Thousand Oaks, CA: Sage Publications.

Age UK. 2015. Age UK Loneliness Evidence Review Evidence Review: Loneliness in later Life. Retrieved from: https://www.ageuk.org.uk/globalassets/age-uk/documents/reports-andpublications/reports-and-briefings/health--

wellbeing/rb_june15_lonelines_in_later_life_evidence_review.pdf (Accessed 01 October 2019)

Al-Hunaiyyan, A., Al-Sharhan, S., Alhajri, R. 2017. A New Mobile Learning Model in the Context of Smart Classroom Environment: A Holistic Approach , International Journal of Interactive Mobile Technologies (iJIM) Vol 11, No.3 (2017) – eISSN: 1865-7923

Ramsey, A.T., Wetherell, J.L., Depp, C., Dixon, D. and Lenze, E., 2016. Feasibility and acceptability of smartphone assessment in older adults with cognitive and emotional difficulties. Journal of technology in human services, 34(2), pp.209-223.

Allan, J., Khong, C.W., Gilhaum, B., Hall, S., Kerwood, J.,Macdonald, A., McNally, N., Nelson, D., Page, S., Stewart, S.,Stovell, D. 1996. The Challenge of Age. Glasgow School of Art,The Foulis Press, Glasgow – United Kingdom.

Anstey, K.J., Wood, J., Lord, S. and Walker, J.G., 2005. Cognitive, sensory and physical factors enabling driving safety in older adults. Clinical psychology review, 25(1), pp.45-65.

Arab, F., Malik, Y. and Abdulrazak, B., 2013. Evaluation of phonage: an adapted smartphone interface for elderly people. In IFIP Conference on Human-Computer Interaction (pp. 547-554). Springer, Berlin, Heidelberg.

Ataie, J.E. and Morgan, D.L. 2015. Focus Groups With Older Adults. The Encyclopedia of Adulthood and Aging, pp. 1-5.

Australian Human Rights Commission, 2014. Age Positive: Older Consumer Fact Sheet, Retrieved from: https://agepositive.humanrights.gov.au/sites/default/files/Older%20Consumers%20Fact%20Sheet.docx (accessed 05 September 2014)

Australian Government, 2017. Superannuation: The Big Picture. Retrieved from: https://www.ato.gov.au/About-ATO/Managing-the-tax-and-super-system/Insight--building-trust-and-confidence/Big-pictures/Superannuation/ (Accessed 1 November 2019)

Averbukh, V. L., Bakhterev, M. O., Baydalin, A. Y., Gorbaskevkiy, D. Y., Ismagilov, D. R., Kazanter, A. Y., Nebogatikova, P. V., Popova, A. V., Vasev, P. A. 2008. Searching and Analysis of Interface and Visualisatian Methaphors. In Human Computer Interaction: New Developments, Croatia, Europe: InTech.

Babich, N. 2018. The Magic of Paper Prototyping. UX Planet. Retrieved from: https://uxplanet.org/the-magic-of-paper-prototyping-51693eac6bc3 (Accessed 15 April 2019).

de Barros, A.C., Leitao, R., Riberio, J. 2014, Design and evaluation of a mobile user interface for older adults: navigation, interaction and visual design recommendations. In: 5th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion, DSAI 2013, Science Direct, Elsevier.

Blashki, K and Isaias, P. 2014. Icon Metaphors for Global Cultures, in: Emerging Research and Trends in Interactivity and the Human-Computer Interface, Oracle Inc. USA.

Blackman, C. R. 1998. Convergence Between Telecommunications and Other Media: How Would Regulation Adapt? In Telecommunication Policy, Vol. 22(3), April, 1998, pp.163-170. Elsevier Science Ltd.

Blattner, A., Sumikawa, D., Greenberg, R. 1989. Ear Cons and Icons: Their Structure and Common Design Principles. Presented at the Nineteenth Annual Hawaii International Conference on System Sciences, Hawaii, USA

Bloch, P.H., Brunel, F.F., and Arnold T.J. 2003. Individual Differences in the Centrality of Product Aesthetics: Concept and Measurement. Journal of Consumer Research, 29, pp. 551-565

Buxton, W. 2007. Sketching User Experiences. San Francisco: Morgan Kaufman.

Campaign Brief. 2013. Mi9 report: “Australia's baby boomers enjoying lucrative 'lifestyle' stage worth an average $1m per household but being shunned by brands”. Campaign Brief, Retrieved from: http://www.campaignbrief.com/2013/02/mi9-report-australias-baby-boo.html (accessed 15 August 2014).

Cao, J. 2018. Paper Prototyping: The 10 Minutes Practical Guide, 27 January. Retrieved from: https://www.uxpin.com/studio/blog/paper-prototyping-the-practical-beginners-guide/, (Accessed 01 April 2019)

Caprani, N., O’Connor, N. E., & Gurrin, C. 2012. Touchscreens for the Older User, Assistive Technologies, Dr. Fernando Auat Cheein (Ed.), InTech, DOI: 10.5772/38302. Retrieved from: https://www.intechopen.com/books/assistive-technologies/touchscreens-for-the-older-user. (Accessed 6 June 2016)

Carmien, S. and Garzo, A. 2014. Elders Using Smartphones – a Set of Research Based Heuristic Guidelines for Designers in Springer - Verlag, Berlin - Heidelberg, DOI: 10.1007/978-3-319-07440-5_3, <https://www.researchgate.net/publication/273456739>. (Accessed 18 February 2019)

Cavus, N. and Ibrahim, D. 2008. M-Learning: An Experiment in using SMS to Support Learning New English Language Words, British Journal of Educational Technology Vol. 40(1), pp.78-91.

Chang, Y. F., Chen, C.S., Zhou, H. 2009. Smartphone for Mobile Commerce, Computer Standards and Interfaces 31(4), pp. 740-747.

Chen, K., Chen, J. V., Yen, D. C. 2011. Dimensions of Self-Efficacy in the Study of Smart Phone Acceptance, Computer Standards & Interfaces, 33, pp. 422-431.

Chisnell, D., Redish, G, and Lee, A. 2006. New Heuristics for Understanding Older Adults as Web Users. Technical Communication. 53, pp. 39-59.

Coleman R., Clarkson J., Dong H., Cassim J. 2007. Design for Inclusivity. A Practical Guide to Accessible, Innovative and User-Centred Design Gower, Aldershot, UK (2007)

Conci, M., Pianesi, F. & Zancanaro, M. 2009. Useful, Social, and Enjoyable: Mobile Phone Adoption by Older Adults. Lecture Notes in Computer Science, 2009, Volume 5726/2009, 63-76. DOI: 10.1007/978-3-642-03655-2_7.

Craig, F. I. M. and Salthouse, T. A. 2000. The Handbook of Aging and Cognition, second ed. New Jersey: Lawrence Erlbaum Associates Inc.

Cowie, I. 2011. Baby Boomers With 80pc of UK Wealth Shouldn't Feel Guilty About Younger Generations' problems, The Telegraph. Retrieved from: http://blogs.telegraph.co.uk/finance/ianmcowie/100013939/baby-boomers-with-80pc-of-uk-wealth-shouldn%E2%80%99t-feel-guilty-about-younger-generations-problems/ (Accessed 02 September 2014).

Curran, C-S. 2013. The Anticipation of Converging Industries, Journal of a Concept Applied to Nutraceuticals and Functional Foods, pp.9-13.

Czaja, S., Beach, S., Charness, N., Schulz, R. 2013. Older Adults and The Adoption of Healthcare Technology: Opportunities and Challenges. International Journal of Technologies for Active Aging 9(3), pp. 27-46.

Danino, N. 2001. Heuristic Evaluation - a Step By Step Guide Article — SitePoint dandino. Retrieved from: https://www.sitepoint.com/heuristic-evaluation-guide/ (Accessed 30 July 2019)

Demirbilek, O., and Demirkan, H. 2004. Universal product design involving elderly users: a participatory design model in Applied Ergonomics 35 in: Elsevier Science Direct Journals. 35(4), 2004, pp. 361-370

Demirkan, H. 1998. Integration of Reasoning Systems in Architectural Modeling Activities. Automation in Construction 7(1-2), pp. 229-236. Elsevier Science.

Dickinson, A., Arnott, J., & Prior, S. 2007. Methods for Human-Computer Interaction Research with Older People. Behav. Inf. Technol., 26(4), 343-352.

Ellis, C. 2007. Telling Secrets, Revealing Lives: Relational Ethics in Research With Intimate Others. Qualitative Inquiry, 13(1), 3–29. https://doi.org/10.1177/1077800406294947

Ericsson. 2014. South East Asia and Oceania. Ericsson Mobility Report Appendix, June 2014. Retrieved from: http://www.ericsson.com/res/docs/2014/regional-appendices-sea-final-screen.pdf (Accessed 28 April 2015).

Ericsson. 2014. South East Asia and Oceania. Ericsson Mobility Report Appendix, November 2014. Retrieved from:

http://www.ericsson.com/res/docs/2014/emr-november2014-regional-appendices-raso.pdf (Accessed 28 April 2015).

Familiant, M, and Detweiler, M. 1993. Iconic Reference: Evolving Perspectives and an Organizing Framework. International Journal of Man-Machine Studies, 39, p. 705-728.

Farrell, S. 2017. From Research Goals to Usability Scenarios: A 7 – Step Method, Nielsen Norman Group. Retrieved from: https://www.nngroup.com/articles/ux-research-goals-to-scenarios/. Accessed 01 May 2019

Fisk, A.D., Rogers, W. A., Charness, N., Czaja, S. J., & Sharit, J. 2004. Designing for Older Adults: Principles and Creative Human Factors Approaches: CRC Press J Taylor & Francis Croup.

Fisk, A. D., Rogers, W. A., Charness, N., Czaja, S. J., & Sharit, J. 2009. Designing for Older Adults: Principles and Creative Human Factors Approaches, Second Edition: CRC Press J Taylor & Francis Group.

Fox, S. 2004. Familiar Concerns Drive Wired Seniors' Online Research, Older Americans and The Internet Part 2, Pew Research Internet Project. Retrieved from: http://www.pewinternet.org/2004/03/28/part-2-familiar-concerns-drive-wired-seniors-online-research/ (Accessed 20 April 2015)

Fulton, J. S. and Marsh, M. 2000. Scenario building as an ergonomics method in consumer product design. Appl. Ergon. 31 (2), pp.151–157.

Gardner, M.M and Christie, B. 1987. Applying cognitive psychology to user-interface design, John Wiley & Sons, Chichester.

Ghazaryan, A. 2015. The Value of UX Research in Product Development. Design Modo. Retrieved from: https://designmodo.com/ux-research/ (Accessed 10 November 2019)

Gibbs Jr, R.W. and Matlock, T. 2008. Metaphor, imagination, and simulation: Psycholinguistic evidence.

Giffins, D. 1986. Icon-Based H-C Interaction. International Journal of Man Machine Studies, 24, pp. 519-543.

Gilleard, C. and Higgs, P. 2005. Context of Aging. Polity Press, Cambridge, United Kingdom.

Global Business Guide Indonesia. 2017, Indonesia's Electronic Component Sector: 4G Smartphones A Future Growth Driver. http://www.gbgindonesia.com/en/manufacturing/article/2017/indonesia_s_electronic_component_sector_4g_smartphones_a_future_growth_driver_11754.php (Accessed 07 April 2017)

Godjali, H., Wong, T.T., Marino, R., Sleigh, A., Davarzani, L. 2010. Accenture. 2010. Ready for Indonesia's Digital Future? http://www.accenture.com/sitecollectiondocuments/pdf/accenture-asean-ready-indonesias-digital-future.pdf. (Accessed 02 April 2015).

Goebel, M. 2007. Ergonomic Design of Computerized Devices for Elderly Persons – The Challenge of Matching Antagonistic Requirements. Universal Access in HCI (HCII 2007), pp. 894-903.

Goh, J. O, and Park, D. C. 2009. Neuroplasticity and Cognitive Aging: the Scaffolding Theory of Aging and Cognition. Resto Neurol Neuros: 27(5): pp. 391–403.

Goodman-Deane, J., Ward, J., Hosking, I., Clarkson, P. J. 2014. A Comparison of Methods Currently Used in Inclusive Design: Elsevier Applied Ergonomics 45 (2014) pp. 886-894.

Guion, L. A., Diehl, D. C., & McDonald, D. 2002. Triangulation: Establishing the Validity of Qualitative Studies, University of Florida, IFAS Extension, Florida – United States of America.

Haan, G.D. 2000. ETAG, a Formal Model of Competence Knowledge for User Interface Design.

Hanington, B. and Martin, B. 2012. Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions. Rockport Publishers.

Hao, Y. 2008. Productive activities and psychological well-being among older adults. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 63(2), pp.S64-S72.

Harun, H. 2011. Smartphone Penetration in Asia Set to Boom. Nielsen 2011. Retrieved from: http://www.nielsen.com/us/en/insights/news/2011/smartphone-penetration-in-asia-set-to-boom.html (Accessed 02 May 2015).

Hawthorn, D. 2000. Possible implications of ageing for interface designers. Interacting with Computers, 12, 507-528.

Hekkert, P. 2006. Design Aesthetics: Principles of Pleasure in Design. Psychology Science 48, p. 157-172.

Herman, S., Soraghan, C., Boyle, G. 2012. Universal Design and Technology for Older People: A Survey Tool for Assessing Technology Design for Older People, in-situ, in an Irish Context. The National Diability Authority (NDA).

Hitchcock, D.R., Lockyer, S., Cook, S., Quigley, C. 2001. Third Age Usability and Safety: an Ergonomics Contribution to Design. International Journal of Human-Computer Studies. Vol. 55(4), USA, ACM.

Hollnagel, R., Levenson, N., Woods, D.D. 2006 Resilience Engineering: Concepts and Precepts. Aldershot: Ashgate.

Hoober, S and Berkman, E. 2011. Designing Mobile Interfaces, Ontario, Canada, O'Reilly Media, 2011.

Hood, L. 2011. Smartphones Are Bridging the Digital Divide, The Wall Street Journal, http://online.wsj.com/news/articles/SB10001424053111903327904576526732908837822 (Accessed 31 August 2014).

Indonesia-Investments. 2017. Penduduk Indonesia (Indonesian Population) Retrieved from: https://www.indonesia-investments.com/id/budaya/penduduk/item67 (Accessed: 24 September 2014)

Industry Superfunds. 2014. Retirement Age. http://www.industrysuperfund.com/understand-super/retirement/retirement-age/ (accessed 29 October 2014).

International Organization for Standardization (ISO) 9241 – 11 1998, Ergonomic requirements for office work with visual display terminals (VDTs), ISO, accessed 01 April 2019, <https://www.sis.se/api/document/preview/611299/>

Intenet Live Stats. 2011. http://www.internetlivestats.com/internet-users/australia/ (accessed 22 Feb 2019)

Ipsos OTX MediaCT. 2012. Our Mobile Planet: United States Understanding the Mobile Consumer. Retrieved from: https://lmarketing.com/PDFs/2012_US_OurMobilePlanet.pdf (Accessed 30 April 2015).

Ishihara, T., Kobayashi, M., Takagi, H., Asakawa, C. 2013. How Unfamiliar Words in Smartphone Manual Affects Senior Citizens; Stephanidis, C. & Antona, M. (Eds.). Verlag, Berlin, Heidelberg: Springer.

Işıklar, G. and Büyüközkan, G., 2007. Using a multi-criteria decision making approach to evaluate mobile phone alternatives. Computer Standards & Interfaces, 29(2), pp.265-274.

Isomursu, M., Ervasti, M., Kinnula, M. and Isomursu, P., 2011. Understanding human values in adopting new technology—A case study and methodological discussion. International journal of human-computer studies, 69(4), pp.183-200.

Jacobsen, T., Buchta, K., Kohler, M., and Schroger, E. 2004. The Primary of Beauty in Judging the Aesthetics of Objects. Psychological Reports, 94, pp. 1253-1260.

Jenkins, H. 2013. Rethinking Convergence/Culture, Rethinking, Cultural Studies 28 (2): 267-297. Doi:10.1080/09502386.2013.801579.

Johanson, G. and Williamson, C. 2013. Information research: Patterns and practice. Tilde University Press, Prahran, Victoria – Australia

Jones, J.C. 1992. Design Methods. John Wiley & sons, Wiley Publishers, United States of America

Jones, M. and Marsden, G. 2006. Mobile Interaction Design. John Wiley and Sons, England, United Kingdom

Khaslavsky, J and Shedroff, N. 1999. Understanding the Seductive Experience. Commun. ACM. 42. pp. 45-49. 10.1145/301353.301407.

Klasnja, P. and Pratt, W. 2012. Healthcare in the Pocket: Mapping the Space of Mobile Health Interventions, Journal of Biomedical informatics 45, pp. 184-198.

Klumb, P.L. and Baltes, M.M., 1999. Time Use of Old and Very Old Berliners: Productive and Consumptive Activities as Functions of Resources. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 54(5), pp.S271-S278.

Kobayashi, M., Hiyama, A., Miura, T., Asakawa, C., Hirose, M. and Ifukube, T., 2011, September. Elderly User Evaluation of Mobile Touchscreen Interactions. In IFIP conference on Human-Computer Interaction (pp. 83-99). Springer, Berlin, Heidelberg.

Krippendorff, K. 2004. Content Analysis: An Introduction to Its Methodology (2nd ed.). Thousand Oaks, CA: Sage.

Kurniawan, S. and Zaphiris, P., 2005, October. Derived Web Design Guidelines For Older People. In Proceedings of the 7th international ACM SIGACCESS conference on Computers and accessibility (pp. 129-135). ACM.

Lakoff, G., and Johnson, M. 1980. Metaphors We Live By. Chicago: University of Chicago Press.

Lakoff, G., 1993. The Contemporary Theory of Metaphor. Cambridge University Press.

Lee, Y. S. 2007. Older Adults' User Experiences with Mobile Phones: Identification of User Clusters and User Requirements, Thesis of Doctor of Philosophy, Faculty of the Virginia Polytechnic Institute and State University, USA.

Leonard, V.K., Jacko, J.A., and Pizzimenti, J.J. 2005. An Exploratory Investigation of Handheld Compuer Interaction for Older adults with Visual Impairments. Proc. ASSETS 2005, 12-19

library/windowsphone/design/hh487169%28v=vs.105%29.aspx (Accessed 11 December 2015).

Li, Y., Klemmer, S. and Landay, J.A. 2008. Tools for Rapidly Prototyping Mobile Interactions, Handbook of Research on User Interface Design and Evaluation for Mobile Technology, January 2008.

Light, P.C. 1988. Baby Boomers. New York, United States of America: Norton.

Light, K. E. and Spirduso, W.W. 1990. Effects of Adult Aging on the Movement Complexity Factor of Response Programming, Journal of Gerontology, Volume 45, Issue 3, May 1990, pp. 107–P109, https://doi.org/10.1093/geronj/45.3.P107

Likert, R., 1932. A Technique for the Measurement of Attitudes. Archives of psychology.

Lindgaard, G., and Whitfield, T.W.A. 2004. Integrating Aesthetic within Evolutionary and Psychological Framework. Theoretical Issues in Ergonomic Science, 5, pp. 73-90.

Long, J. and Whitefield, A. 1989. Cognitive Ergonomics and Human-Computer Interaction, USA: Cambridge University Press.

Luoh, M.C. and Herzog, A.R. 2002. Individual Consequences of Volunteer and Paid Work in Old Age: Health and Mortality, Journal of Health and Social Behavior 43, no. 4 (2002): 490-509.

Marcus, A., 2003. Icons, symbols, and signs: Visible languages to facilitate communication. Interactions, 10(3), pp.37-43.

Maguire, M. and Osman, Z., 2003. Designing for Older and Inexperienced Mobile Phone Users. In Proceedings of HCI International, pp. 22-27. New Jersey: CRC Press.

Malik, S.A. and Edwards, A.D., 2008. Mobile HCI and older population. In HCI and the Older Population, Workshop at the HCI 2008 (pp. 21-22).

Massimi, M., Baecker, R., and Wu, M. 2007. Using Participatory Activities with Seniors to Critique, Build, and Evaluate Mobile Phones. In Proceedings of the 9th international ACM SIGACCESS conference on Computers and accessibility, Pages 155-162, Arizona, USA. ACM.

McCarley, J.S., Kramer, A.F., Colcombe, A.M. and Scialfa, C.T., 2004. Priming of pop-out in visual search: A comparison of young and old adults. Aging, Neuropsychology, and Cognition, 11(1), pp. 80-88.

Mihailidis, A., Boger, J., H. Kautz, H. 2008. Technology and Aging: Selected Papers from the 2007 International Conference on Technology and Aging. In International Conference on Technology and Aging, ISBN 978-1-58603-815-1, Amsterdam, IOS Press. http://site.ebrary.com/id/10216836.

Mitzner, L.T., et al. 2010. Older Adults Talk Technology: Technology Usage and Attitudes, Journal of Computers in Human Behavior, Vol.26, No.6, Pages 1710–1721.

Moran, T.P. 1981. The Command Language Grammar: A Representation for the User-Interface of Interactive Systems. Int. Journal of Man-Machine Studies Vol. 15 (1), pp. 3-50.

Mortensen, D. 2019, The Basics of Recruiting Users for Usability Testing, Interaction Design Foundation. https://www.interaction-design.org/literature/article/the-basics-of-recruiting-users-for-usability-testing. Accessed 19 November 2019

Mortensen, D. 2019. Pros and Cons of Conducting User Interviews. Interaction Design Foundation,https://www.interaction-design.org/literature/article/pros-and-cons-of-conducting-user-interviews. Accessed 02 November 2019

Murphy, C., 2018. A Comprehensive Guide To Wireframing And Prototyping: Smashing Magazine https://www.smashingmagazine.com/2018/03/guide-wireframing-prototyping/ (Accessed 20 March 2019)

Murata, A. and Iwase, H., 2005. Usability of touch-panel interfaces for older adults. Human factors, 47(4), pp.767-776.

Nagel, D. 2011. Will Smart Phones Eliminate The Digital Divide? The journal: Transforming Education Through Technology. https://thejournal.com/articles/2011/02/01/will-smart-phones-eliminate-the-digital-divide.aspx (accessed 19 March 2015).

Nielsen, J. and Landauer, T.K., 1993, May. A mathematical model of the finding of usability problems. In Proceedings of the INTERACT'93 and CHI'93 conference on Human factors in computing systems (pp. 206-213). ACM.

Nielsen, J. 1994. Usability Engineering. Morgan Kaufmann, San Francisco - USA

Nielsen, J. 2006. Growing a Business Website: Fix the Basics First https://www.nngroup.com/articles/design-priorities/ (Accessed 20 October 2019)

Nielsen, J. 2012. Usability 101: Introduction to Usability. Nielsen Norman Group.

Nielsen, J. and Molich, R. 1990. Heuristic evaluation of user interfaces. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 249-256). ACM.

Nodder, C. 2015.Turning Questions into Tasks, Retrieved from: https://www.lynda.com/User-Experience-tutorials/Foundations-UX-Usability-Testing/421803-2.html. Accessed 13 April 2019.

O'Connel, T.A. 2007. The Why and How of Senior-Focused Design. In Lazar, J. (ed.), Universal Usability: Designing Interfaces for Diverse Users. NJ, USA: John Wiley and Sons, Ltd.

Oborne, D.J. 1987. Ergonomics At Work, Wiley,2nd ed. Chichester West Sussex ; New York.

Omori, M., Watanabe, T., Takai, J., Takada, H., and Miyao, M. 2002. Visibility and Characteristics of Mobile Phones for Elderly People. Behavior & Information Technology, 21(5), 313-316 in People and Computers. XI Springer-Verlag, London, UK , 1996, pp.19-33.

Pak, R., McLaughlin, A. 2011. Designing Display for Older Adults. Boca Raton: CRC Press.

Patrick, K., Griswold, W. G., Raab, F., Intille, S. S. 2008. Health and the Mobile Phone. American Journal of Preventive Medicine 35(2), pp 177-181.

Papadakis, S. 2007. Technological convergence: Opportunities and Challenges. Ensayos de la Unión Internacional de Telecomunicaciones. Recuperado de http://www. itu. int/osg/spu/youngminds/2007/essays/PapadakisSteliosYM2007.pdf (Accessed 12 November 2014).

Patton, M. Q. 2002. Qualitative Evaluation and Research Methods (3rd ed.). Newbury Park, CA: Sage Publications.

Pedlow, R., Kasnitz, D. and Shuttleworth, R., 2010. Barriers to the adoption of cell phones for older people with impairments in the USA: Results from an expert review and field study. Technology and Disability, 22(3), pp.147-158.

Potter, S., and Roth, E., Woods, D., Elm, W. 2000. Bootstrapping Multiple Converging Cognitive Task Analysis Technique for System Design. In Chipman S.F., Shalin, V. L., Schraagen, J. M (Eds). Cognitive Task Analysis, p. 317-340. New Jersey: Lawrence Erlbaum Associates.

Punchoojit, L and Hongwarittorrn, N. 2017. Usability Studies on Mobile User Interface Design Patterns: A Systematic Literature Review, Advances in Human-Computer Interaction, vol. 2017, https://doi.org/10.1155/2017/6787504.

Ravden, S. and Johnson, G., 1989. Evaluating usability of human-computer interfaces: a practical method. Halsted Press.

Rheinfrank, J. J., Hartman, W. R., Wasserman, A. 1996. Design for Usability: Creating Strategy for the Design of A New Generation of Xerox Copier. In Usability: Turning Technology into Tools pp. 15-40, USA, NY: Oxford University Press.

Rogers, Y. 1989. Icons at the Interface: Their Usefulness. Interacting with Computers, Vol. 1(1) - Apr. 1989, pp. 105–117.

Roth, S. 1999. The State of Design Research. Design Issues, 15(2), pp. 18-26

Roth, E., Patterson, E. 2005. Using Observational Study as a Tool for Adaptive Strategies. In Montgomery, H., Lipshitz, R., Brehmer, B (Eds.). In: How Professionals Made Decisions. Mahwels: Lawrence Erlbaum Association.

Roto, V., Law, E., Vermeeren, A., Hoonhout, J. 2011. Bringing clarity to the concept of User Experience,in: http://www.allaboutux.org/files/UX-WhitePaper.pdf (Accessed 02 November 2019)

Rowan, R. M. 2013. Cross-Cultural Technology Design: Creating Culture-sensitive Technology for Local Users. Huatong Sun. Technical Communication Quarterly, 22:2, pp. 191-194, doi: 10.1080/10572252.2013.733672, New York, NY: Oxford UP, 2012.2.

Ruben, J. and Chisnell, D. 2008. Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests, Wiley, Indianapolis.

Russo, P. and Boor, S. 1993. How Fluent is Your Interface? Designing for International Users. In: Conference Proceedings of the Conference on Human Factors in Computing Systems, pp. 342–347. Boston, US, Addison-Wesley Longman Publishing.

Sanoff, H. 2001. Community Participation in Methods, in Design and Planning. New York: John Wiley & Sons Inc.

Schensul, J.J. 1999. Focused group interviews. J. J. SCHENSUL; MD LECOMPTE; BBK NASTASI; S. P. BORGATTI (eds.). Enhanced ethnographic methods: Audiovisual techniques, focused group interviews, and elicitation techniques. London: Altamira Press, pp.51-114.

Shade, S. 2015. Pilot Testing: Getting It Right (Before) the First Time, Nielsen Norman Group, Retrieved from: https://www.nngroup.com/articles/pilot-testing/. (Accessed 03 May 2019).

Sharma, S., Singh, P., Sharma, R., Aditya, M. 2012. GAe Based User Interface in Mobile Operating System. International Journal of Computer Science, Engineering and Applications (IJCSEA), pp. 177-184

Shadiev, R., Hwang, W.Y., and Huang, Y. M. 2015. Pilot Study: Facilitating Cross Cultural Understanding with Project-Based Collaborative Learning in an Online Environment. Australasian Journal of Educational Technology 31(2).

Shank, G and Darke, P. 1999. Understanding Corporate Data Models, Information and Management, 35(1), pp. 19-30.

Shedroff, N. 2001a. Experience Design 1. Indianapolis, USA: New Riders.

Shedroff, N. 2001b. Elements of Experience Design. Peachpit Pearson http://www.peachpit.com/articles/article.aspx?p=23343 (Accessed 10 October 2017).

Shneiderman, B. and Plaisant, C. 2009. Designing the User Interface: Strategies for Effective Human–Computer Interaction, 5th ed. USA, Addison-Wesley, Pearson.

Siau, K. 2005. Human-computer interaction: The effect of application domain knowledge on icon visualization. Journal of Computer Information Systems, 45(3), pp. 53-62.

Siek, K.A. 2008. Mobile Design for Older Adults. In Handbook of Research on User Interface Design and Evaluation for Mobile Technology, Vol. 1, Lumsden, J. (ed.), Aston University, London, UK: IGI Global.

Snyder, C. 2003. Paper Prototyping: The Fast and Easy Way to Design and Refine User Interfaces. USA: Morgan Kaufmann.

Smith, S.L and Mosier, J.N. 1986. Application of guidelines for designing user interface software. Behaviour & information technology, 5(1), pp. 39-46.

Sonderegger, A., Schmutz, S. and Sauer, J. 2016. The influence of age in usability testing. Applied Ergonomics, 52, pp. 291-300.

Statista. 2014. Smartphone user penetration in Indonesia as share of mobile phone users from 2014 to 2019*. Retrieved from: https://www.statista.com/statistics/257046/smartphone-user-penetration-in-indonesia/ (Accessed: 11 November 2014)

Statista. 2015. Number of Smartphone users in Indonesia from 2011 to 2018 (in millions). www.statista.com/statistics/266729/smartphone-users-in-indonesia/ (Accessed 30 April 2015)

Statista, 2017. Market share of mobile operating systems in Indonesia from January 2012 to June 2019*. Retrieved from: https://www.statista.com/statistics/262205/market-share-held-by-mobile-operating-systems-in-indonesia/ (Accessed 01 April 2017)

Strengers, J. 2012. Smartphone interface design requirements for seniors, in Information Studies, `University of Amsterdam: Amsterdam.

Stubbs, G. 2012. “Baby Boomers: The Greatest Untapped Opportunity For Marketers”. Mi9, http://mi9.com.au/blog.aspx?blogentryid=1101760&showcomments=true (accessed 05 September 2014).

Suoranta, M. and Mattila, M. 2004. Mobile Banking and Consumer Behavior: New insights Into the Diffusion Pattern, Journal of Financial Services Marketing 8, pp. 354 – 366.

Sydney Morning Herald. 2016. Australia at 24 million: The challenges facing a growing and ageing nation. from: http://www.smh.com.au/comment/australiaat-24-million-high-points-and-hazards-in-the-demographic-data-20160212-gmszk2.html. (Accessed 23 February 2019)

Tan, J. Ward, W. and Ziaian, T. 2010. Experiences of Chinese Immigrants and Anglo-Australians Ageing in Australia: A Cross-cultural Perspective on Successful Ageing, Scars, Journal of Health Psychology, 15(5), pp. 679-706.

Tang, H.H., and Kao, S.A. 2005. Understanding the real need of the elderly people when using mobile phone. In: Human–Computer Interaction International Conference.

Thurmond,V.A. 2001. The Point of Triangulation. Kansas City, KS: University of Kansas Medical Center.

Thompson, C. J., Locander, W.B. and Howard R. Pollio, H. R. 1989, "Putting Consumer Experience Back into Consumer Research: The Philosophy and Method of Existential-Phenomenology," Journal of Consumer Research, 16 (September), pp. 133-147.

Tsai, C-C. 2009. Conceptions of learning versus conceptions of web-based learning: The differences revealed by college students. Vol. 53, Issue 4, December 2009, Pp. 1092-1103. Elsevier

Tsai, S.Y., Kuo, C.J., Chung, K.H., Huang, Y.L., Lee, H.C. and Chen, C.C., 2009. Cognitive dysfunction and medical morbidity in elderly outpatients with bipolar disorder. *The American Journal of Geriatric Psychiatry*, *17*(12), pp.1004-1011.

Tseng, J. 2017. User Experience: Discovery and Research. https://medium.com/@judytseng/introduction-to-ux-design-process-90f198b9f6d9. (Accessed 10 November 2019)

Turner, N.2019. UX for The Masses (http://www.uxforthemasses.com). In: Veal, R. L. 2019. How to Conduct User Experience Research Like A Professional. Retrieved from: https://careerfoundry.com/en/blog/ux-design/how-to-conduct-user-experience-research-like-a-professional/ (Accessed

Umemuro, H. 2004. Lowering Elderly Japanese Users' Resistance Towards Computers by Using Touchscreen Technology. London: Springer - Verlag.

United Nations. 2013. World Population Ageing 2013. Department of Economics and Social Affairs. Retrieved from: http://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2013.pdf (Accessed 02 April 2015).

Usability.gov. 2013. Retrieved from: https://www.usability.gov/what-and-why/usability-evaluation.html

User Experience Professionals' Association. 2012. Usability Body of Knowledge. Retrieved from: https://www.usabilitybok.org/cognitive-task-analysis/ (Accessed 20 April 2019).

Van der Veer, G.C. 2008. Cognitive Ergonomics in Interface Design-Discussion of a Moving Science. J. UCS, Vol. 14(16), pp. 2614-2629.

Vierra, T. 2014. Communications Consultant, “Smartphone & Tablet Ergonomics”. Neighborhood Market Association, http://neighborhoodmarket.org/smartphone-and-tablet-ergonomics (Accessed 19 November 2015).

Ware, C. 2004. Information Visualization. San Francisco, CA: Morgan Kaufmann Publishers, Christopher North.

Weinschenk, S. 2011. 100 Things Every Designer Needs to Know About People. New Riders, United States of America.

Westrenen, F. V. 2010. Cognitive Work Analysis and The Design of User Interface: Cognition, Technology & Work, 2011, Vol.13(1), pp. 31-42, Springer-Verlag, London - UK.

Wiedenbeck, S. 1999. The use of icons and labels in an end user application program: an empirical study of learning and retention. Behaviour & Information Technology, Vol. 18(2), pp. 68-82.

Wilson, C. 2013. Interview techniques for UX practitioners: A User-Centered Design Method. Newnes.

Whitenton, K. 2013. Minimize Cognitive Load to Maximize Usability, Nielsen Norman Group, https://www.nngroup.com/articles/minimize-cognitive-load/ (Accessed 20 June 2016).

Worldometer. 2014. Current World Population. Retrieved from: http://www.worldometers.info/world-population/ (Accessed 26 November 2014).

Wei, J., and Salvendi, G. 2004. The Cognitive Task Analysis Methods from Job and Task Design: Review and Reappraisal. Behaviour Information Technology 34(4), pp. 273-199.

Veal, R. L. 2019. How to Conduct User Experience Research Like a Professional. Retrieved from: https://careerfoundry.com/en/blog/ux-design/how-to-conduct-user-experience-research-like-a-professional/ (Accessed 01 November 2019)

Victorian Government. 2019. Research user experience (UX) - Digital Standards, How to find out what your users actually need and avoid assumptions. Retrieved from: https://www.vic.gov.au/research-user-experience-ux (Accessed 21 November 2019)

Yamasaki, Y. and Kayes, D. C. 2004. An Experimental Approach to Cross Cultural Learning: A Review and Integration of Competences for Successful Expatriate Adaptation. Academy of Management Learning and Education Vol. 3(4), pp. 360-379.

Zhang, L & Yuan, X & Wang, L & Dong, D. 2007. Design and Implementation of Ergonomics Evaluation System of 3D Airplane Cockpit. 1047-1055. 10.1007/978-3-540-73321-8_117.

