

Enhancing smartphone's usability for elderly in Finland

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<p>By the end of 2007, 16.5 percent of Finnish population are older than 65, and this percentage was predicted to be double in next 30 years. However, only a small amount of smartphones were able to be accepted by elderly, mostly because these devices are too hard to use.</p> <p>Application developers are usually in lack of interest in this special group of users. Even if developers want to create applications for this group, the lack of guidelines theoretical foundations leave their applications nearly unusable by elderly.</p> <p>The purpose of this research is to discover what are elderly's needs and capabilities when using mobilephones. In order to carry out the research, three methods of usability testing were applied from the total of 17 questionnaires, 5 personal interviews and 4 participation observations .</p> <p>The result showed some important improvements would make mobile's application more usable for for elderly. Some studies by other researchers are also summarized into a general guidelines for application's design. Many popular incorrect usability examples are also listed to be avoided.</p>	
<p>Keywords Usability, observation, questionnaire, interview, smartphone, iOS, Android, Windows Phone.</p>	

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I. Introduction

Since the first iPhone was introduced in June 29, 2007 (Mathew Honan, 2007) , smartphones with multi-touch screens have been widely adopted all over the world and become one of the fastest spreading technologies of mankind (Michael DeGusta, 2012).

With the iPhone, Steve Jobs redefined the definition of smartphone as the phone is not only smarter but also easier to use by everyone. Five years later (January, 2013), a report of Nielsen indicated that 48 percent of mobile subscribers in USA are using smartphone and soon it will be the most popular device. However, Nielsen also pointed out the big graph in smartphone penetration by age where only 22% of elderly (over 65) have smartphone (Figure 1.1). What are the factors preventing seniors from using “easier phone”?

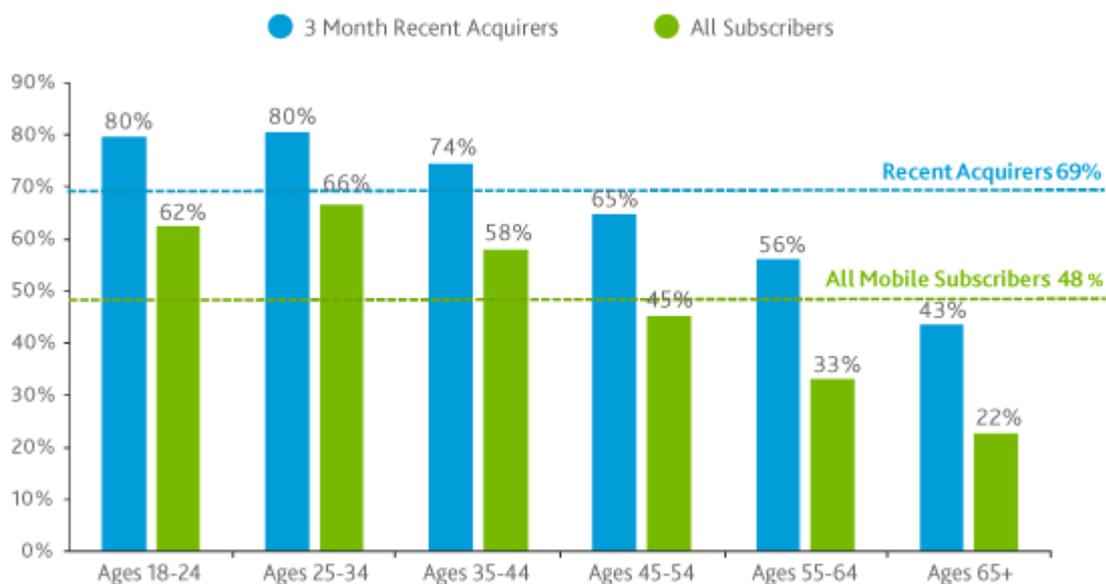


Figure 1.1: Smartphone penetration by age in USA, Jan 2013. (Source: Nielsen)

This research will focus on the smaller group, the reasons behind the slow adaption of smartphone for elderly in Finland and how to solve these issues.

1. Background of the study

European Union decided to take the year 2012 as “European year for Active Aging and Solidarity between Generations 2012”. EU wants to turn the threat of “grey age” into “silver chance” for all European countries. However, there is a lot of developer who couldn’t see the opportunities in catering the elders group. While almost of the programmer are younger than 35 (more 80%) according to the survey by LinkedIn (MachineGunnar, 2012). Many of programmers forget or don’t even care to create an application for whom-“lack of ability to use technology” (B.Neves, F.Amaro, 2012).

There are over 800 000 applications for iOS and 600 000 applications for Android at the end of 2012 (Apple, 2013; Google Play, 2013). However, among these applications, not many are designed for elderly and even fewer are actually used (Neil Versel, 2012).

In 2007, in Finland, about 16.5% population are older than 65, and this percentage is predicted to be doubled in 30 years (Statistics Finland, 2007). This is both a challenge and opportunity for IT industry to provide a better service for society. Since elderly is a considerable percentage of the population, Finland and other developed countries should make more effort to satisfy this special group.

2. Research questions

There is a big gap between the potential demand and the current diffusion of smartphone for elderly. Hence, this research will address following questions:

Question 1: What the elderly really need when they use mobile phone?

Mobile phones are part of elderly’s life, but what are the most necessary purposes of using these devices? Do elderly’s need stop only at phones and messages or they also need other phones’ functions for later life?

Question 2: How can we convince them to accept, not just adopt smartphone?

Many seniors only use phones as they were forced to use without any real interest. Is there any ways to make them feel happier and more positive toward mobiles?

Question 3: What are the difficulties elderly faces when using smartphone?

When moving from old mobiles with many physical buttons to smartphones with mostly touch screens, what cause most troubles for elderly?

Question 4: How can we enhance smartphones so that they can be easier to use?

The ultimate purpose of this research is to find out what can be improved for a friendlier smartphone. The more improvements can be found, the better smartphones can help the elderly.

3. Aim and object of the study

The main focus of this research is about how we can design a better user interface for seniors, so there will be some part which will not be included in this paper or limited mentioned.

- What **WILL NOT** be covered in this paper

Hardware: as the hardware and phone are basically designed by big companies, and they have a lot of their own research for the best interest. Even if we can find some errors in the design of these phones, it will not benefit anyone since we cannot send the suggestion directly to the company.

Market analysis: As I started the research by finding the need of society for more dedicated smartphone for elderly but I won't go deeply into the market research since it will distract the focus of my research.

Individual: Elderly has highly distinguished need and ability when using mobile. For example: some elderly only need a simple phone to call; some others need health-care functions for their decrease in health situation; some have very good vision while others have vision impairments. Therefore designing an easy to use and learn applications for elderly can be a complex task. So my research will not cover the need of every individual but to identify the common issues.

Changes: As my research was conducted for quite a long time, and by the time you read my papers, many things may been updated or changed. So when you see the examples of my research, the actual user interface may not be the same. Those screen shots are just examples to describe the differences in design.

- What **WILL** be included in this research?

User behavior: How will the elderly use the smartphone? What are the characteristics? Since programmers mostly create applications for others, it would be wiser to understand more about the client needs and wants.

Software: Which software solution is best for customers? Today, in the application market, there are many so called good applications, is that really good so users can have more choice or get lost in the market? What can developers learn from previous implementations?

Design guidance: What should be done to improve the usability of smartphone for elderly? In the end of this research, some expected guidance and notice for old people- oriented design will be summarized for quick improvement.

4. Research methodology

The research is conducted by both quantitative and qualitative methods. Each method has its special features to serve specific goals at one research's state.

Quantitative method:

Data collection was preceded though survey. Short questionnaires written in both English and Finnish were distributed to elderly in Finland. The survey purpose is to get a quick respond and brief data about mobile oriented thinking and usage by elderly in Finland.

Qualitative methods:

Two qualitative tests were conducted to find out more information about the result.

In-depth interviews: This is the most common qualitative method since it offers the opportunities for all participants chance to express themselves more freely. Since those interviews are targeted to elderly, five interviews are conducted in Vanta city center – Vantaan kaupunki Mersonkoti – in an informal ways and held in similar friendly manner in order to reduce the stress for the interviewees.

Participation observations: What people tell us about what they do and what they like usually is contradicted by their behavior. (J.Nielsen, 2001; N.Mack et al., 2001). The early observation had started before the research actually happened. By watching how seniors using mobile phone in

daily life, many hypotheses can be developed. These hypotheses will be supported or rejected by later finding or serve as the initial point in creating the questionnaires.

The later phase of observation is conducted when the research got enough information about what seniors need. In this phase, elderly were asked to try different mobile applications so the researcher can identify elderly's ability and behavior.

5. Research difficulties and advantage :

Before digging deeper into the research, a small analysis of researcher's difficulties and advantages of researching this topic was made. This analysis really affects how the experimentation is executed.

a. Advantage

Have contact closely with some elderly in Finland: as I worked as personal assistant for some elderly in Finland, all of them have some difficulties under aging concepts. So it is good to see how they adapt to smartphone.

As a foreigner student, I can see stuffs that Finnish usually forget or hard to recognize. There are many things differences in cultural and life style between Finland and Vietnam and other countries. Those differences can lead to different approach in adapting technology.

Understanding how to program for mobile phone: Even though, this paper is not related to programing but understand how programing work on mobile phone can help me in many ways. I can know, what is the limitation of technology at the time of the research and what the programmers usually forget when creating an application.

b. Difficulties

I don't understand Finnish: this turn out to be the most challenging issue in this research. It's hard for me to reach for the Finnish newspapers and documents. Luckily, I can find many publish about Finnish elderly in English and I also get help from some of my Finnish friends. Moreover, many Finnish seniors speak fluent English.

Finnish cultural and network: Finnish cultural and behavior also create some barrier for me; I find it hard to make small talk with stranger. Furthermore, older people tend to avoid question about their life and show their difficulties in their life.