Appendices

An Investigation of Cognitive Ergonomics Framework
of Smartphone User Interface Design
for Late Adulthood Users

by Alfandi Nugroho Yahya
© 2017

List of Appendices

Appendix A. Ideation

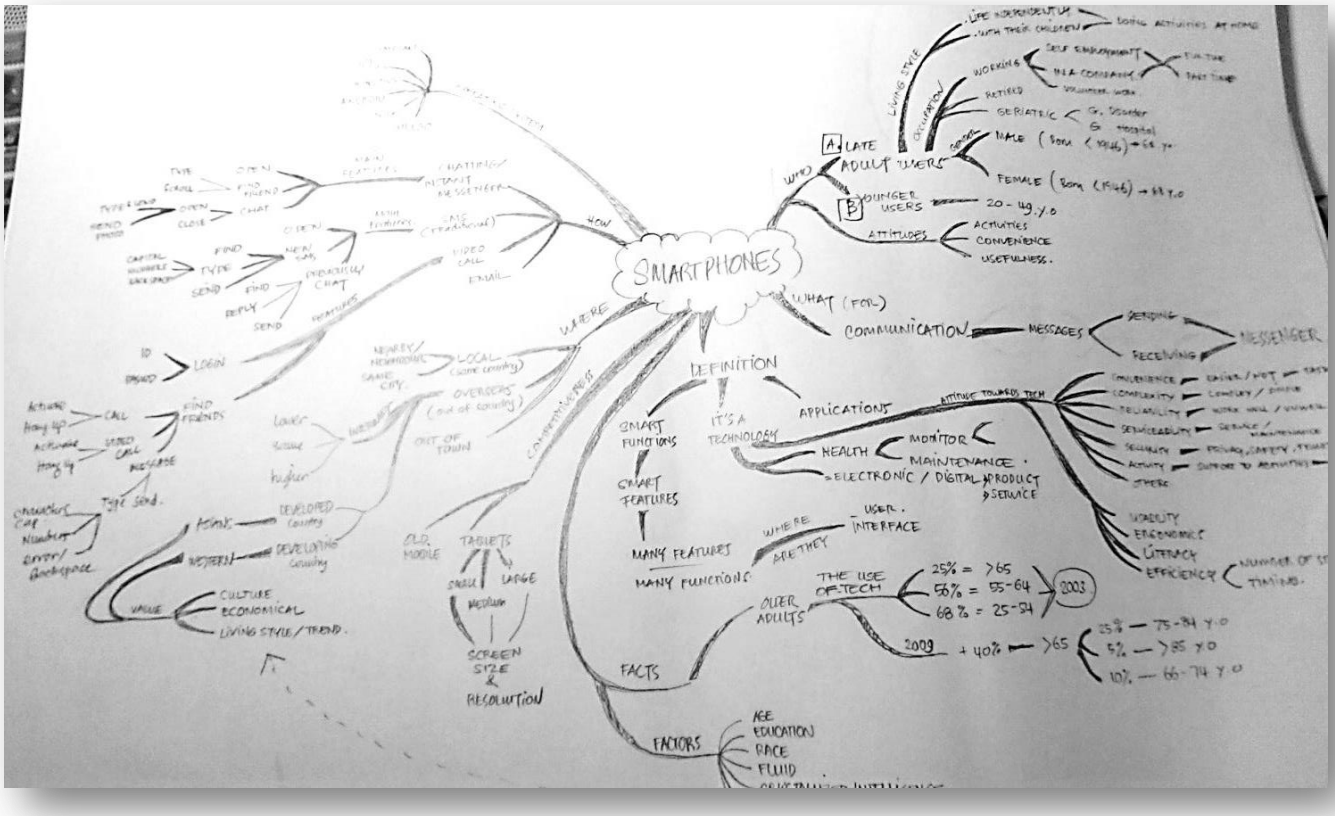


Figure A.1. Ideation and Design Thinking

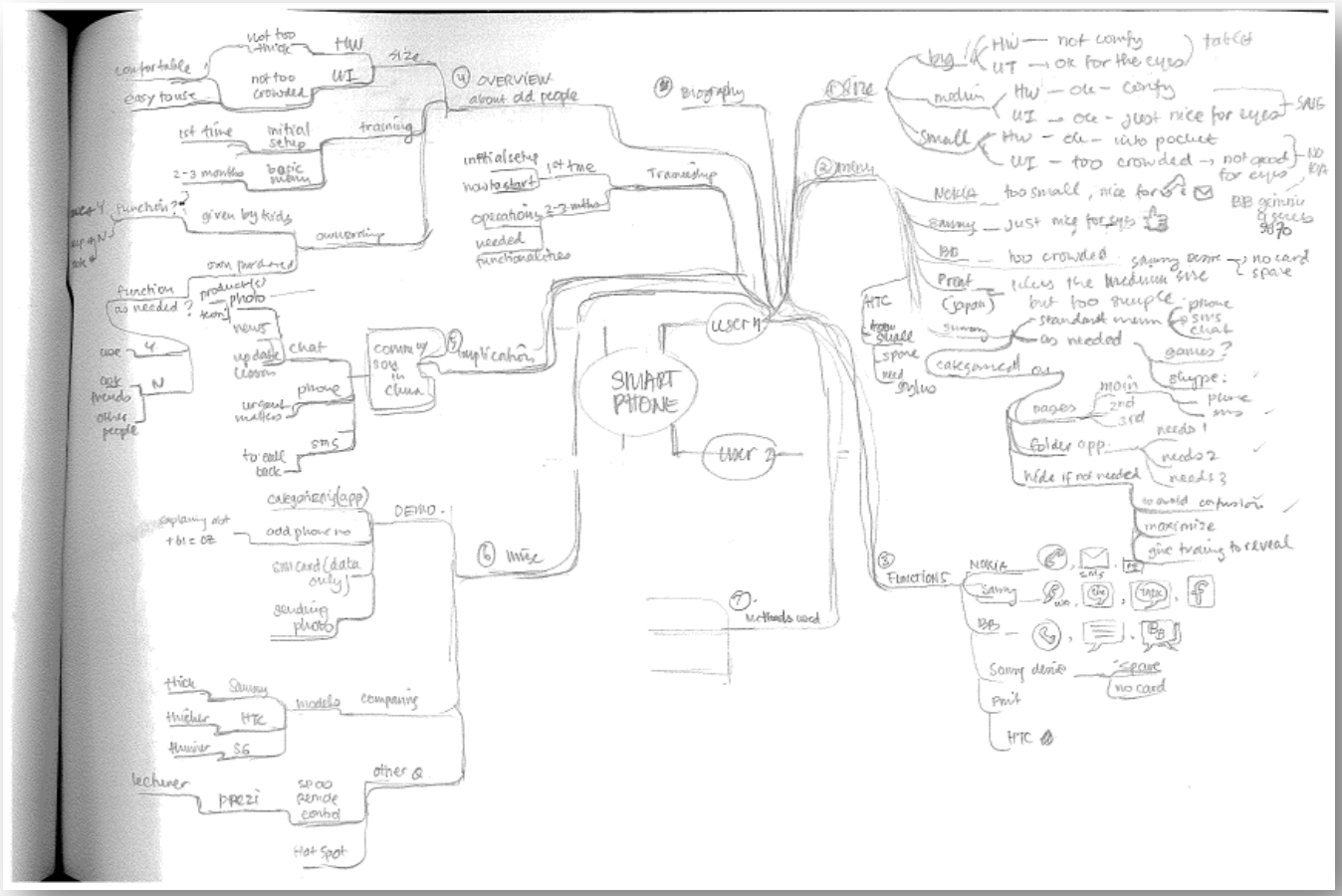


Figure A.2. Ideation and Design Thinking 2

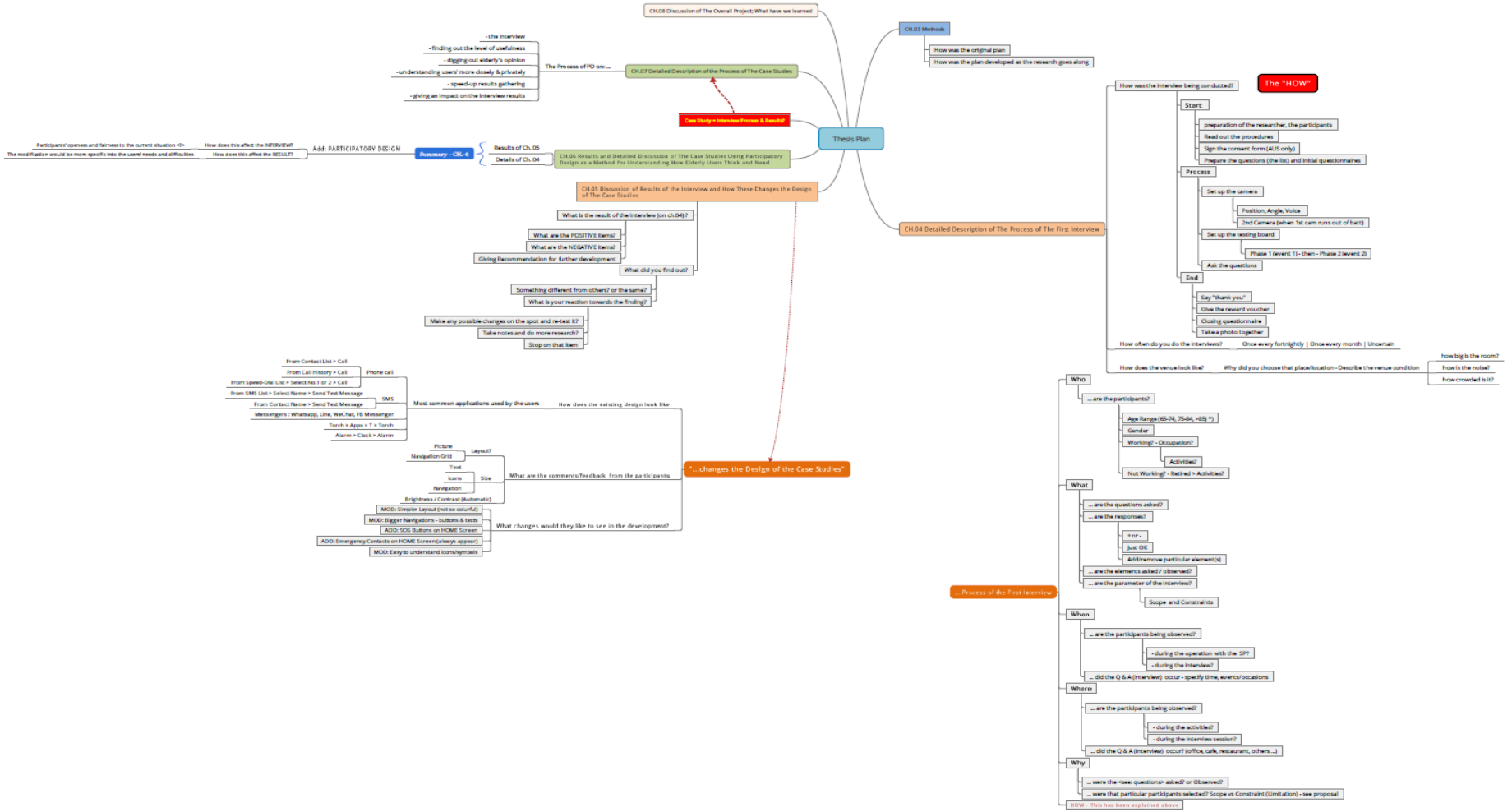


Figure A.3. Overall Thesis Structure

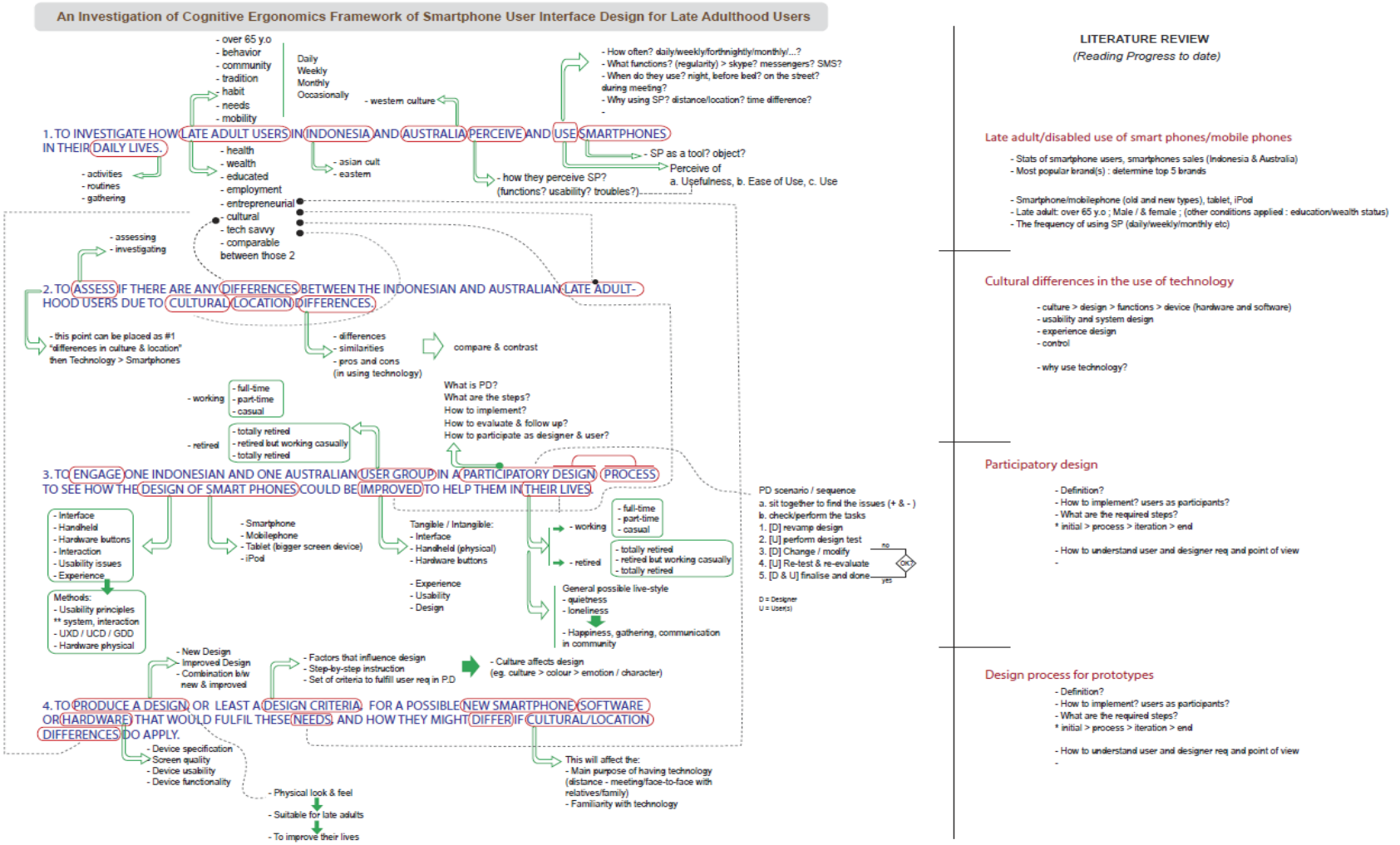


Figure A.4. Thesis Structure and linkage to sub-points

Appendix B. Testing Board Evaluation Materials

Figure B.1. Initial Data Gathering – Existing Phone Models

Phase 1 Interview – Testing Board

Figure B.2. Testing Board Page 1

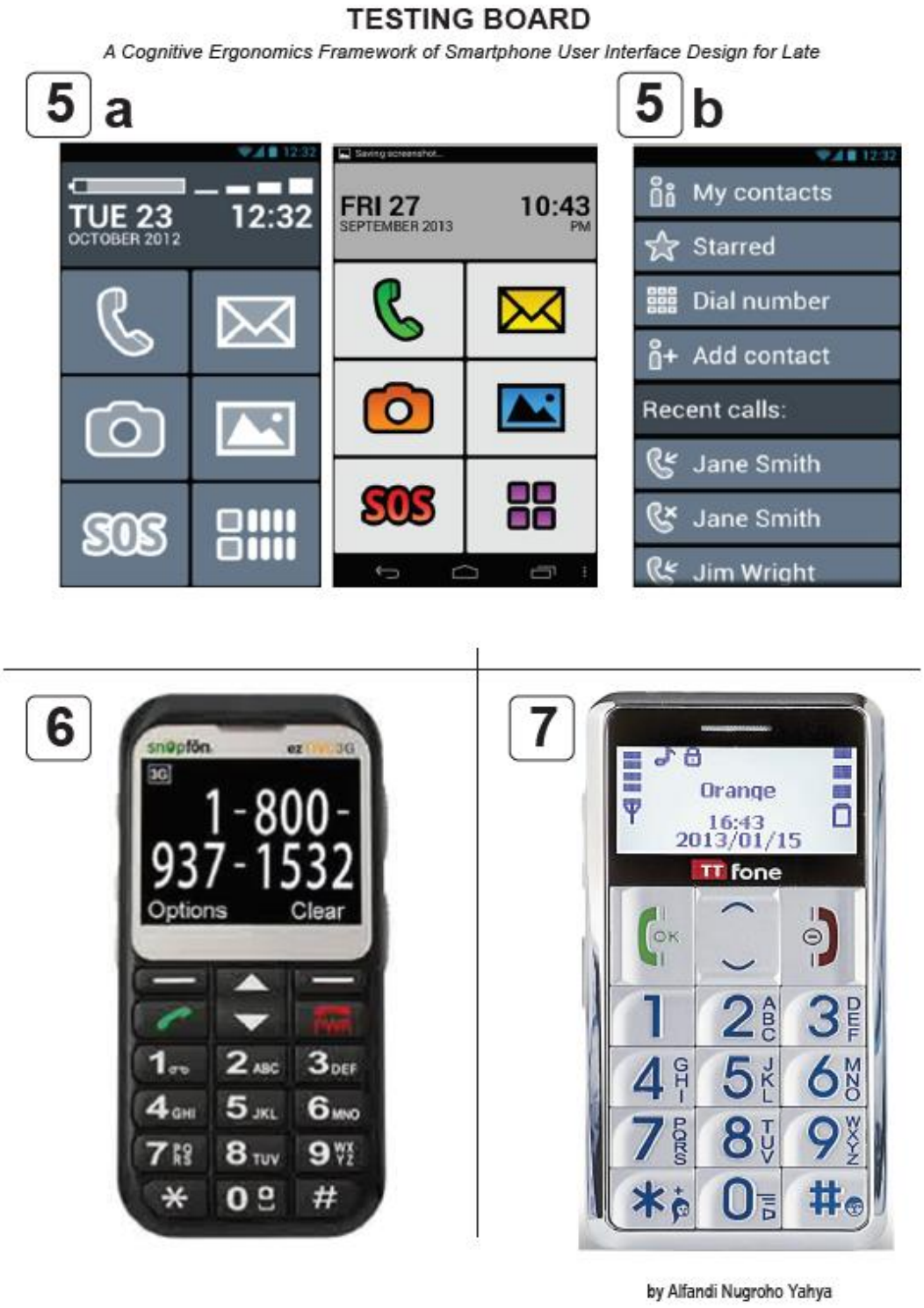


Figure B.3. Testing Board Page 2

Figure B.4. Testing Board Page 3

Appendix C. Participants Profiles and Phones

INA (1 = Very Low, 2 = Low, 3 = Medium, 4 = High, 5 = Very High) – INA = INDONESIA

Part. No.	Age	Sex	No. of devices	Working(W)/ Retired (R)	Technology Literacy/Skill	Smartphone Literacy/Skill	Software/UI Issues	Hardware Issues	Overall Complain (5 = very high complain)
1	71	M	7 (4 old)	W	5	4	2	1 batt,data	1
2	72	M	3 (1 old, 1 Tab)	W	5	5	1	1 data,screenSize	2
3	93	F	1 (old phone)	R	3	2	2	2 physical	5 too difficult
4	72	M	1	R	4	3	3	3 physical	2
5	74	F	2 (1 old)	W	2	1	5	4 physical-remote	4 difficult to use
6	67	M	3	R	4	4	2	2 IoT CISCO	2
7	75	F	4 (1 Tab)	R	4	4	2	2 physical	3
8	78	M	4 (1 Tab)	R	1	2	4	3 physical, tablet	4
9	68	M	4 (1 Tab)	W	4	3	3	2 access thumb	2
10	67	F	3 (1 Tab)	W	3	3	3	2 keyboard	2

AUS *(1 = Very Low, 2 = Low, 3 = Medium, 4 = High, 5 = Very High) – AUS = AUSTRALIA*

Part. No.	Age	Sex	No. of phones	Working(W)/ Retired (R)	Technology Literacy/Skill	Smartphone Literacy/Skill	Software/UI Issues	Hardware Issues	Overall Complain (5 = high complain)
1	70	F	1 (iPhone)	W	3	3.5	3.5	5 vol button	3
2	70	F	1 (iPhone)	W	3	3.5	3	3 FB access	2
3	72	M	1 (iPhone)	W	3	2	2	2 BG vs FG	5 too difficult
4	67	M	1 (iPhone)	W	4	3	2	3 vol	2
5	72	M	2 (iPhones)	W	4	5	1	2 siri	1
6	72	F	1 (iPhone)	R	2	2.5	4	2 Fat finger	3
7	80	F	1 (Smsung)	R	2	2.5	4	4 Fat finger	5
8	80	F	1 (iPhone)	R	2	2.5	4	3 eyes	5
9	71	M	1 (Hua Wei)	R	3	3	2	3 fat finger	2
10	74	M	1 (iPhone)	R	2	3	3	4 fat finger	3

Figure C.1. Participants Profiles and Phones Ownership Assessment

Appendix C. 1. Participants' Profiles from INDONESIA

Participant No. /Code	01/IH	**Location**	Indonesia
Period of Interview	07 July 2018	**Education**	Professor
Age Range	70–75 (exact age is 71)	**Occupation**	GP (TCM)
Gender	Male	**Other info**	GP community member, Consultant, Lecturer
Device used 1	O2	**OS**	Symbian
Device used 2 & 3	Samsung (Galaxy S4 and Ace Series)	**OS**	Android
Device used 4 & 5	Nokia 3310 & 3350	**OS**	Symbian
Device used 6	Blackberry	**OS**	Blackberry RIM
Device used 7	ZTE (Chinese Smartphone)	**OS**	Symbian with Chinese Operating System

Participant No. /Code	02/AS	**Location**	Indonesia
Period of Interview	08 July 2018	**Education**	Electrical and Mechanical Engineer
Age Range	70–75 (exact age is 72)	**Occupation**	Senior ME building consultant
Gender	Male	**Other info**	Freelancer
Device used 1	Lenovo YOGA Tab-3 – 8 inch	**OS**	Android
Device used 2	Xiaomi Mi-4	**OS**	Android, Chinese Version
Device used 3	NOKIA 1200	**OS**	Old Nokia OS

Participant No./ Code	03/TY	**Location**	Indonesia
Period of Interview	08 July 2018	**Education**	High School
Age Range	90–95 (exact age is 93)	**Occupation**	Housewife
Gender	Female	**Other info**	Member of the church choir, swimming club for old people, and yoga
Device used	Very old Nokia – used to have it a long time ago	**OS**	NOKIA Symbian

Participant No./ Code	04/CN	**Location**	Indonesia
Period of Interview	13 July 2018	**Education**	Bachelor
Age Range	70–75 (exact age is 72)	**Occupation**	Formerly a Magician
Gender	Male	**Other info**	There is a little issue with his memory capability.
Device used 1	Samsung Galaxy Ace (taking turns with wife)	**OS**	Android

Participant No. /Code	05 /RN	**Location**	Indonesia
Period of Interview	09 July 2018	**Education**	Dentistry
Age Range	70–75 (exact age is 74)	**Occupation**	Dentist

Gender	Female	**Other info**	Church choir, elderly church community, elderly sport community
Device used 1	Samsung Galaxy Ace	**OS**	Android
Device used 2	iPad	**OS**	iOS

Participant No. /Code	06/KY	**Location**	Indonesia
Period of Interview	12 July 2018	**Education**	Master of Science (Statistics and Mathematics)
Age Range	65–70 (exact age is 67)	**Occupation**	Lecturer in statistics, mathematics and science, senior consultant in statistics and economics.
Gender	Male	**Other info**	Church community, economics expert/consultant forum, business analyst and consultant.
Device used 1	Samsung S3	**OS**	Android
Device used 2	NOKIA Lumia	**OS**	Windows 8 for Mobile
Device used 3	Microsoft Phone	**OS**	Windows 10 for Mobile

Participant No. /Code	07/SS	**Location**	Indonesia
Period of Interview	14 July 2018	**Education**	High School
Age Range	75–78 (exact age is 75)	**Occupation**	Housewife
Gender	Female	**Other info**	Owned a Home-Business
Device used 1	Nokia 7230 (White)	**OS**	Symbian
Device used 2	Nokia 3500 (Black)	**OS**	Symbian
Device used 3	Tablet – Samsung 7”	**OS**	Android
Device used 4	iPad *) – belongs to SS’s child	**OS**	iOS
Note	Shared use of smartphone devices including the tablet. Wi-Fi is currently installed at SS’s home.		

Participant No. /Code	08/KF	**Location**	Indonesia
Period of Interview	14 July 2018	**Education**	GP in Traditional Chinese Medicine
Age Range	75–80 (exact age is 78)	**Occupation**	KF was a GP in Chinese Medicine
Gender	Male	**Other info**	Owned a home-business industry
Device used 1	Nokia 7230 (White)	**OS**	Symbian
Device used 2	Nokia 3500 (Black)	**OS**	Symbian
Device used 3	Tablet – Samsung 7”	**OS**	Android
Device used 4	iPad *) – this device belongs to KF’s children	**OS**	iOS
Note	Shared use of smartphone devices including the tablet. A fast internet connection is installed at home.		

Participant No. /Code	09/SY	**Location**	Indonesia
Period of Interview	16 July 2018	**Education**	Architect

Age Range	65–70 (exact age is 68)	**Occupation**	Entrepreneur, Businessman
Gender	Male	**Other info**	Types of business: electrical, mechanical, telecommunication; Supplier & distributor
Device used 1	Samsung Galaxy S3	**OS**	Symbian
Device used 2	Samsung Galaxy A5	**OS**	Android
Device used 3	Samsung Tablet 7”	**OS**	Android for Tablet
Device used 4	Blackberry Onyx 2	**OS**	Blackberry

Participant No. /Code	10/TF	**Location**	Indonesia
Period of Interview	16 July 2018	**Education**	N/A
Age Range	65-70 (exact age is 67)	**Occupation**	Housewife, Entrepreneur
Gender	Female	**Other info**	Involving in electrical trading
Device used 1	Nokia 8300 – Touch Screen, Slide Phone	**OS**	Symbian
Device used 2	CDMA Phone	**OS**	Android
Device used 3	Samsung Tablet 7”	**OS**	Symbian for CDMA

Appendix C. 2. Participants from AUSTRALIA

Participant No. /Code	01 / FO	**Location**	Australia
Period of Interview	08 August 2018	**Education**	Law Degree
Age Range	70–75 (exact age is 70)	**Occupation**	Lawyer, Legal Advisor
Gender	Female	**Other info**	Government officer
Device used 1	iPhone 6S	**OS**	iOS

Participant No./Code	02 / JO	**Location**	Australia
Period of Interview	10 August 2018	**Education**	Not specified
Age Range	70–75 (exact age is 70)	**Occupation**	Community Service Admin
Gender	Female	**Other info**	
Device used 1	Galaxy Ace – owned by JO wife	**OS**	Android
Note	JO uses smartphone most of the time, takes turns with her husband once a while.		

Participant No./Code	03 / JH	**Location**	Australia
Period of Interview	10 August 2018	**Education**	Engineer
Age Range	75-80 (exact age is 80)	**Occupation**	Retired
Gender	Male	**Other info**	Helping out his wife in the community centre
Device used 1	Galaxy Ace – owned by his wife	**OS**	Android
Note	JH takes turns on his wife's smartphone.		

Participant No./Code	04/QQ	**Location**	Australia
Period of Interview	30 September 2018	**Education**	Bachelor Degree
Age Range	65–70 (exact age is 67)	**Occupation**	Entertainer
Gender	Male	**Other info**	N/A
Device used 1	iPhone 6	**OS**	iOS

Participant No./Code	05/CW	**Location**	Australia
Period of Interview	03 October 2018	**Education**	Not specified
Age Range	70–75 (exact age is 72)	**Occupation**	Retired, traveller, entertainer
Gender	Male	**Other info**	Work as a freelance tour guide
Device used 1	iPhone 5	**OS**	iOS
Device used 2	iPhone 6S+	**OS**	iOS

Participant No. /Code	06/GO	**Location**	Australia
Period of Interview	12 September 2018	**Education**	Not specified
Age Range	70–75 (exact age is 72)	**Occupation**	Retired – in a retirement village
Gender	Female (represented by her nephew)	**Other info**	N/A
Device used 1	Samsung Galaxy S6	**OS**	Android

Note	Representing auntie

Participant No. /Code	07/AN	**Location**	Australia
Period of Interview	12 September 2018	**Education**	Not specified
Age Range	75–80 (exact age is 80)	**Occupation**	Retired
Gender	Female	**Other info**	
Device used 1	Samsung Galaxy S6	**OS**	Android
Note	This user is acting on behalf of his relatives (parents and auntie)		

Participant No./Code	08/SL	**Location**	Australia
Period of Interview	31 August 2018	**Education**	Not specified
Age Range	70–75 (exact age is 71) 75–80 (exact age is 80)	**Occupation**	Retired, but living at home
Gender	Female	**Other info**	
Device used 1	Samsung Galaxy (model is N/A)	**OS**	Android
Note	This user is acting on behalf of parents and auntie.		

Participant No. /Code	09/LE	**Location**	Australia
Period of Interview	02 October 2018	**Education**	Engineer
Age Range	70–75 (exact age is 71)	**Occupation**	Freelance consultant
Gender	Male	**Other info**	Works 2 days a week – Wednesday, Thursday
Device used 1	Huawei	**OS**	Android
Device used 2	iPad	**OS**	Apple iOS

Participant No. /Code	10/KI	**Location**	Australia
Period of Interview	16 September 2018	**Education**	Economics/accounting
Age Range	70–75 (exact age is 74)	**Occupation**	Retired
Gender	Male	**Other info**	Born in Hong Kong, Citizen of Australia.
Device used 1	iPhone 5	**OS**	iOS

Appendix D. Participants Evaluation on Testing Board and their phones

Participant no. 1 (IH)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model No. 2	• Attractive Display • Easy-to-recognise icons and symbols • Better display colour (colour combination) and device shape design	Maintain the attractiveness of the display properties.
2.	Model No. 1	• Standard design and phone shape to be considered as a smartphone	Standardize the shape design (at least for the elderly users).
General comments and suggestions o Maintain the aesthetic values on the display screen. o Display clarity is important for late adulthood users. o Icons and symbols should be meaningful.			

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1.	Smartphone icons and symbols	Memorizing icons and symbols meaning	• Icons and symbols should be meaningful and easy to understand. • Required guidance to understand the meanings
2.	Smartphone keyboard	Learn how to use the QWERTY keyboard on a touch-screen device	Practice and guidance
3.	Smartphones apps	Learn to interact with the other apps.	Practice and assistance

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1.	Smartphone with touch-screen & mobile phone with physical buttons	Make a phone call Send SMS	Keyboard with physical buttons are preferable A physical keypad is easier to operate than the touch-screen keyboard .

Participant no. 2 (AS)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 2	Colourful display screen	Maintain the coloured display
2.	Model no. 1	▪ Clear and clean layout ▪ Numbers (1-3) undefined ▪ Space under number 0 (zero) is undefined	Maintain the clarity

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1.	Smartphone	Phone, SMS, Phone Book	Shortcut to HOME, Daughter without having to mention specific names. Symbols could be used to represent these items
2.	Smartphone	WhatsApp, WeChat messengers	Simplify the instant messengers for typing and sending pictures
3.	Smartphone	Camera, Photo Gallery, Video	Maintain camera / video resolution. These could possibly be made in a higher resolution
4.	Smartphone & Tablet	Ms.Word, Excel, Powerpoint	Icons and symbols on the apps should be understood and more easily distinguished to perform the tasks more efficiently.
5.	Smartphone & Tablet	Youtube, Google Chrome	
6.	Smartphone & Tablet	Settings: Wi-Fi, Brightness - Contrast	

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1.	Smartphone	GPS Functions	Should be auto-enabled to track elderly position
2.	Smartphone	Torch	Installed as a default app.
3.	Smartphone	Emergency Buttons	Created to access relatives or police, ambulance, or hospital.
4.	Smartphone	Phone Book + Photos	
5.	Smartphone	Different device with the same OS	Alignment in the functions

Participant no. 3 (TY)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1	Model no. 3	Phone and camera buttons are clear and obvious. SOS button is clear, no idea of the real use. It is just a 'red' button	
2	Model no. 5		

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	Other Smartphone	Swipe L – R Slide Up – Down Zoom In – Out	Need assistance to perform these actions
2	Other Smartphone	Read the online news Text is too small Not comfortable to read text from a screen	Need assistance to: Enlarge the text Drag up and down Flick through the pages
3	Other Smartphone	Using the video call	Need assistance to find the app on the list and get the app turned on.

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	Smartphone	Confused with the buttons on the screen	Clear physical buttons are more convenient to use
2	Smartphone and Cell-Phone	• Afraid of making mistakes and getting nowhere to go. • No ability to troubleshoot when errors happen.	• Assistance is required to exit from the error. • Otherwise, turning off the phone would be the best solution.

Participant no. 4 (CN)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1	Model no. 4 & 6	Similar to the participant's first phone model. Recall the 'Snake' game	
2	Model no. 4 & 8	Clear display and text Physical keypad is more preferable	Need a shortcut to the phonebook due to frequent access.

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	Smartphone	Youtube	
2	Smartphone	Instant Messengers (Whatsapp)	
3	Smartphone	Media Player	
4	Smartphone	Browser (Pizza order)	Simplify the flow. Participant took 15 minutes to find the way to order pizza.

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	In-Car Audio Systems	These operations are performed in the car: - AM/FM Radio - CD/DVD Player - Remote car-keys	Smartphone should be designed with similar functions to the car audio systems. This is a way to recall the memory of the elderly users on how to operate technology

Participant no. 5 (RN)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 4	No.4 looks similar to the participant's first phone model which looks like a	

		brick.	
2.	Model no. 6		

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
		Phone Book access	Need assistance to store the person's contact details into the device. Bigger display is necessary to avoid accessing incorrect name.

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	Pager	• Easy to operate due to the limited number of device buttons. • Each device has physical buttons instead of touch-screen.	• Physical buttons are easier to use and operate. • Maintain the user experience of a technology, especially for the elderly users. • Prior experience to technology is essential for the elderly to use the next technology development.
2	Laptop & Projector		
3	Intercom units		
4	Handy-Talkie		

Participant no. 6 (KY)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1	Model no. 1	Clear and visible navigations	- Space and gaps between the buttons should be made bigger and more clear. - A 'drop-shadow' could help solve this.
2	Model no. 4 & 6	Considered to be very old models in the market. Only able to make phone calls and send	

		SMS, or play the 'snake' game.	

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1		Read online news	Keep the current size (at least for KY). Maintain the position of the page slider and the QWERTY touch-screen keyboard
2		Using the instant messengers (WhatsApp and Line)	
3		Youtube	Maintain the screen high resolution display (for the benefit of elderly users.
4		Camera & Photo Gallery	

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	Smartphone	Watching videos on Youtube and listen the audio via the internal speakers	Bigger and louder speaker should be necessary for elderly with hearing aids or low-hearing issues.
2	Smartphone	Setting up the ringtone volume to an optimum or maximum	
3	Smartphone	A vibrate feel when typing a message	This feature is to give sense of response when typing to the weakening of tactile touch.
4	Smartphone	Activate a vibration alert	It is useful to have the 'vibrate' mode for a noisy environment or an elderly person with a hearing impairment.

Participant no. 7 (SS)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1	Model no. 4 & 6	When making a phone call: - Keypad – big enough - Display – big enough - Keypad – clear layout, numbers and visibility	- Maintain the simple, big, clear and clean buttons to provide better access and touch. - No fancy buttons or navigation are needed.
2	Model no. 3 & 5	Interaction Large icons and buttons	

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	Mobile Phone	Making a phone call: - Need clear direction	Better flow is required to give better access
2	Tablet 7 inches	Instant messengers	Clean and clear display of text messages and numbers.
3	Tablet 7 inches	Camera and Photo Gallery	High resolution screen and picture outcomes are required.
4	Tablet 7 inches	Browser	Always need an assistance to go online.
5	Tablet 7 inches	Youtube	Required easier access to the video controls
6	Tablet 7 inches	Skype	Need assistance to login

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	Mobile phone and Tablet 7-inches	**Typing:** - Cannot feel the 'touch' when typing messages.	- Physical keypad or keyboard to give the 'feel-of-touch' - Keypad is better than a keyboard.
2	Mobile phone	**Alarm:** - Sometimes, participants cannot hear the alarm or system alert	A special decent internal loudspeaker needs to be installed for the elderly users with hearing issues.

Participant no. 8 (KF)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1	Model no. 1	- Screen: large - Icons: easy to understand (mostly) - Layout: consistent	- Maintain the screen size and resolution - Maintain the icons and symbols design - Maintain the page consistency (in the overall systems) - Maintain the physical buttons
2	Model no. 2		

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1		Setting: adjust the systems brightness and contrast	shortcuts
2		Browser (Google Chrome)	
3		**Youtube:** - Listen to songs - Access the full-screen view - Rotate the screen	Shortcuts

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	Tablet 7-inches	**Typing:** Using touch-screen keyboard versus the keypad	Physical buttons work best for KF
2	Tablet 7-inches	Controlling the ringtone volume on the hardware.	Accessibility to the hardware volume control is better than on the setting.

Participant no. 9 (SY)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1	Model no. 4 & 6	Big screen size, number and text	
2	Model no. 3 & 5	Big navigation buttons The buttons fit into the fingertips	

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	Smartphone & Tablet	Instant messengers (WhatsApp, Line, Facebook messenger)	All-in-one app
2	Smartphone & Tablet	Camera	Trying to operate the expert mode, but need more assistance
3	Smartphone & Tablet	Photo Gallery	Shortcut to enable editing
4	Smartphone & Tablet	Browser Big and comfortable display screen.	
5	Smartphone	Reading online news: - Different 'feel' of online and newspaper - Too much colour is distraction. - 5.5 inches display is suitable to read news.	Interaction should be improved on the online newspaper, such as flick through the pages.
6	Smartphone & Tablet	**Youtube:** Confusing icons and symbols on the player	An assistance is required to understand the icons and symbols on the Youtube player.
7	Smartphone (& tablet)	**System:** Mistakenly uninstalling system or apps.	Need a way to recover from this or preventing users to access the system properties.
8	Smartphone & Tablet	Language issues	Direct access to language setting and explanation. An assistance will solve this issue.

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions

1	Bang & Olufsen Phone	Making phone calls and sending SMS - Simple navigation buttons (physical) - Body size and thickness is suitable - Longer battery life - Very stable	Smartphone should be made similar to the functions on this phone, except the data connectivity should be added into the phone.

Participant no. 10 (TF)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1	Model no. 4 & 6	Similar to the participant's previous phone model: - Big navigation buttons - Fit to female fingertips	
2	Model no. 3 & 5	Both models have similar navigation	The use of physical buttons is important for elderly users

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	Mobile Phone	Phone, SMS, Phone book	Physical keypad is convenient
2	CDMA Phone	Torch	A shortcut to this function
3	Tablet 7-inches	Browser, Youtube,	
4	Tablet 7-inches	Skype	
5	Tablet 7-inches	Instant Messengers (WhatsApp, Facebook messenger)	Keep the keyboard appeared on the screen.
6	Mobile Phone	Alert and alarm	Vibration is necessary to support the ringtone volume.

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	Mobile phones	Long Battery life	Need to apply similar power capability to the smartphone device.

Summary of Participants from Australia

Participant no. 01 (FO)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 01	Model no. 1 has: • Big buttons • Clear text • Clear layout • Clear navigation. • Good color to avoid making mistakes	• HOME button should always be available as the most accessed button. • Physical buttons would be very helpful for elderly users. • The position of "home' button should be in the centre of the smartphone.

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1.	iPhone 6	Software update Regular or too often	Do not update too often for older people
2.	iPhone 6	Unclear terminologies on software update "adds multitasking gesture to the original".	Use simple language and easy to understand.
3.	iPhone 6	Phone Book Text is too small.	Text size adjustment for better readability.
4.	iPhone 6	Phone book No photo on contact list, but difficult to add or create a new one.	Easy task to data entry on contact list
5.	iPhone 6	An error occurred on the device. No indicator on the display about the error, the phone stops working. FO obtained assistance from Apple Store.	User should be notified what the error is about and how to fix it (without being necessary to visit the Apple Store.
6.	iPhone 6	A diary connected to the computer. - Too colourful and confusing	Clearer text size is better provided than a colourful display

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1.	iPhone 6	Holding the device: - The size is not suitable for female hand-grip.	Maintain the thickness, but adjust the overall device size.
2.	iPhone 6	- Volume buttons get pressed accidentally.	Auto-lock the volume buttons. Shortcut to pre-adjust volume level.
3.	iPhone 6	Device size is changed when new model comes in	Maintain the size for a few models.

Participant no. 02 (JO)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 1	Good and suitable for elderly users. Those have: Big buttons Big screen size Big texts/numbers	Maintain the simplicity. Do not add 'fancy' items or decorations on the elderly's phone.
2.	Model no. 2		
3.	Model no. 4		

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1.	Samsung Galaxy Ace	Camera & Photo Gallery User was not familiar with smartphone camera	An assistance is necessary to teach how to use the smartphone camera. Get used to the hand-grip to be able to take good pictures
		Facebook Upload and share photographs	
		Music Player via Bluetooth earphone. Not familiar with the setting and connection	A step-by-step guide could be helpful.

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1.	Samsung Galaxy Ace	Smartphone Camera Not used to the hand-grip to take pictures	An assistance could be helpful.
		Buttons are too small for users to hit the 'shutter' button.	Manufacturer should differentiate elderly's fingers and younger users.

Participant no. 03 (JH)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 4	The physical buttons are clear and user can feel the buttons.	Maintain the physical buttons.
2.	Model no. 1	The white background made this model more apparent to the users' vision. Icons, images, buttons are clear on the display.	There should be inclusion of physical buttons on the navigation.

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	Samsung Galaxy Ace	Reading online news: - Navigating through the pages - Navigating the right content	- Simple layout - Simple navigation - Clear indicator to get into the right spot. - Colour differentiation would be helpful to distinguish the navigation.
		Look at some pictures on wife's Facebook page, operated by wife.	-

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
		Reading online news on	A white background and black

		the Personal Computer. Used the PC keyboard to access browser. PC monitor is more readable than the smartphone. PC has different feel than the smartphone.	text or object in front of it would increase the text and object clarity to elderly users. Distinct object with patterns would be valuable to indicate the exact 'spot'.

Participant no. 04 (QQ)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1	Model no. 2	Nice display colour on the navigation Compact device size	The placement of coloured navigation should be accurate to provide users the exact spot.
2	Model no. 8	Screen size too small Features are too little, only on the main screen	Users should be able to distinguish between old-style phone and a smartphone
3	Model no. 1	Most useful model due to the big screen	Maintain the big screen display to make users easy to navigate.

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	iPhone 6	- Seeking digital music score on the internet and saving the files into internal memory: - Music score is too small to read on the smartphone.	
2	iPhone 6	Camera	
3	iPhone 6	**Photo Gallery** - Edit (delete, rotate) - Transfer to laptop.	A device with multi functions will be beneficial
4	iPhone 6	**Gmail** account Sending and receiving emails.	
5	iPhone 6	Facebook news Obtained from wife	Facebook is a waste of time for this user
6	iPhone 6	Youtube	A display screen as iPad would be better than a smartphone screen size.

7	iPhone 6	**Phone and SMS**: - Utilized to contact people with old-style phone. - Concern with ethics in sending messages	
8	iPhone 6	**Instant Messenger**s (Whatsapp).	
9	iPhone 6	**Alarm** Utilised as a wake-up alarm	Shortcut to setup, provide pre-set functions
10	iPhone 6	**Torch** Utilised at night	Should be installed as a default app.
11	iPhone 6	FM Radio app. - Listening to old 60's songs while mobile.	Should be able to install on iPhone.
12	iPhone 6	Smartphone interface is cluttered with meaningless icons/symbols.	Create more meaningful icons or symbols. Use bright colour to maximise elderly people's vision. High contrast rate could be beneficial.
13	iPhone 6	Emergency access	Should be created as elderly people are also getting older.
14	iPhone 6		

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	iPhone 6	Internal memory to store pictures and files.	Maintain the memory size or could make it bigger.
2	iPhone 6	**Phone finder** Happened when hidden somewhere in the room.	User would need to whistle when the phone is lost, and the device would activate the beeps.
3	iPhone 6	**Withdraw cash**	For the next development, smartphone can function like an ATM machine.

Participant no. 05 (CW)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions

	Model no. 4 & 8	Not the user's choice: No colour	
		Changing setting is a challenge.	Deep interaction will make users confuse and lose track.
		Adding contact	
		Bluetooth / Wi-Fi connection	The signal indicator looks similar to the wi-fi icons.
	Model no. 1 & 3	Colour makes easy to access and navigate Weather indicator is clear Red & Green buttons are clear	
	Model no. 5a & b (Big Launcher)	Clear interface with colour	

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	iPhone 5 & 6	Navigation buttons: - Moving icons to bin - Different pressure gives different result	Assistance Instruction guides
2		**SMS** Preferably using voice command.	
3		**Browsing** **Google Chrome** - Chrome is more reliable than Safari. - Utilisation of voice command to search - Used for Internet Banking	
4		The icon of Wi-Fi SSID 'secured' connection	This icon might be confusing to elderly
5		**Icon movement** Click > Drag > Move icons	
6		**Translator:** Chinese – English	
7		**Youtube** Search for Movies, TV programs,	

8		Reading online news	
9		Alarm, timer, reminder • Wake-up call • Parking reminder	
10		**Games** Bejewelled: Adjust volume on/off - Turning the phone volume off accidently.	There should be an indicator to the overall sound volume.
11		**Bluetooth connection** Bluetooth Earphone	
12		**Camera & Video**	
13		**Photo & video viewer** Edit: rotate, crop, zoom in/out. Jump from one picture/album to another Shorten the video duration.	
14		**IP-based camera** from CCTV to Smartphone	
15		**Magnifier** reading newspaper	
16		A compass app	
17		FM Radio app	
18		Siri voice command	
19		Stock exchange	
20		Calculator	
21		Phone Tracker	
	General comments: – Elderly users need assistance to operate technology – Practice to get into habit is necessary – It is not easy to teach old dogs a new trick.		

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1		Device microphone Need bigger hole when the case is attached	

2		Bigger memory storage is preferable.	
3		Phone to PC transfer	Need an assistance to perform this task.

Participant no. 06 (GO)ticipant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 1, 3, 5	Good layout Navigation models & structures	Navigation/buttons should be suitable or fit to fat fingers, to distinguish buttons easily

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1.	Samsung Galaxy S6	S6 was purchased of the older model	The phone development should adapt from the previous model to avoid re-adjustment to the current one.
		Solid and dark colour on BG and buttons were preferred	To emphasize icons/buttons

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
	Samsung Galaxy S6	Earphone Port – Unable to listen to FM Radio using earphone	Clear direction/point to the port,
	Samsung Galaxy S6	Alarm button shortcut	Should be placed on the hardware/device. Have to be able to snooze easily

Participant no. 07 (AN)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model 1-2	No comments to any models	No suggestion is required. Just pleasing for the eyes

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1.	Samsung Galaxy S6	GPS Function	Connectivity between software and hardware to track location (especially for people with dementia)
2	Samsung Galaxy S6	Password recognition for older people	Finger print method should be maintained

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	Samsung Galaxy S6	Buttons size	Button size should be made reasonable to navigate (pressing the buttons).
2	Samsung Galaxy S6	GPS Tracker	Sending signal to emergency contacts when the person is falling down

Participant no. 08 (SL)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 4	Look similar to older models (navigation, control, screen)	Newer model should adapt some/most functions of older ones.
2.	Model no. 6	Look similar to older models (navigation, control, screen)	Newer model should adapt some/most functions of older ones.

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1	**Samsung Galaxy**	Disoriented when navigation deeper than 3 pages	One-to-three click-away only

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
1	**Samsung Galaxy**	– Monitoring device for people with dementia – Screen lock – easy setup – Emergency situation	– Hardware and software connection – Maintain area for emergency contacts

Participant no. 09 (LE)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 1 & 2	4-main control area that always visible	Need to apply to any phone models for easier navigation control
2.	Model no. 3	Give direct access to emergency navigation	Maintain the navigation and position

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1.	**Huawei**	Brightness – contrast adjustment is not easy to find. Unreadable text	Placement of auto adjust brightness – contrast on the hardware, including auto zoom in/out to enhance readability (news)

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
	Huawei	Hand grip somewhat difficult to manage due to silicon case over the phone	Better material should be produced to cover the phone, as well as to ease the hand-grip be more comfortable

Participant no. 10 (KI)

Participant Selection on the Test Board

No.	Selection	Comments	Suggestions
1.	Model no. 8	– Big hardware (device) size – Preferred touch	– Maintain the size, especially for a user who has difficulties to hold an

		screen phone – Just to make phone calls and send SMS	object i.e. smartphone device – Requires to feel the touch/tactile

Participant Review on Software and Display Design

No.	Device	Tasks & Comments	Suggestions
1.	iPhone 5	Note: low vision user Utilise phone to make phone calls Has fat fingers as an Asian male Unable/difficult to operate page sliders Hard to type using small QWERTY keyboard on touch-screen phone	Bigger gaps between buttons may be necessary for him Enable speech recognition to simplify typing

Participant Review on the Hardware

No.	Device	Tasks & Comments	Suggestions
	iPhone	Placing phone in the pocket and the device makes outgoing call.	Requires auto-lock to avoid unexpected operation when phone is in the pocket

Appendix E. Questionnaire Responses

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify: iPhone
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: to connect with friends and families					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy, convenient to use					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: it's difficult to learn how to use various messaging apps					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Camera and gallery. I like to take pictures.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: to speak and share messages with others					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: other messaging apps besides whatsapp are too much for me to understand.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy and straightforward					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: radio. It’s good to listen to some news/music while commuting					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: too complicated.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify: Iphone
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Youtube. As an entertainment.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Torch. Very helpful in urgent situation					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: difficult to use messaging apps					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify: iPhone
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Camera and gallery.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Gallery. I like to browse over pictures that I took in the past.					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Software update. Most of the time it changes the layout or function of the phone.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: to communicate					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy to use					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: never use it because it looks complicated.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy to use.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason:easy to use.					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: difficult to find contact number.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify: iPhone
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy to understand					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy to understand					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: never really tried other functions.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify: Huawei
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: to communicate with others					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify: Camera
	Please write the reason: Camera and gallery are good to capture moments.					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: little bit hard to use. Keyboard is bit confusing and small.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify: iPhone
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: just need few steps to be able to communicate					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: convenient to use					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: keyboard is too small for my fingers					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: whatsapp for work. Other messaging apps to connect with community.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy and convenient for messaging					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify: phone book
	Please write the reason: bit difficult to find contact number					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify: Lenovo
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: browser and youtube. To watch news, and videos.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: games. Relaxing.					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: often overlap with whatsapp/other messenger apps					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: contact friends and family					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: quick, easy to use					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: font is too small to read					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: I use Whatsapp daily for its group chat					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: the quality of the camera is pretty good					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify: alarm
	Please write the reason: sometimes the alarm didn’t ring just because the phone is low on battery					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy to use. Basic function of a phone.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Gallery. To view pictures and photos.					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Browser. Slow respond, sudden quit.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: chat group with communities					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify: youtube
	Please write the reason: watch tutorials and funny videos					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: don’t really use it					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: easy to track conversation					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: simple steps, easy to do					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify: phone book
	Please write the reason: bit confusing to find a contact details – too many information on one page					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: whatsapp group. to keep updated with other family members, and/or friends.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: all of my community group use it					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: rarely use it					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: it's saving much time to call rather than messaging.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: it allows me to leave non-urgent messages on chat app to be read later.					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: speed dial button as it's quite hard to set.					

Title of Project : An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Name of Researcher : ALFANDI NUGROHO YAHYA

Institution : CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	SD (1)	D (2)	N (3)	A (4)	SA (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3"-4"	☐ 5"-6"	☐ 6"-7"	☐ >7"	☐ Don't know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Youtube. To watch videos.					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Home button shortcut. Easy to exit all apps.					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason: Prefer to use whatsapp or other messaging apps rather than sms.					

Appendix F. Respondents Data Summary

- **Data of Smartphone Interaction on different apps**
  - **Participants from Indonesia**

	IH	AS	TY	CN	RN	KY	SS	KF	SY	TF	
No	1	2	3	4	5	6	7	8	9	10	**mean**
1	2	4	3	3	2	1	2	4	5	3	2.9
2	3	4	2	2	2	1	4	3	5	1	2.7
3	3	5	4	3	3	2	2	1	4	2	2.9
4	4	4	3	2	5	2	1	5	3	2	3.1
5	4	3	2	4	5	2	4	2	2	3	3.1
6	2	3	2	2	5	3	2	4	5	2	3
7	4	5	3	2	3	3	3	3	4	2	3.2
8	4	4	3	4	2	3	2	2	5	3	3.2
9	4	4	2	3	4	4	5	5	2	5	3.8
10	3	4	3	3	3	2	2	1	4	3	2.8
11	5	2	2	4	2	3	1	2	4	5	3
12	2	3	3	2	4	2	3	2	5	2	2.8
13	5	2	2	3	3	5	3	2	3	4	3.2
14	4	4	2	5	2	3	2	3	3	3	3.1
15	5	4	2	2	2	3	1	3	5	4	3.1
16	4	2	1	3	5	3	4	2	5	3	3.2
17	3	4	3	4	3	3	4	2	4	2	3.2
18	4	4	2	2	5	2	4	5	3	2	3.3
19	4	3	2	4	5	2	4	2	5	3	3.4
20	3	5	2	4	2	3	1	2	3	5	3
21	2	3	2	2	4	2	3	2	2	3	2.5
22	5	2	1	3	3	3	3	2	3	4	2.9
23	4	3	2	3	2	2	2	4	5	3	3
24	2	4	3	2	2	4	4	3	5	1	3
25	3	5	4	3	3	2	2	1	4	2	2.9
	3.5	3.6	2.4	3.0	3.2	2.6	2.7	2.7	3.9	2.9	
26	3	2	3	4	2	3	1	2	4	5	2.9
27	3	2	2	2	2	3	1	3	2	4	2.4
28	2	3	4	2	5	3	2	4	2	2	2.9
29	3	3	3	2	4	2	3	2	2	1	2.5
30	3	3	3	2	4	2	3	2	2	1	2.5
31	3	4	5	3	2	2	2	4	5	3	3.3

	2.8	2.8	3.3	2.5	3.2	2.5	2.0	2.8	2.8	2.7

Figure G.1 Data of apps interaction on the phone device

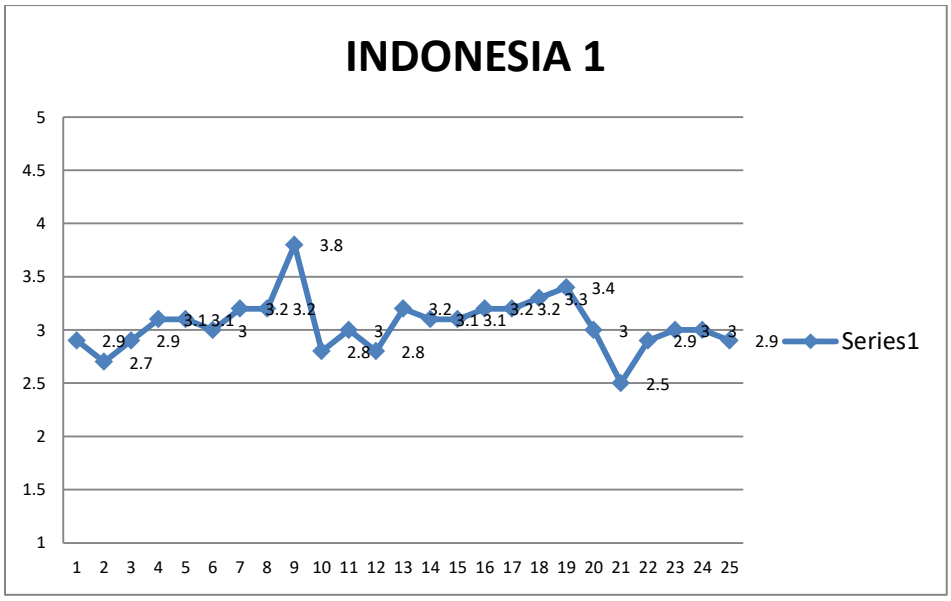


Figure G.2 The Functions and Features Interaction on Smartphone Device

- **Participants from Australia**

	FO	JO	JH	QQ	CW	GO	AN	SL	LE	KI	
No	1	2	3	4	5	6	7	8	9	10	**mean**
1	3	2	1	3	5	3	2	4	2	4	2.9
2	3	4	3	1	4	2	3	2	2	3	2.7
3	2	3	4	2	4	2	3	4	1	3	2.8
4	2	2	2	3	4	2	3	2	3	1	2.4
5	2	3	4	3	3	4	2	3	2	2	2.8
6	2	3	3	5	3	3	5	4	2	3	3.3
7	1	3	4	4	5	3	2	3	4	5	3.4
8	2	3	1	4	2	4	2	2	3	3	2.6
9	3	5	3	2	3	5	2	3	4	4	3.4
10	2	2	3	2	2	3	2	1	3	4	2.4
11	4	2	3	2	2	3	3	4	2	2	2.7
12	2	2	3	2	4	2	4	2	2	2	2.5
13	3	4	3	1	3	2	3	2	3	2	2.6
14	3	2	5	3	4	2	3	5	2	3	3.2
15	2	5	3	3	4	3	2	2	5	1	3
16	2	2	3	4	2	4	2	3	3	3	2.8
17	2	5	2	3	4	2	3	2	2	3	2.8
18	4	2	5	3	4	2	3	2	3	5	3.3
19	2	4	2	3	4	2	3	2	1	4	2.7
20	2	2	4	3	4	2	3	2	2	1	2.5
21	3	2	3	4	2	3	1	2	4	5	2.9
22	2	3	3	2	4	2	3	2	2	1	2.4
23	1	3	3	2	3	3	3	3	4	2	2.7
24	2	4	5	2	2	2	4	3	5	1	3
25	3	5	4	3	3	2	2	1	4	2	2.9
	2.4	3.1	3.2	2.8	3.4	2.7	2.7	2.6	2.8	2.8	
26	2	3	5	1	2	3	2	5	3	4	3
27	1	5	3	2	3	4	2	3	2	3	2.8
28	3	4	2	4	3	2	2	3	2	2	2.7
29	2	2	3	4	3	1	1	5	3	4	2.8
30	2	3	4	2	2	2	2	3	4	5	2.9
31	2	2	3	3	2	3	4	3	2	1	2.5
	2.0	3.2	3.3	2.7	2.5	2.5	2.2	3.7	2.7	3.2	

Figure G.3 Data of apps interaction on the phone device

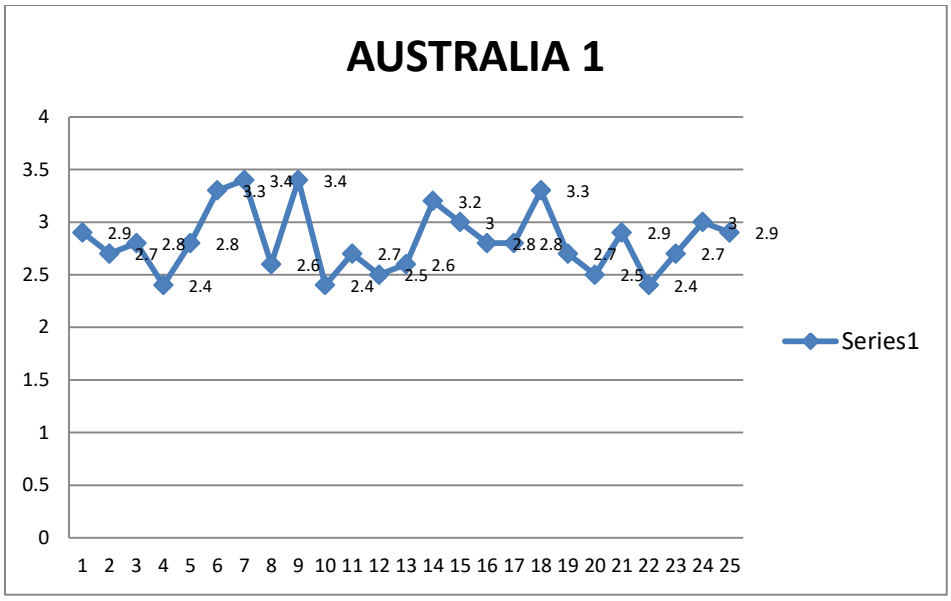


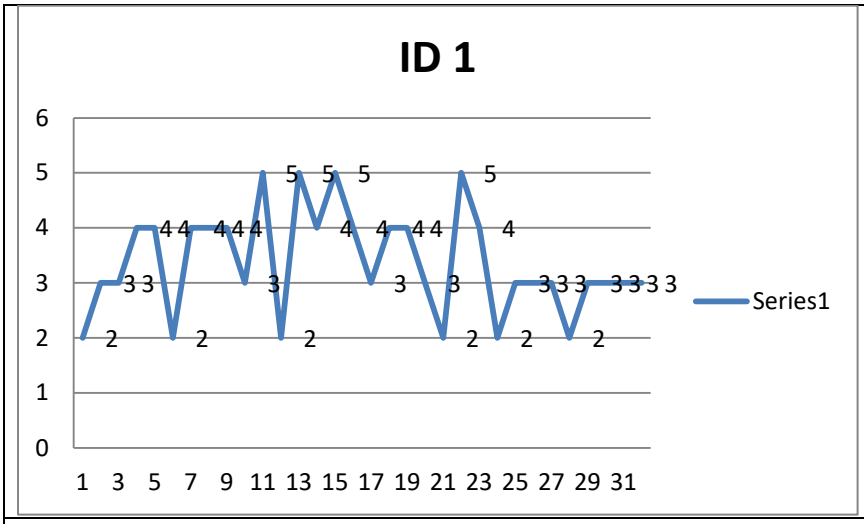
Fig G.4 The Functions and Features Interaction on Smartphone Device

Appendix G. Data of Features and Functions Used By The Participants

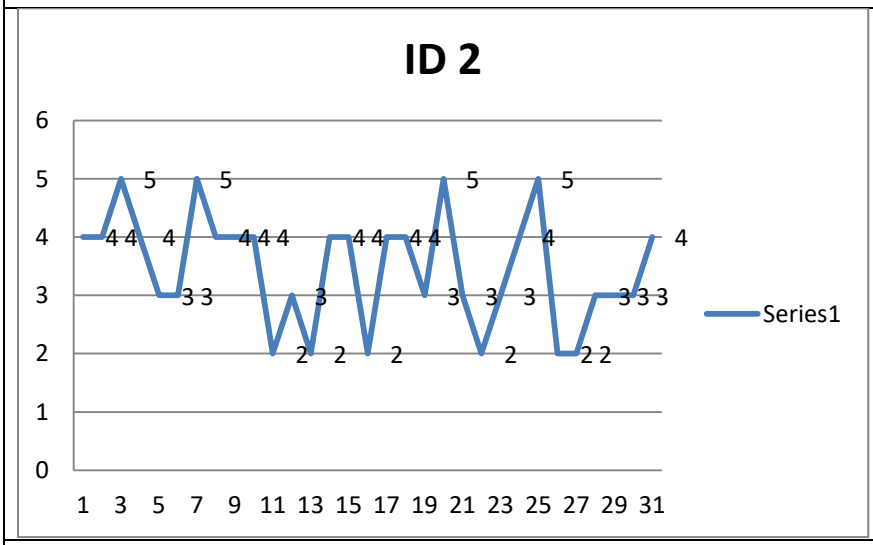
Participants from Indonesia

(ID = INDONESIA; "1" = participant no.1)

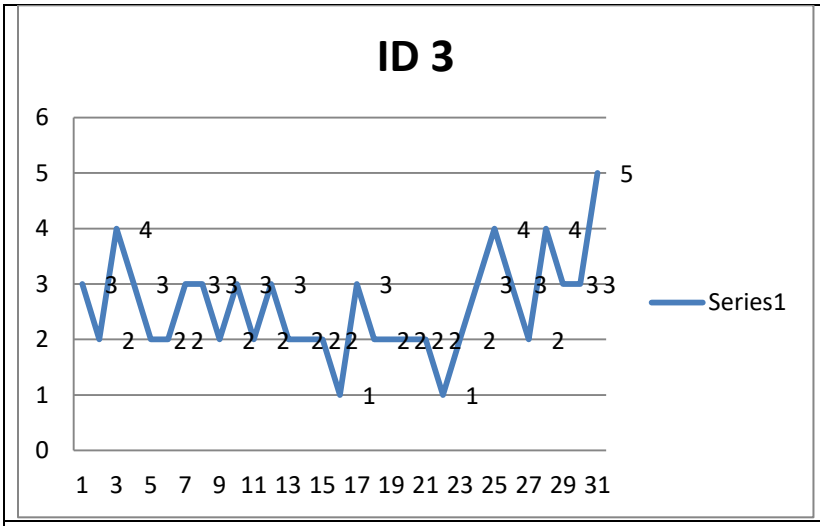
Appendix G.1 Country of Participants: INDONESIA



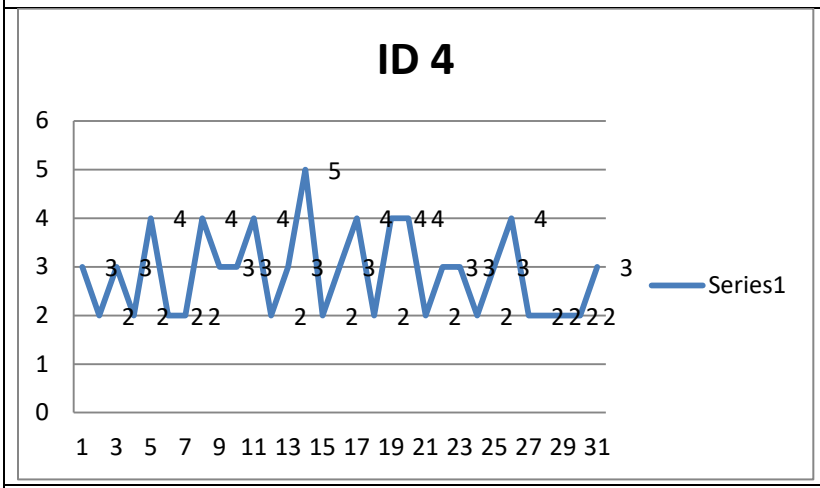
Participant no. 1



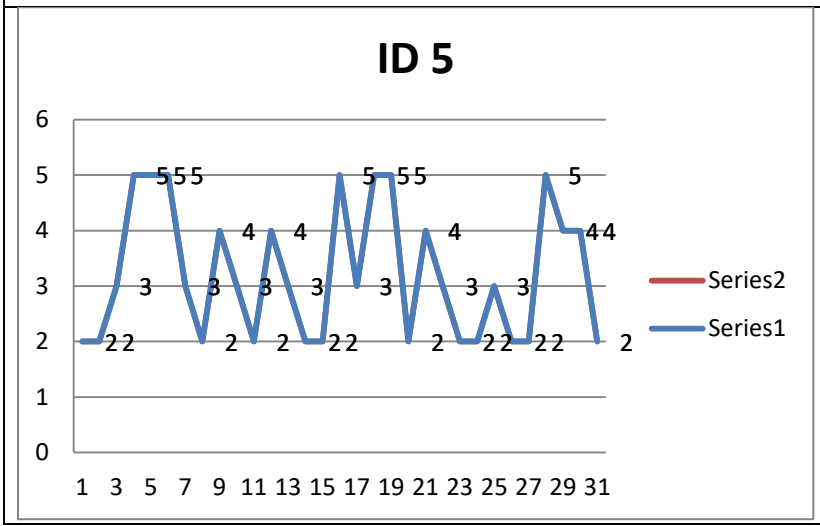
Participant no. 2



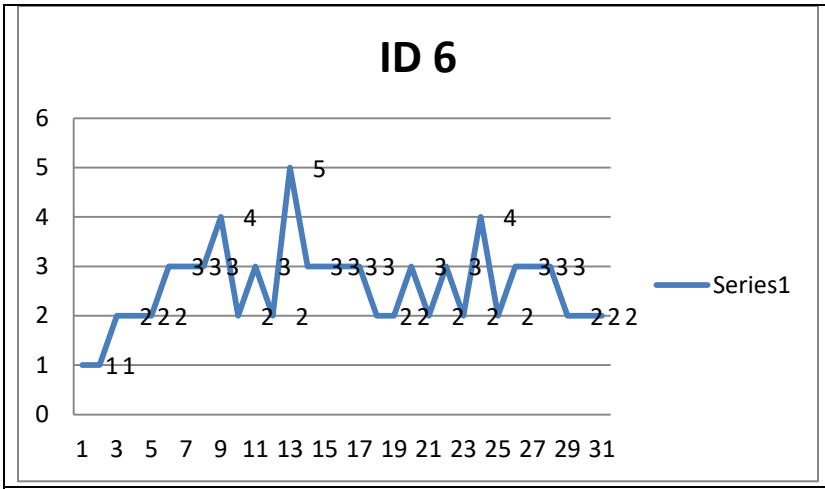
Participant no. 3



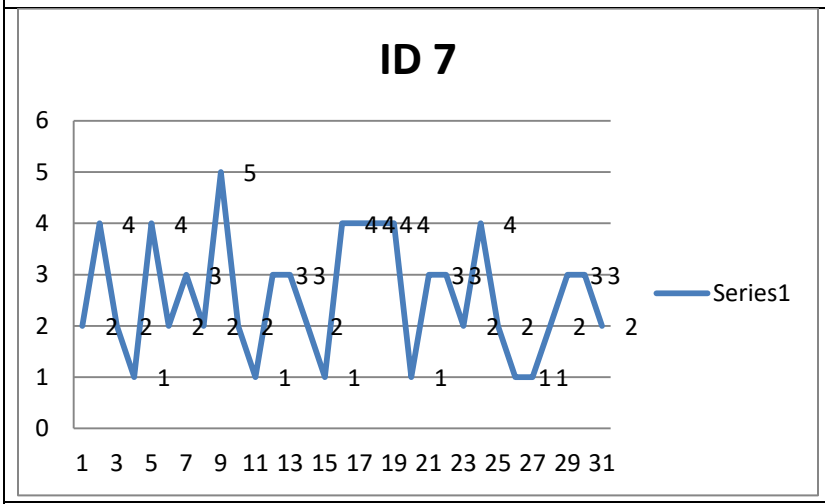
Participant no. 4



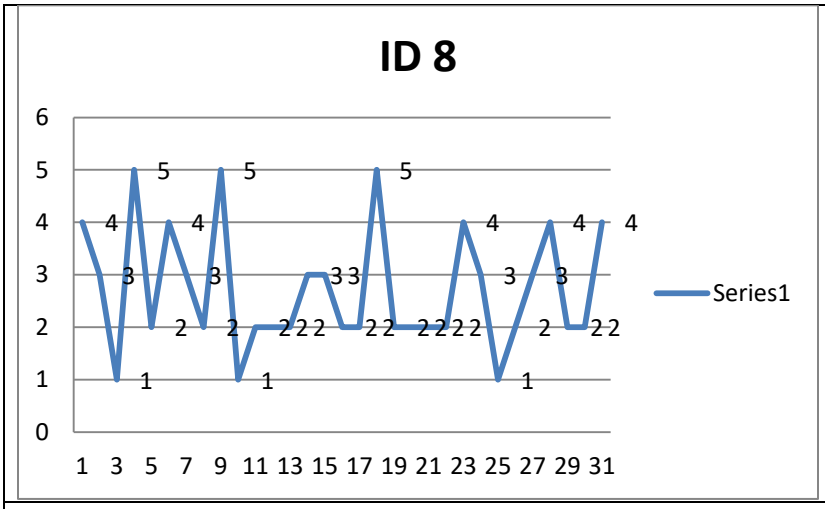
Participant no. 5



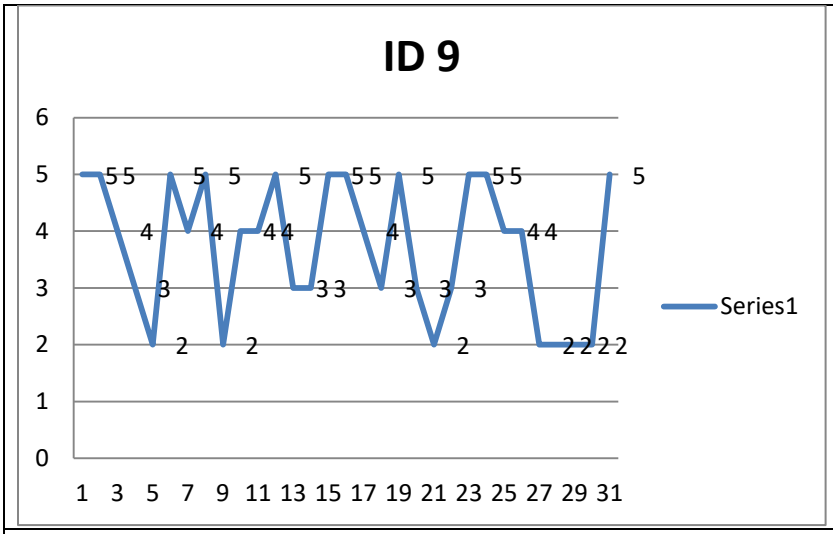
Participant no. 6



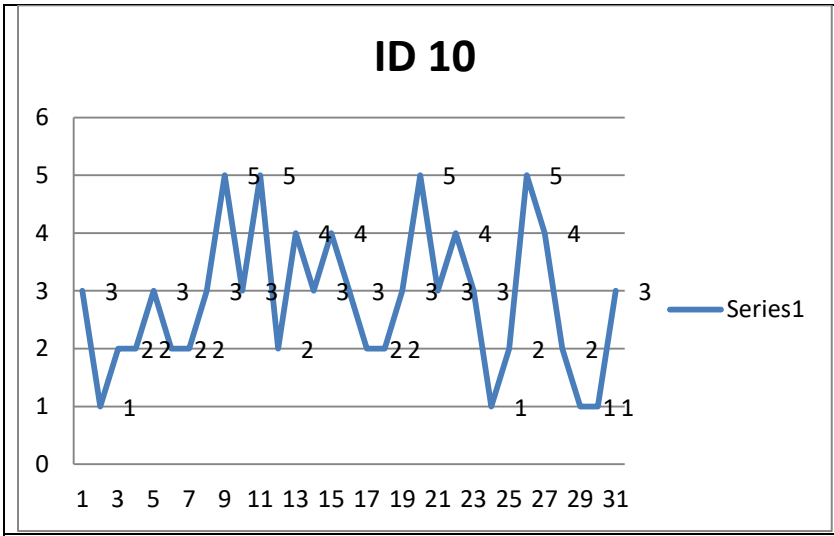
Participant no. 7



Participant no. 8



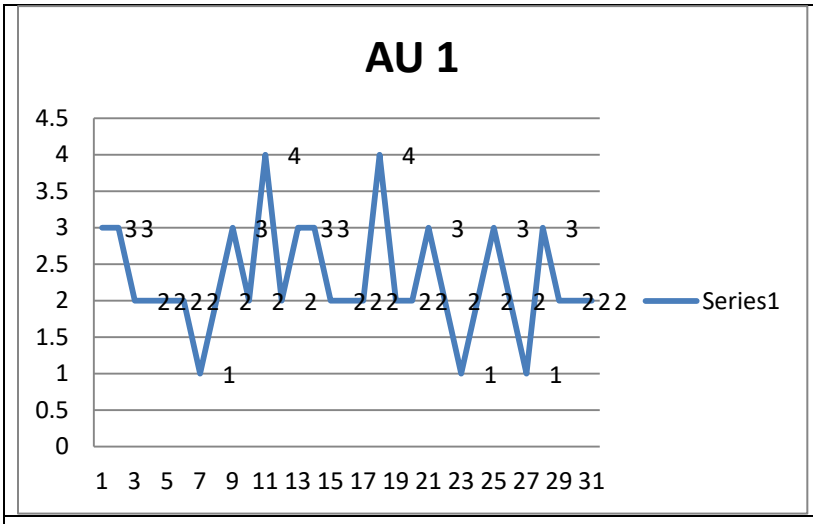
Participant no. 9



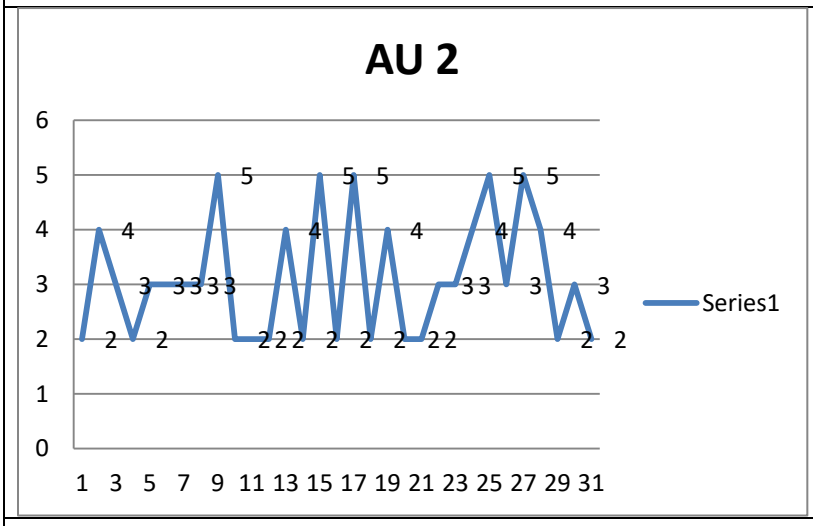
Participant no. 10

Participants from Australia
(AU = Australia; "1" = Participant no.1)

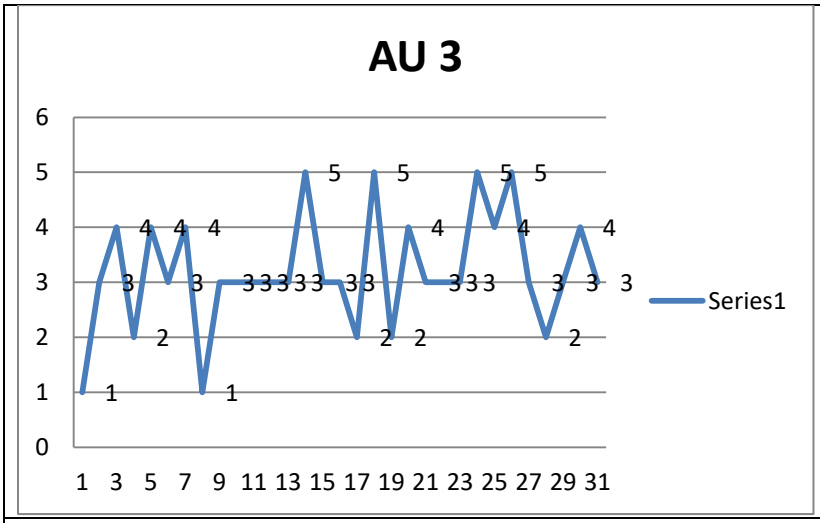
Appendix G.2 Country of Participants: AUSTRALIA