6. Organization of this paper:

This paper is divided into six chapters.

The first chapter provides an overview picture about the whole research plan and the reasons behind the research. The why and what inside the study, methods to reach the goal and some challenges/chance may appear during the work.

Chapter 2: Literature review: this part mainly review the theoretical issues with the main concepts in this study. As it is a huge waste of time and effort to research again something others spent years to discover, benefit from previous researches are the vantage points to achieve new finding.

Chapter 3: Methodology: This chapter shows in more details how were the quantitative and qualitative methods were applied. There are three methods in which were used in this research: papers surveys, deep interviews and observation. Three methods approached in somewhat different ways and gave out also different result.

Chapter 4: Analyzing the result: After having the data collected from previous chapter, the data will be analyzed to become useful information. Simple quantitative (triangulating and data graph) analysis and simple qualitative analysis (critical incident) will be used in regard with the alignment of theoretical frameworks.

Chapter 5: Valuable studies: This chapter lists some of the best study and finding which can take a decisive role in application's success. Some of the cited studies are done by big organizations, while the rest is the result of my small private research. Therefore, readers won't need to spend time to find these problems again but apply directly to your design. Some dilemmas also been raised in order to let the readers decide what is best for their applications.

Chapter 6: Conclusion: The last chapter ends this research based on the main finding and tested hypotheses. The readers can decide how much effort they commit when creating software for seniors people in Finland. In the last chapter, there is also a list of limitation and challenges in the research and suggestions for further developments.

II. Literature review

This chapter presents some literature research which supports the understanding of the research problems, some self-defined definitions can also be found for later reading. It consists of 3 main parts:

The first part is the introduction about the interaction between people and machine, what the usability is all about.

The next part is all about the small machines, which we are going to explore deeper during the research.

The last part- the elderly in Finland, also included some deeper researches about the seniors before the main test.

1. Human computer interaction

Nowadays, we are living in the information age, when everything is connected and computerized. Those incredible improvements in technology provide mankind the nearly limitless opportunities with the machines. The biggest limitation is the user itself (Buxton, 2001).

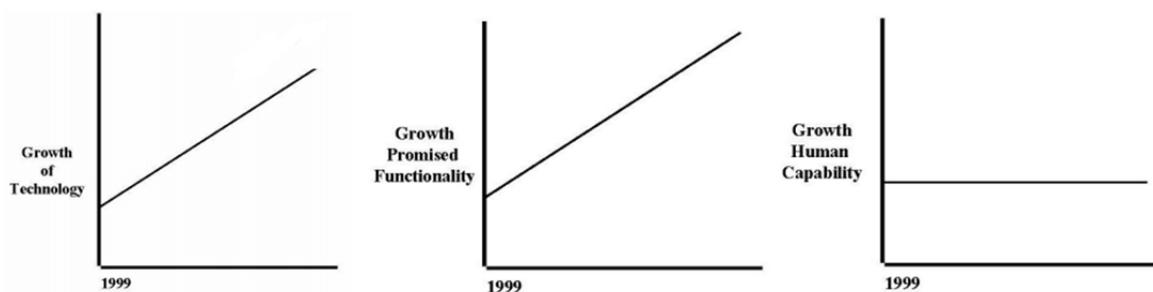


Figure 2.1: Moore 'Law, Buxton's Law and "God's law" differences (Buxton, 2001)

There was a time when the cost for training user is much cheaper than the price to buy machines, but things have changed. In many systems, price for making users acquainted with the system is much bigger than the hardware and software installation – mostly because the system is too hard to use or not compatible with the users. Therefore, configure the system based on the user is a better solution than forcing the people based on the system.

M.Jørgensen and K.Moløkken indicated that “user understanding” takes the most important role in the success of an IT project. So far, all IT students and school spent many hours in training for programming and design but always lack of practical training about dealing with real users. Even for experienced programmers, they may have not conduct the needed usability tests but apply their own view to customers’ thinking (Carol M.Banum, 2011). That causes a lot of trouble since most users are not expert-user, especially for the main target of this research- the elderly.

“Programmers aren’t evil. They work hard to make their software easy to use. Unfortunately, their frame of reference is themselves, so they only make it easy to use for other software engineers, not for normal human beings.” Erika Rogers, 2004.

a) Human computer interaction

According to Scott Klemmer (2012) and ACM SIGCHI resource 2009, Human-Computer Interaction (HCI) is about the design-evaluation-implementation of the interaction between human and computer. In HCI study, we create-try-apply many user interfaces with the focus on the people who are going to use the system.

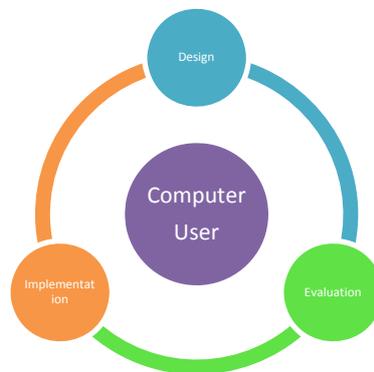


Figure2.2: The overview of Human Computer Interaction (S. Klemmer. 2012)

b) Usability

User interface are becoming more important part of computer than they used to be (J.Nielsen, 1993). The revolutions in technologies ensure that the Moore’s law will hold true at least until 2015. It is now possible for general consumers to buy computer cheaper with better processing power every two years. Application developers no longer have to concern with optimizing the computer resources (CPU speed, memory, bandwidth, etc.) but instead, they can focus on the ultimate goal – making life easier for the users.

The best well-known definition of usability comes from the International organization for Standardization (ISO) which states: “The effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in particular environments...” ISO DIS 9241-11. In short term, usability is all about giving users the best abilities to complete tasks.

c) Characteristic of usability:

Studying about usability is to step inside the full of conflicts and dilemmas filed.

Usability is visible but invisible.

When you wake up in the morning, have you ever asked: “why my bed/ pillows/ blanket have that size? Why my toothbrush has that length? Will I buy the toothbrush if it has 50 cm length?” “Why the television control has the different color for On/Off button? What will happen if that button is the same color with all others? Or what will happen if all these buttons have different colors?”

“Why you use your favorite search engine/ web browser/music player more than others”

The reason is really simple: usability.

Usability is there, we know it is right inside every product but we don't recognize it until something wrong happens. (Donald A. Norman, 2002,17-22)

Usability is measurable but immeasurable.

Usability performs an important role in the success of an IT product, but how much will a bad design kill your application? There are a lot of examples how bad designs can waste huge amount of money. For example: one famous report by Fisher and Sless (1990) showed that, an Australian insurance company can save 536 023 \$ per year for only a 100 000 \$ usability improvement project.

Fisher and Sless's example is clearly countable but if we go for more detailed view, we can't measure the effect of every change (J. Nielsen, 2012). On the other hand, issues such as “If I make this button bigger by one inch, how many more people will use my

product?” or “Will they stop using our product if the button doesn’t seem clickable?” are much harder to quantify and analyze without spending a great amount of time on them.

Furthermore, as in the previous definition about usability from ISO, we must evaluate the usability based on “specific users” –not just anyone, which makes the measurement of usability heavily user oriented. Some change in design can be enjoyed by some people but also can cause anger for others since we are all different.

There are also minor differences between well-known usability consultants in defining the metric system of usability.

J.Nielsen [1993] stated that there are 5 main attributes which evaluate the usability:

- Learnability: The system should be easy so that users can start working with system really soon.
- Efficiency: The one who is acquainted with the system can provide high level of productivity.
- Memorability: The ability to get back to the system after a period of not using it without study everything all over again.
- Errors: People make errors routinely (Donald A. Norman, 2002, 105), even the computer operator can miss press something which cause huge trouble. It’s crucial for system to minimized the errors and recover from those. Especially, catastrophic errors must not occur.
- Satisfaction: The system should provide user with satisfaction when using it, not with because they have to.

There are also other expressions, for example Whitney Quesenbery [2003] using his 5Es model to describe usability where you can show the balance of each dimensions, and Perter Merville[2004] use the honeycomb to illustrate usability under other concepts.



Figure 2.3 : The Perter Merville’s concept is presented as honeycomb (Perter Merville, 2004)

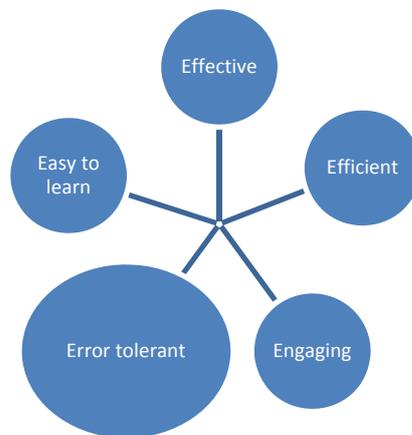


Figure 2.4: 5Es by W. Quesenbery, where each dimensions can be describe with optimized sizes to calibrate the balance (Whitney Quesenbery, 2003, 2).

2. Computer- smartphone

With a tiny screen and a new way of interaction, mobile phone requires many new usability researches than previous studies for computer, although at some points, user experience studies still remain the same.

a) Smartphone

The term- smartphone- is not something new to everyone. Since it was first mentioned in 1973 and introduced to consumers in 1994 with the price about 1099 US dollars (C.O. Malley, 1994). However, the development of those “intelligent-personal-devices” peaked in 2007 with the announcement of the revolution products – iPhone (Charles Arthur, 2012). In early of 2013, for the 1st time, smartphone outsold ‘dumb’ phones.

There are many different definitions about smartphone but according to J.Nielsen, [2012], we can divide mobile phones into 3 different categories according to their user experience (UX):

Regular phones (stated as ‘dumb’ phone or feature phones with tiny screen) served as the majority phones for consumer for a long time and still keep the dominant position in developing countries. Until recent years, most of the researches about mobile usability for elderly took these regular phones as main focus. They usually offer horrible or no internet connection support.