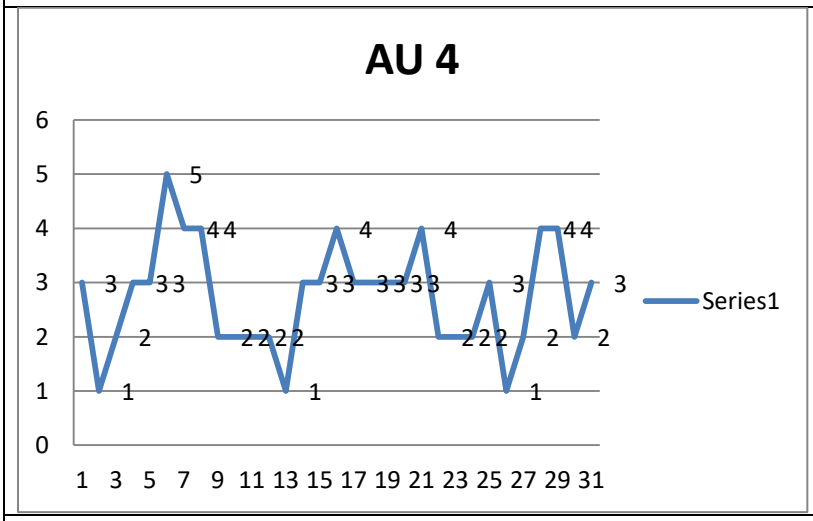
Participant no. 1



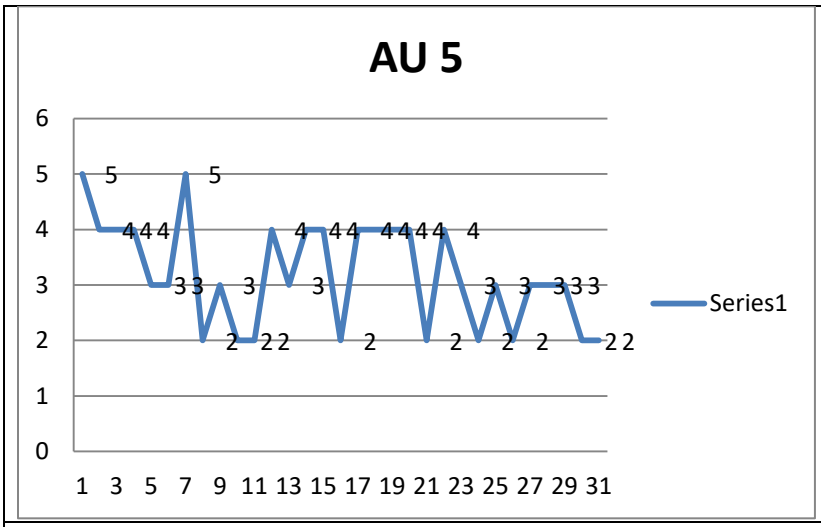
Participant no. 2



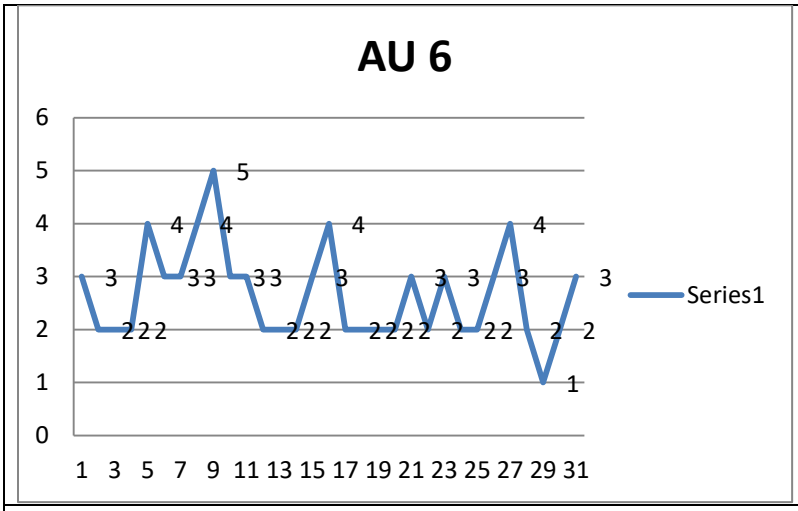
Participant no. 3



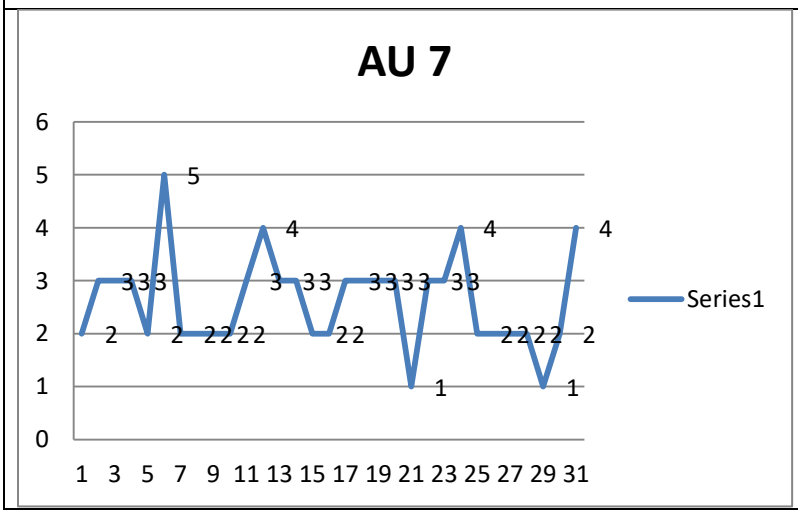
Participant no. 4



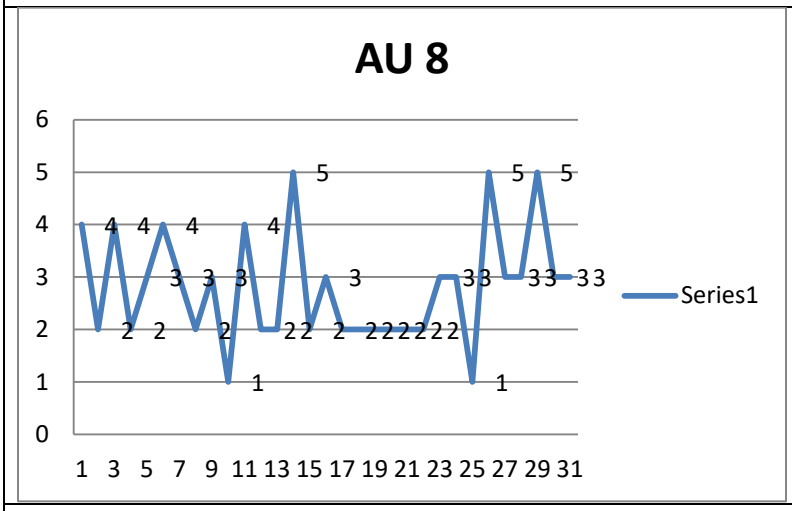
Participant no. 5



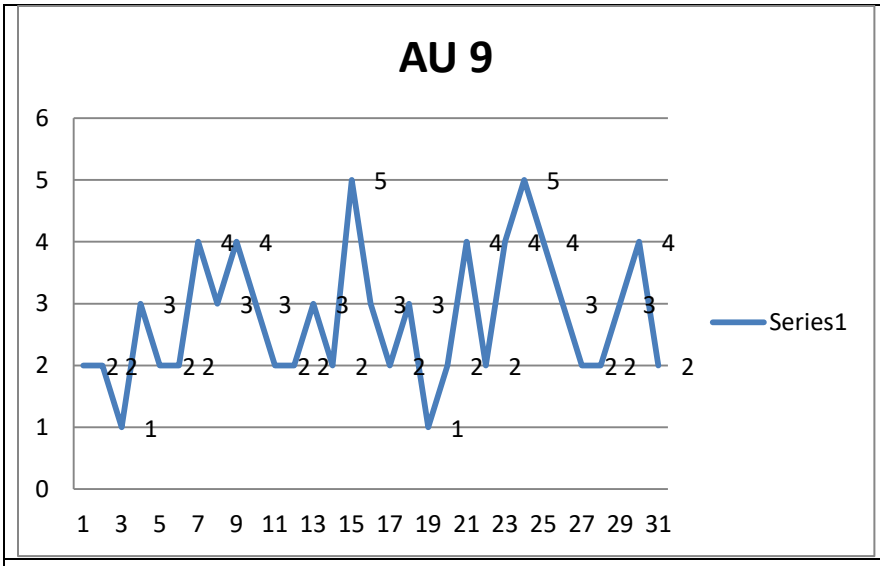
Participant no. 6



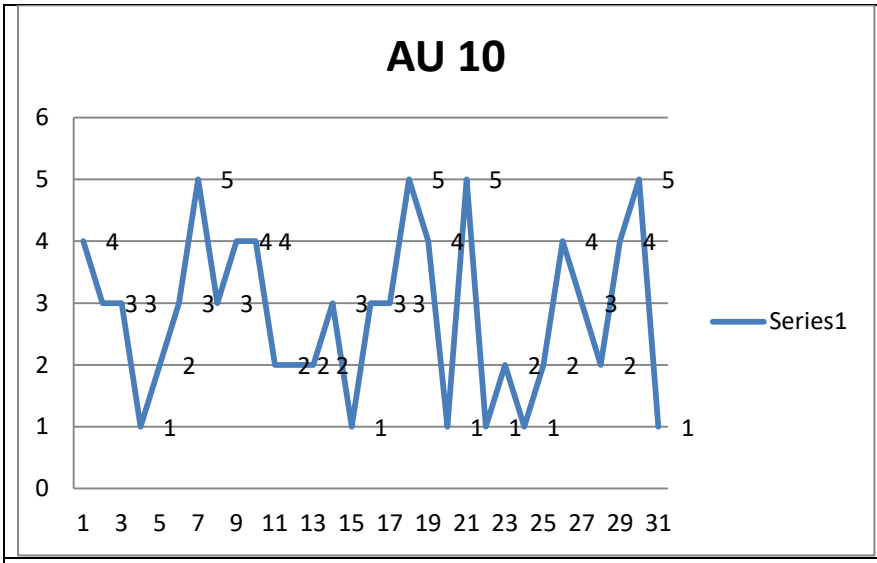
Participant no. 7



Participant no. 8



Participant no. 9



Participant no. 10

Appendix H. Design Development Process – Low-Fidelity Prototyping

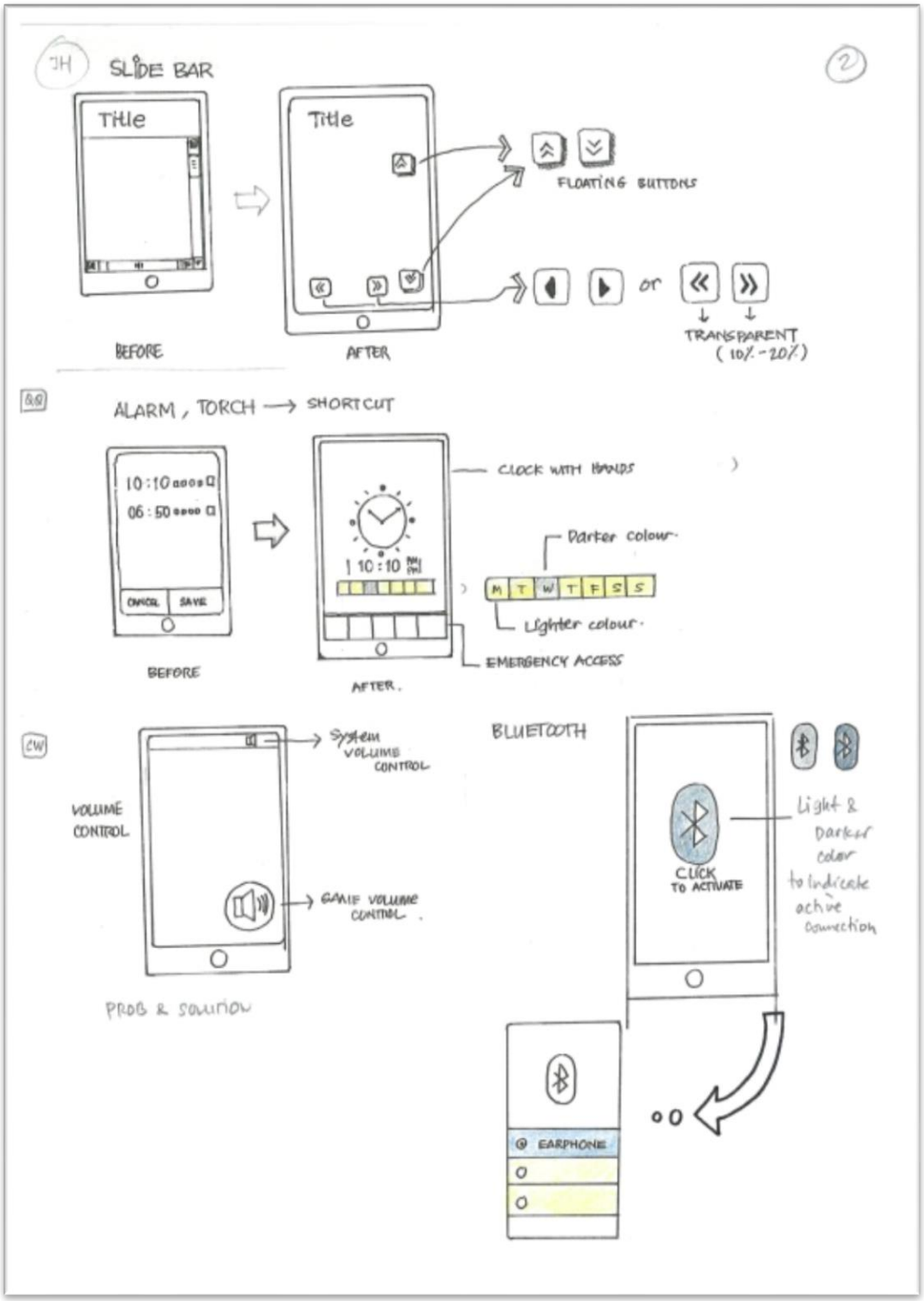


Figure H.1. Evaluation Prototype (slide bar, alarm and Bluetooth connection

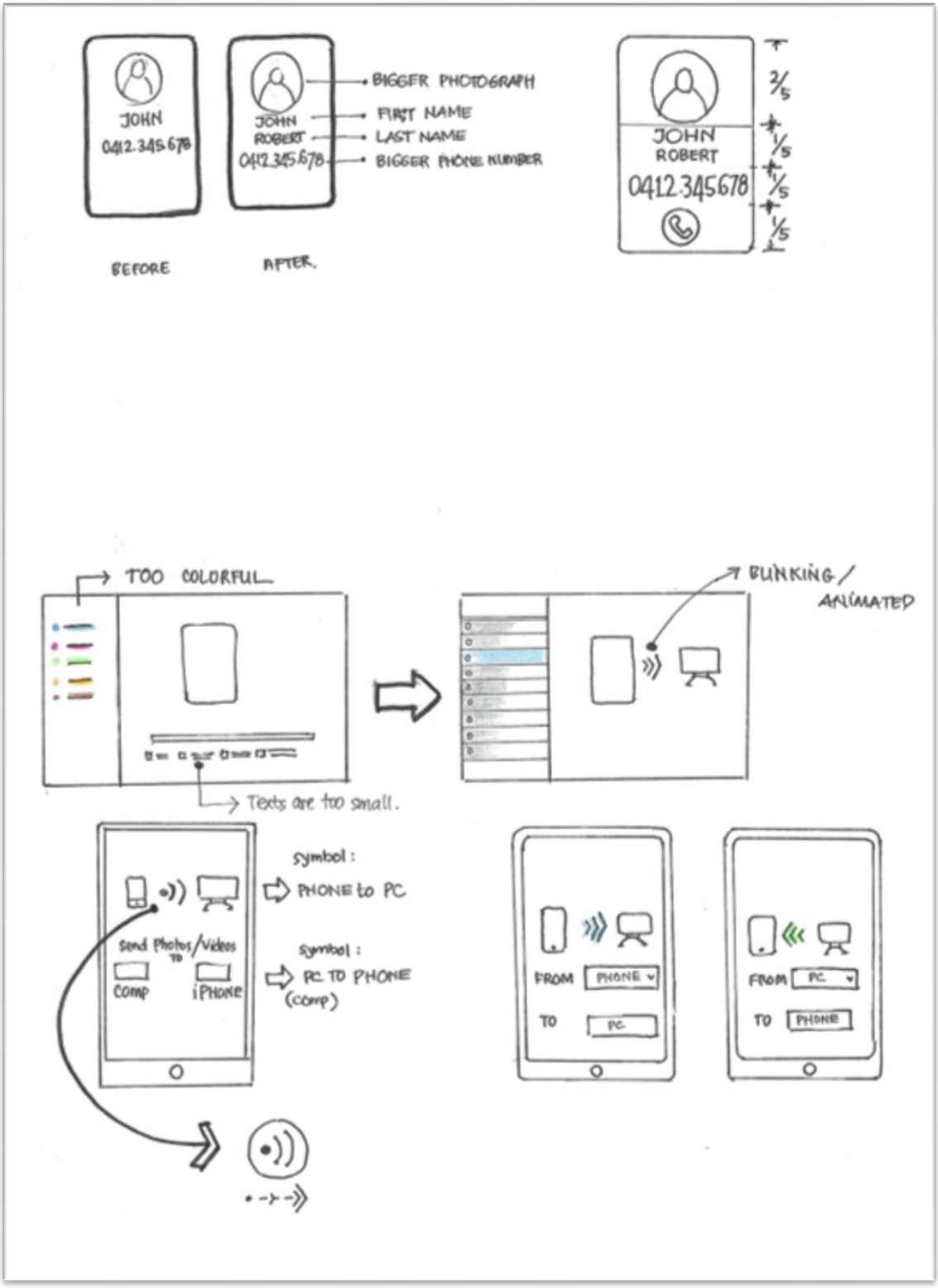


Figure H.2. Evaluation Prototype (contact person – phone call, PC to Phone connection)

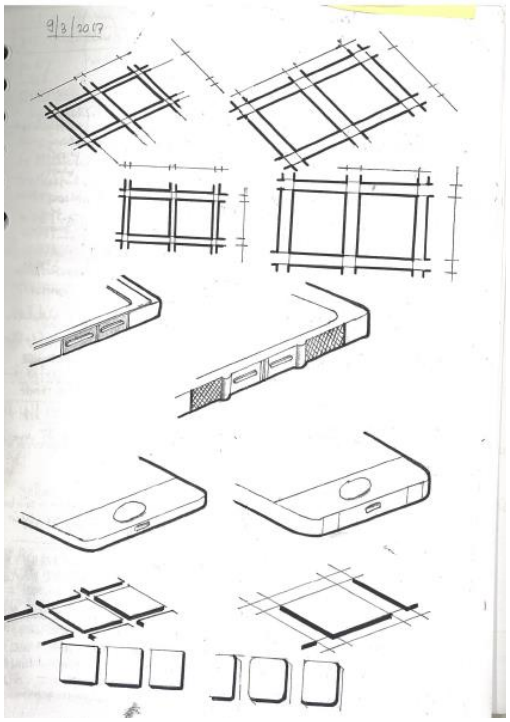


Figure H.3. Evaluation Prototype (button and gap size)

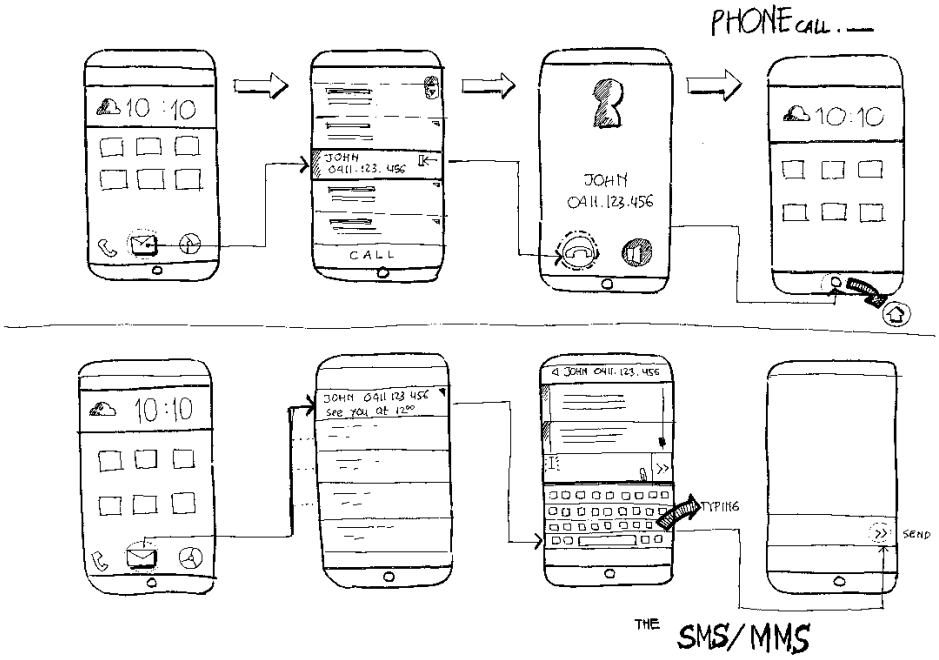


Figure H.4 Evaluation Prototype of Scenario Based Testing (Phone call and SMS)

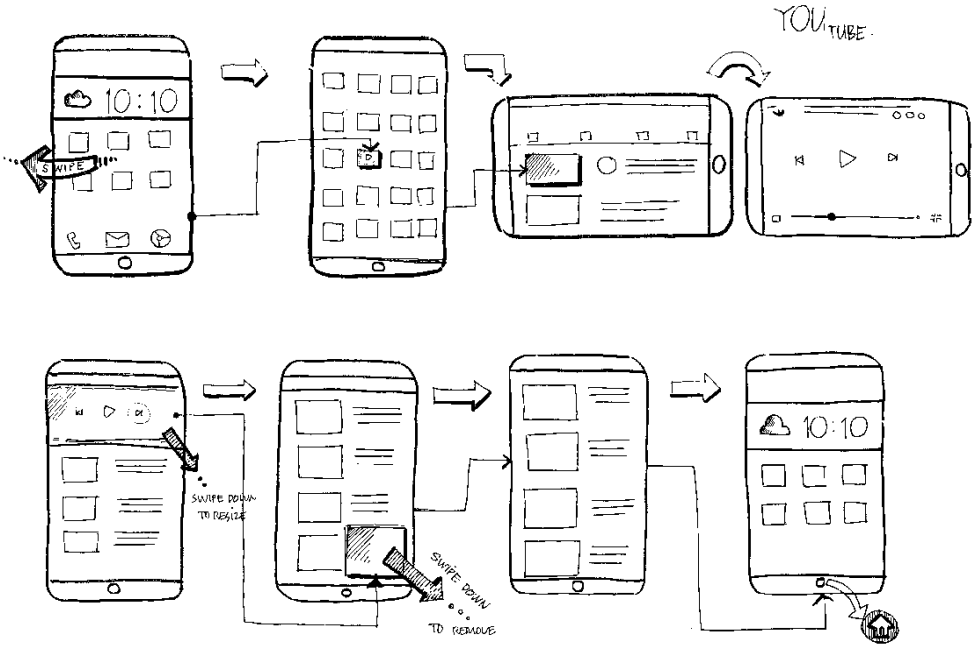


Figure H.5 Evaluation Prototype of Scenario Based Testing (YouTube application)

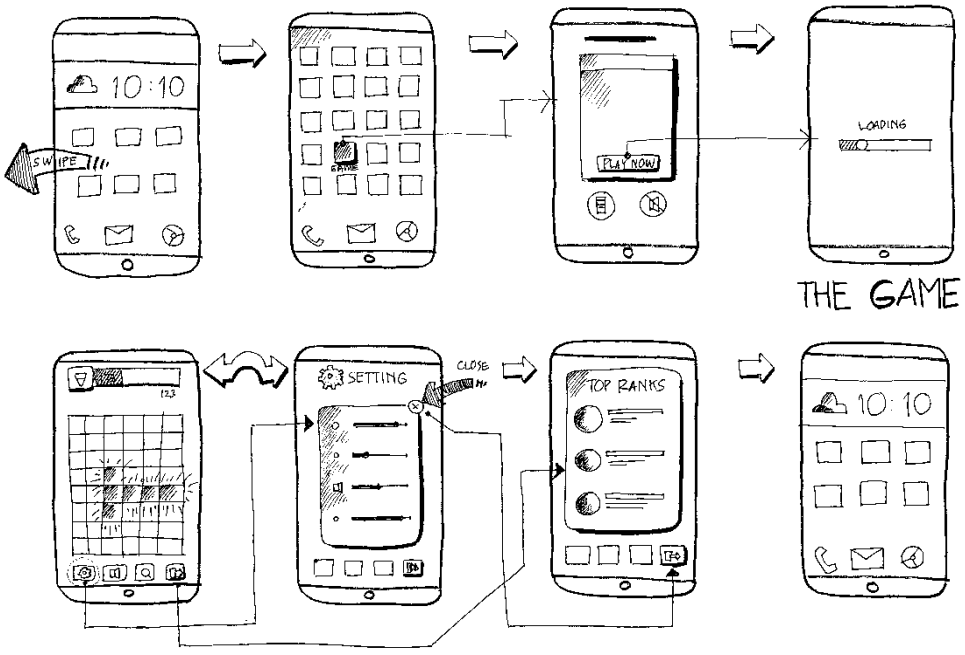


Figure H.6. Evaluation Prototype of Scenario Based Testing (Game and Tally board view)

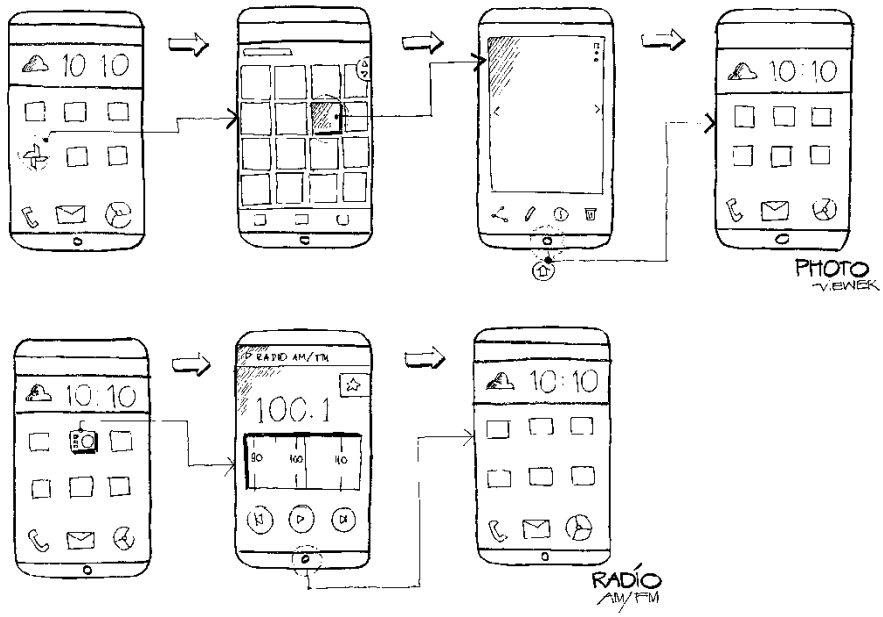


Figure H.7 Evaluation Prototype of Scenario Based Testing (Photo Gallery and Radio FM)

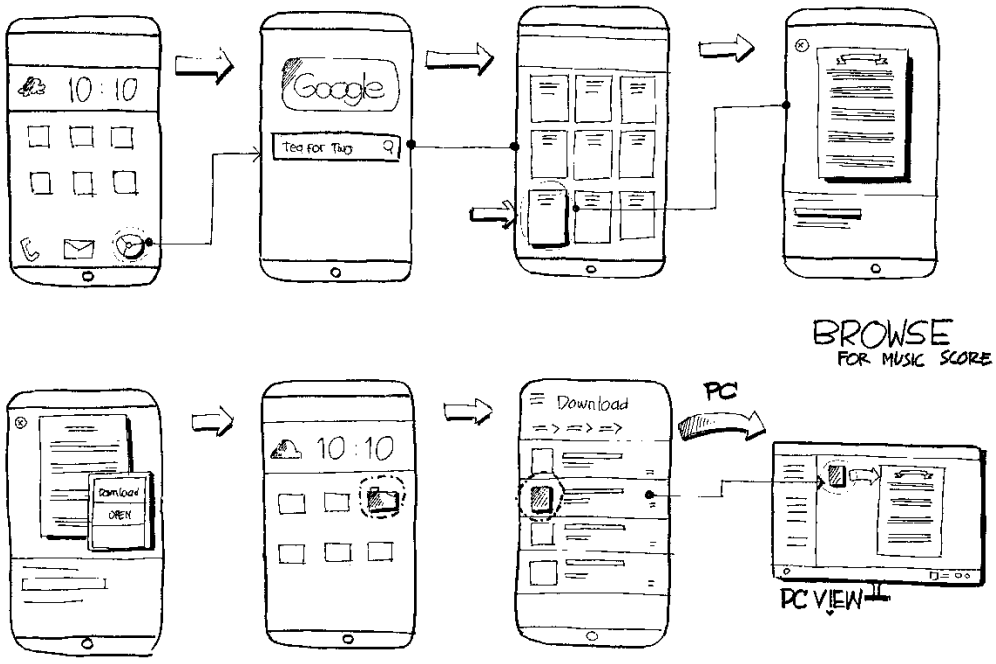


Figure H.8. Evaluation Prototype of Scenario Based Testing (Internet browser)

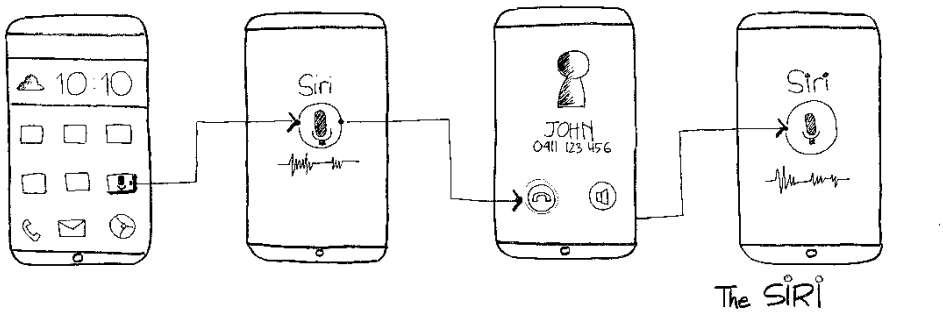


Figure H.9. Evaluation Prototype of Scenario Based Testing (Voice Command using Siri)

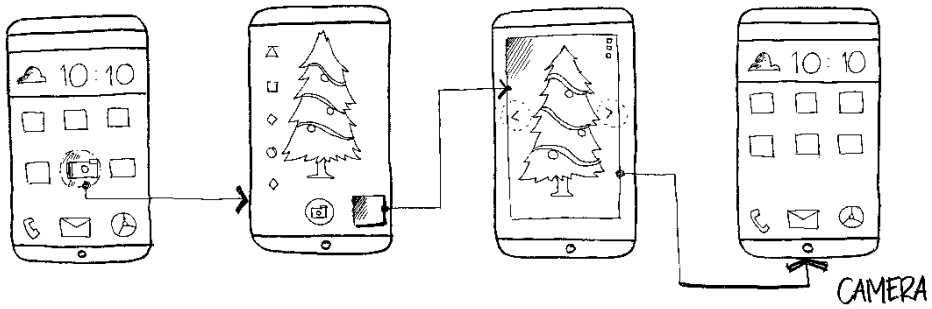


Figure H.10. Evaluation Prototype of Scenario Based Testing (Photo Preview and Editing)

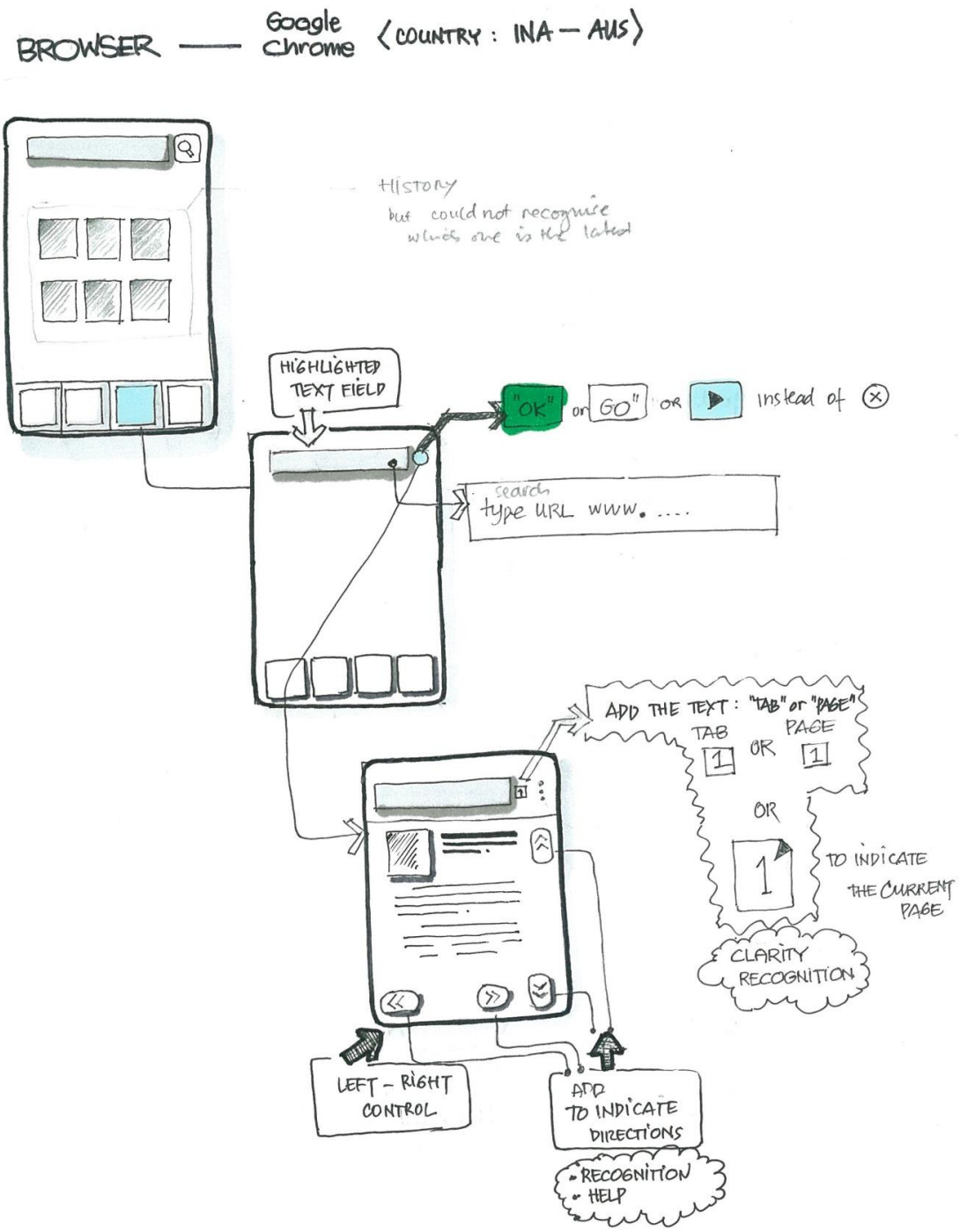


Figure H.11 Evaluation Prototype (Search Bar on Google Browser app)

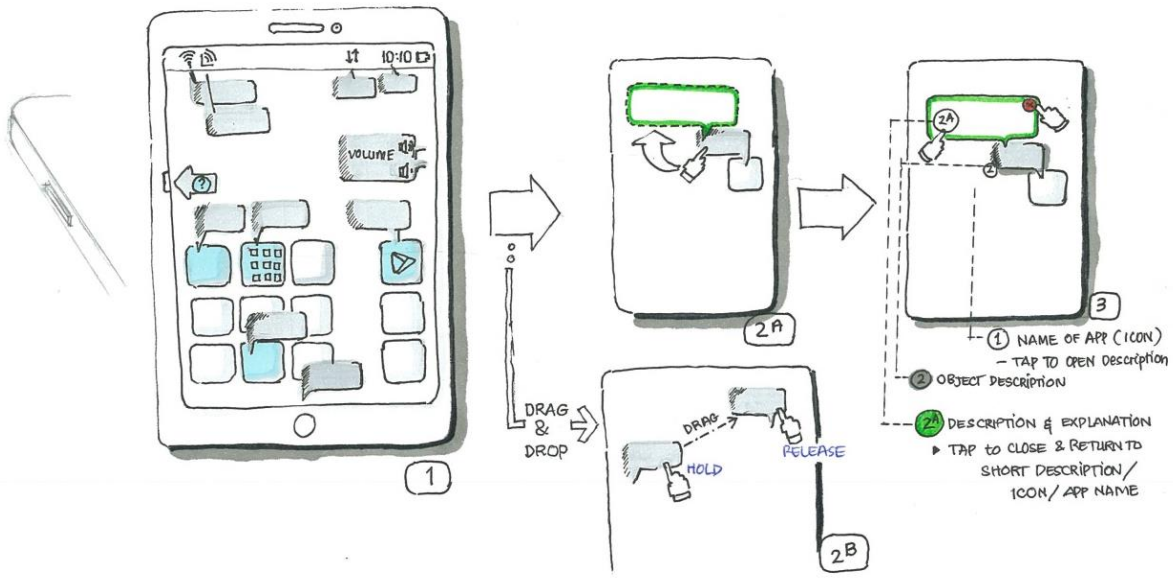


Figure H.12. Evaluation Prototype (Help Button)

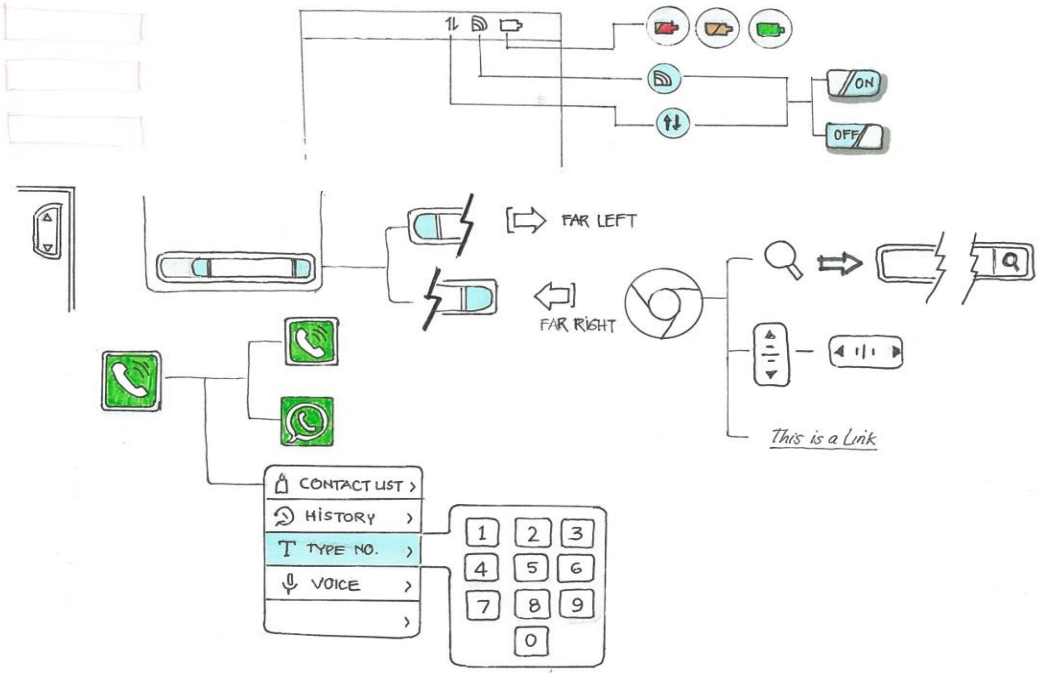


Figure H.13. Evaluation Prototype (Page Slider and Pull-Down menus)