Smartphone (early smartphone such as BlackBerry, etc.) appears in the market for also a long time but didn’t get much attention from customers and researchers. These early smartphones usually come with medium screens and full size keyboards (A-Z or QWERTY keyboard). Only some of those have 3G, Wi-Fi and web-browsing support.

Full-screen phones (such as iPhone, Android and Windows Phone) equipped with nearly device-sized multi-touch screen. They were introduced to the market for few years and get huge attention from everyone. However, since the demand on fast and secret in developing, the usability tests were usually done after the phones released or in small scale, for example: the first publicly usability testing of iPhone was conducted many months after its release. After many years of continuous improvement, the graphic user interface (GUI) of these devices are become less –whacky- but there are a lot of thing need to be improved for friendlier communications.(R. Budiu and J. Nielsen, 2011)

Nielsen Norman group indicates much better task success rate from full-screen phones than older-phones

Table 2.1: Task Success rates for Different phones (Nielsen Norman Group).

Phone	Success rate
Features phone	44%
Smartphone	55%
Touch phones	74%

From this part, all the smartphones/phones mentioned in this research, means the full screen touchscreen phone only, since those “cheaper” phones returns bad results and soon becomes obsoleted inside developers’ eyes. Since Apple iPhone is the most popular touch phones by now, most of the usability testing also use iPhone as the test object, although some mention about Android and Windows Phone also can be raised.

b) Interaction of smartphone

“I suspect we will be seeing touch screens used for more applications than ever before”(B. Shneiderman, 1993).

Go along with high definition full-screen, smartphones introduce a long developed but not yet popular (until iPhone arrived) method of interaction for consumers – the multi-touch screen. Moving to a new communication way, the best approach is from the previous popular input methods with mice, the main takeaway from the table is “they have their own strength and weakness”. Having the ability to emphasize their strengths and alleviate their weakness will greatly reduce the difficulty users have when adapting to new input.

Table 1.2: Different between mouse and fingers input (R. Budi & J. Nielsen, 2011)

	Mouse	Fingers
Precision	High	Low
Number of points specified	1	Usually 1,2-3 or more
Number of control	Main : Left, right More: scroll and extra buttons.	1
Homing time	Yes	No
Signal states	Hover, Mouse-down, Mouse-up	Finger down, Finger up
Visible pointer/ cursor	Yes	No
Obscures view of screen	No ; we thus allow for continuous visual feedback	Yes; especially in small devices like mobile
Suitable for mobile	No	Yes

Suitable for large screen	Yes, cause the acceleration	No, cause of arm fatigue.
Direct engagement with screen	No	Yes
Ease of learning	Fairly easy	Virtually no learning time.

3. Human – elderly in Finland

Who will use your application? Oh, that’s easy; he is Timo, 68 years old man from Finland. Not quite, getting to know who the human will use our product involves a lot more than first name and age. (L. Wroblewski, 2002, 13)

There are many more things you need to know about your clients before starting to develop the system:

Who are your customers? (L. Wroblewski, 2002 ; Faulkner, 2011)

What are your client goals? (J. Nielsen, 1993; Carol, 2011)

- Task Analysis.
- Functional Analysis.

How they communicate?

What are their capacities to process limitation?

Can you categorize your customers? (Carol, 2011)

- User class
- Level of expertise
- User’s workplace/ environment
- Age

How fast the user will change? (Nielsen, 1993)

This part is all about the huge potential users group, who are ready to adapt smartphones when the time and chance comes.

a) Elderly:

“An aging population has become a demographic trend of the majority of developed societies” (B. Neves, F. Amaro, 2012.).

When we start aging? Stay out of theoretical definitions, what everyone thinks? During the SCiM student conferences in Maribor 2012, all participants and I got many different answers from different random interviewees about their opinions about aging.

6 years old girl: “When we start working”.

9 year old girl: “If someone’s older than me, she is old”

22 years old women: “Aging means that your hair gets gray, you’re wrinkly. You go to bed early and wake up early”

25 years old men: “We are constantly developing; it is not the question of when we start, for we start aging from year one of being born”

37 years old men: “Around 30, when you realize your body not as young as it used to be and you cannot eat the whole pizza”

81 years old women: “I have never felt that I was growing old, except now when my legs hurt. When I was 40, I used to think 50 are old, when I was 50, I think 60 are old, but nowadays being 60 is not an age at all.”

83 years old men: “I’m 83 and I’m still active, I don’t feel the age. I’m happy and healthy now”

81 years old men: “I stayed fit until I was 65 year old, but I’m still don’t feel old until now”

As we can see, everyone have their own definition about how people can be considered “old”. Most of the cases, “grey hair” citizens don’t want to be considered old and they have strong a will to do more and enjoy more in society. Many English speaking elderly also don’t want to be called as ‘elderly/ elder’ ‘old people’ ‘or ‘seniors’ but just a special user group or experience users (A. Smith, 2012).

Among organizations and countries, there also have a lot of debates about when should citizens are considered “old”:

According to (G.Gerbner, L. Gross, 2006), life style and cultural define the differences stages of the life circle and aging people’s role.

World Health Organization and most developed countries (WHO) legislatively agreed the chronological age 65 as definition of elderly.

In UK, the Friendly Societies Act enacted the definition of old age as “any age after 50”

Meanwhile the UN reduces it to 60 + to suitable with African situation.

In some Asian countries, people only get old when they become grandparent.

In some other countries, retirement is the turning point of beginning ageing. Retirement

also defined as “. . . *those who are disabled from work by age and invalidity have a well-grounded claim*

to care from the state.” (William the First). Since German became the first nation adopt retirement in 1881, based on the current age of their Chancellor, Otto von Bismarck. Measuring old age by retirement usually lack of scientific and hard to considered suitable to current longer-life society. (USA social security)

As the life expectancy continues to rise, those who once seen as “old” are not consider “young” or “not so old”.

So, are all the seniors similar? S. McKee (2001, p.49) strongly criticize many public policies are so naïve and inappropriate in thinking about “one size fits all” solution. E.g. the conflating 65 years old with 95 years old.

D. Fisk and A. Rogers (2012) state that individual have different approach to his ageing; however seniors have common biological, psychological and social characteristics. They suggested grouping older adults into two groups: (1) From 60 to 75 and (2) over 75.

M. Rubino, David G. Winter (2004) and S.V. Ukraraintseva (2001) shows that individual faces the time subjectively. Age should be defined not by “unit of time” but by quantitative change of a biomarker of aging per unit of age in an organism. Most of the case, universal-related changes in organism do more effect to health than the aging itself.

B. Neves and F. Amaro 2012 also divided ages by non-chronological indicators to identify the adaption of elderly in technology:

Functional age: biological age, relates to physical and cognitive capabilities of an individual (J.E. Graham, A.B. Mitnitski, 1999)

Perceived age: subjective age refers to an individual’s self-perceived age. It is still a subjective measure, but W. Linn and K. Hunter (1979) showed that the elderly with younger age perceptions had better psychological functioning.

Social age: people’s age according to social and cultural experiences.

Cognitive age: self-perceived age that is framed by four indicators: feel-age, look-age, do-age, and interest-age. (B. Neveus, F. Amaro, 2012)

P.Gregor and F. Newell (2002) believed that the years of life is not the main factors of categorizing elderly. They crudely divided elderly by their disabilities; some may have more than impairments, so researching into accessibility focus on single group may not provide appropriate solutions. Gregor and Newell divided “aged people” into 3 groups:

Fit older people: do not appear any disabled but functionality need different from when they were younger.

Fail older people: have one or more disabilities, often face ones, have general reduction in other functionalities.

Disabled older people: who been affected by long-term disabilities, their functional abilities critically depend on other faculties, and keep decreasing.

Researchers may have different methods of separately seniors based on their research purpose. In this research; I spend more determination on finding the common solutions not the specific problems. The fact is: “we don’t become old in one day”. Aging is a slow and quiet process, in my research; I categorize elderly into 3 groups based on age for ease of data analysis:

Group 1: 50-64 years old

Group 2: 65-74 years old

Group 3: Over 75.

b) Age-related issues and implication for design

Understanding the capability and limitation of senior’s users can help designer create better user interface (N. Caprani, E. O’Connor 2012). As we grow older, we change and develop, increase some skills, loose others, especially the ability to adapt to age-related problems. Some changes have more affect than others about how we adapt to technology (E.g.: visual impaired, tremor cause more obstacles than wrinkled skin).

Due to ageing, people are going to face changes in their sensory, motor and cognitive, which cost them more time to learn, create more errors , and easier to forget how to operate the system. Therefore, elderly are expected to have different approach to technology from youths (M. Conci, F. Pianesi, M. Zancanaro,2009).

Bosmas and Charness (1996) conduct several tests to compare the ability between senior and youths in adapting skills:

- Elderly does not mean more ineffective.
- Older adults get good compensation of decrease in health. If they decline in perceptual-motor measure, they usually look farther ahead. “Within their domain of expertise, older adults have learn to identify the conditions under which their performance is adversely affected by age-related declines and to selectively avoid these condition”
- Particular type of experience is related to preservation of certain cognitive abilities. The ability to learn new skills also related to his/her sustained experience. So, the best way of helping seniors learning new skills is making those new skills similar from their previous expertise.

Z. Roupa and M. Nikas(2010) specified that “ due to the deduction in all biological and mental functions, seniors can easily get exhausted and lose patience”. For this reason, they need more appropriate support and guidance in order to deal with new difficulties.