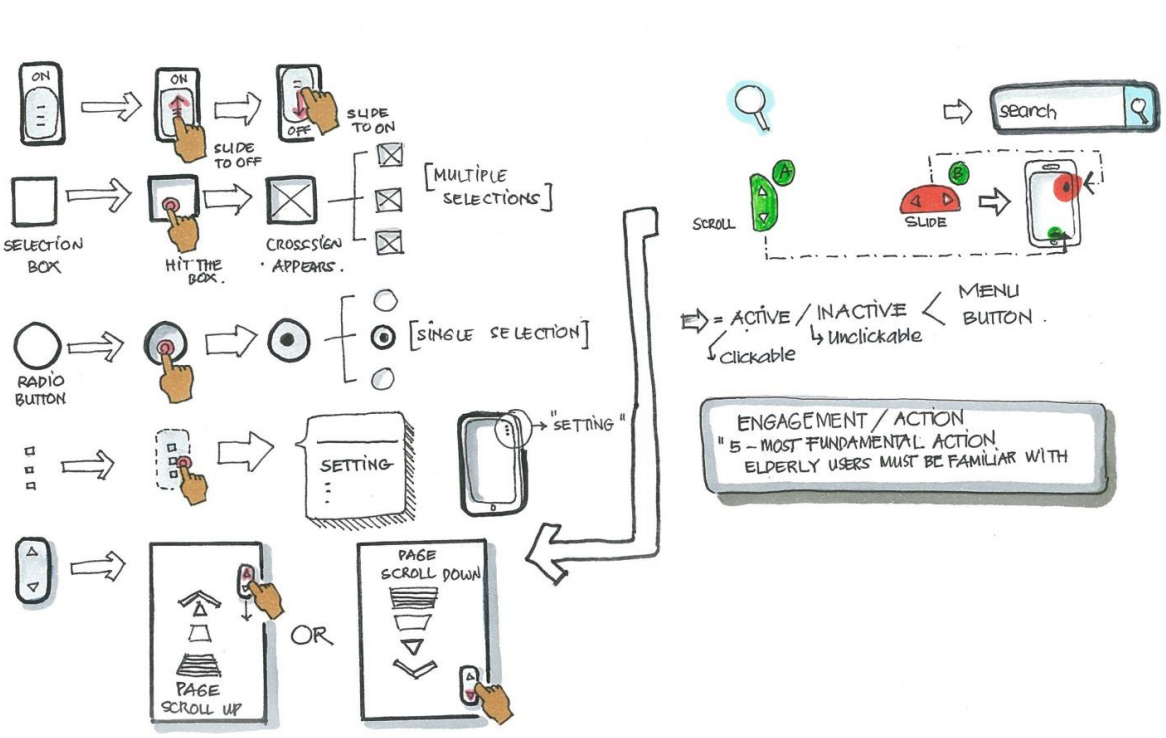


Figure H.14 Evaluation Prototype (Radio button, Page Sliders/Scrolls, Setting, and Switch ON/OFF)

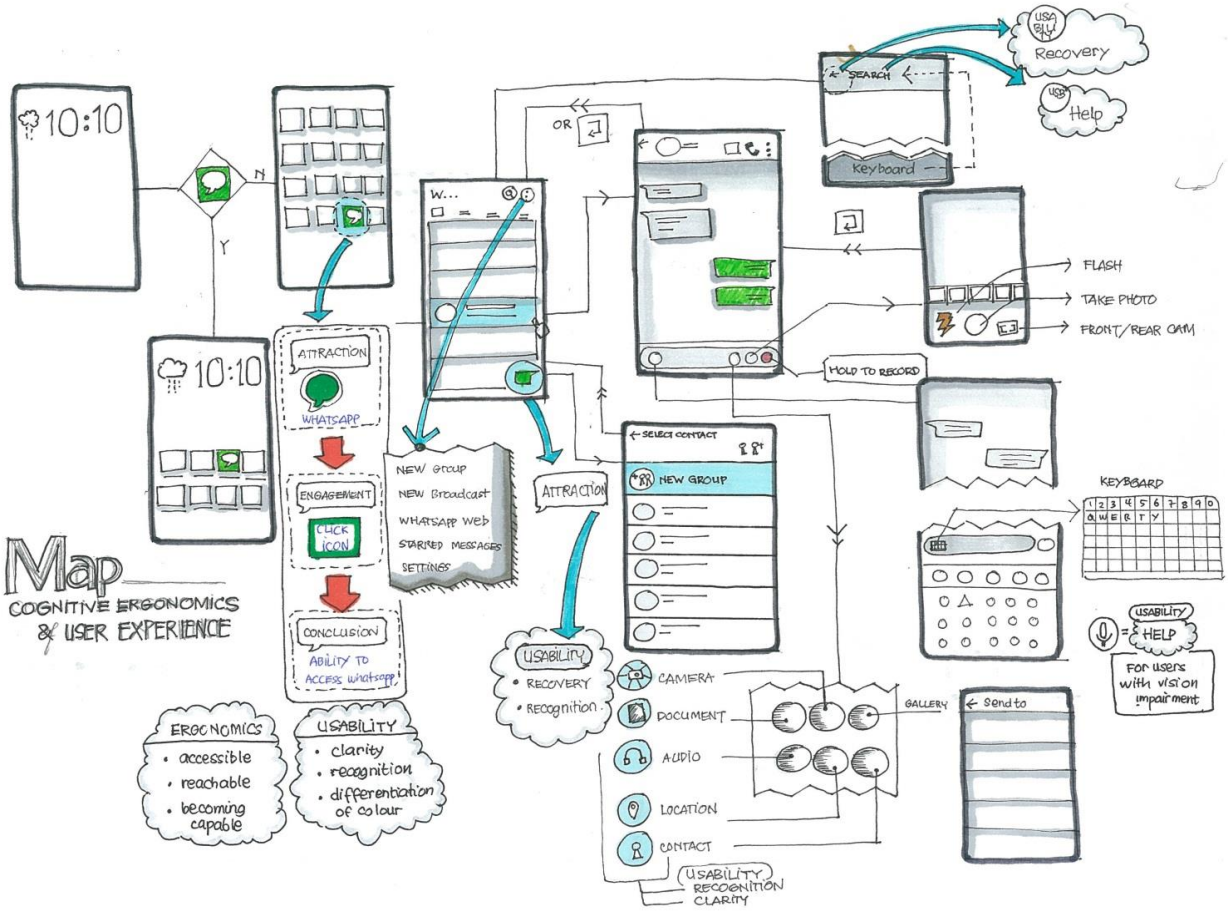


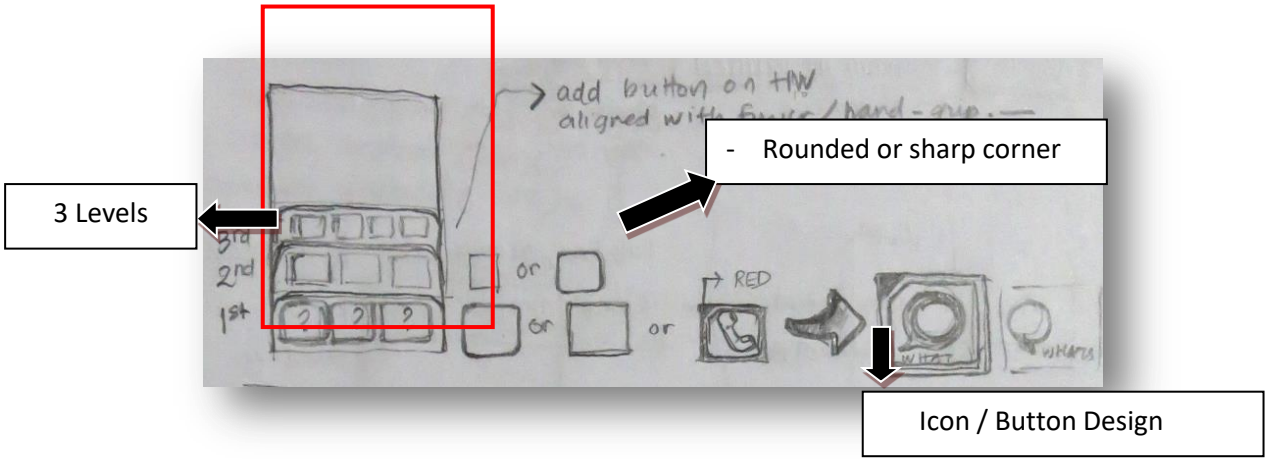
Figure H.15. Map of Cognitive Ergonomics and User Experience Assessments Elements

Appendix I. Draft Sketches of Navigation Evaluation and Development

The users were given instruction to express their needs and preferences of the navigation while the researcher sketched up

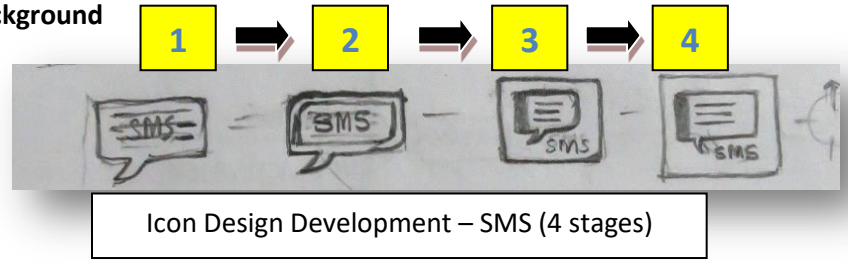
.

1. **Area Level**



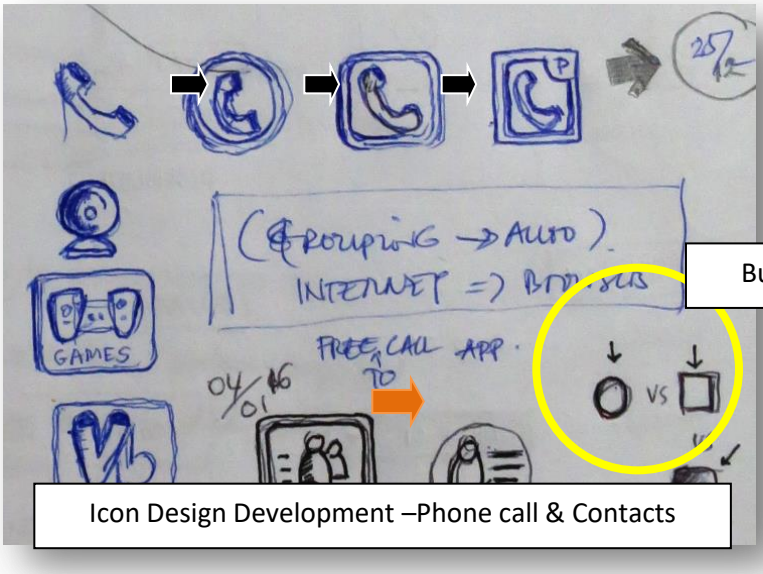
2. **Button Background**

A

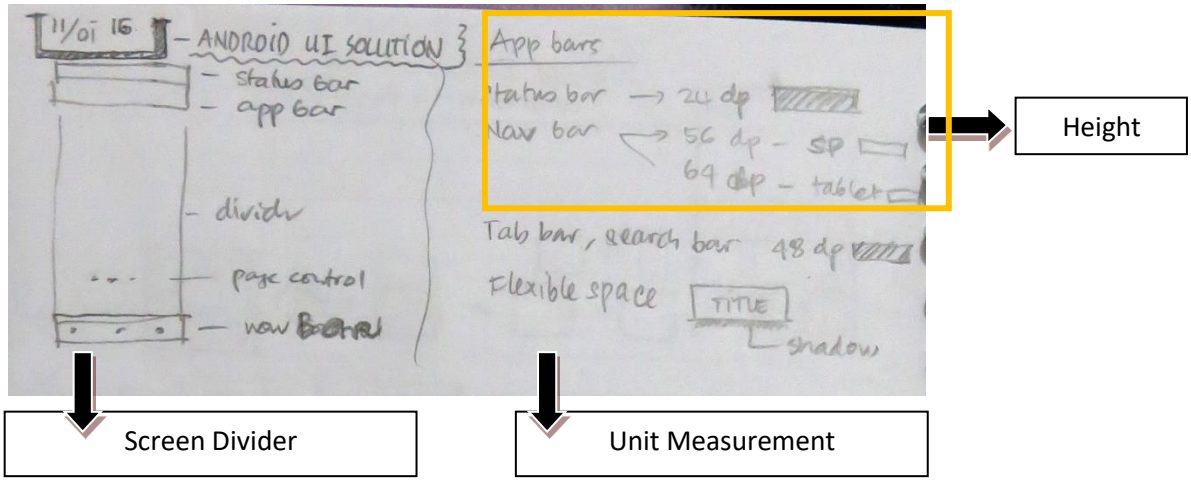


Icon Design Development – SMS (4 stages)

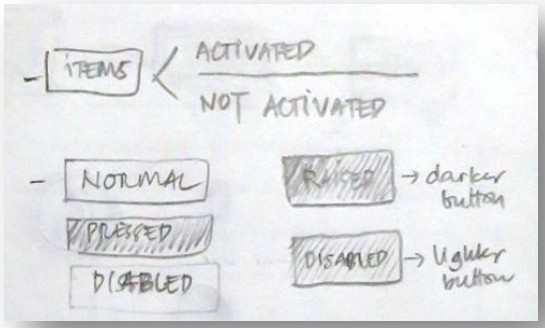
B



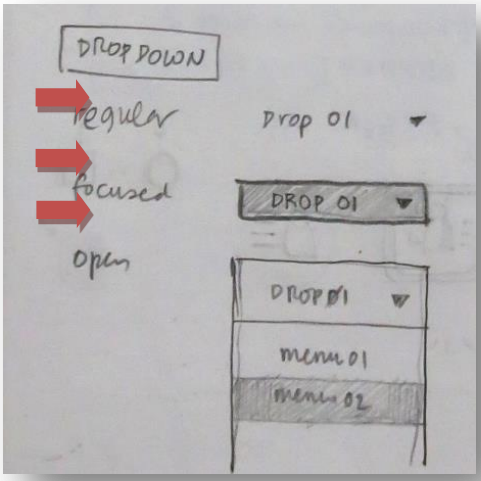
3. **Android Screen Measurement (based on Research)**



4. **Navigation & Interactivity**
   a. **Button on the NORMAL and PRESSED stages**

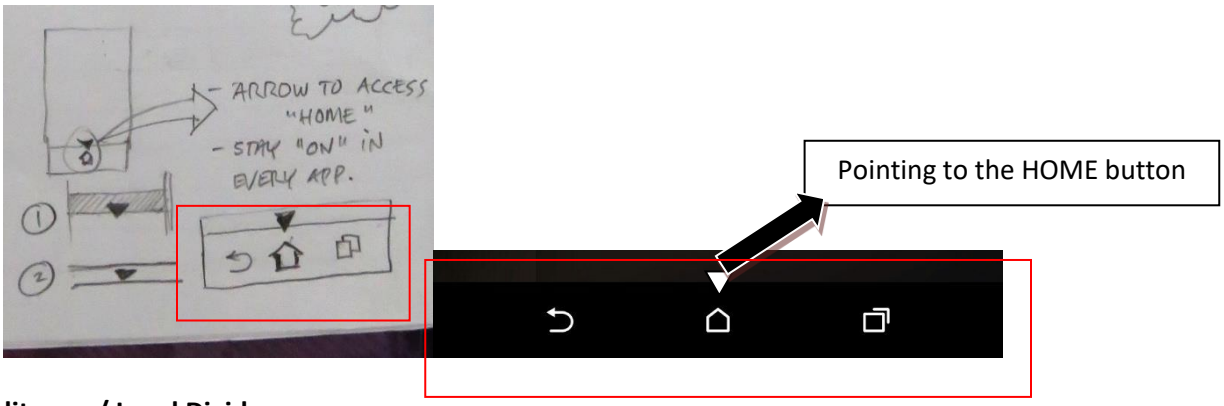


b. Drop-Down Menu

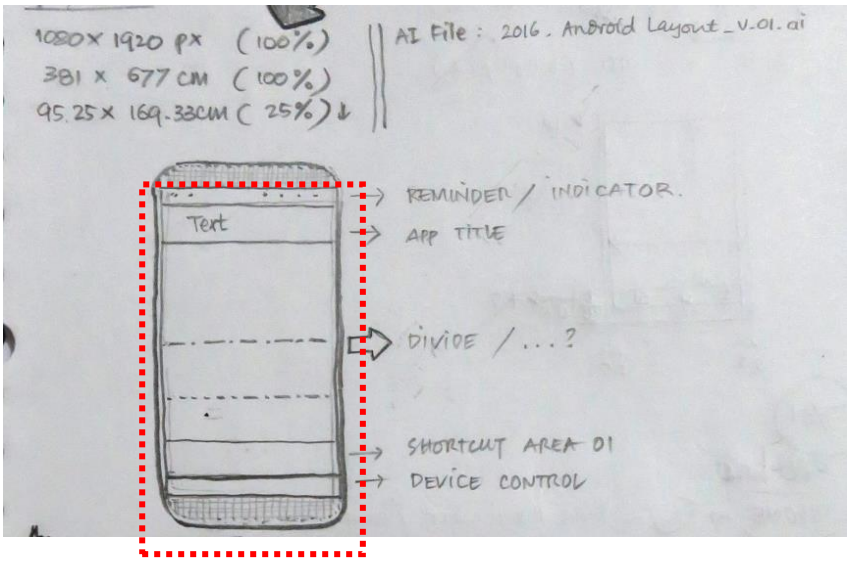


5. **Contact Photo Profile**

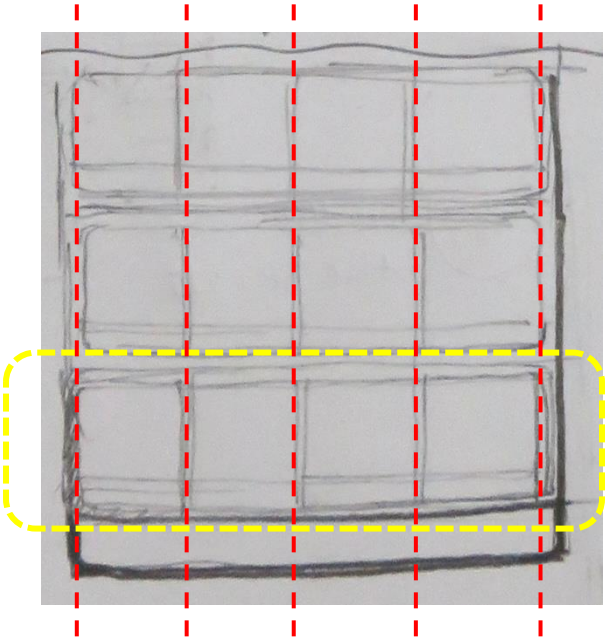
6. **Main Navigation Placement**



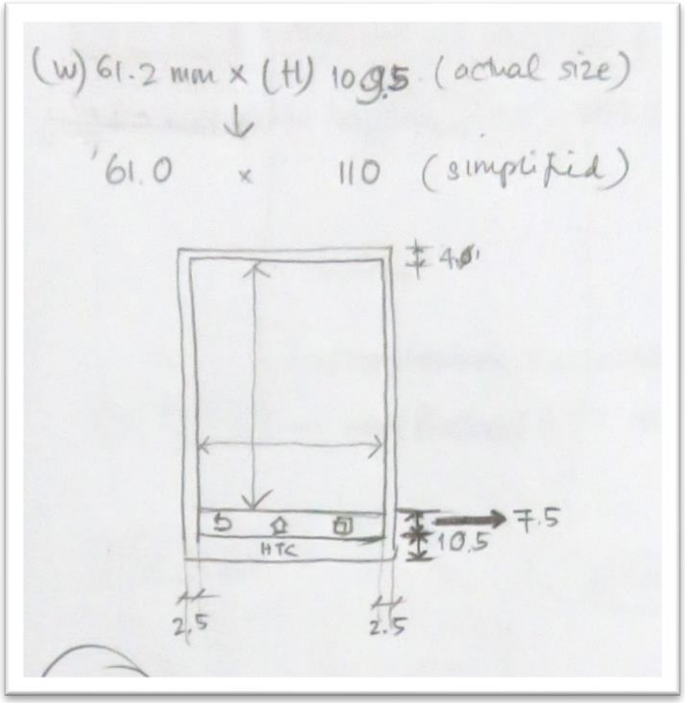
7. **Split area / Level Divider**



8. **Proposed Grid System with Level Divider**



9. **Rough Area Measurement for Prototype**



Appendix J. Explanation of each level of the navigation layer.

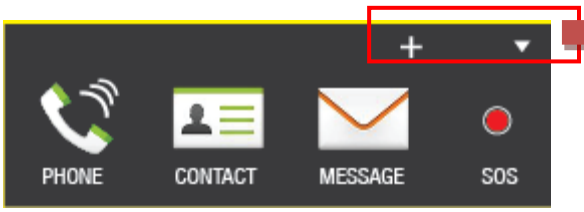
(based on request on interview / observation)

1. Emergency contact

- This is to enable users to make contact in case of emergency
- This area will stay on place to avoid any difficulties in finding the person's name

- **Red Dots** are to indicate "Emergency Contacts"

2. Communication Area (Level 02)



Level 02 area specification:

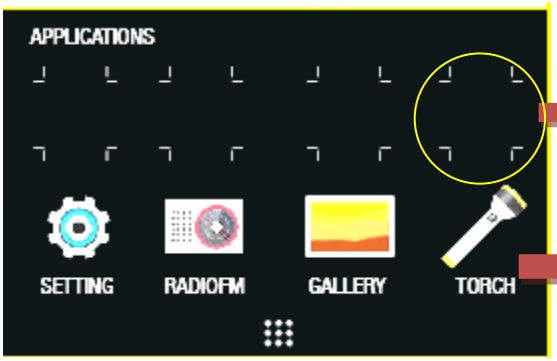
- This area is utilized for communication and emergency (SOS)
- User cannot remove this area but can add the 3rd level.
- Little triangle indicates options

3. Messenger Area (Level 03)

Level 03 area specification:

- This area is utilized for messengers (Whatsapp, SMS, Line, or KakaoTalk)
- User can remove this area
- Little triangle indicates options

4. Other Application Area



- This is the indictor of empty spots for new apps. User can add other applications into these slots in the HOME Screen.

- Top 4 of preferred applications based on user observation and interview.

Appendix K. New Design and Frameworks Development

The 18-point Cognitive Ergonomics

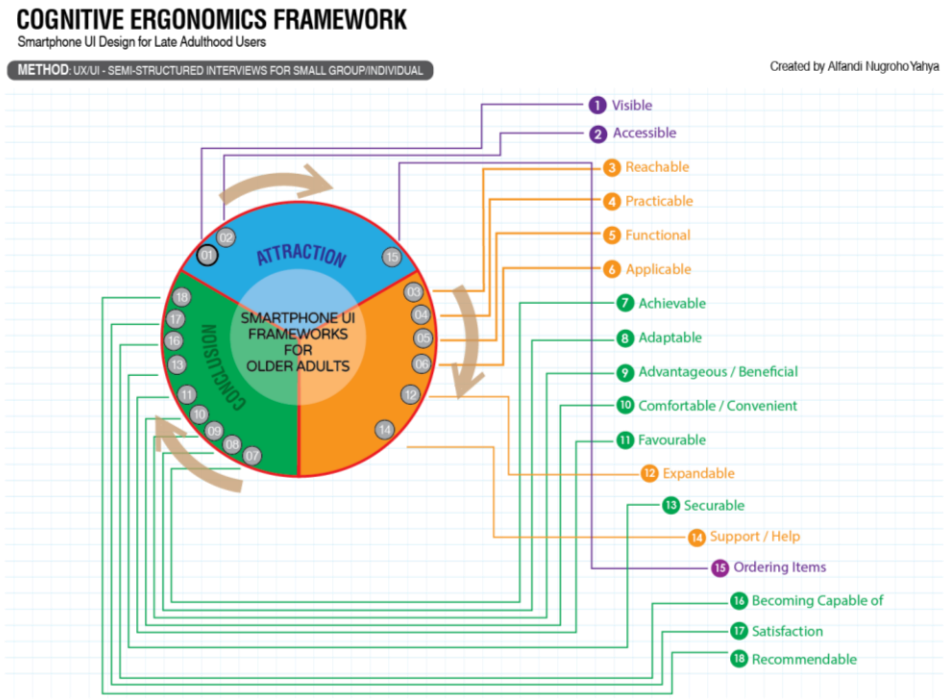


Figure J.1. Cognitive Ergonomics Frameworks of Elderly Smartphone Design

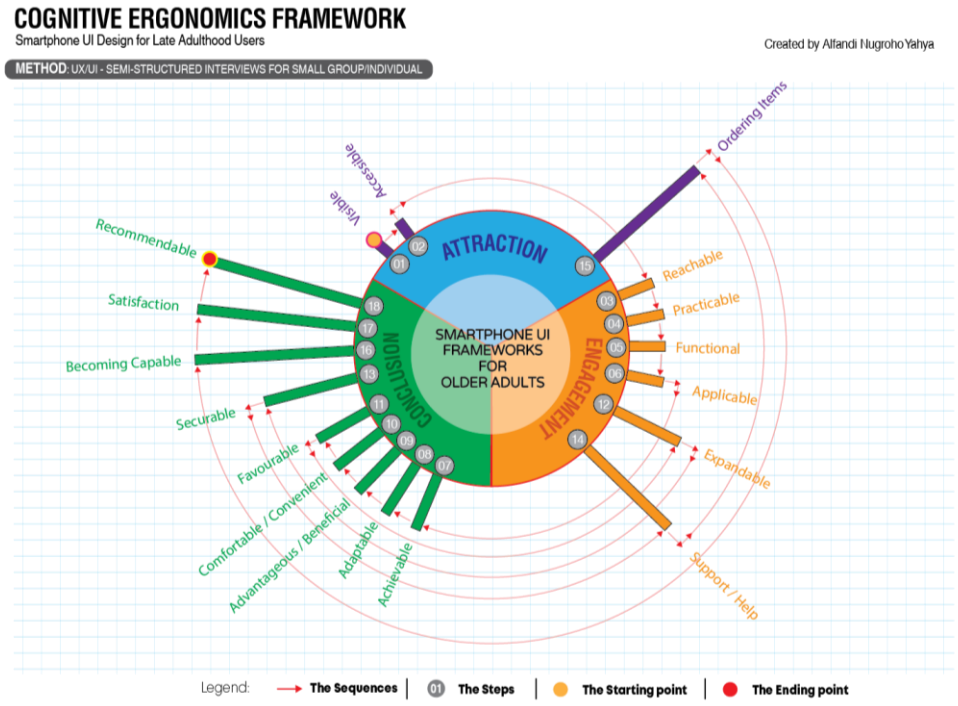


Figure J.2. Final Diagram of Cognitive Ergonomics Frameworks – Elderly Smartphone Design (with ordering numbers)

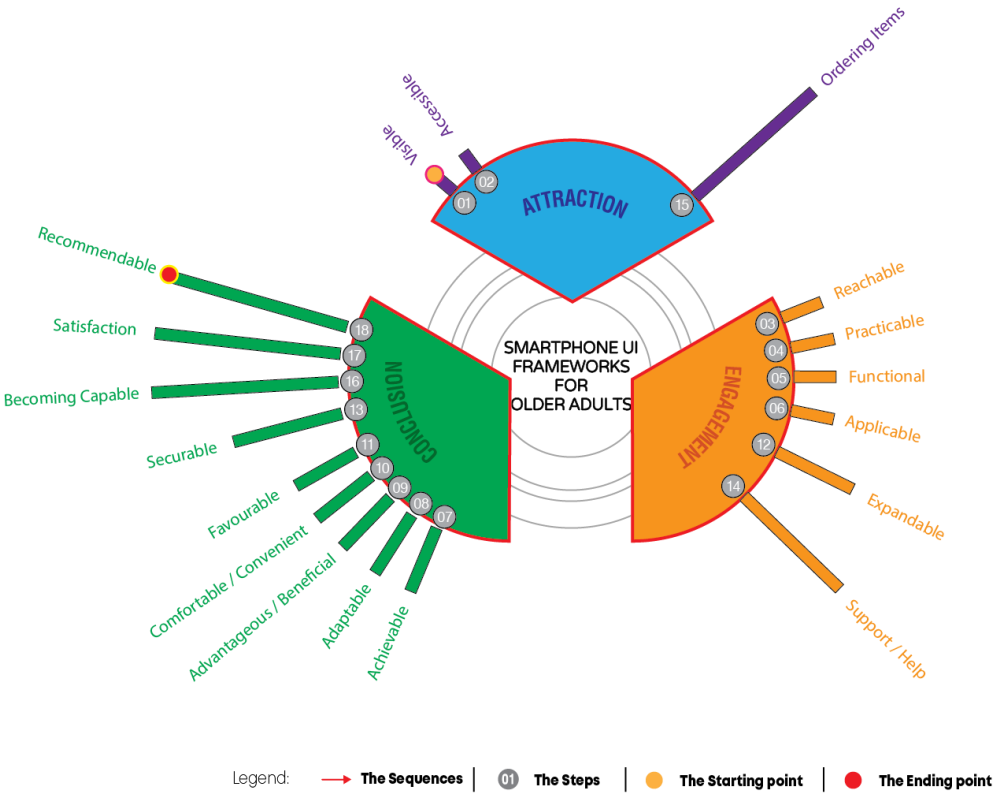


Figure J.3. The 18-Point of Cognitive Ergonomics – broken down based on three-element of User Experience by Shedroff (2001)

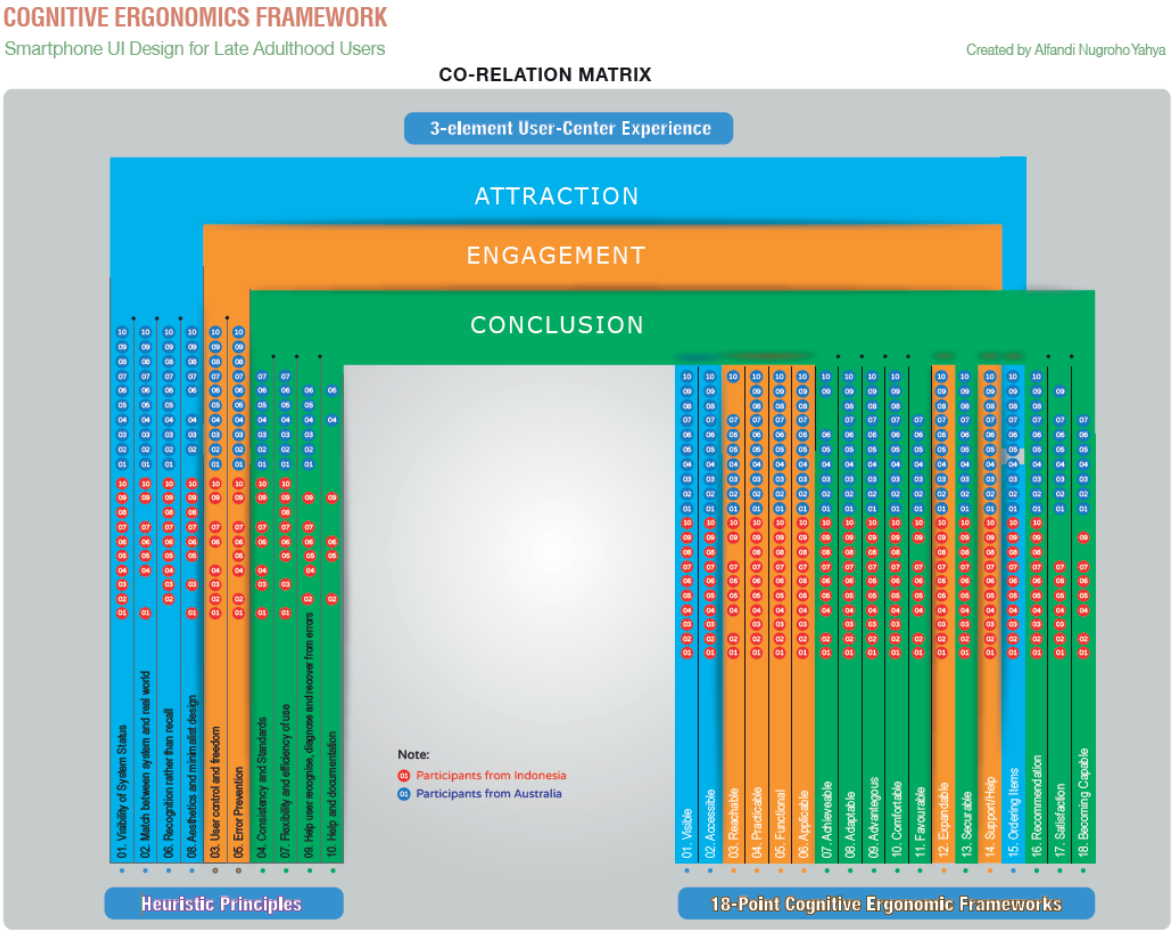


Figure J.4 Co-Relation Matrix of the new 18-point Cognitive Ergonomics Framework

Appendix L. New Design and Development of Smartphone User Interface Development

❑ Redesign Issue no. 01: System Terminologies

Problems identified in the findings

- There are many irregular terminologies used in the navigation.
- There are different categories the users can visit or access but older people might not get to the designated point.

Country of occurrence

Indonesia and Australia.

Expected Redesign

- Minimize the jargon used in the layout and navigation names.
- Use easy-to-understand icons and symbols.

❑ Redesign Issue no. 02: Vision and Hearing Impairment users

Problems identified in the findings

Unable to read text and numbers clearly, including images, icons, and symbols.

Country of occurrence

Indonesia and Australia

Expected Redesign

- Flashing images or icons
- Brighter colour on the UI and higher contrast rate between background and foreground
- Fewer colour combinations on the UI
- Audio recognition could be used to enhance the activities.

Draft Sketches of the Proposed New Design

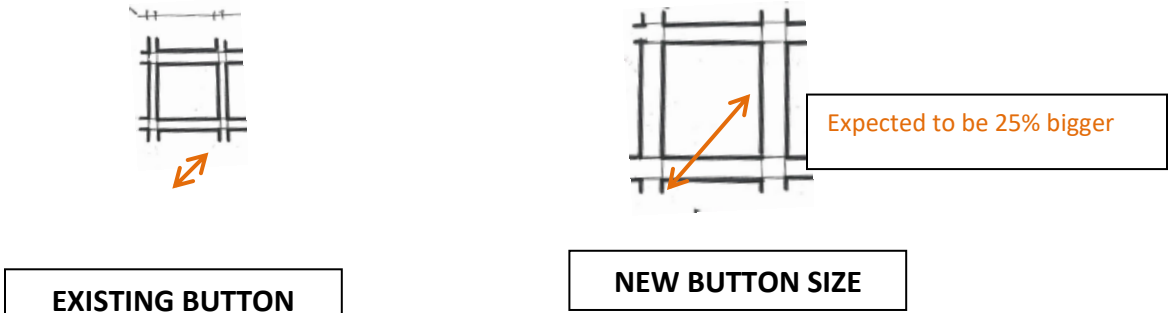


Figure K.1 Button size modification

❑ Redesign Issue no. 03: Direct Access

Problems identified in the findings
Direct access to the desired point

Country of occurrence
Indonesia and Australia

Expected Redesign
Users should be able to get into their desired point using not more than three clicks.

Draft Sketches of the Proposed New Design
The Information Architecture of Main Navigation to Sub level 2.

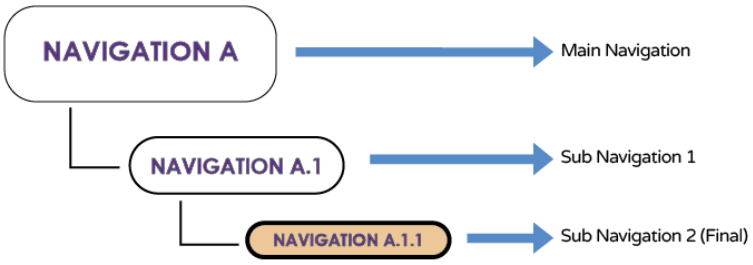


Figure K.2 Navigation Structure

❑ Redesign Issue no. 04: Volume Buttons Position for Left-Handed Users

Problems identified in the findings
Volume Button on the left hand side of the handset.

Country of occurrence
Indonesia and Australia– specific to left-handed users

Expected Redesign
Give more space to the up and down buttons or move the buttons into higher position than the current one. This redesign will differentiate between touching the buttons or the textured surface.

Draft Sketches of the Proposed New Design

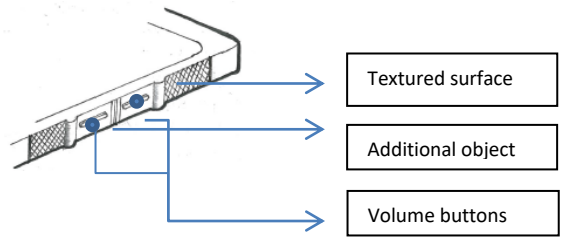


Figure K.3 Separators for Volume Control (iPhone)

❑ Redesign Issue no. 05: Photographs on Contact Information

Problems identified in the findings
User cannot identify the callers by looking at the text and there are no photographs with the contact name; i.e., name “John” can be confused with others.

Country of occurrence
Indonesia and Australia

Expected Redesign
- Caller ID is to include photographs.
- Large photos and text are necessary to identify callers.

Draft Sketches of the Proposed New Design (if available)

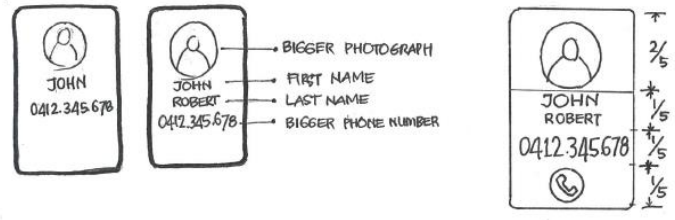


Figure K.4 Size and placement of Contact Photograph

❑ Redesign Issue no. 06: Phone Alert System Toggle Shortcut On and Off

Problems identified in the findings
Phone warning sounds/audio alert, especially during outdoor use, alarm, and in meetings.

Country of occurrence
Indonesia and Australia

Expected Redesign
A shortcut should be available on the main screen or built as a physical button to help users turn the volume all the way up in an outdoor environment and all the way down during meetings.

❑ Redesign Issue no. 07: Phone Warning Clarity

Problems identified in the findings
Phone warning text was not clear to the participants due to its small size.

Country of occurrence

Indonesia and Australia

Expected Redesign
Text in the warning message should be made bigger and flashy. It will help the user distinguish between idle stage and warning one. Animated text (zooming in and out) can possibly be accommodated into the development.

Draft Sketches of the Proposed New Design
Text and Images are resized to make a better clarity and readability.

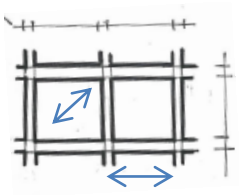
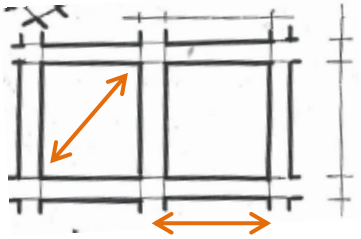
Current Design	New Design
	

Figure K.5 Warning button size

❑ Redesign issue no. 08: Smartphone-to-PC Connection

Problems identified in the findings
The indicator of PC and smartphone connection for file transfer was not clear.

Country of occurrence
Indonesia and Australia

Expected Redesign
In the internal systems, the PC should have a clear and easy-to-understand element on the interface to indicate the sync between the PC and the smartphone.

Draft Sketches of the Proposed New Design (if available)

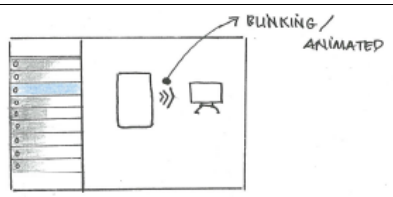
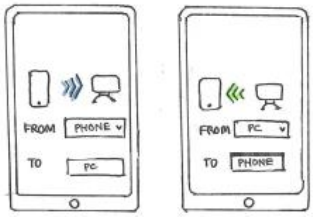
	
Animated arrow sign to determine connection	**From PC to Smartphone or From Smartphone to PC connection indicator**

Figure K.6 Image and Icons clarity to connect to PC

❑ Redesign Issue no. 09: Cluttered Objects or Elements

Problems found (based on the interview)
Application/icons cluttered on one page.

Country of occurrence
Indonesia and Australia

Expected Redesign

- Giving better space between each icon and allow the user to categorize the functions easily (i.e., instant messenger, social media, photo or video, phone call).
- The icons indicating a folder should be bigger than the default.
- A shortcut should be provided to auto-adjust the position

❑ Redesign Issue no. 10: Auto-Update On/Off

Problems identified in the findings

The auto-update systems caused more issues or problems for the elderly users due to a lack of understanding of technical terms. An auto-update function should be disabled for elderly users to avoid any errors.

Country of occurrence
Indonesia and Australia

Expected Redesign
Creating an update for elderly users while avoiding making significant changes to the layout and functionalities.

❑ Redesign Issue no. 11: Hardware Size for Female Users

Problems found on the findings
Device size (hardware) is not suitable for a female handgrip. The iPhone 6 is thicker than the previous models but it creates more problems with the handgrip. The screen size is somewhat suitable but a bit too big for female hands.

Country of occurrence
Indonesia and Australia

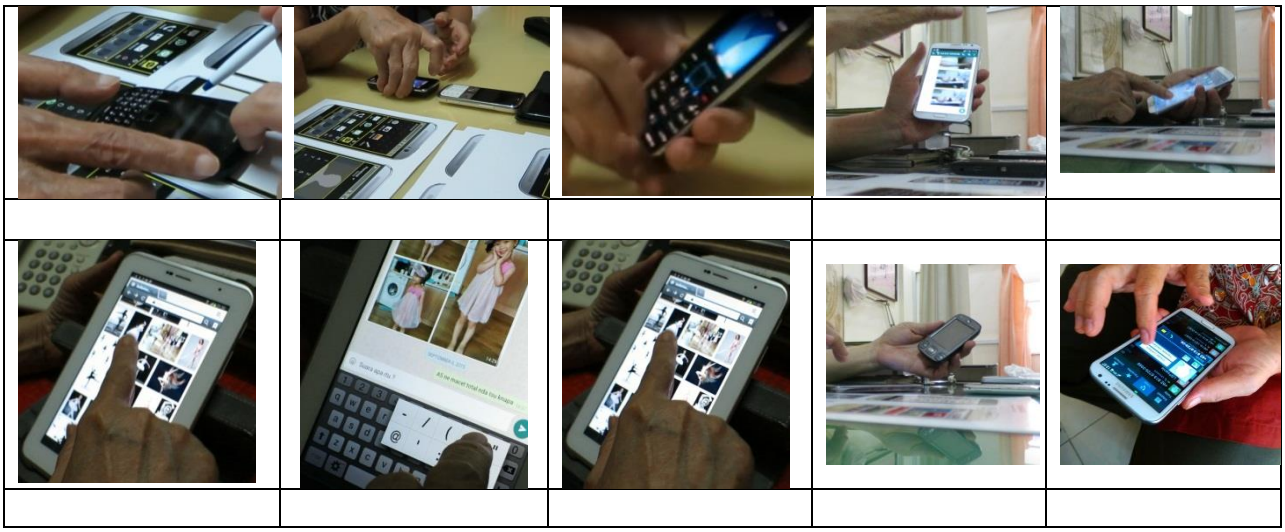
Expected Redesign
Obtain average female hand-grip measurement.

Appendix M. Phone Devices Owned by the Participants

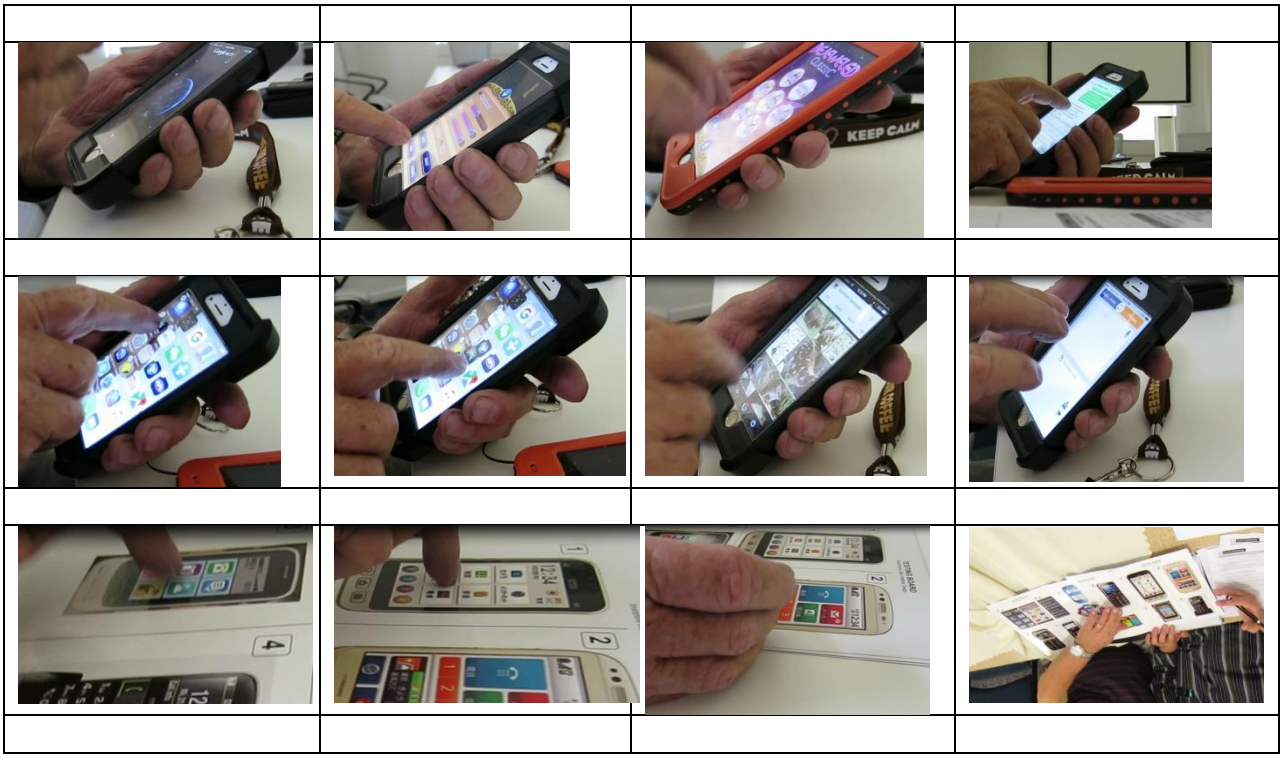
A. Participants in Indonesia

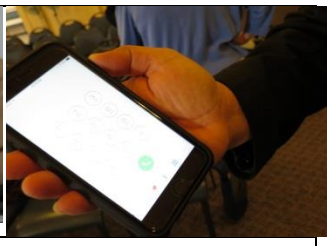
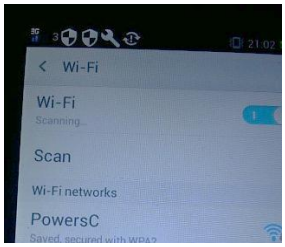
Some photographs to represent participants in Indonesia interact with the phone during the semi-structure interview

1	2	3	4	5	6	7
						
AS				TY		
						
SY				TF		
						
KY	SS/KF					
						
SY	KF/SS	KF/SS				



B. Participants in Australia



Appendix N. The Forms

These forms are used to support the semi-structured interview

Part 4: Student must complete this section

1. I have discussed with my supervisor issues relating to copyright and intellectual property.
   ☑ Yes ☐ No

2. I have discussed with my supervisor issues relating to joint authorship of any publications arising from my research. (See *Information Regarding Authorship and Joint Authorship for Higher Degree by Research Students and Their Supervisors* at http://research.curtin.edu.au/forms/policies.cfm.)
   ☑ Yes ☐ No

3. I have discussed with my supervisor the level of support for my project and the access to essential facilities in my Enrolling Area. (See *Essential Facilities for Higher Degree by Research Students* at http://research.curtin.edu.au/forms/policies.cfm#essential.)
   ☑ Yes ☐ No

4. I have ticked "yes" to one or more sections of Part 2, Ethics and Research Practice Clearance. If yes, I have discussed the submission of the relevant application/s for ethics clearance with my supervisor.
   ☑ Yes ☐ No

Student Declaration of Accuracy

Please sign below to confirm that the information provided by you on this application form is accurate and true.

Signature of Student [redacted] **Date** 18/05/15 (DD/MM/YY)

On completion of all student Parts, please forward this application form to your Supervisor. Your Supervisor, Chairperson of Thesis Committee, and Head of Enrolling Area will complete as appropriate for forwarding to the Graduate Studies Committee in your Faculty for approval.

Figure N.1. Ethics Approval for Low risk Research (01)

(viii) I undertake to do all things necessary to protect any of the University's Intellectual Property which may be capable of Commercialisation as directed in Clause 6 of the *Ownership of Intellectual Property* policy.

Dated this 18 (date) day of May (month) 2015 (year)

Signature of Student [redacted]

Note: When a student submits their thesis, they are asked to grant to Curtin University of Technology or its duly authorised agents the right to archive and to make available their thesis, at the required/desired level of access, in whole or in part in the University Libraries in all forms of media, now or hereafter known.

Part 3b: Head of Enrolling Area must complete this section

Accepted for and on behalf of the Curtin University of Technology

Dated this 24/6/15 (date) day of _____ (month) _____ (year)

Signature of Head of Enrolling Area [redacted]

Figure N2. Ethics Approval for Low risk Research (02)

4. Application for Conversion *(where applicable)*
It is confirmed that the Supervisor has provided a letter of approval/support. ☑ Confirmed

5. Recommendation
We recommend this application for admission to Confirmed Candidature. ☐ Yes, with no conditions

or
We recommend this application for admission to Confirmed Candidature subject to the following condition/s. ☐ Yes, subject to the specified conditions

or
We recommend this application for admission to Confirmed Candidature noting that the student/supervisor must apply for the following ethics clearance. ☐ Yes, ethics clearance required

☐ "Form A" Human Research Ethics Application ☐ Animal Ethics Application

☑ "Form C" Human Research Ethics Application ☐ Other Ethics Application

Signature of Supervisor [redacted] **Date** 19.06.2015 (DD/MM/YY)

Signature of Chairperson [redacted] **Date** 19.6.15 (DD/MM/YY)

Signature of Head of Enrolling Area [redacted] **Date** 24/6/15 (DD/MM/YY)
(Please ensure the Copyright and Ownership of Intellectual Property Part is also signed).

When signed, please forward this form to the appropriate Faculty Graduate Studies Committee.

Figure N.3. Ethics Approval for Low risk Research (03)

Office of Research and Development

GPO Box U1987
Perth Western Australia 6845

Telephone +61 8 9266 7863
Facsimile +61 8 9266 3793
Web research.curtin.edu.au

12-Jun-2018

Name: Andrew Hutchison
Department/School: Department of Design
Email: A.Hutchison@curtin.edu.au

Dear Andrew Hutchison

RE: Ethics Office review outcome
Approval number: 14948

Thank you for submitting your application to the Human Research Ethics Office for the project **An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users**.

Your application was reviewed through the Curtin University Low risk review process.

The review outcome is: **Not Yet Approved**.

It was the Review Body's view that this application does not comply with the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007).*

You may not commence data collection.

The Review Body has asked for clarification on the points below;

1. You may wish to reconsider the use of the words "elderly people" in your information statement.

2. You mention in your application that participants are to be actively professionally to improve the likelihood that they are not mentally dependent. How do you define professionally? Is this part of your sampling method?

3. As an advisory note, having worked on these kinds of studies, you need to explain a little better how you intend to analyse the data. You could also think about using the 'think aloud protocol' to elicit user feedback on interfaces but in a controlled (or private) environment. Be clearer about any tasks you are asking them to undertake and -again - how you analyse this.

4. Flyer - Add the Curtin logo and the 1st sentence of the HREC statement (below), remove mobile phone number.

5. Information Sheet - remove mobile phone number, add full HREC statement (below).

Curtin University Human Research Ethics Committee (HREC) has approved this study (HREC number XX/XXXX). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email [illegible]@curtin.edu.au.

**** Where you are amending a document please highlight the changes before you resubmit. If you are providing a justification for a point raised by the low-risk review process please upload a word document titled 'Response to Reviewer' ****

Figure N.4. Ethics Committee Approval

DICARI PARTISIPAN

Dibutuhkan partisipan untuk ambil bagian dalam interview dan diskusi dalam ***pengembangan perangkat Smartphone bagi orang tua.***

Kriteria:
Pria atau Wanita
Usia 65 tahun keatas
Mempunyai Smartphone

Jika Anda memenuhi syarat tersebut di atas, kami ingin mendengar dari Anda untuk dapat berpartisipasi dalam sesi interview yang berlangsung kurang lebih 30–45 menit. **Identitas Anda akan dirahasiakan.**

Informasi lebih lanjut hubungi

Alfandi Yahya (Peneliti)
Email: **alfandi.yahya@postgrad.curtin.edu.au**
Mobile: **0416 989 168**

Figure N.5 Participant Recruitment Forms (in Bahasa)

PARTICIPANT NEEDED

Seeking volunteer to take part in an interview and group discussion to ***improve the utilization of smart-phone device for older adult people.***

Criteria:
Male or Female
Age 65 years old and above
Have a smartphone device

If you meet the above criteria, we would really like to hear from you to participate in an interview session which will take approximately 30–45 minutes. **Your identity will be kept anonymous.**

For more information, please contact

Alfandi Yahya (Researcher/Investigator)
Email: **alfandi.yahya@postgrad.curtin.edu.au**
Mobile: **0416 989 168**

Figure N.6 Participant Recruitment Forms (in English)

Appendix O. Survey Forms
Appendix O.1 CONSENT FORMS In Bahasa.

Indonesian

CONSENT FORM

Judul Project:
Suatu investigasi Framework Cognitive Ergonomics pada tampilan antar muka Smartphone untuk Pengguna Lanjut Usia.

Name Peneliti: ALFANDI NUGROHO YAHYA

1. Saya menyatakan bahwa saya telah membaca dan mengerti pernyataan dengan bahasa sederhana untuk penelitian tersebut dan mendapat kesempatan untuk bertanya.

2. Saya mengerti bahwa keikutsertaan saya adalah bersifat sukarela dan saya bebas untuk mundur kapan saja tanpa member alasan apapun.

3. Beberapa hal akan dilakukan selama interview dilangsungkan:
   - Selama interview akan dilakukan rekaman audio, hal-hal yang dilakukan di smartphone akan direkam dengan video (hanya pergerakan tangan yang akan direkam)
   - Semua contoh di mana adanya keterlibatan hubungan yang bergantung dengan pihak yang terlibat, maka ada telah dikonfirmasi bahwa partisipan atau non-partisipan dalam penelitian ini tidak akan berpengaruh pada nilai / penilaian / kerja

4. Beberapa kegiatan lain akan dilakukan pada waktu sesi interview

5. Saya (menyetujui/tidak menyetujui) untuk berpartisipasi pada studi di atas (coret yang tidak perlu)

DISETUJUI,

Nama Partisipan	Tanggal	Tanda Tangan
Nama yang bertanggung jawab	Tanggal	Tanda Tangan

Alfandi Nugroho Yahya

Peneliti	Tanggal	Tanda Tangan

Appendix O.2 Consent Form in English.

Curtin University

English

CONSENT FORM

Title of Project:
An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

This research project will describe the development process in designing an effective Smartphone interface using cognitive ergonomics methods for late adulthood users located in Australia and Indonesia.

The population of the world is growing every year. At the same time, the number of people aged over 65 years old is also increasing. In order to achieve more effective smartphone user interface design for older adults, user interface designer should follow the principles of ergonomics, such as easy operation, less memory load, and efficiency to create the design.

Name of Researcher: ALFANDI NUGROHO YAHYA

1. I confirm that I have read and understand the Plain Language Statement for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.
3. Some of the following action will be performed during the interview session
   - Interviews will be audio-taped; action on smartphone will be video-taped (only hand movement will be recorded).
   - AI instances where a dependent relationship is involved, confirmation that participation or non-participation in the research will have no effect on grades/assessment/employment)
4. Any other inquiries will be notified during the interview session.
5. I agree / do not agree (delete as applicable) to participate in the above study.

ACKNOWLEDGEMENT,

Name of Participant	Date	Signature

Name of Person giving consent	Date	Signature
Alfandi Nugroho Yahya		
Researcher	Date	Signature

Curtin University

Project Title

An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users

Receipt Form: Interview/Observation Compensation (Adult)

Please sign below to indicate that you have received the promised compensation for your participation in the interview / observation

Date	
Compensation Received	
Please print your name	
Please sign your name	

Thank you for participating in the interview / observation session!

We appreciate your valuable time and contribution to the research project.

Regards,

Alfandi Nugroho Yahya
Researcher

INTERVIEW GUIDELINES

Introduction
The purpose of this interview is to learn and give as much information as possible about a Smartphone product in which how the Smartphone will be used by elderly people.

Aim
To observe and learn from real user
To observe closely what you do and say (both the pros and cons aspects) about Smartphone device, including:
Physical interaction
Flow of the work

Questions
If you do not understand or unsure about something, of if something happened too quickly, you may ask the researcher to repeat or re-explain.

Condition of the Interview
I will explain and describe how the interview works, that may include:

- I will give you time to ask questions prior to the interview
- I will not include participant name in any notes
- I will not tell you how to do things

We may begin the observation / interview session when you are ready

Curtin University

INTERVIEW SCRIPT

Good morning / good afternoon …

- My name is Alfandi Nugroho Yahya, I am [calling] from Curtin University
- I am in the process of doing a Research Project of Redesigning a new Smartphone User Interface for elderly people.
- I believe you are currently suing a Smartphone product. So, the changes I will make may have an effect on you.
- As part of the Smartphone product design process, I am trying to spend some time with people who use a Smartphone device. By doing this, we can ensure that problems and issues can be addressed, with the intention of ensuring that the new product will be a genuine improvement from the user's perspective and will make your work more effective.

- I wonder whether it would be possible for me to interview you within next week

- The interview will take place at Curtin University, Bentley Campus. The process would simply involve sitting with you while you navigate around or operate your Smartphone. I would spend no more than 1 hour with you.

<*wait for response on the venue and time*>

- Should I contact you again next week to confirm our interview schedule

<*wait for response*>

- Can we confirm contact details and timing now?

<*wait for response and confirm the date, time and venue of interview*>

- Thanks for your time I'll look forward to seeing you next week.

Curtin University

INTERVIEW RECRUITMENT FORM

Contact Details

Items	Information	Remarks
Name		
Phone No.		
Email		
Contact No.		
Visit Date/Time		
Room no.		
Confirmation	Confirm / not confirm (will call back / others, …)	

*) this information is for administrative purpose will **NOT** be published under any circumstances.

Appendix O.6 Interview Recruitment Form

Curtin University

INTERVIEW SCHEDULE

(for admin purpose only)

No.	Name	Day	Date	Time	Phone	Suburb	Venue	Sign

Appendix O.7 Interview Schedule

Curtin University

A. Respondent Details

Number	
Code Respondent	
Date/Time	
Place of observation	
Gender	
Occupation	
Age (Year of Birth)	

B. Device Details

Smartphone Ownership

No.	Brand	Screen Resolution	OS	Provider	Bought Period Month | Year	Remarks
1						
2						
3						

C. Functionalities Analysis

01. Main Functions

No.	Function	Navigation steps	Duration	Like	Dislike	Remarks

Appendix O.8 Respondent Details and Functions Analysis on phone ownership

02. Secondary Functions

No.	Function	Navigation steps	Duration	Like	Dislike	Remarks

General Feedback for Improvement

Appendix O.9 Questionnaire Type 1

Title of Project	: An Investigation of Cognitive Ergonomics Framework of Smartphone User Interface Design for Late Adulthood Users
Name of Researcher	: ALFANDI NUGROHO YAHYA
Institution	: CURTIN UNIVERSITY – SCHOOL OF DESIGN AND ART (Digital Design)

Please put ☑ or ☒ to indicate your respond to the questions.

Description: **SD** (Strongly Disagree); **D** (Disagree); **N** (Neither Agree or Disagree); **A** (Agree); **SA** (Strongly Agree)

Section A

No.	Questions	**SD** (1)	**D** (2)	**N** (3)	**A** (4)	**SA** (5)	Remarks
1	The phone shaped fit into users' hand	☐	☐	☐	☐	☐	
2	The keys prevent slipping	☐	☐	☐	☐	☐	
3	The smartphone edges help users locate buttons easily	☐	☐	☐	☐	☐	
4	Commonly used buttons (home, volume, power) are placed in the intuitive location	☐	☐	☐	☐	☐	
5	The buttons are shaped in large and spaced to support functions	☐	☐	☐	☐	☐	
6	The buttons are not required tight grasping and twisting the wrist	☐	☐	☐	☐	☐	
7	The highlighted buttons when pressed give you better view of access	☐	☐	☐	☐	☐	
8	The menus are easy to explore	☐	☐	☐	☐	☐	
9	The menus are easy to navigate	☐	☐	☐	☐	☐	
10	The display has high-resolution	☐	☐	☐	☐	☐	
11	There is no glare or reflection from the touch screen	☐	☐	☐	☐	☐	
12	Voice activation is available to determine system status	☐	☐	☐	☐	☐	
13	Voice activation is available to activate dialing	☐	☐	☐	☐	☐	
14	Voice activation is available to activate text entry	☐	☐	☐	☐	☐	
15	The error notification is clear	☐	☐	☐	☐	☐	
16	Screen reader technology is easy to access	☐	☐	☐	☐	☐	
17	Speed dialing is easily accessible	☐	☐	☐	☐	☐	
18	Shortcut dialing is easily accessible	☐	☐	☐	☐	☐	
19	Any-key answer is available	☐	☐	☐	☐	☐	
20	Touch-screen can be started easily by touching in any position	☐	☐	☐	☐	☐	
21	The indicator of ringing and vibrating mode is clear	☐	☐	☐	☐	☐	
22	The indicator of battery status, signal strength, and roaming is clear	☐	☐	☐	☐	☐	
23	There is a clear distinct on selected navigation	☐	☐	☐	☐	☐	
24	Gesture movement is consistent across all screen navigations	☐	☐	☐	☐	☐	
25	Smartphone layout is consistent and easy to get familiar	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	
	Messaging – messenger or sms	☐	☐	☐	☐	☐	
26	Easy access text-based messaging	☐	☐	☐	☐	☐	
27	Easy keyboard pop-up	☐	☐	☐	☐	☐	
28	Easy to find characters	☐	☐	☐	☐	☐	
29	Easy to function the navigations	☐	☐	☐	☐	☐	
30	Easy to type the word(s)	☐	☐	☐	☐	☐	
31	Easy to type the sentence	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	

Questionnaire 1

Section B

A	What is your age range?	☐ 65-70	☐ 71-75	☐ 76-80	☐ 80-85	☐ >85
B	What is your occupation	☐ Working			☐ Retired	
C	How many Smartphones do you have?	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4
D	Which Smartphone brand do you use most?	☐ Samsung	☐ LG	☐ Nokia	☐ HTC	☐ Others, please specify:
E	What is the Smartphone monitor screen-size of the smartphone on point D?	☐ 3”-4”	☐ 5”-6”	☐ 6”-7”	☐ >7”	☐ Don’t know
F	What functions do you use most? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason:					
G	What functions do you LIKE? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason:					
H	What functions do you NOT like? *(you can choose more than 1)*	☐ SMS	☐ Phone	☐ Chat	☐ Photo	☐ Others, please specify:
	Please write the reason:					

Appendix O.10 Questionnaire Type 2 (including observation guides)

Questions on 10-Heuristic Evaluation Items including participant live demonstration

1. What application(s) do you use daily? (add if more than 3)

No	Application	Frequency of use (Hourly, daily, weekly)	Duration of use (Minutes, hours, etc)	Purpose	Level of Difficulties
1					1 2 3 4 5 (Very Easy – Very Difficult)
2					1 2 3 4 5 (Very Easy – Very Difficult)
3					1 2 3 4 5 (Very Easy – Very Difficult)
					1 2 3 4 5 (Very Easy – Very Difficult)

2. How do you find the button design on your Smartphone?

No	Application	Ease of Use (1 = very easy | 5 = very difficult)	Aesthetics (1 = very bad | 5 = very good)	Comments
1				
2				
3				

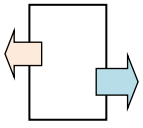
3. How do you like the navigation on your Smartphone to be presented?

		
1. Icon only	**2. Icon + Text**	**3. Others, please specify**

4. How easy do you distinguish these following **icons** for an operation?

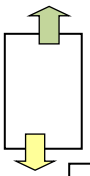
A	B	C
OK or CANCEL	☑ or ☒	YES or NO
1 2 3 4 5 (Very Easy – Very Difficult)	1 2 3 4 5 (Very Easy – Very Difficult)	1 2 3 4 5 (Very Easy – Very Difficult)

5. How easy for you to **operate** these followings:



1 2 3 4 5 (Very Easy – Very Difficult)

SLIDE (Left – Right)



1 2 3 4 5 (Very Easy – Very Difficult)

SCROLL (Up-Down)

6. Have you ever changed your language setting to other languages than what you know? And why?
(e.g. You change from English to Dutch and vice versa because of some reasons).

7. What will you do if the following erroneous circumstances happens during the process:

   a. You make a mistake on your Smartphone during the operation
   (e.g. you press Whatsapp application button instead of PHONE)

   b. You make some mistakes on your Smartphone
   (e.g. You have deleted a contact name by accident)

   c. You receive an error message.
   (e.g. You cannot connect to the Wi-Fi Network)

   d. Do you find any prior warning on the '**error**' that will make you aware of what is happening?
   Do you consider this as error or confirmation?
   e.g. Prior to deleting photo > system will ask you to confirm before deleting
   e.g There is a message "Uninstalling/removing system application will normally cause an error on other application/system"

8. Can you determine what error have you commonly made when you are using the Smartphone?

No	**Application** (e.g Whatsapp)	**Functions** (e.g. adding emoticon)	**Level of Severity** (1 = Low | 5 = High)	**Comments** (e.g. why does that happen?)
1			1 2 3 4 5 (Low Severity … High Severity)	
2			1 2 3 4 5 (Low Severity … High Severity)	
3			1 2 3 4 5 (Low Severity … High Severity)	

9. Is there anything you are confused of in your Smartphone?

Eg.

No.	**Items** (e.g. Why such items are confusing to access or navigate)	**Where does it occur?** (e.g. page, icons, texts)	**Level of Severity** 1 = low | 5 = high
1	Too consistent or too similar		1 2 3 4 5 (Low Severity … High Severity)
2	No consistency between page, icons and themes		1 2 3 4 5 (Low Severity … High Severity)

3	No consistency on menu styles and layout		1 2 3 4 5 Low Severity High Severity
4	*Others, please specify …*		1 2 3 4 5 Low Severity High Severity

10. How do you experience these following items on your smartphone?

a. **Standard / General Functionalities**, *e.g. main menu, phone button, SMS, others …*

b. **Internal factors in the application**, *e.g. text style, font type in Messenger, others …*

c. **Icon Design versus the overall style**, *e.g. icon color & shape and the background theme.*

d. If an error happens on your Smartphone, is there any **ERROR** message you don't understand? Please specify where it happens and why do you not understand the error.

No	Where did it happen	Why do you not understand?	Comments
1			
2			
3			

e. How do you normally **recover** from the 'error'? *(e.g search for solution on the Internet, etc)*

11. How do you find the Smartphone (1) Object, (2) Action, (3) Options visibility? Do you recognize the existence on your Smartphone?

e.g.

a. **[OBJECT]** Icon Text or Labels : text position is located underneath or on the side of the icon.
b. **[ACTION]** The [<] and [>] button : indicate left and right slide (it usually takes place on the photo gallery)
c. **[OPTION]** Text/button is greyed out : indicate inactive or unclickable navigation.

12. How do you use the most general functionalities on your Smartphone compared to the Old Phone?

Smartphone Brand		**Model/Type**		**Year**	
Old Phone Brand		**Model/Type**		**Year**	

No	Functions (add more if necessary)	Smartphone 1 = very easy | 5 = very difficult	Old Phone Model 1 = very easy | 5 = very difficult	Comments
1	Phone Call	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	
2	Send SMS	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	
3	Turning on/off	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	

4	Playing game	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	
5	*Other, please specify*	1 2 3 4 5 *Very easy* *Very Difficult*	1 2 3 4 5 *Very easy* *Very Difficult*	
6				

13. From your point of view, how those functionalities could be better developed?

No	On the Smartphone	Comments
1		
2		
3		
4		
5		

14. Have you ever endeavored any **other Smartphone** devices?
E.g. If you are using Android phone, have you ever used the iPhone or Nokia and vice versa.

If yes, answer to these following questions below. If No, go to Question 15.

No.	Your Device		Other Device	
	Brand	**Model / Type**	**Brand**	**Model / Type**
1				
2				
3				

- How do you rate the **VISUAL AESTHETICS** on your Smartphone compared to the other device?
a. Icon-set for **tools, utilities, messengers browsers.**

No.	***Your Device*** 1 = Very unsatisfactory | 5 = Very Satisfactory	**Other Device** 1 = Very unsatisfactory | 5 = Very Satisfactory
1	1 2 3 4 5	1 2 3 4 5
2	1 2 3 4 5	1 2 3 4 5
3	1 2 3 4 5	1 2 3 4 5

Comments:

b. Icon-set versus **background design / layout.**

No.	***Your Device*** 1 = Very unsatisfactory | 5 = Very Satisfactory	**Other Device** 1 = Very unsatisfactory | 5 = Very Satisfactory
1	1 2 3 4 5	1 2 3 4 5
2	1 2 3 4 5	1 2 3 4 5
3	1 2 3 4 5	1 2 3 4 5

Comments:

c. The overall icon, text, colour, object detail and clarity.

No.	***Your Device*** 1 = Very unsatisfactory | 5 = Very Satisfactory	**Other Device** 1 = Very unsatisfactory | 5 = Very Satisfactory
1	1 2 3 4 5	1 2 3 4 5
2	1 2 3 4 5	1 2 3 4 5
3	1 2 3 4 5	1 2 3 4 5

Comments:

15. Have you ever used **PC or Laptops** to work together with your Smartphone? How was your experience in operating the functions? *(If Not, go to Question no. 16).*
    e.g. Photo transfer through USB connection and charging

Rate	*Comments*
1 2 3 4 5 *Very easy* *Very Difficult*	

16. How **assistance or guidance** is important to operate the Smartphone basic functionalities to support your daily activities?

Rate	*Comments*
1 2 3 4 5 *Least important* *Most Important*	

17. How do you find the experience of **customizing** your Smartphone for personal use?

Rate	*Comments*
1 2 3 4 5 *Least important* *Most Important*	

18. How do you rate yourself in the use of the Smartphone on your daily life?

No	Items	**Level of expertise** 1 = novice | 5 = expert	Remarks/Comments

1	Skill	**1**	**2**	**3**	**4**	**5**	
2	Comfort	**1**	**2**	**3**	**4**	**5**	
3	Privacy	**1**	**2**	**3**	**4**	**5**	
4	Satisfactory	**1**	**2**	**3**	**4**	**5**	

19. How do you find your interest to use a Smartphone more than any other communication device to support your daily activities?

Rate	*Comments*
1 2 3 4 5 *Least important* *Most Important*	

20. Overall comments or suggestions for the next development

Appendix P. Semi-Structured Interview Detailed (including Observation Guidelines)

❑ SEMI-STRUCTURED INTERVIEW & OBSERVATION PROCEDURES

There are some procedures to be carried during the interview session on older adult users as follows: (some guidelines will be read out by the researcher).

1. The ways respondent reveals themselves on how they perform action on their smartphones

Remarks/Notes

2. Respondents communicate with the researcher through these following mechanisms:

In Action Notes:	Always	Sometimes	Never	Notes
– The eyes				
– **The quality of body gestures** *confused or not sure to the navigation, errors occurred, comfortable sequences to navigate the smartphones.*				
– **The gestures** *Users play around with hardware navigation (volume control, HOME button, others)*				
– **The smiles** *To determine something has worked properly after a few users attempts*				
– **Listlessness** *To determine users confusedness on what they should do, what to press next and how to recover from error.*				
– **Impressions or expression** *To determine the 'language' of understanding the action, happiness to perform the action.*				
– Number of Hit *To determine steps performed during the observation. The scope would be based on scenario (owned or given by the researcher).*				
– Study of action performed during the interview session (choose one) o At work o At home or o At other places, specify …				
– Others, specify….				
Remarks/Notes				

3. Language as a tool in recording – after consent has been signed by the participants (the use of "Bahasa" would be translated into English transcript)

This may include but not limited to the use of:

A. Verbs :

Purpose: To determine action performed on the device(s)

In Action Notes:	Always	Sometimes	Never	Notes
– See				
– Perform				
– Hit				
– Operate				
– Listen				
– Others, specify….				
Remarks/Notes				

B. Adverbs

Purpose: Is a one-shot description of a single verb telling what the respondent is doing, it is to determine mood and/or feeling at a particular moment.

In Action Notes:	Always	Sometimes	Never	Notes
– Chat/use the messenger excitedly				
– Browse the image pleasantly				
– See the photographs cheerfully or laughingly				
– Others, specify …				
Remarks/Notes				

C. Adjectives

- To determine satisfactory/dissatisfactory on the devices and its interaction.

In Action Notes:	Always	Sometimes	Never	Notes
– Delighted				
– Cheerful				
– Contented				

– Joyous				
– Others, specify …				
Remarks/Notes				

D. Other phrases of all kinds

- To determine other feelings from the respondents that may not be covered on the list. This will include the action on body language to determine the respondent either comfortable or not during the actions.

In Action Notes:	**Always**	**Sometimes**	**Never**	**Notes**
Body Language				
Remarks/Notes				

4. The Observation Environment

- *This is to describe the situation in which the participants are being observed.*
- *This also describes the physical environment (room that includes the interior aspects), and social environment (other people in the room that may include friends or relatives who will potentially distract the participants in any ways).*
- *This item is taken into consideration to anticipate different respondent behavior due to the comfort in a particular environment.*
  - **Indicator of observation venue**

In Action Notes:	**Sufficient**	**OK**	**Insufficient**	**Notes**
– **House/apartment *)**				
○ Living room				
○ Dining room				
– **Work place**				
○ Meeting room				
○ Guest room				
– Restaurant/food court *)				
– Shopping centre				
– A seminar room				
– Others, specify …				
Remarks/Notes				

*) select one

5. Room setting

- This is to observe whether an observation room is equipped with proper tools

In Action Notes:	Sufficient	OK	Insufficient	Notes
– Testing Board [R]				
– Participant's Smartphone(s)				
– Video Recorder [R]				
– Audio Recorder [R]				
– Camera [R]				
– Tables/Chairs?				
– Others, specify …				
Remarks/Notes				

- **Stimulus To The Q & A**

  Does the participant require close assistance or guidance from the researcher?