As Bosmas and Charness (1996) pointed out the abilities of learning new skills greatly based on people’s expertise, but the challenge here is: elderly (who born before 1945) mostly have no used of computer or graphic user interface yet. J.Nielsen (1993, p 50) summarized “the generations of computers and user interface” so we can easily estimate how familiar elderly people acquainted with interface based on their aged. Technically, graphic user interface with pointing devices (mouse) has not arrived until 1980s, causing traditional generation (before 1980) a huge graph when adapting today’s technology.

Caprani (2012) summarized 4 changes in physical and mental condition when our hair getting grey, I also add the profession for full issues get by elderly which effect the implementation design (Table 2.3).

Table 2.3: Characteristics of seniors (Caprani , 2012)

CHARACTERISTIC OF AGEING				
Perceptual	Psychomotor	Cognitive	Physical	Profession
Vision and hearing decline.	Slow and imprecision in control, tremors.	Memory, divided intension, information processing decline, losing patience.	Muscle strength reduce, fast exhaustion.	Lack of expertise on computer

c) Making elderly accept the technology

How to persuade the elderly to accept smartphone? How to measure their acceptance?

Explaining user acceptance of new technology is often considered as one of the most mature research area in information system.(V Venkatesh, G.Morris, B.Davis 2003). Understanding how people accept a technology is not only about technology but also heavily depends on psychology and sociology. Since the computers become irreplaceable part of our society, many models and theories has been constructed, favored, choose and rebuilt.

From 1975-1980, after many researches, Ajzen and Fishbein developed “Theory of reasoned action” which defines a chain of psychological behavior towards an object, represented as a chain: beliefs -> attitude -> intention -> behavior (RJ Vallerand, 1992).

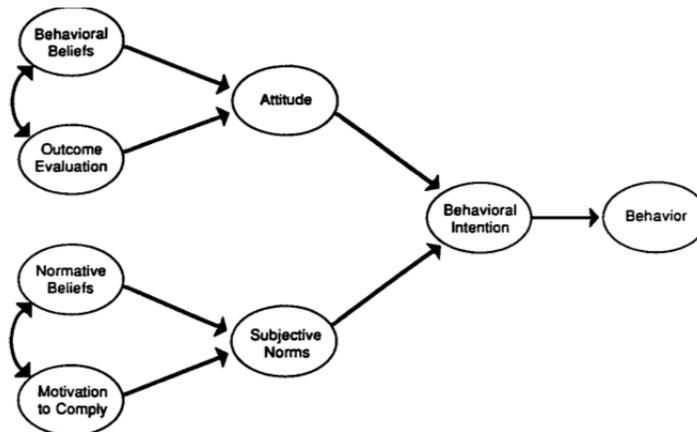


Figure 2.5: The basic theory of reasoned action (R.J. Vallerand, 1992)

Based on theory of reasoned action, in 1989 David developed the most well-known model how users accept and use a technology -Technology Acceptance Model (TAM). This theory created a basic theory about how users come to accept new technology. According to David, there are two main factors which indicate how people accept a technology:

- Perceived usefulness: “the degree to which a person believes that using a particular system would enhance his or her job performance” (David, 1989)
- Perceived ease of used: how people use the system without much effort.

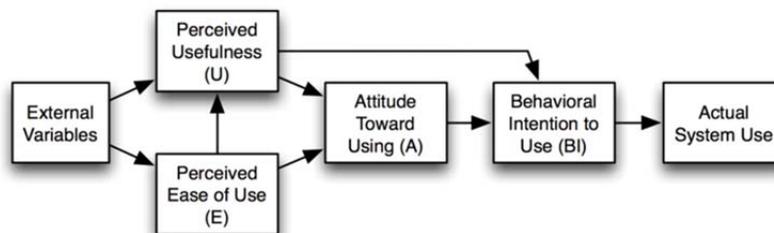


Figure 2.4: David's TAM (version 1) 1989.

Venkatesh, G. Morris, B. Davis, 2003 further developed TAM and developed the United Theory of Acceptance and Use of Technology (UTAUT) which “add the prediction of intention and behavior over and above what is already known and understood”.

J. Biljon, P. Kotzé, 2007 go one more step further when develop the UTAUT from general technology acceptance into Mobile Phone Technology Acceptance Model (MOPTAM) which have some major changes:

- Include the social influence and adaption to mobile context.
- Include facilitating condition
- Focus on mobile phone

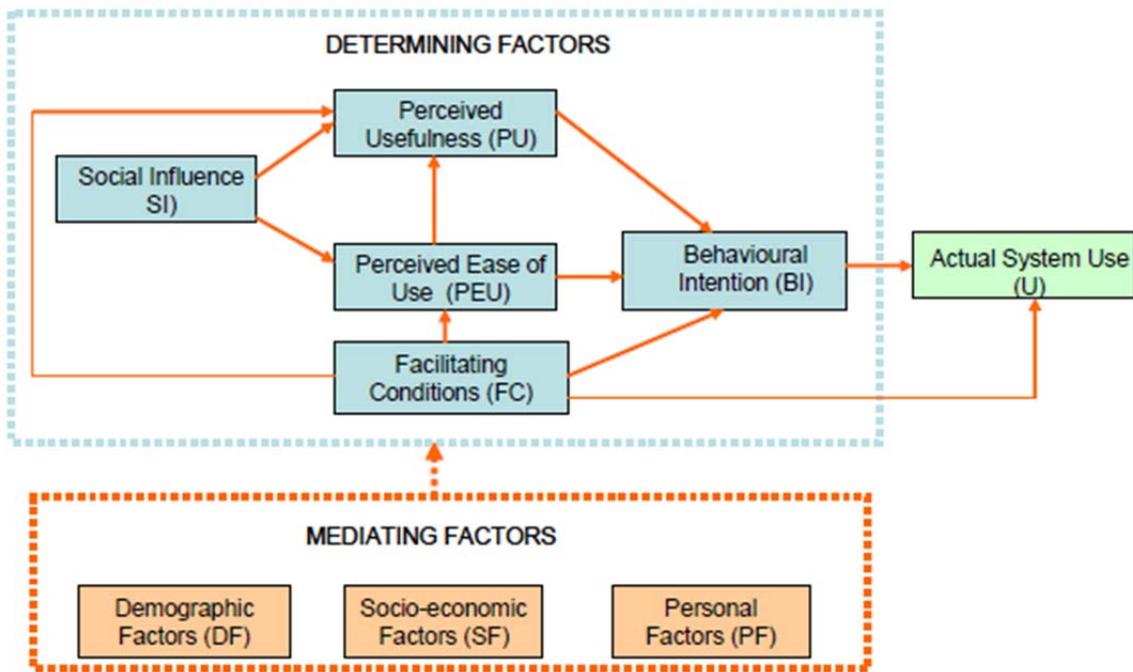


Figure: 2.5 : MOPTAM (by J.Biljon and Kotze 2007)

Social influence (SI) and mediating factors: Both researchers HS. Kwon (2000) and J. Biljon(2007) pointed out that mobile phone was never a first wish to buy by elderly themselves. Elderly usually get the mobile phone from family as a gift for personal safety. There is no doubt that the social and outside factors always push elderly positively into using mobile phone. Furthermore, if we go to any mobile phone retailer shop today, there are more smartphones than “dumb” phones in the display shelves, older users are not left with many options to go “back in time” with old “dinosaur phones”. Also need to be well aware that, many big companies like LG, Samsung, and Ntt DoCoMo have long developed many mobile phones with hug buttons and nearly no function except calling, however, just ask yourselves, have you ever seen these “faithful phones” for elderly appear on your local shops?



Figure 2.8: LG phone dedicated for elderly... which I never seen in retail shops (K. Symonds, 2008).

During the period, this research were processing, many smartphones which dedicated to elderly were introduced to the market. Notably, we can name the mobile Stylistic S-01 developed by Fujitsu (Mobile World Congress) and Georgie phone (which cost extra 150 pound from any normal smartphone for extra installation). Those improvements also won't be further because this research is about to improve usability of popular phones in market not the unknown ones. (According to MOTAM, these dedicated models don't have enough needed facility condition in Finland's market).

In contrast with public's opinion, there is no real evidence to show that elderly avoid using new technology as long as these technologies can support their interest and expectation. S. Sintonen(2008, p116) confirmed that: "aging people are not that tending to avoid technology as it could be proposed beforehand". J. Abascal , A Civit (2001) declared that many elderly have overcome the difficulties and started using the mobile phone, as those devices provided them a great enhancement of possibilities of carrying out an independent life. Fisk (2009) also recognized that elderly generally have a positive attitude towards technology and will use the product if they need it.

Recent evidence suggests that the most reason for non- adoption of digital technologies is a lack of interest, rather than affordability or difficulties. Coleman (et al., 2010)

Interestingly, E Rukzio and K. Leichtenstern (2006, 15) when researching about how people interact with touch screens pointed out similar result with both Bosmas & Charness(1996) and J. Abascal (2001). "Older users in particular prefer direct mobile interaction techniques because they want to avoid as much input on the mobile device as possible". Elderly are always ready physical effort to use new technology if we tell them how to benefit from these changes and guide them in the way they used to be acquainted. Although there are still some users mentioned a fear of smart environment will blackout people, people will depend on technology too much and lose control.

d) Elderly in Finland:

Unlike children, who mostly have the similar hobbies like candies and toys, people are getting more diverse along with time (SCiM). Elderly is extremely distinct from each other, that why this research focus only on "Finnish silver age" not all seniors. So, what distinguish elderly here from other countries?

Economic:

Traditionally, Finland is considered to be a Nordic welfare state, where people have broad participation in working life, low unemployment, and redistributive welfare policy (A. Pelkonen, 2007). Besides that, Finland has one of the most dynamic and developed economic system in the world (An aging Europe, 2009). Many international competitiveness rank Finland in the top positions and ICT-driven economic recovery – usually called the Finnish 'miracle' (M. Castell & P. Mimanen, 2002).