In Action Notes:	Always	Sometimes	Never	Notes
– Did the researcher ask questions all the time to guide participants?				
– Did the researcher ask question only at the beginning of the conversation? Then the respondents carry on with the answers, including performance on the device.				
– Did the researcher and respondent ask and answer the questions as they go along the tasks on the scenario?				
– Did the researcher ask question only at the beginning of the conversation? Then the respondents carry on with the answers, including performance on the device.				
– Did the researcher and respondent ask and answer the questions as they go along the tasks on the scenario?				
– Others, specify …				
Remarks/Notes				

- **Reaction of The Respondent**

In Action Notes:	Always	Sometimes	Never	Notes
– Accept the questions and give suitable answer or live demonstration on their phone?				
– Do not understand the questions and that may lead to confusion to answer.				
– If it is respondent directed, how do they carry that out the tasks?				
– How serious when the respondent takes the process on individual task (or overall)				
– How much interest during the talks/live demonstration on the phones				

– How does the respondent handle himself if there's problem – note to usability issues.				
– Is the respondent ability equal to the tasks				
– Does he/she have special abilities? Age versus appropriate tasks to be carried out, i.e. user may require reading glasses to perform tasks on their phone.				
– Others, specify …				
Remarks/Notes				

- **Implication of Reaction (to indicate in the routine situation)**

In Action Notes:	Always	Sometimes	Never	Notes
– Does the respondent seem to function independently?				
– How is the behavior in relation to the group situation? (i.e. the participants community in an aged-care).				
– What are the external factors that may be influencing the respondent reactions?				
– Others, specify …				
Remarks/Notes				

- **How much researcher attention is offered to assist the older adult participants?**

In Action Notes:	Always	Sometimes	Never	Notes
– Accept the questions and give suitable answer or live demonstration on their phone?				
– Do not understand the questions and that may lead to confusion to answer.				
– If it is respondent directed, how do they carry that out the tasks?				
– How serious when the respondent takes the process on individual task (or overall)				
– As much as the participant wants				
– As much as the researcher thinks the participant needs or requires				
– Others, specify …				
Remarks/Notes				

- **Field Interviews**

In Action Notes:	Always	Sometimes	Never	Notes
– Involve one-on-one sessions with participants in their natural environments.				
– Interviews are semi-structured, meaning the researcher prepares questions in advance but adjusts the script based on a participant's responses.				

– This type of interview is in contrast to shadowing. Field interviews typically occur in one place for about one or two hours, excluding travel.				
– Given the limited context and time frame of field interviews, researchers may choose to supplement them with a diary study. *Diary studies can provide more insight into the participant's context over a much longer period of time.*				
– Others, specify …				
Remarks/Notes				

- **Interview Context**

In Action Notes:	Always	Sometimes	Never	Notes
– The interview should occur where the app will be used most often, providing researchers with a better understanding of the context of use.				
– Apps that don't have a clear location associated with them may benefit from a diary study combined with a field interview.				
Remarks/Notes				

i.e. The diary for participants at home or in the aged-care may indicate that they spend most of their time at home, at a friend's house, or at the community area. The interview could be held at their home, but the researcher can probe into their activities at the other location.

❑ RECORDING / NOTE TAKING GENERAL GUIDELINES ON DEVICE INTERACTION BEHAVIOR

- **Details to observe (and record if permitted)**

In Action Notes:	Always	Sometimes	Never	Notes
– Where does the respondent put the object?				
– Who holds the object (smartphone device)?				
– Who is pointing on the object (smartphone device)/navigation?				
– How is the environment during the observation/any distractions (quiet, busy, noisy, relax, or others …)				
– What is the reaction on carrying out the tasks (accepting, eager, resistance, choosy, or others …)				
Remarks/Notes				

- **Details of the participants manners/actions**

In Action Notes:	Always	Sometimes	Never	Notes
– How does he hold the device? Does he have any supporting tool such as stylus pen? Others?				
– Does he play with the smartphone device cover, the case, during action performing? Others?				

– Systematic & well-organized in the action? Or the respondent tends to use back/home button frequently? Others?				
– Comfortable during the observation? Restless? Tense? Able or unable to stay for the observation? Others?				
Remarks/Notes				

- **The manner of respondents can be broken down into these following actions, such as:**

In Action Notes:	**Always**	**Sometimes**	**Never**	**Notes**
– Socialize – (i.e. how much? With the community or others?)				
– Speak to somebody else during the observation? (i.e. friends or someone that helps navigate on the phone).				
– Easy to get distracted by the surroundings? What are the distractions?				
Remarks/Notes				

- **Interest on performing tasks on the device**

In Action Notes:	**Always**	**Sometimes**	**Never**	**Notes**
– Special like/dislike? Why? Any specific comparison to other object(s) or device(s)				
– Commenting on the tasks being performed				
– Pace of action (slow or speed up) – this may include device familiarity and frequency of use.				
Remarks/Notes				

- **Researcher roles**

In Action Notes:	**Always**	**Sometimes**	**Never**	**Notes**
– Giving appropriate support if necessary (**not** direct participants to the navigation)				
– Attention on individual participants on specific or general tasks. Reason? Hardware/Software issues?				
– How much attention was given away to the respondents (apart from assisting participants for observation purpose)				
Remarks/Notes to specify reason(s)				

- **Leaving the observation Desk / Room**

In Action Notes:	Always	Sometimes	Never	Notes
– Talking eagerly and leave or dismiss the session pleasingly				
– Smacking lips				
– Stonily				
– Upset				
– Easy and calm				
Others, please specify (Remarks/Notes)				

- **What do they do after the session ends?**

In Action Notes:	Always	Sometimes	Never	Notes
– Discuss about something else (relevant to the topic or totally irrelevant)				
– Stands talking				
– Stands and wait for any further instruction				
– Gets or gives something related or not related to the observation (i.e. food, drink or others?)				
– Go to bath room and relief				
– Say good bye.				
– Discuss about something else (relevant to the topic or totally irrelevant)				
Remarks/Notes				

❑ USER RESEARCH QUESTIONS

- **User Needs**

  Purpose: to make high (overall app concept) and low screen layout levels design decisions.

- **How do they do things today? (observe for something unique)**

In Action Notes:	Scale 1 to 5				
– What is the important? *(from the most and to the least important)*	1 Low	2	3 Med	4	5 High
– What needs have not been met?	1 Low	2	3 Med	4	5 High
Remarks/Notes					

❑ Context of use of the smartphone

Purpose:

To understand where, why and when surrounding app usage, such as: environment, time of day, constraints, people involved, motivations and types of interruptions.

- **Perception of icons, symbols and other image elements**

I.e. how older adult users perceive mobile banking as insecure. Expectation: develop educational strategy as part of the apps marketing plan, emphasize security measures more prominently in the UI design of their device.

In Action Notes:	Always	Sometimes	Never	Notes

- **Language and Nomenclature (users may or may not change the language selection)**

Speaking on the older adult users' language in terms of explaining some terminologies on hardware/software,

In Action Notes:	○ Hardware	○ Software
	specify	*specify*

- **Norms of the users' behaviour**

It is about typical social behaviours within older adult user group in each country or domain. Which norms should be incorporated or avoid when designing an app.

In Action Notes:	Always	Sometimes	Never	Notes

❑ **SHADOWING AND USER INTERVIEWS**

- **Shadowing interview**

This is often referred to as a 'sit back' technique, where the researcher may probe with some questions but it's generally undirected. The researcher simply follows participants as they go about their activities.

In Action Notes:

- **Context and Duration of interview**

The context and duration will vary depending on the complexity of the participants' smartphone applications and the research goals.

In Action Notes:

- **Privacy during the interview session**

Shadowing for long periods of time can raise some privacy issues for the person being shadowed.
It is important to establish a rapport with participants beforehand.

In Action Notes:

❑ OBSERVATION GUIDELINES

- **Observation Record**

Number of Smartphones owned and used, including frequency of use.

Brand and Type of Smartphone / Mobile phone/Cellular phone

Frequency of used Period of ownership	Rarely (1-2 times per day)	Moderate (3-5 times per day)	Regularly/frequently (>5 times per day)
• New Phone (< 1 year)			
• Moderate (1-5 years)			
• Old Phone (>5 years)			
Remarks/Notes			

- **Functions and Purposed**

List of functions to demo: messaging, browsing, games, pleasure, others

Frequency of used Period of ownership	Rarely (1-2 times per day)	Moderate (3-5 times per day)	Regularly/frequently (>5 times per day)
• New Phone (< 1 year)			
• Moderate (1-5 years)			
• Old Phone (>5 years)			
Remarks/Notes			

- **SIMCARD Used (Pre-paid or Plan/Contract)**

Various SIM Card based on individual Telecommunication Service Provider

No	Provider	Advantages	Disadvantages
1			
2			
3			
4			
5			

6			
Remarks/Notes			

- **The use of SIMCARDS (above) on the phone**
  It is about where the participants put the SIMCARD on their phone

Frequency of used / **Period of ownership**	**Rarely**	**Moderate**	**Regularly/frequently**
• New Phone (< 1 year)			
• Moderate (1-5 years)			
• Old Phone (>5 years)			
Remarks/Notes *on the use of phone SIMCARD*			

❑ **REVIEW ON PARTICIPANTS CURRENT DEVICES**

- **Smartphone Feedback (+)**

This section will describe the feedback on the devices, including the proposed ones on the print out

Frequency of used / **Period of ownership**	**Rarely**	**Moderate**	**Regularly/frequently**
• New Phone (< 1 year)			
• Moderate (1-5 years)			
• Old Phone (>5 years)			
Remarks/Notes *(use other page to sketch)*			

- **General Key aspects of the observation**

– **Setup**

Is the app ready to use or it needs setup, registration, or initial setting. Point of observation should cover the number of clicks and error handling. User is expected to perform general setup of the phone (i.e. ringtone, alarm, date/time or as preferred)

Remarks/Notes *(use other page to sketch)*

– **Flows and Layout**

A researcher's scenario can/may be used to utilize this observation (i.e. making a phone call, turn the flashlight on/off, etc).

In Action Notes:	**Always**	**Sometimes**	**Never**	**Notes**
– Layout				

– Navigation				
– Buttons Position				
– Buttons Spacing				
– Buttons numbers on a page				
– Buttons Reachability				
– Main Button(s) Reachability				
Remarks/Notes *(use other page to sketch)*				

– **Standard UI Design or elements.**

This may include the use of a scenario can be used to utilize this observation (i.e. making a phone call, turn the flashlight on/off, and accessing unfamiliar applications).

In Action Notes:	Always	Sometimes	Never	Notes
– Colour combination (background and buttons),				
– Button and text				
– Button borders				
– Size of individual navigation				
Remarks/Notes				

– **Feedback**

This section will describe the feedback on the devices that needs improvement,

Frequency of used / Period of ownership	Rarely	Moderate	Regularly/frequently
• New Phone (< 1 year)			
• Moderate (1-5 years)			
• Old Phone (>5 years)			
Remarks/Notes *(use other page to sketch)*			

- **SUGGESTIONS ON FUTURE DEVELOPMENT**

  This section will describe the development of the future devices. This may include but not limited to:

– Additional **buttons or navigations** or default application

Remarks on observation (use other page to sketch)

- The change of **colour** (solid/transparent)

Remarks on observation (use other page to sketch)

- The change of **interface design layout/theme**

Remarks on observation (use other page to sketch)

- Others, please specify

Remarks on observation (use other page to sketch)

- **OBSERVATION ON PRODUCTIVITY APPS**

  Points on this observation:

In Action Notes:	Always	Sometimes	Never	Notes
– The apps are more full-featured				
– Encompass everything from social network to mobile banking				
– Time spent on the apps varies, based on context and task				
– Others, specify …				
Remarks/Notes				

- **Observation on Hierarchical Structure**

  Points of observation: (scale point 1 – 5 to assess user familiarity on this section)

  1 = very unfamiliar – 5 = very familiar

Tasks and points of observation	Scale of familiarity (1-5)				
– Switch to 'List' and 'Detail' views	1 Low	2	3 Med	4	5 High

– Scrollable list of items (.i.e. text, images, video, others)	1 Low	2	3 Med	4	5 High
– Tab controls to navigate to other sections of the app (go to 'Home' screen, switch apps, back to previous)	1 Low	2	3 Med	4	5 High
Remarks on observation (use other page to sketch)					

- **Observation on Accelerators and Shortcuts**

  Points of observation: (scale point 1 – 5 to assess user familiarity on this section)

  1 = very unfamiliar (low level) ; 5 = very familiar(high level)

Tasks and points of observation	Scale of familiarity (1-5)				
– Text entry for message,	1 Low	2	3 Med	4	5 High
– Search function	1 Low	2	3 Med	4	5 High
– Key in text on the search field,	1 Low	2	3 Med	4	5 High
– Typing up text using the keyboard	1 Low	2	3 Med	4	5 High
Remarks/Notes *(use other page to sketch)*					

- **Immersive Applications**

Immersive mode hides a device's on-screen buttons and notification bar so that app content is given as much canvas as possible.

Observation points on the immersive apps	Scale of familiarity (1-5)				
Focus on the content. The status bar (battery and network info are hidden).	**1 Low**	**2**	**3 Med**	**4**	**5 High**
□ Youtube video playback controllers will be invisible during the Play	1 Low	2	3 Med	4	5 High
– **Customized User Experience (UX)**	1 Low	2	3 Med	4	5 High
□ The immersive apps often provide a fully customized user experience.	1 Low	2	3 Med	4	5 High
□ There are no standard controls outlined in the HIG	1 Low	2	3 Med	4	5 High
Remarks/Notes *(use other page to sketch)*					

- Table below is to determine the strengths and weaknesses on apps using various styles.

Style	Strengths	Weaknesses	Feedback/Comment
○ **Utility** *Ability to quickly access specific*			

type of information and perform a narrowly defined task.			
○ **Productivity** *Full-featured apps, encompass everything from social network to mobile banking*			
○ **Immersive** *Used to play games, view rich media, perform specialized tasks*			
Remarks/Notes *(use other page to sketch)*			

❑ OBSERVATION ON GESTURES

(Based on iPhone Gesture list > need to find the Android's)

- **Participants Gestures Observation**

Observation Points on Gestures	Scale of familiarity (1-5)				
– Is the respondent able to perform well in the action? *(scale 1-5 : 5 is being well perform)*	1 Low	2	3 Med	4	5 High
– Does he/she have difficulties to perform one of the actions? *(scale 1 – 5 : 5 is being the most difficult)*	1 Low	2	3 Med	4	5 High
– How does he/she recover from the difficulties? *(scale 1-5 : 5 is being most difficult)*	1 Low	2	3 Med	4	5 High
Remarks/Notes *(use other page to sketch)*					

Table of observation list, analogous to mouse click on the computer (scenario may be used)

No	Gesture	Action	IF performed using mouse	Action on Smartphone	Diagrammatic of action *(graphic illustration maybe used)*
1	**Tap**	To select a control or item	*Single mouse click*	Tap on the button to activate Tap on blank area to release option	
2	**Drag**	To scroll or pan	*Controlled, any direction, slow speed*	Tap > drag > release	
3	**Flick**	To scroll or pan quickly	*Less controlled, directional, faster speed*	Tap > swipe fast > stop when reaching the desired position or point.	
4	**Swipe**	Used in a table-view row to reveal the delete button	*Click on ">" or "<" to swipe over pages*	Tap finger area > ▪ Position on the right area to swipe left ▪ Position on the left to swipe right	
5	**Double tap**	Zoom in and center a block of content or an image Zoom out (if already zoomed in)	*Single click on the center of image*	Tap 1 > tap 2 simultaneously > release finger	

6	**Pinch open**	Zoom in	*Ctrl + Middle Scroll button up direction*	Tap > hold > pinch open > release	
7	**Pinch close**	Zoom out	*Ctrl + Middle Scroll button down direction*	Tap > hold > pinch close > release	
8	**Touch and hold**	In editable text, to display a magnified view for cursor positioning Also used to cut/copy, paste, and select text	*Left click > hold > highlight > release click* *Ctrl + C to copy* *Ctrl + X to cut* *Ctrl + V to paste*	Double Tap on text > drag the "o" icon to indicate the beginning and the end of highlight area.	
9	**Custom**	Used for keyboard (typing)	*Tap on the keyboard*		
10	**Others**	Please specify			
Remarks/Notes *(use other page to sketch)*					

Note: some actions may not be relevant to Smartphone navigation as not comparable to PC

Permission to Use Comments and Photographs

Subject/Participant:

I grant to [researcher name] the right to use my comments and take photographs of me and my property in connection with the above-identified subject. I authorize [your company name], its assigns, and transferees to copyright, use, and publish the same in print and/or electronically.

I agree that [researcher name] may use these comments and photographs without my name and for any lawful purpose, including, for example, such purposes as publication/book content, publicity, illustration, advertising and web content.

I understand I will be paid [payment amount – if relevant] in return for my participation in the above-identified subject as participants in this research project.

I have read and understand the above

Signature :
Printed Name : Date :
Address :

An Investigation of Cognitive Ergonomics Framework of
Smartphone User Interface Design for Late Adulthood Users

Document Set A

(admin purpose only)

Respondents from INDONESIA

Forms File Name

No.	File Name	Yes	No	Remarks
1.				
2.				
3.				
4.				
5.				
6.				

Respondent Codes (check folders for detail information)

File names: **2015.Obser_user_01_XX.docx** (XX indicates letter of respondents' names)

01 IH	Code: IN-01
02 AS	Code: IN-02
03 TY	Code: IN-03
04 CN	Code: IN-04
05 RN	Code: IN-05
06 KY	Code: IN-06
07 KF	Code: IN-07
08 SS	Code: IN-08
09 SY	Code: IN-09
10 TF	Code: IN-10

File names: **2015.Qstn_User_01.docx**. Please see the details below:

01	=
02	=
03	=
04	=
05	=
06	=
07	=
08	=
09	=
10	=

Figure M.1 Document Cover for Admin Purpose

An Investigation of Cognitive Ergonomics Framework of
Smartphone User Interface Design for Late Adulthood Users

Document Set B

(admin purpose only)

Respondents from AUSTRALIA

Forms File Name

No.	File Name	Yes	No	Remarks
1.				
2.				
3.				
4.				
5.				
6.				

Respondent Codes (check folders for detail information)

File names: **2015.Obser_user_01_XX.docx** (XX indicates letter of respondents' names)

01 FO	Code: AU-01
02 JH	Code: AU -02
03 JO	Code: AU -03
04 QQ	Code: AU -04
05 CW	Code: AU -05
06 SL	Code: AU -06
07 AN	Code: AU -07
08 GO	Code: AU -08
09 LE	Code: AU -09
10 KI	Code: AU -10

Note: supply code and name (e.g. IH = Ivan Hardi)

File names: **2015.Qstn_User_01.docx**. Please see the details below:

01	=
02	=
03	=
04	=
05	=
06	=
07	=
08	=
09	=
10	=

Note: supply code and name (e.g. IH = Ivan Hardi)

Figure M.2 Document Cover for Admin Purpose

An Investigation of Cognitive Ergonomics Framework of
Smartphone User Interface Design for Late Adulthood Users

Document Set A-01

Content: **Respondents from INDONESIA**

☐ **Forms File Name**

No.	File Name	Yes	No	Remarks
1.				
2.				
3.				
4.				
5.				
6.				

☐ **Respondent Codes (check folders for detail information)**

File names: ***201x.Obser_user_01_XX.docx*** *(XX indicates letter of respondents' names)*

No	Code	Participants
01	Code: IN-01	
02	Code: IN-02	
03	Code: IN-03	
04	Code: IN-04	
05	Code: IN-05	
06	Code: IN-06	
07	Code: IN-07	
08	Code: IN-08	
09	Code: IN-09	
10	Code: IN-10	

File names: ***201x.Qstn_User_01.docx****. Please see the details below:*

No	File Code
01	ID
02	ID
03	ID
04	ID
05	ID
06	ID
07	ID
08	ID
09	ID
10	ID

Figure  **se**

An Investigation of Cognitive Ergonomics Framework of
Smartphone User Interface Design for Late Adulthood Users

Document Set B-01

Content: **Respondents from AUSTRALIA**

Forms File Name

No.	File Name	Yes	No	Remarks
1.				
2.				
3.				
4.				
5.				
6.				

☐ **Respondent Codes (check folders for detail information)**

File names: ***201x.Obser_user_01_XX.docx*** *(XX indicates letter of respondents' names)*

No	Code	Participants
01	Code: AU-01	
02	Code: AU -02	
03	Code: AU -03	
04	Code: AU -04	
05	Code: AU -05	
06	Code: AU -06	
07	Code: AU -07	
08	Code: AU -08	
09	Code: AU -09	
10	Code: AU -10	

File names: ***201x.Qstn_User_01.docx****. Please see the details below:*

No	File Code
01	ID
02	ID
03	ID
04	ID
05	ID
06	ID
07	ID
08	ID
09	ID
10	AU

Appendix Q. Participants Evaluation using Heuristics Principles

This section shows a summary of the results of participants from Indonesia concerning the software or display design of the smartphone user interface design.

	Category	Issue Details	Link to Theory Theory Statement	Solution
1	SIZE	ON SCREEN NAVIGATION	USABILITY Consistency & Standards	RESIZE/ENLARGE
2	SIZE	TEXT	USABILITY Consistency & Standards	
3	SIZE	NUMBER	USABILITY Consistency & Standards	
4	SIZE	ICONS & SYMBOLS	USABILITY Consistency & Standards	
5	SIZE	KEYBOARD (QWERTY)	USABILITY Consistency & Standards	
6	ICONS/SYMBOLS	UNCLEAR ICONS/SYMBOLS	USABILITY Recognition VS Recall	BETTER INTERPRETED NEED ASSISTANCE NEED TRAINING
7	ICONS/SYMBOLS	UNSENSIBLE ICONS/SYMBOLS	USABILITY Recognition VS Recall	
8	ICONS/SYMBOLS	MEANINGLESS ICONS/SYMBOLS	USABILITY Recognition VS Recall	
9	PAGE LAYOUT	TOO SIMPLE	USABILITY Aesthetics & Minimalist Design	EXTRA DECORATIVE ELEMENTS
10	PAGE LAYOUT	TOO CROWDED	USABILITY Aesthetics & Minimalist Design	CATEGORIES TO SIMPLIFY
11	VISION	SCREEN COLOUR	USABILITY Aesthetic & Minimalist Design	ADJUSTMENT & SETTING
12	VISION	SCREEN BRIGHTNESS	USABILITY Aesthetic & Minimalist Design	
13	VISION	SCREEN CONTRAST	USABILITY Aesthetic & Minimalist Design	

14	SETTINGS	UNCLEAR CATEGORY	USABILITY Match between System & Real World	ASSISTANCE TRAINING MANUAL GUIDE (SIMPLIFIED VERSION)
15	SETTINGS	TOO COMPLICATED (TOO MANY STEPS)	USABILITY Match between System & Real World	
16	INSTRUCTION	JARGON	USABILITY Speak the User Language	SIMPLIFICATION CLARITY/ ”DOWN-TO-EARTH” LANGUAGE ASSISTANCE TRAINING
17	INSTRUCTION	TECHNICAL	USABILITY Speak the User Language	
18	INSTRUCTION	UNDEFINED	USABILITY Speak the User Language	
19	PSYCHOLOGICAL	AFRAID OF GOING BACK	USABILITY Ability to Recover from Error	MULTIPLE TRAINING & RE-TRAINING
20	PSYCHOLOGICAL	AFRAID OF MAKING MISTAKES	USABILITY Ability to Recover from Error	
21	PSYCHOLOGICAL	AFRAID OF GETTING ERRORS	USABILITY Ability to Recover from Error	
22	HARDWARE	VOLUME BUTTON’S POSITION: ACCIDENTALLY PRESSED	USABILITY Error Prevention	CHANGE THE POSITION / LOCATION
23	APPLICATIONS	TORCH	USABILITY Recognition rather than Recall	MAINTAIN
24	APPLICATIONS	EMERGENCY	USABILITY Recognition rather than Recall	CREATE ONE DIRECT ACCESS TO RELATIVES 4-NAME ACCESS
25	DEVICE SECURITY	ACCIDENTLY MAKING RANDOM PHONE CALL	USABILITY User Control & Freedom	PROVIDE AUTOLOCK

Figure O.1 Summaries of Participant Needs, Comments, and Suggestions on the Phone Device.

Appendix R. Participants Design Solution and Recommendation

No	Redesign Objects	INDONESIAN users		AUSTRALIAN users	
		Items (Issues)	Design Solution	Items (Issues)	Design Solution
1	**PHONE OWNERSHIP**	Users have 7 (seven) phones, included the Smartphone and old-style phone	Developing UI for each type of device (one for the smartphones, one for the old-style phone).	Users mostly have 1 (one) smartphone, maximum 2 (two) smartphones.	Developing UI for each type of device, consider the similarities.
2	**HAND-GRIP**	Right-Handed type, index finger will operate the navigation. Two-hand grip, thumbs are navigating.	Developing UID that will be comfortable for a 1-hand grasp while another finger is navigating.	Right-handed + index finger Left-handed + index finger Both-hand + thumbs	External phone case to enable proper hand-grip with different fingers navigating around the screen.
3	**BUTTONS & SPACES**	Smartphone with touch screen capability	Gaps or buttons separations should be big enough to allow precise touch	Smartphones with touch screen capability	The gaps should be significant in space and colour (darker colour is preferred), to avoid pressing two buttons at the same time.
		Old-style phone with physical buttons	Buttons should appear more onto the phone surface to give better touch feel		
4	**ICONS & SYMBOLS**	Recognition and identification of icons and symbols of the apps/system: - Unable to recognise the icons - Unable to understand the meaning.	- Trial-and-error - Required assistance to learn and understand the meaning & functions of the icons or symbols - Never seek assistance in store	Recognition and identification of icons and symbols of the apps/system: - Unable to recognise the icons - Unable to understand the meaning.	Seek for proper assistance from friends, relatives, and more likely to the phone store.
5	**LANGUAGE SELECTION**	Non-English background using the phone with English terms. The system in Bahasa could not determine the exact functions.	Assistance is required to understand the language (if in English), the icons and the functions.	Users have no issue with the system language, except the installed applications, such as using the Line, Viber, WeChat messengers that developed outside the western countries.	A little assistance to distinguish the terms would be helpful.
6	**APPS – INSTALLED**	This application should be provided as default: - Instant messengers - Reminders, calendar - Video conference app	Auto-install when the device is purchased	This application should be made available as default: - FM Radio - Facebook - Torch	Auto-install when the device is purchased and provide shortcut

				- Videos (Youtube)	
		Applications by default: - Phone, SMS		Applications by default: - Phone, SMS	
7	**APPS – SYSTEMS**	- Wi-Fi – Bluetooth - Wallpaper setup - Text size adjustment	The shortcut should be provided at the main page.	- Wi-Fi - Bluetooth	The shortcut should be provided.
		- Volume control (incl. buttons)	Physical buttons for volume control preferable.		
8	**APPS – TOOLS**	Currency Exchange app	Make this app more visible.	Torch/Flashlight	Auto-install as one of the default apps.
9	**ERROR PREVENTION**	Afraid to access different apps	Provide clear indicators of the accessibility	Afraid to access different apps	Provide clear indicators of the accessibility
10	**ERROR RECOVERY**	When errors occur.	Users are doing these steps: 1. Trial-and-error 2. take the battery out 3. resetting the device 4. seek for assistance from friends or relatives 5. go to the phone store	When errors occur	Seek for assistance from: 1. Friends/relatives 2. Phone store
11	**LAYOUT**	A 'home' screen filled by apps is acceptable to obtain direct access.	Locate the apps and get them grouped accordingly during the installation and system update.	Need a plain and not-overloaded 'home' screen	Do not make the icons appear on the 'home' screen after the installation.
12	**COLOUR**	Background and buttons colour will ease in the interaction.	Good colour combination upon system installation Colour presets should be provided to enhance the modification	Straightforward and plain colour will ease in the interaction.	Simple colour or B/W tone combination can be provided, while the colourful could also be offered as the second option.
13	**SYSTEM UPDATE**	Auto-update will enhance the better solution.	Preferable to have the Auto-Update running.	The Auto-update will distract the mental load model	- Disabling the auto-update - Contact the phone store for assistance with the update.
14	**DRAG & DROP MECHANISM**	- More likely to rearrange icons' position and grouping to suit the needs. - If icons are disappeared, users will use the "MENU" button to find.	A development of an easy-to-move and arrange mechanism.	No concern on moving or grouping the icons as this feature will confuse the users.	Icons or folders should be initially arranged based on the regular needs.
15	**BRIGHTNESS & CONTRAST ADJUSTMENT (SYSTEM)**	Brightness/contrast should be adjustable to fit the	Providing direct access to the system setting on the home UI	No specific concern on the screen brightness/contrast. The setting	Contact the phone store for assistance with the setting.

		environment	and prioritise the functions.	will be left as it is; if any assistance is required, users might visit the phone store for help.	
16	**EMERGENCY ACCESS**	Need to get direct access and visible all the time.	Speed dial to top-3 users (families or relatives) *) Dial to emergency services is not necessary as it might not be helpful.	Need to get direct access and visible all the time.	Direct access to emergency services (ambulance, police) as well as families and relatives.
17	**THE METAPHOR**	Not easy to distinguish the meaning of an object metaphor	The use of metaphor has to be associated with the icons or symbols; including the text underneath the icons.	Same as the Indo participants. Some users may have been forgetting after being assisted by others.	A regular assistance is required to construct a regular habit.
18	**PERSONALISATION**	The issues cover the personalisation of layout, colour, text (type and size), and settings.	- Grouping these items to enable direct access to personalise the device User Interface. - Easy-to-recognise items are preferable	Not too worry about personalising the layout. Users are more reluctant to change the styles of interaction due to regular habits.	Default screen with the optimum level of comfort should appear on the layout without being necessary to change regularly.

Appendix S. Participants Recommendations on the new frameworks (using sketches) – confirmed interview

Appendix Q.1 Participants from Indonesia (IN – Indonesia)