Elderly doesn't need to work to fight for living fee after their retirement. Beside their pensions, government ensures and supports their living when needed. They only work if they want, mostly for leisure not for money. Pensioners in Finland rarely face financial issues. For example, Yle confirmed that, nowadays nearly half of seniors are heading out from familiar territory to explore their home country or the wider world. (Yle (2)).

This is a big different from other countries, where in some developing countries, old people still struggle to earn money in order to support their own life. Even in UK, one in five pensioner lives below the poverty line (Sara McKee, 2010). In developing countries, things are even worse for the elderly due to the complete lack of government's supports.

Furthermore, in comparison with the GDP per capita in Finland, the smartphone is not something too expensive although some elderly still don't want to pay too much money for phones. The price of smartphone is dropping and can be achieved easily by most elderly in Finland. On the other hand, for people in developing countries, smartphone is still considered luxury even for working-aged. For example, the price of an iPhone can equal from one to two month salary for a medium-class workers.

Society:

The first impression about Finnish society is that its population is aging faster than any other countries in Europe (An aging Europe, 2009).

Finland can also be characterized as a prime example of Information Society. Finland has one of the highest rates of mobile telephone and broadband usage in Europe and successful developments in electronic services, such as e-commerce and e-government.(E Jokisuu, M. Kankaaranta,2007)

In Finland, the Constitution of Finland stated that public authorities must provide resident with adequate social, health and media services (An aging Europe, 2009). This ensures the seniors never struggle in health care and social services.

Health care:

Finland has the highest satisfaction score among Europe country, when 88% responses are positive in comparison with 41.3% average in Europe (OECD). These welfare and health services are funded by:

- 60% municipal tax
- 33% :Central government transfer
- 8% Client fees(An aging Europe, 2009)

Although equality is highly valued in Finland, there is some small inequality inside the healthcare system. For example: Private sector, private insurances and occupational health care are usually not available for elderly (Lauri, 2008, 58)

Long term care service in elderly house was never the first option in late-life. The order of taking care of elderly can be seen as: (Anja Declercq, 2013)

- First, self-care.
- Then, family care.
- Last: formal care.

Cultural:

The main characteristic of Finnish people is their independence. Old people tend to live independent without help from other as long as possible. The fact is: people over 70 year old need help in at least one activity of daily living such as toileting and dressing (E. Ruth,J. Rautiainen,2007) . With the support from welfare services in Finland, more and more elderly can live and cope with age-related issues than before. In 2005, only 6.8 percent of people aged over 75 need long-term institutional care (An aging Europe,2009).

Finnish is always seeking more contribution from “silver chances” and looking forward to those as an opportunity (Alexander Stubb – Finland’s minister for European Affairs and foreign trade, 2012).The argument is: “Aging should not be seen as a burden or liability for society, but rather an asset. Think: silver potential”. Alexander also cites his father as sample of a ripe old age (77). His father -Gorän still the chief talent scout of the National Hockey League (NHL), write newspapers, attend over 200 ice hockey matches a years, drive for 8 continuous hours, and have no plan to retired.

In some Asian country, children and grandchildren have main responsible for their parents/ grandparents. Old people in Asian countries prefer living in big families with many generations not only because the health problems but also for the joy and happiness.

Education:

There is no doubt that Finland stands on top of the world in education. According to PISA and OCED, Finnish 15-year old student and 16-59 year old adult score among the highest in developed countries for prose literacy, document literacy, qualitative literacy (OCED,2000). However, the most impressive thing about Finland is their elderly education – University of third age (UTA).

H. Lui(2002) in his research described : “Finland has a relatively formal policy and strong government commitment in elderly education” thus provide not only general study (as UK and US)but many specific education for third age people . Ministry of education in Finland states that

Education is considered as a fundamental right of citizens of all ages; the education system has long support the lifelong learning.

All the UTA are officially supported and funded by government. All citizens, whom usually be considered inside “Forgotten age” group by UK, received an equal opportunity for independent study at university without any requirement of qualification. Ministry believes that “learning is important to keep older mental agility and reduce the need for social help”. Studying has no lower or upper age limit.(Open University)

UTA are integrated inside normal universities in Finland, by 2013, there are 10 over 20 university in Finland has UTA.

Especially, thanks to the fact that Finnish speak quite good English facilitated my research a lot. According to European commission 2012 and Varieng, about 70% of Finnish people can speak English, 73% of people like to speak English with foreigners. The rate maybe lowers for elderly but definitely, Finland is among highest percentage population can speak English (except English speaking countries).

History:

Finland used to be considered as a “forest sector society” until the ‘miracle’ expanded welfare during 1970-1990, which brought Finland into the top developed countries. Thus it created a big gap between generations, which was affected greatly from historical changes.

A. Antikainen (2005) categorized generations in Finland into 3 groups according to their birth year:

Born after 1956 (less than 57 year old)–“the welfare generation with many educational choices”: this generation was flourishing with hobbies and good education. Education became a commodity.

Born between 1936 and 1955 (from 58 to 77 year old)-“a generation of structural change with growing educational opportunities”. Work is the center of their life; education opportunities are opening however only children from upper or middle class can get benefit from advance education.

Born before 1935 (older than 78 year old) - “war generation with scant education”. People of this generation got a surprisingly small amount of education or educational experience. Furthermore, they have strong impact and bad memory from the wars. This group faces several problems in adopting technology caused of very old age, lack of literature skills and computer familiarity.

e) What Information mobile can help elderly? What is their problems and need?

“The Internet seems well suited to the needs of the elderly, as a fairly sedentary population with considerable leisure time, especially for social networking, hobbies, and services as the home delivery of groceries” (Norris, 2001, 84).

The rise of mobile systems and its widespread adoption open a huge domain for applications, many new offering are being developed along the empirical questions: “how effective these systems are? How people in various social-demographic sectors actual use the systems? How mobile applications can contribute to the improvement of the quality for aged-people?” Below issues are not all but the most trivia ones:

Health: health is always one of the most challenging issues when people get old:

It's clear that mobile phone cannot help elderly from falling, urinary incontinence, heart attack, etc. but mobile can provide many other solutions: J. Katz and E. Rice (2005) analyze some possible mobile benefits for health care can be achieved:

In Spain, 76.6 % of the patients have mobile phones in comparison with 36.5% internet users. Therefore, mobile health applications can be more effective.

Text messages are an efficient way to remind patients

In Italy, 58% of patients who are older, less educated, less familiar with technology can successfully adapt to mobile report systems.

In Asia, 32% students who received text messages about weight reduction achieve better weight loss.

In Hong Kong, there is a system used mobile as the based for medical digital scan information and distribution

In conclusion, J Katz stated that: “there are substantial benefits available via mobile health applications for the elderly (once they have undergone the necessary training, of course)”.

If we want to find some health application for mobile, we can easily meet a countless number of available applications in the market. However, due to such high amount of application not many applications can receive the attention needed. K.Zheng , R. Padman (2007) also notice about the situation that many information technology-enable healthcare applications have failed because their interfaces are difficult to use. Little attention has been paid in the health informatics community to design effective user interface that are acceptable for healthcare professionals.

Loneliness and social exclusion:

As previous mentioned, Finnish people are highly independent people, there are only about 14% elderly people (over 65) live with their children (R. Disney, E. Whitehouse, 2002).

Independence living also has side effect, elderly are getting less care from family and relatives. Especially in the winter time, elderly are more likely to be depressed with the fear of being alone.

Loneliness is there in our nature, we all experience loneliness at some stage, no matter our age or social situation. However, those feeling are more intensive for those above pension age, almost one in ten people aged over 65 reported feeling regularly or always lonely. It is often triggered by the loss of social networks and companions – friends or family members, unemployment, poor skills, low income, poor housing, high crime, bad health, family breakdown. (Calouste Gulbenkian Foudnation)

Situation is worse if seniors live in rural area, lack of people, far from city center and their family members rarely visit them. If the elderly live in hospital or long-term healthcare center, they are getting less care from family and relative over the years (yle (3)). Isolation and loneliness can be detrimental to both mental and physical health of old people, this is a major source of anxiety as people grow older. Especially in Finland because of its geographical location, the ‘lack of light in winter’ causes about 14% population suffer ‘winter blues’ and 9%

seasonal affective disorder (SAD), with the loneliness and social interaction lost can lead many elderly to suicide(Heikkinen ME, Lönnqvist JK , 1995).

Technologies allow elderly to acquire information from various source as well as communicate with other people located in geographically distant places. The benefits are even greater for people, who spend most of the time at home or have difficulties with transportation (S. J. Westerman, D. R. Davies, 2000).

Drinking:

Drinking was long considered a sad statistic in Finland, it the number 1 cause of death for men and second for women for many years (statistic Finland, 2012).

"There is now a retired drinking generation that is accustomed to using alcohol. Life changes associated with aging, such as retirement or widowhood can leave a void which is filled by alcohol," Mari Sipola (yle (1))

Even though alcohol and substance abuse has long plagued the elder population in Finland, it is mostly unreported, undiagnosed, or ignored by the society. Drinking habit often comes from loneliness and social exclusion issues, when they live alone and out of society's mainstream, people and family members are often unaware and can't provide assistant for the elder person on time. Furthermore, even though elderly people drink a lot, they are less likely to cause troubles as youngers, so for society, it can be seen as personal matter. In the end, no one notice, no one care until it is already too late.

"He stumbles while carrying out the trash, falls down the stairs, and breaks an arm. At the Emergency Room the doctor asks about his alcohol use. He says he only has a couple with the boys at Happy Hour every afternoon. He lies about the drinking he does alone because he doesn't want to give it up. It has become a friend to him now, the only friend he can count on to be there."-
An answer from an old drinker. (Buddy T,2006)

In Bolton, Greater Manchester, dedicated handsets are given to addicts to help people quitting alcohol by reminders, SMS and taking them out of loneliness (Daily mail reporter, 2011).

• *Volunteer and sharing knowledge:*

Elderly are not useless, they have high expert skills which has been trained for years. After their retirement, most elderly want to keep contributing for the society. Although most organizations

haven't recognized and valued their contribution, the elderly in Finland involve more than average in voluntary works (A. Ehlers, G. Naegele, M.Reichert, 2011). Overall, 40% of Finns aged 65-79 stay active in voluntary work with about 17 hours per month committed.

Memory does not disappear right after we retired. Each year, about 17000 seniors (average 69 year old) participates in UTA programs to learn new things and to share their previous value knowledge (Open University education). Many reports have been published about elderly's knowledge, experience, how they coped with ages, etc. Those unmeasured knowledge should be supported more and more.

• ***Happiness and satisfaction:***

“Living is not about adding years to life but life to years.”

Active aging is not only about lengthen the life expectancy, and keep a healthy life, but also about enjoying the life. Pensioners have more time to spend for their own leisure then when they were busy with works. Elderly can spend time with several activities such as:

Playing game on mobile: for many people, that sounds weird because people usually stops playing game after adult time.(N. Caprani, 2012 and K. Gerling, J. Schild, M. Masuch, 2010.)

Other entertainments: watching movie, radio, audio books, online shopping, travel, etc.

f) Society's view:

Many researches have been conducted; many policies have been raised for the better good of 'silver ages'. But in reality, people view the elderly in more negative way.

What youngers think:

“I definitely don't like getting old, it must be bad”-23 year old student.

Aging is generally understood in negative way, according to S. Sintonen (2008, p50), the inability to feel positive about one's own aging is a barrier to understanding older people. Most of the time, those feeling are related to our preconception about getting old.

For some in the Finnish society, old people are more or less the source of stress for others. Said in Finnish “Olet aikuinen vain kerran ja lapsi kahdesti” – translated to English as: “You can only be adult once but twice a child.” A somewhat controversial statement, since most people don’t wish to be seen as a child.

The elderly are commonly depicted as technophobic - as “a person who fears, dislikes or avoids new technology” (B. B. Neves, F. Amaro, 2012). The idea of “technophobic seniors” is used widely in cartoons, commercials and video, in which the elderly usually use computer really ridiculous. Just take a quick search in Youtube about:

College Humor: Old people use a computer: The Game Show.

Lenovo ThinkPad advertisement: Don’t leave a laptop in your grandma’s hand

Cloudy with a chance of Meatballs (cartoons) - Old people and computers – cut scenes

Even some late-adult people (around 55-65) also raises doubts about their parents’ computer skill.

“I would give up everything if my father can use the Microsoft Office, for him, it’s a miracle”. Mr. Pettonen – Financial management (64 years old).

What programmers think:

Programmers / developers are the main people who are able to make the change in future information technology. However, most of the time, they cannot see the potential from elderly

“The elderly are usually against the changes, just as they keep using Microsoft office 2003 than the 2007/2010 version”. Bite student- Haaga Helia UAS.

“Our company hasn’t included elderly in our development yet.” Mr. Quang, Software developer in Sayduck.

“Why develop for someone who can’t use?” IT student- Metropolia UAS

4. Other definitions

Conversion rate: The percentage of visiting users who end up taking a “desired action”. On e-commerce sites/ applications, the desired action is to buy something. Thus a conversion rate of 3 percent means that of every 100 people who arrive at the site, 3 turn into paying customers and 97 leave without buying anything. (J. Nielsen, 2013).

Typography: can be understood simply as ‘letter form’ – or how to present printed pages from written material. This is very important part of the design because it effect significantly how people read and feel about our product. However, this feature usually is forgotten in school’s

education and gets no attention from programmers. For many years, the only things, students usually know about typography are ‘Font’ and ‘size’. Under visual design concepts, typography has 6 different parts: (S. Klemmer, 2012)

Point/Font size: It may look consistently ‘set in stone’, but the font size is considerable different from font to font. E.g.: The size 26 of **S** (Arial)- **S** (Garamond) has big difference.



Figure 2.9: Size differences between Fonts (S. Klemmer. 2012)

Leading: Usually the Uppercase has 20% bigger size than lowercase.

X- height: the height of the lower case letter. Some Fonts have **high x-height** (Lucida Bright), other have low **x-height** (Baskerville), **normal x-height** (Gill Sans). In web-design, high x-height is usually easier to read.



Figure 2.10 : X-height (S. Klemmer. 2012)

Ascenders & descenders: improve the recognition of the words. They’re usually only available on lowercase characters, that why many road signs are no longer use all capital letters.



Figure 2.11: ascenders and descenders (S. Klemmer. 2012)

Weight:



Figure 2.12: weight (S. Klemmer. 2012)

Serifs: is a small line attached to the end of a stroke in a letter or symbol



Figure 2.13: serifs (S. Klemmer. 2012)

Interface metaphor: a figure of speech in which an expression is used to refer to something that it does not literally denote in order to suggest a similarity. (Wolfram Alpha)

III. Research methodology

This chapter focuses on the techniques of data gathering which are commonly used in understanding the user's activities: questionnaire, interview and observation. This chapter is dedicated to collecting information in order to answer those questions raised in first chapter. It starts with the examination of research questions based on TAM/MOPTAM models, from then more detailed tasks will be revealed to research. From these tasks, a framework with both quantitative and qualitative methods will be built in order to achieve desired goals. The next part describes how the quantitative method is conducted through the surveys. The two last parts are about conduction of two more qualitative researches based on what we get from survey and theoretical research's result. The result from all three methods will be analyzed and discussed in later chapters.

1. Research Framework

The MOPTAM is considered to be a good theory guideline toward \research's goals. As most of the readers of this research cannot do anything to change social influence (SI) for elderly as discussed in chapter 2, these criteria will be left out of the research. Under TAM/MOPTAM our goals can be understand as focusing on:

Perceived usefulness → Behavior intention

Perceived ease of use → Behavior intention

Improvement in usability (will be discuss on 5th chapter)

It is not simple to start everything from books only. Most research and analysis, whether it is qualitative or quantitative, begin with the observation from everyday life. These observations serve as the initial point to identify patterns or calculate simple value. After that, more detailed works using structured framework and theory will be conducted to further discover and analyze the issues (Roger, Sharp, 2011, p269). The most important thing needed to be aware of during the research is to never let the researcher's own opinion influence the result. Readers who read the report don't have any interest in creating system for the writer (J. Nielsen, 2013). The conclusion of the report must be supported by the result, not the investigator's opinion.

Conventionally, social research method is divided into two types: qualitative and quantitative.

Table 3.1: Characteristic of Quantitative and Qualitative research (D. Anderson, 2006)

Quantitative	Qualitative
Answer the question: “How many?”	Answer the question: “What? Why?”
Give out numbers, quantities, countable figures	words, images and undiscovered problems
Literature review must be done early in study	Literature review may be done as study progresses or afterwards.
Measurable	Interpretive
Sample size concerned	Sample size is not concerned.

This research combines both of the methods to eliminate their weakness and strengthen the final result.

Table 3.2: Overview of data gathering techniques (Rogers & Sharp, 2011)

Technique	Good for	Kind of result	Advantage	Disadvantage
Questionnaire	Answer specific questions	Quantitative and qualitative	Can reach many people with low resource	The design is crucial. Response rate may be low. Response may be not what you want
Interviews	Exploring issues	Mostly qualitative	Interviewer can guide if necessary. Encourage contact between developers and users.	Time-consuming. Artificial environment may intimidate interview.
Direct observation	Understand user’s activities	Qualitative	Give insights that other techniques can’t give	Very time consuming. Huge amount of data.

First of all, questionnaires will be created to collect demographic data and check the importance of issues raised from grounded theory. Generally, the questionnaires will give the metrics value about most urgent problems (quantitative) but there are also some comment fields inside the questionnaires, which result in qualitative data (Roger, Sharp, 2011, p271).

After that, some interviews in specific group of users will be hold in order to double check the accuracy of questionnaires and explore the user's desires, which may not be mentioned in theory and questionnaires (X. Faulkner, 2000).

In the end, the direct observation in the field will exploit and confirm the issues from all previous works. This is the most qualitative and time consuming method, however it also gives out the most accuracy result and can also discover unfound problems. The overall framework is illustrated in figure 3.1.

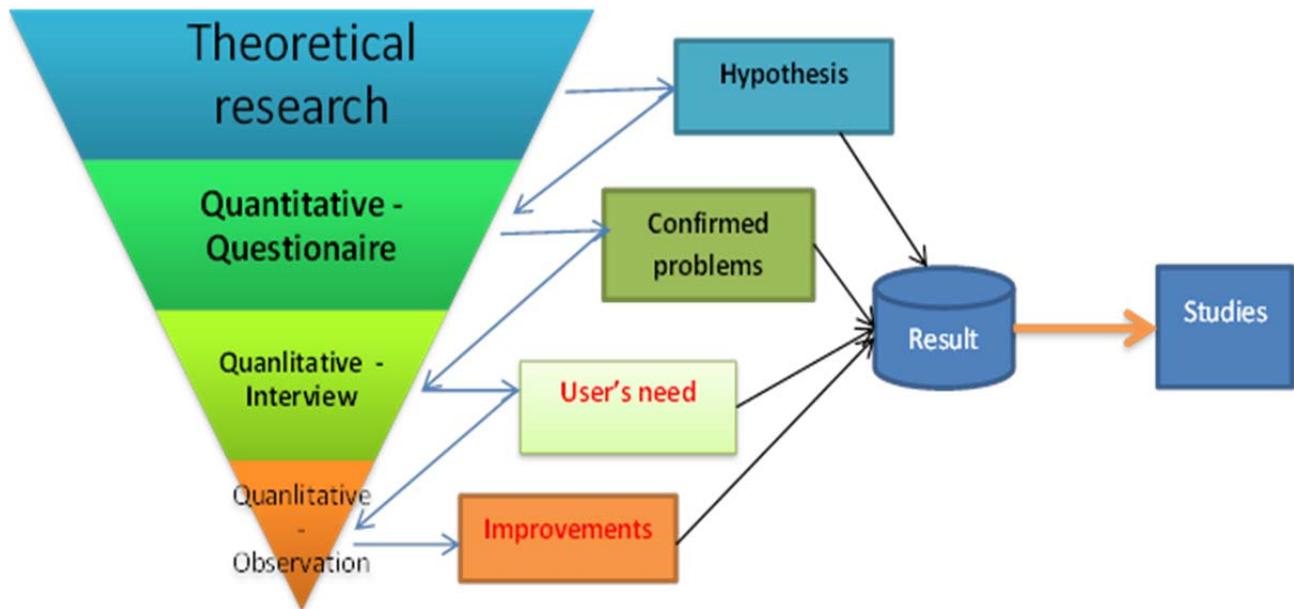


Figure 3.1: Research Framework

2. Quantitative research – questionnaire

One of the best ways which the usability engineer can gather information about users' opinion is questionnaire. Without much time (except the questionnaire design), investors can collect vast amount of data for analyzing.

a) Goals and questions

As mentioned in the research framework, the main purpose of this method is to support and prioritize the problems according to TAM/MOTAM theory.