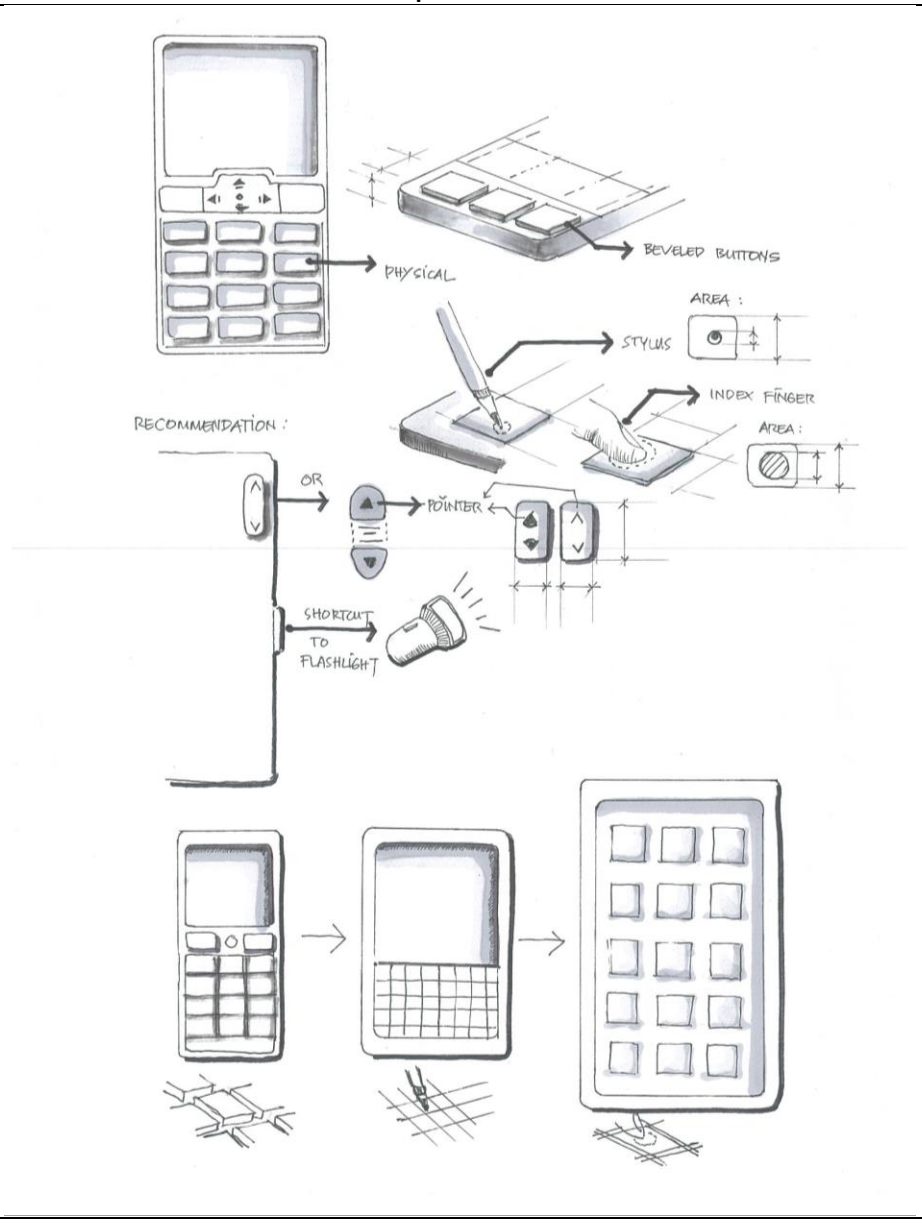
Participant no. IN-01


Figure Q.1 Button and Page Slider Size

Participant no. IN-03, 07, 08

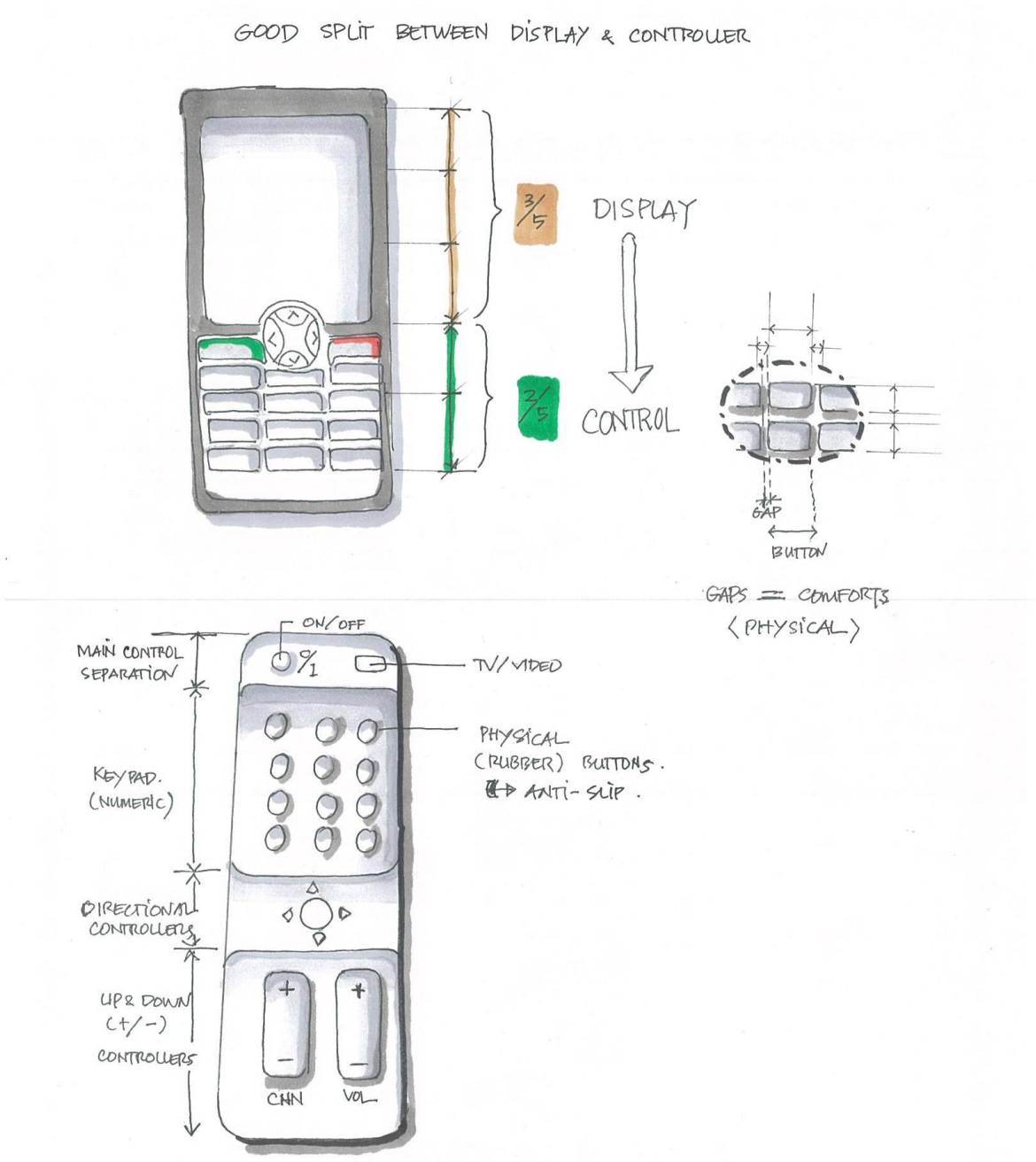


Figure Q.2 The Recommended Split between Display and Controller

Participant no. IN-04

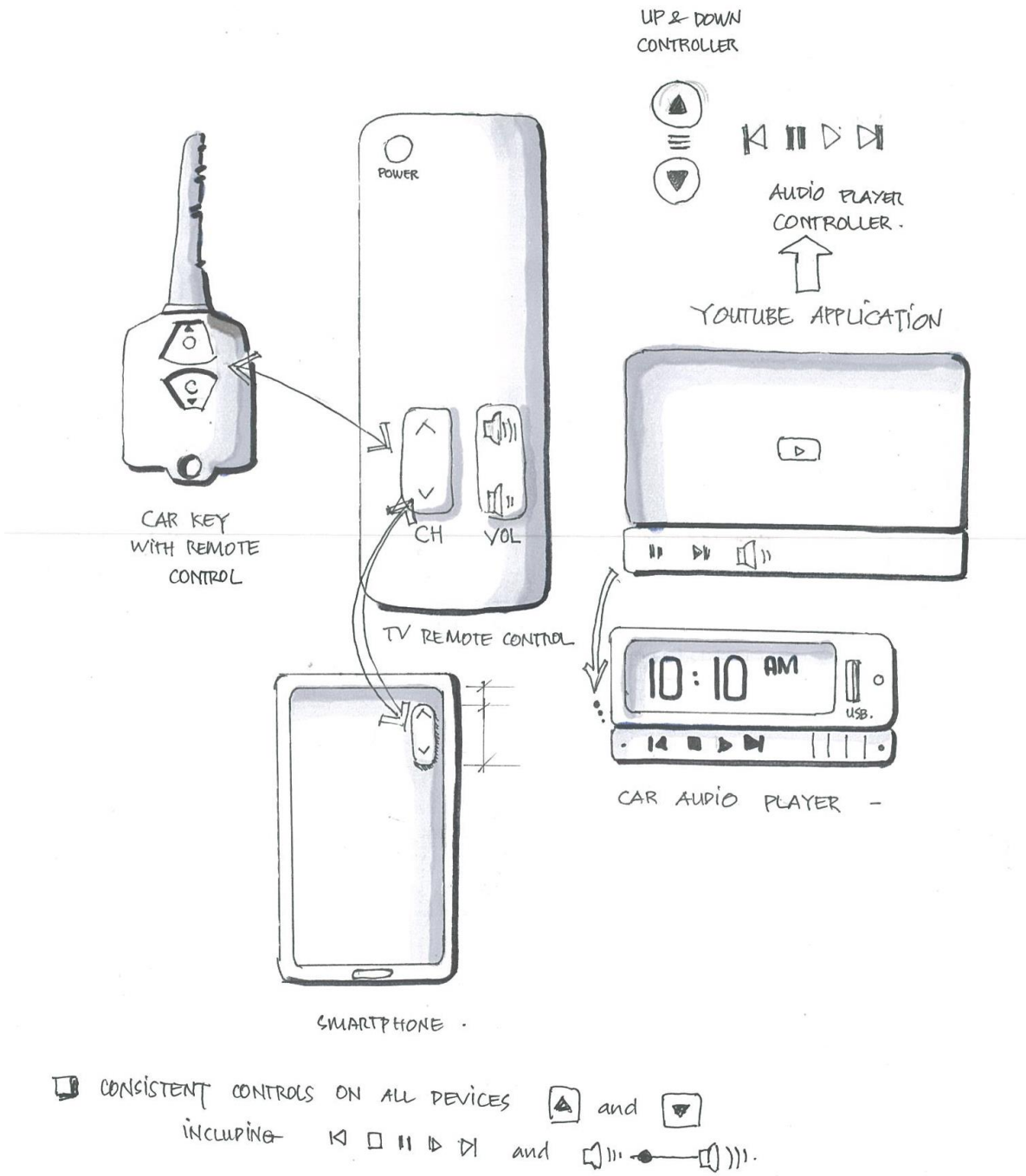


Figure Q.3 Touch Screen Page Slider versus Traditional Remote Control

Participant no. IN-05

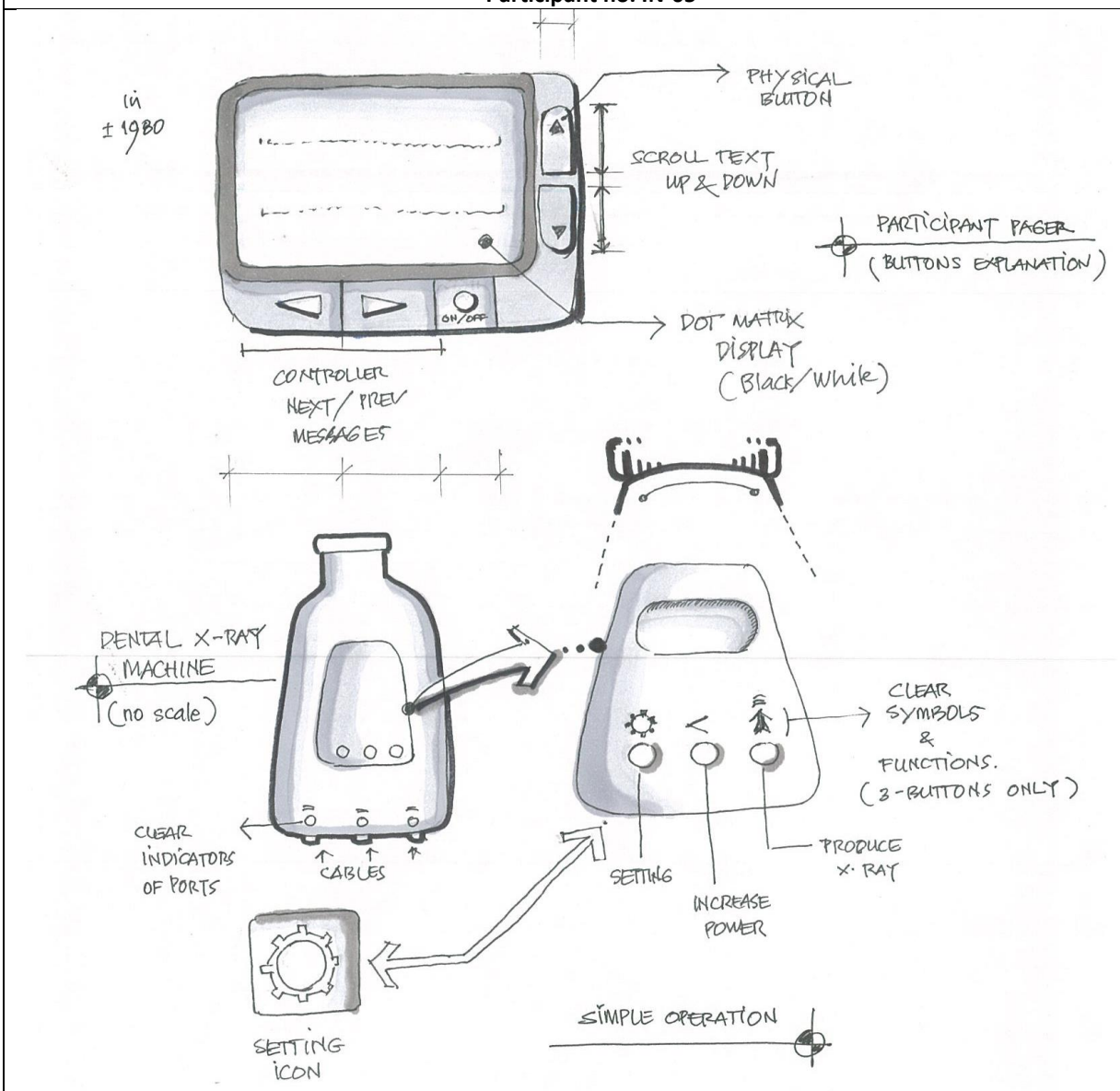


Figure Q.4 Recommended Controller as in Pager and X-Ray Machine

Participant no. IN-06

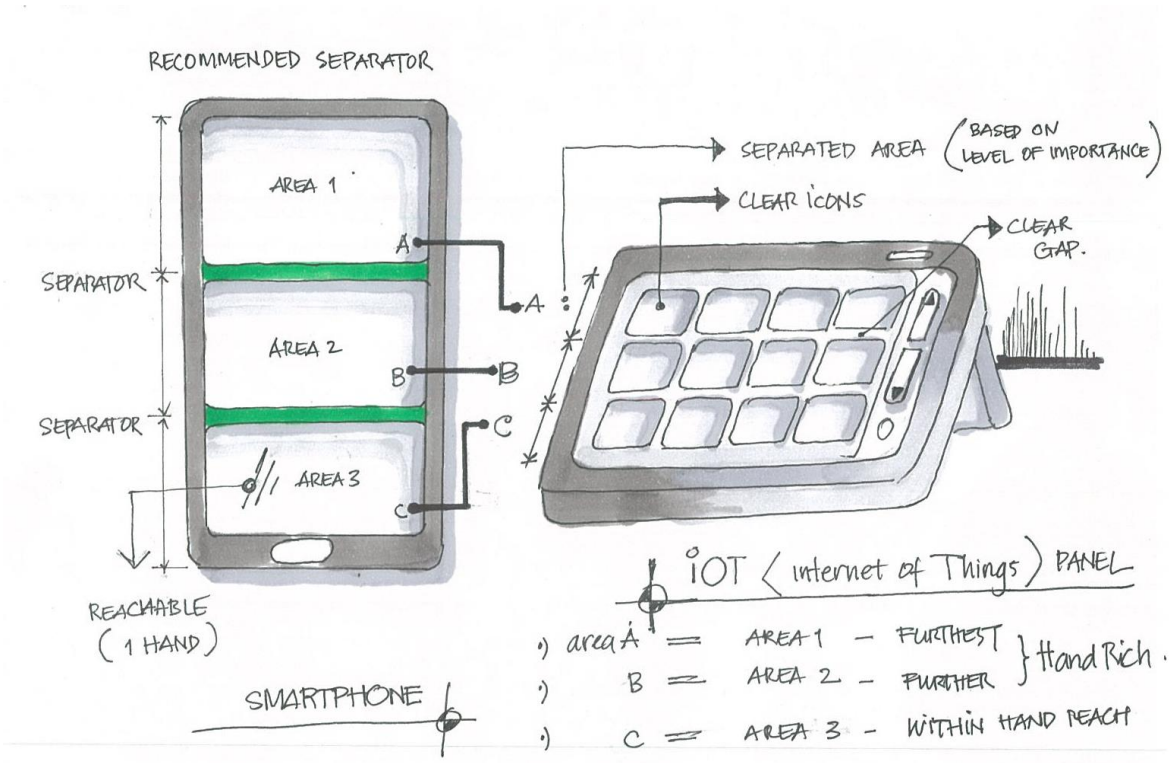


Figure Q.5 Smartphone Screen Division as comparable to Internet of Things (iOT)

Participant no. IN-09

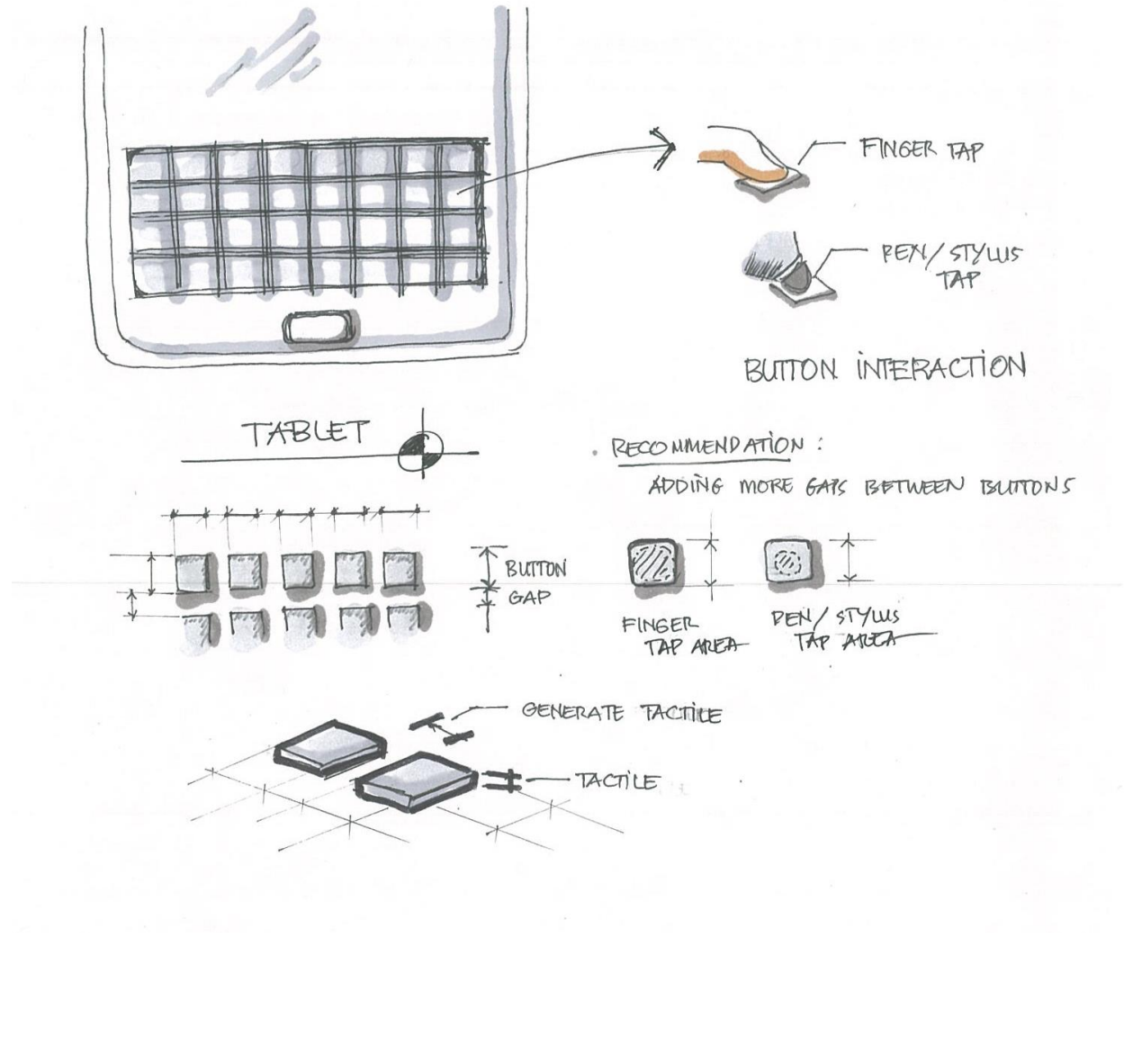


Figure Q.6 Button Size on a Tablet Device using fingertips and Stylus

Participant No. ID-09, 10

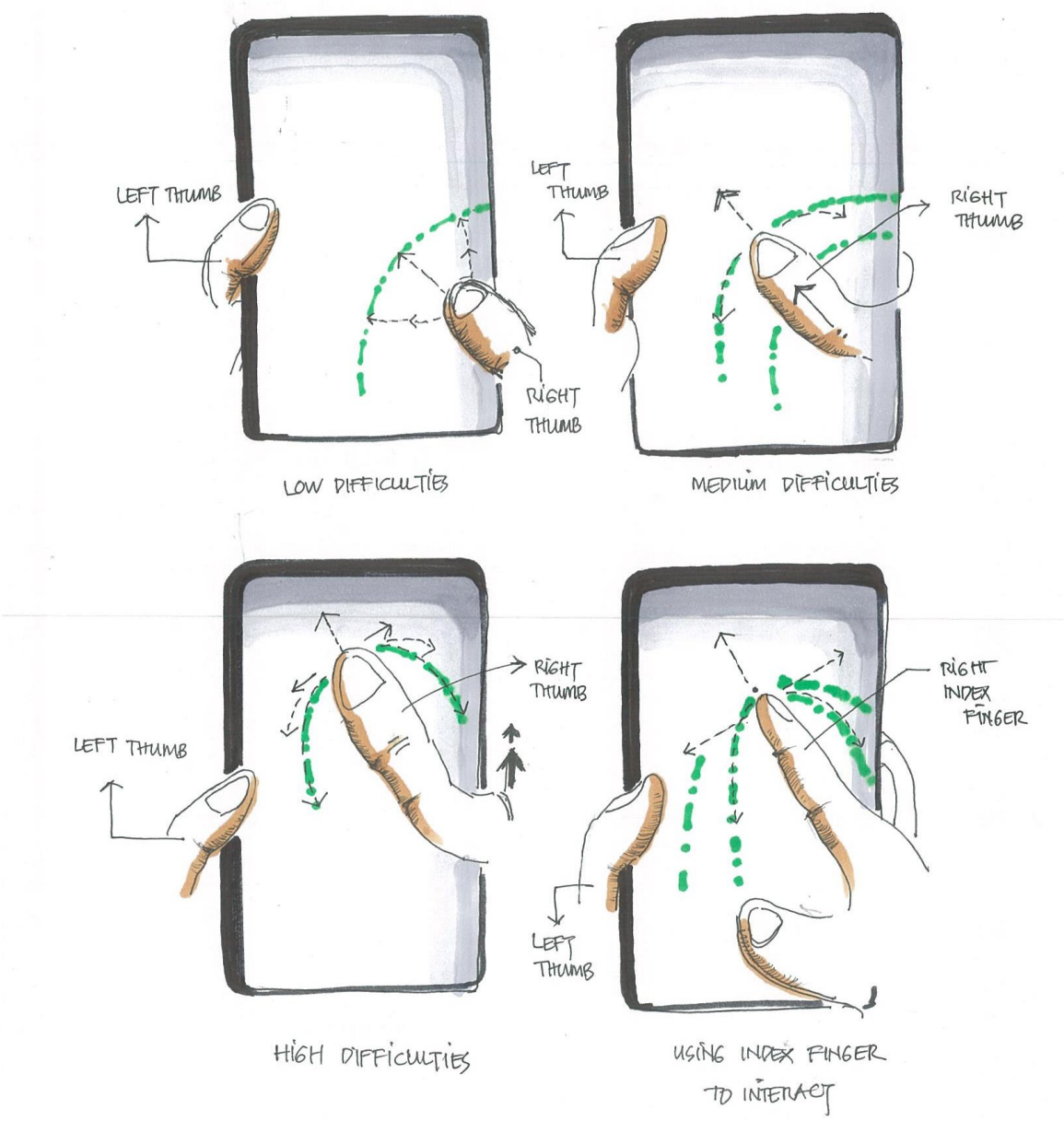
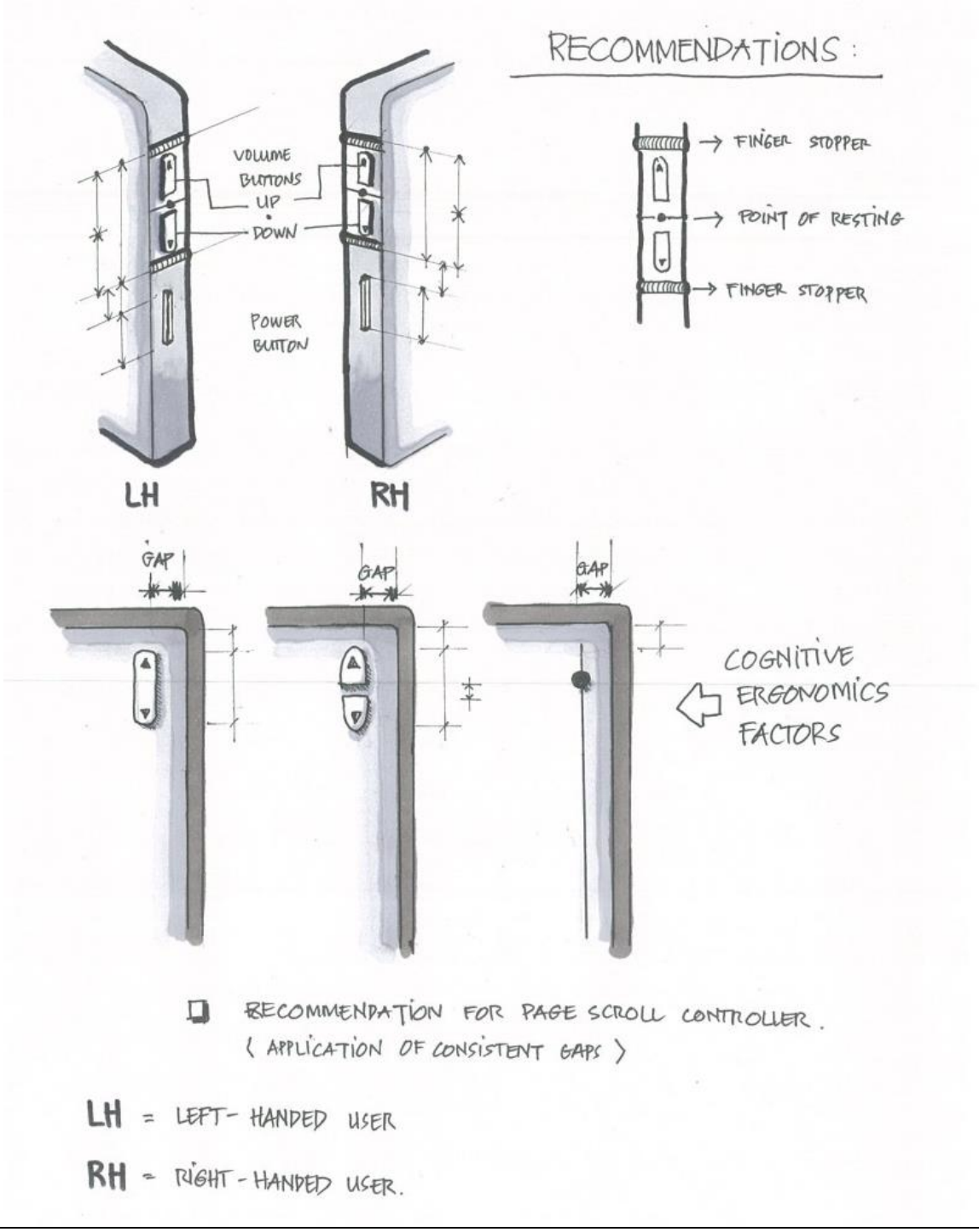


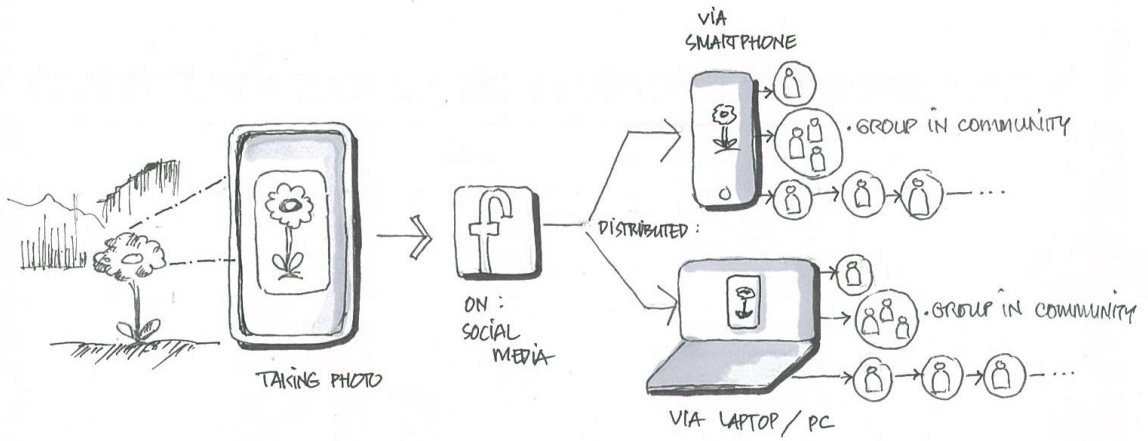
Figure Q.7 Smartphone Buttons and Reachable Area

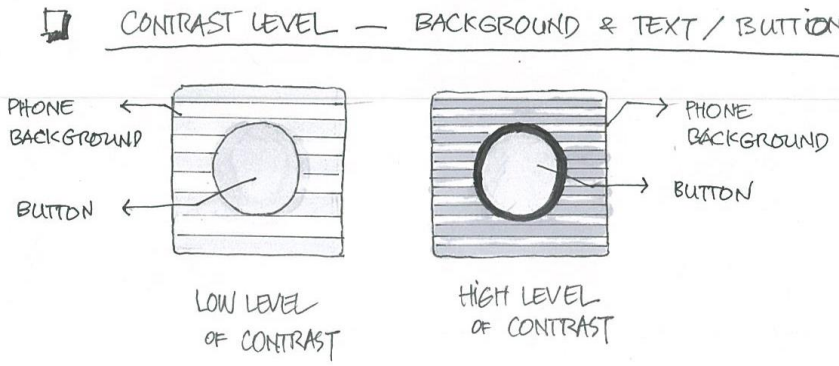
Participants from Australia (AU – Australia)

Participant no. AU-01

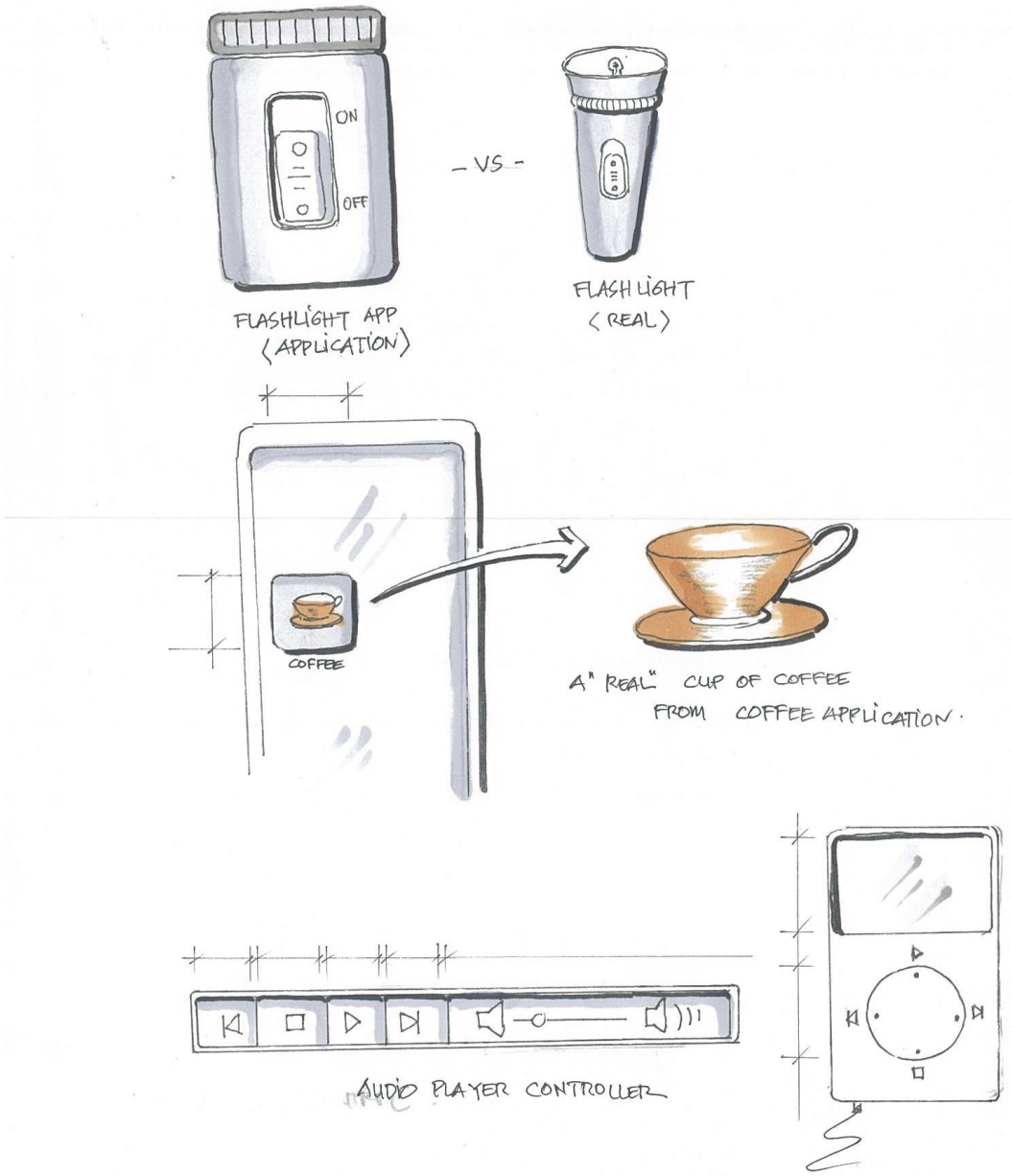


Participant no. AU-02, 03

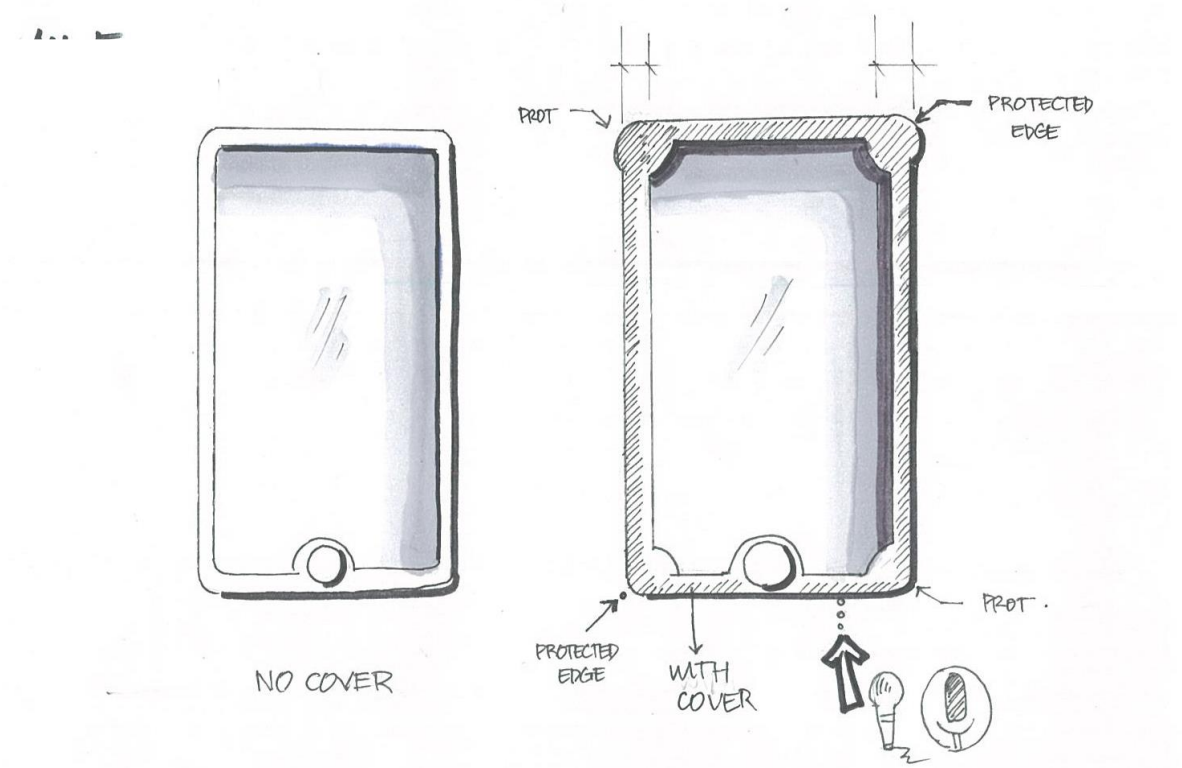


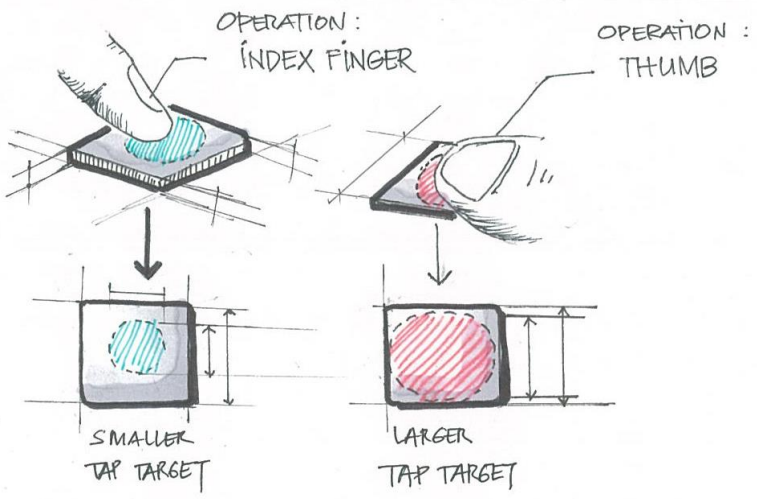


Participant no. AU-04



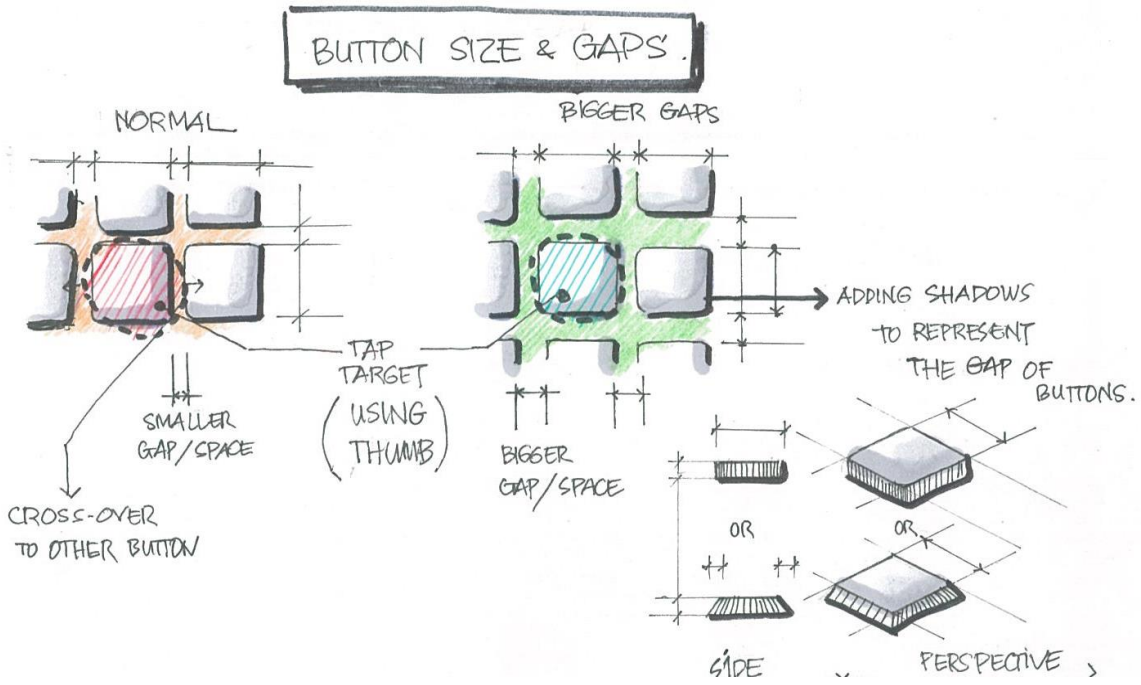
Participant no. AU-05





☐ PARTICIPANT HAS 4 LARGE FINGERS. TO INTERACT ON THE PHONE

Participant no. AU-06-10



Appendix T. New Design Development

Phase 2 Confirmed Design Development.

Figure T.1 Phase 2 Confirmed Design Development

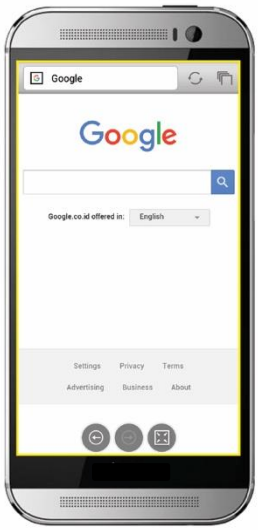


Figure T.2 Phase 2 Confirmed Design Development (Cont'd)

Phase 2 Confirmed Design Development

This section below is the confirmed design development (interview session 2) with screen annotation.

Figure T.3 Phase 2 Confirmed Design Development – Main Screen (with annotation)

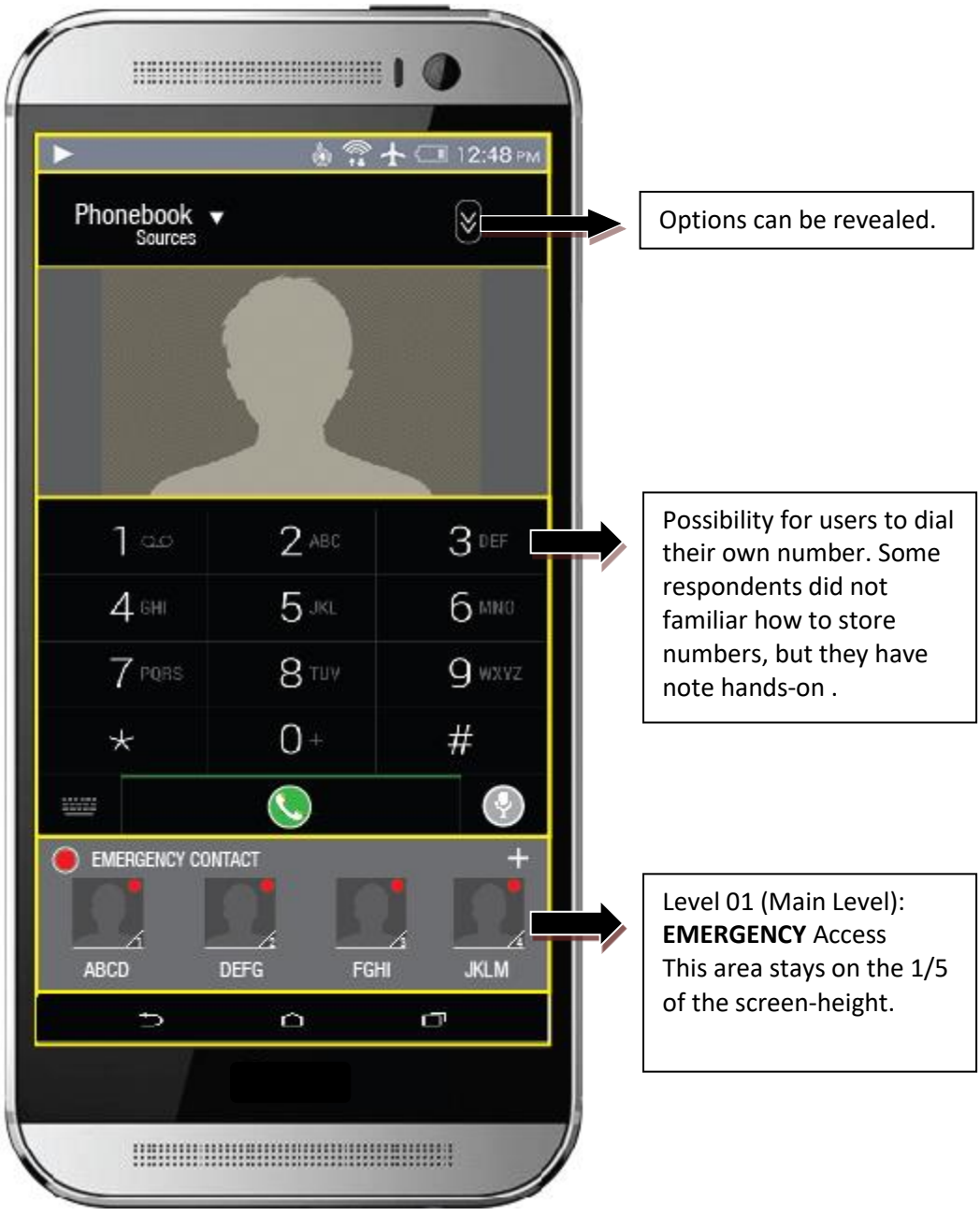


Figure T.4 Phase 2 Confirmed Design Development – Scenario: Making phone call from phone book application (with annotation)

Note: The Red dots ● *indicate that the spots are empty (available) for other names*

Figure T.5 Phase 2 Confirmed Design Development – Expected options to make a call

Grey Background on buttons

Grey 75% is located behind each button to enable user to click more easily on the button.

Area for Messenger apps.

Red dots indicate the contacts have been placed into the Emergency area.

Screen Name: Main (Home) screen.

Figure T.6. Phase 2 Confirmed Design Development (Main Screen)


YOUTUBE
10:10
2:20
Friday, June 27
APPLICATIONS
SETTING
RADIO FM
GALLERY
TORCH
MESSENGERS
LINE
WHATSAPP
KAKAOTALK
CHROME
PHONE
CONTACT
MESSAGE
SOS
EMERGENCY CONTACT
PAGE 1
PAGE 2
TOP RANKS
JOHN
Siri
The SIRI
CAMERA

Figure T.7. The new UI Design for older adult smartphone user interface design using new UI Frameworks

Figure T.8. The new UI Design for older adult smartphone user interface design using new UI Frameworks (Main Page)

All sketches and images were created by
Alfandi Nugroho Yahya