What are the elderly's needs from handsets?

What are hindering the elderly from using smart devices?

Many specific questions have been drawn out in order to clarify the goals and the research background, because creating a proper questionnaire is the most important thing in this gathering data method (X Faulkner, 2000):

Who are the users of the mobile? Is the method of grouping elderly in previous chapter good enough?

What characteristics can affect the familiar of people with technology?

How well can people get familiar with technology?

What do people expect from smartphones?

What user interface do elderly feel easy to use most?

b) Theory's background

To create enough questions without lengthening the questionnaire, the previous researches give many hints to understand what should be found and what can be deduced from questionnaire.

Elderly group is decisively important (either categorized by 'unit of time' or 'non-chronological indicators') (B. Neves, F. Amaro, 2012; M. Rubino, David G. Winter, 2004 ; S.V. Ukraraintseva ,2001)

Although most of people believed gender take an important role in deciding how people think about a product's usability, this belief has been proved wrong (S. Djamasbi, T.s Tullis (2007); P.Kitirojpan, S. Teeravarunyou; X. Faulkner, C. Hayton (2011)). This is the main reason why the gender check box, which was written in first version of questionnaire, was removed from the final version.

Professions/jobs associated with technologies (mail, internet, television) are also an important aspect deciding how people are familiar with technology in general. It defines the level of a user's expertise (X. Faulkner, 2000, p25; Bosmas, Charness, 1996).

What do people really expect from mobile and its potential?

Which typography, input, image do they feel familiar with?

c) Questions guideline

As the oriented users of this questionnaire are old people, a proper design must be made in order to reduce the resistant from interviewee:

Font size must be big enough for elderly to read. (For example: font Times New Roman size 16).

Introduction about the survey's purpose should be short.

All interview's personal information must be kept secret and untraceable.

The questionnaire should be done in less than 10 minutes. The longer it is, the less accurate it will be (Herzog, 1981; Pete Cape, 2010).

There should be no unclear-boundaries between numbers. For example, many surveys categorize ages like: 50-65, 65-80 and over 80, which makes people age 65 and 80 feel confusing.

d) Creating the questionnaires

There are 2 methods of making the questionnaire: paper questionnaires and online questionnaires (Roger, Sharp, 2011, p 244). Each method has its pros and cons, however, only printed papers were used in this research:

Many elderly are not familiar with computers.

People are less likely to answer online survey if they don't get certain benefit or are asked by friends.

Many elderly don't use emails. Although they do use computers and internet, they still don't feel relax when doing that.

The first version was created at an early stage in the research; the later version (final) reduced and simplified a lot from the initial one.

The initial version was quickly built to support the discovery of problems

Has four parts: Information about interviewee, mobile opinion, separate parts between users with smartphone and normal phones

Three separate kinds of handsets: regular, featured and full screen phones (which was divided based on J. Nielsen (2013)). Images are included in the selection to help people easily pick a phone.

The questions concerning smartphones' use are constructed with rating scales format. The scale is from 1 to 5, which expresses from strongly disagree to strongly agree.

Separate parts between person who used smartphone and person who haven't even used.

All the scales are made starting from most negative to most positive in order to reduce errors and efforts needed for answers. As a part of human's natures, people tend to be lazy when focusing on repeat detail. For example: many researchers, in the first group of questions, they scale from most disagree to most agree, in later question, they scale from opposite side (from most agree to most disagree), which can makes readers give out wrong response.

The final version was finished 1 month later. It took less time to be answered and provided better focus than the 1st version.

Add the introduction to every questionnaire so the interviewee would know the purpose of questions.

Interviewees are assured that their personal information is retained anonymous.

In case interviewees cannot give an exact answer, they are recommended to leave those questions blank answers.

The check boxes about genders are removed.

Only two type of handsets left, as the result of grouping features phones and regular phones together.

Distinguish between smartphone and non-smartphone customer is removed.

Remove the rate scale and replace by multiple choice checkboxes and yes/ no question. This is quite a challenge decision as the 'rating scales' created many variables and made elderly think more.

Add a usability part at the end of the survey; this part would give a quick feedback about what people think 'ease of use' for them. It is mostly pictures so people can quickly answer and it is placed at the end of the research to make sure even already tired elderly can finish the task.

Although the final version is longer than the initial (5 pages to 4 pages) but in the testing before distribution stage, it requires less time and effort to read a lot to answer.

The Finnish version was done by my Finnish friends about 3 weeks after the final English version was ready.

Since my Finnish language skill is not good, I asked for help from my Finnish friend - Mr. J. Huttinen. The analysis of the result are assisted by Ms. Lan (a Vietnamese who was born and lives in Finland). I am very grateful to them as without them I would have met a lot more difficulties.

e) Conduct the research

In the beginning, some help requests were sent to 'Vanhainkoti' (English translated term would be 'house for elderly') but did not get much response. Most of the cases, the reason is that people in long-term care services are too weak and they don't want to meet strangers. It's also hard to get response from random elderly; maybe Finnish people are shy and a little bit afraid. Most elderly tried to avoid strangers, but some others were nice and happy to answer the survey. According to some Finnish's friend's recommendations, the best place to ask elderly is inside drinking bars; however it may result in low accurate data and therefore those data can't be applied.

About 40 surveys were printed out and distributed through my friend's network. Many people helped me to distribute the questionnaires; this is where the main data for my research came from. Only 3 are delivered by me in total of 17 feedbacks received.

3. Qualitative research – interview

Interview can be understood as 'conversation with purpose'. Many kinds of interview were developed by social engineers and can be used to obtain information. Open ended unstructured

interview is applied in this research (Rogers, Sharp 2011, p228; X. Faulkner, 2000, p42). The reasons are:

No detail information about the interviewees is provided in advance.

Forcing elderly with different background into a structured/ formal interview may cause resistance and unnatural reply.

a) Test preparation and guidance.

Conducting open-ended / unstructured interview is the most difficult method and requires more concentration than structured ones. However, the open ended conversation can go considerably deeper with more unpredictable answers (X. Faulkner, 2000). In order to perform the interview successful, a carefully detailed plan about the interview should be drawn out in advance.

Prepare to get familiar with seniors, read in advance about their psychology and some basic health's situation

Some ready-made questions are planned and written in papers before the conversation.

Voice recorder was prepared but during the interview, only the paper note was used.

Some elderly and even the translators are not comfortable with the voice record. Notes on papers may miss some of the information but more likely make elderly more relaxing during interview.

The questionnaire in previous test was used as the question plan in this interview.

A small gift is prepared for each interviewee as a grateful token for their help.

Also focus on the common issues of users, remove individual opinion.

b) Test goals.

What are the common difficulties in old age?

What are the purposes of using mobile phone?

Difficulties they meet?

Confirm the result and eliminate possible errors from surveys.

c) Test condition.

Getting in touch with elderly and ask for an interview is somewhat not easy. In the beginning, interview was not a part of the research. It took me some time before I could get the help from Ms. Thuy – a nurse in Meronkoti (a house for elderly in Vantaa city). She helped me with contacting the manager of the center, arranging the interviews and assisting as a translator. There were 5 interviews were conducted in two days:

All interviewees are over 80 years old, living alone and most can hardly take care of themselves and are not familiar with technology.

The first day was conducted in 20th March, 2013 and lasted about 4 hours with 2 seniors participated (each took about 2 hours). In the first interview, 2 selected seniors were in good mental health so they could take long time interview. In the first day, the examinees only know that they would have an interview but they were not made clear of the purpose yet.

The second day was about two weeks later, lasted 3 hours with 3 seniors being interviewed. The three elderly were not in good health condition, which is why the interviews were quite short.

Two of fives interviewees did the papers survey in advance. This is a good test about the accuracy of papers survey since the questionnaire is unreliable (X. Faulkner, 2000, p35). All interviewees were well-prepared before the conversation, based on the normal schedule in the center. The interviews took places after 1:00PM, after elderly had taken bath and lunch.

With assistance from Ms. Thuy, the interviews got a lot easier because:

The conversations were made in elderly's private rooms, so they didn't fall into lab-environment. They could show the researcher how they live every day, which kind of technology they feel familiar with.

They did not feel lost in the conversation because the translator is who taking care of them every day.

Ms. Thuy is Vietnamese so she can translate to me in our mother tongue.

Furthermore, Ms. Thuy did not only help as a translator but she was also an expert in nursing elderly. She told me many delusions and problems in advance so I had better preparations before conducting the interviews.

d) Conducting the test

Before the interview, seniors were well-prepared and stay in their rooms. The researcher and translator come together inside the room to begin the interview.

We started with some short introduction about interviewer from translators.

Some warm up question about elderly's health were raised.

Let the interviewees talk freely and minimize the disruption of their speech.

Many of the times, the interviewee talked a lot about their young life, their experience and their family

After some time, focus the interviewee into technology life. Most of them go along with interviewee's expression.

Some sample questions about technology life:

- How do you use television?
- How often do you call your family and relatives?
- Do you feel any difficult when using these devices (remote control, alarm, phones)?

Only a small show of smartphones is given to test the reaction of elderly.

This situation happened in an interview in day 2 as one interviewee's health dropped so the interview just last about 20 minutes.

Some relax question so examiners don't feel as they are inside a technology research. This method resulted in some interesting finding.

Closing session and giving the gifts to the seniors.

4. Qualitative research - observation

In order to fully understand the users, interview is one of the best methods; however, J. Nielsen (1993, p210) showed a case when 50% response in interview are uncorrected from observation. The interviewees thought they understood the problems, whereas in fact they did not. Moreover, some people are tending to reduce the negative feedback, and don't wish others to think that they are not good at something.

a) Research goal

Obtain the necessary data to influence the interface improvement.

Verify the response from interviews.

Explore additional issues.

From the interviews and questionnaires result (which will be discussed in next chapter), the specific goals of the observation is the ability/ feedback of user from doing:

Reading (which typography they prefer most)

Texting/ input method (which methods suit them best)

Call relatives

b) Research preparation and guidance

“You can observe a lot just by watching”-Yogi Berra (HCI course). Reduce interfere when user using the devices, only provide help when needed.

People can act differently while being watched (X. Faulkner, 2000, p39).

The improvement data may be overloaded since many new things can pop up during the observation J. Nielsen (1993).

According to J. Nielsen (2000), 5 is the best number of users in one usability tests.

“Elaborate usability tests are a waste of resources. The best results come from testing no more than 5 users and running as many small tests as you can afford.” J. Nielsen (2000).

Close hanging out with users: a lot of daily life problems would not show up in a short observation, but come out eventually after some time. This kind of issue requires a long time observing the target users, but it's quite hard to be achieved. How much time can a programmer spend with elderly? Maybe a few days per year with their parents/ grandparents and the opinion are still subjective since there is a huge difference among elderly. Furthermore, the elderly are not expert enough to tell their problems clearly to the researcher.

There are a lot of problems need to be discovered from the interview's and questionnaire's result. Many of them require lab-environment, expensive equipment (such as eye-tracking camera needed for navigation tests), etc.

Some deep research about : navigation, speed typing, response when getting errors, play games, using social network, etc. are left out of the research due to time and facility constraints.

Speech recognition is a bad idea for input message because it is likely to create more troubles and efforts than to fix it (Ben Shneiderman, 2000; J.L. Newman, B. Theobald, S.J. Cox, 2010).

Get the good first impression – you might not get the second chance (Carol M. Barnum, 2011, p87). About 80% of users spend only few seconds on a website before deciding whether the site is worth exploring or they should move on. The same problems happen more critically for elderly with technology product, since they are lack of patient than youths. Therefore, I don't spend much time training the testers in using applications but I would rather ask them on the act. People prefer taking the action directly than reading or waiting the introduction.

c) Test condition

Because of some limitation, I only can get the test from 4 seniors aged from 55-70. All of them can speak English fluently and have some experience with computer. All of them are suffered from either aging or disease; they need help in their daily life.

The test sample is quite small; however if 5 users can discover about 85% of problems, 4 users can achieve about 75% result (Measuring usability; J. Nielsen, 2000)

Only 1 user used traditional/ regular phone, half of the testers (2 seniors) used physical keyboard smartphone, the last one used iPhone3.

All the tests are conducted in seniors' house:

Some impacts of noise and distraction can be happened during the test. E.g.: children, pets, incoming calls. It can affect the result but it would make the situation more realistic. All testers don't feel that they are in a research. The environment is informal, no stress or real demands are raised; they get the feeling of doing a friendly request than forcing to do a test.

The test was conducted in private: 1 researcher, 1 tester.

Software/ applications prepared:

Reading test:

- iBooks (version 3.1) by Apple
- "Messages" default message application by Apple.

Typing test:

QWERTY layout: Default text keyboard, Note application by Apple.

T9 key board: Fastpad lite by Ben Lefevre (version 2.1.9).

New layout keyboard (T6): Tiki note powered by Tiki Lab. (version 2.12)

Hand writing: Google translate by Google (version 2.0.1).

Some other assumption but was soon taken out of the test: Drovak keyboard, Swift input, voice input.

- Drovak: is a good design, especially for those who have not tried a QWERTY keyboard. In early phase it was examined in the hope to reduce a lot of typing effort for elderly. However it turned out to be really bad in word suggestion and detection, because of all the vowels are placed together in one place.
- Voice input: Some tests were also tried out but got too far below the expectation, especially in Finnish language and elderly's difficulties.

- SWIFT/ Swype input: are new methods of typing where users don't need to put their fingers up on the screen but rather moving around the keyboard. Many people gave them a positive feedback, but when it comes to elderly it caused too many troubles.

Calling test: Fliple. by Cristi Paraschiv (version 1.7.6)

Some prototypes were developed in early phase of this research as navigate and design test were not used because they would need too much time to get some result as good as readymade software. Furthermore, researcher's subjective idea and design can also affect the result.

d) Conduct the test

Reading:

Each participant is asked to read books using application iBooks. Each time, the font size, font type and contrast are changed.

There are only 2 font sizes in the application.

7 font types: Only 4 are testes.

- Seravek : San-serif ,
- Geogria, Iowan,Times New Roman : Serif

Light: day light condition.

Themes : White and Night

Room condition: Light.

When using iOS, users can change the display font of SMS, Note, calendar, mail, in phone's accessibility setting → large text. There are 6 bigger sizes which available for configuration: 20, 24, 32, 40, 48, and 56pt. Each participant is asked to read some text message and give out the feedback, the observation happens silently while reading.

Typing test:

Unlike many other researchers, who categorize input methods into physical: T9, QWERTY and touchscreen; my research only focus on touchscreen and its solutions since touchscreen can perform any input layouts.

Under this test, all the inputs were asked to try separately. 3 input methods (Apple keyboard (Figure 3.2) , Fastpad (Figure 3.3), Tikinote(Figure 3.4) were tested by all 4 testers. The handwriting (Google translate) was added into the test later so only 2 elderly participated in the test.

QWERTY is the most common keyboard in smartphone today. There is only some minor different between iOS, Android and Windows Phone keyboards in color, size and negative spacing between buttons. However, it was not the most popular input methods, according to Tomi Ahonen Consulting, in 2009, 73% of mobile phones sold in 2009 is still using T9 physical keyboard, as we all know the features phones are the one, dominated the world for so long. There is no doubt about number of people, who familiar with the T9 keyboard, is a lot more than who have learned the bizarre order of keys on a QWERTY keyboard. And definitely that people with ages are less much familiar with QWERTY.



Figure 3.2 : Apple's note application



Figure 3.3: Fastpad Lite Application (Fastpad)



Figure 3.4: TikiNote Application

By moving to touchscreen, all mobile companies are silently removing the option typing by T9 from input methods. But touchscreen offers developers the ability to create everything they want, T9 is one possibility they brought to the users.

The testers were asked to type a long text message and give their feedback. Observer sat aside and took note about some problems occurred.

Calling test:

Old people usually have much less contact than youths, from the interviews, most of the elderly (over 80) have only less than 20 contacts in their list. Is there any better solution than scrolling on the long line list to find the contact? And why don't support the memory of elderly by pictures?

The Fliple application was used in this test to analyze this hypothesis.



Table 3.2: Fliple Application

IV. Data analysis

This chapter summaries and analyzes the data collected in pervious tests. The results are presented separately in three parts according to the research progress: questionnaire survey, interview and observation. Each research inherits the result from previous research as the focus for deeper investigation.

1. Questionnaire

This part analyzes only the important data collected from questionnaires. Complete result from questionnaires can be found in Appendices E: survey data.

a) Data analyzed

As mentioned in chapter two, my research categorizes elderly into 3 groups: Group 1 (young-elderly, below 64 years old), group 2 (from 65-79), group 3 (over 80). From the initial point of research, the categorization was just developed from theoretical framework, but as the research went further, the grouping proved to be really fit the Finnish condition.

In total, 35 copies of surveys were printed and delivered in both languages, however only 17 feedback returned (four copies-23.52% are in English, and the remaining (13 copies-76.5%) are in Finnish). Among four English replies, three responses are from group 1 (75%), only one from group two.

Table 4.1: Number of respondents

Age group	50-64 (Group 1)	65-79 (group 2)	Over 80 (Group 3)
Received feedbacks	4	5	8

The highlighted notice for language criteria is: in all English response, almost the free-to-fill areas are answered in Finnish. It can be understood by natural, although people can be fluent in English, mother tongue is still more convenient for expression.

There are 6 elderly, who stay in health care center, all are over 80 years old and cannot afford to live independently. They and 2 other elderly in group 3 are staying in nearly zero-level in computer-proficiency. 5 of 8 people have never use computers and 3 only use computer very rare. The only person in group 3, who shows the most positive familiarity with computer, was a

carpenter. X. Faulkner (2000) gave an amusing short definition about this group of novice users: someone who is afraid that if they touch the keyboard, they will break the system.

I also got 5 feedbacks from group 2, the result is more positive than group 3. One of them used QWERTY -smartphone and decided to answer the questionnaire in English. Seniors in this group show much more technology understanding in comparison with Group 3. None elderly in both group 2 and group 3 have ever used touch screen phones.

Among 4 young-elderly group 1 (below 65), 2 are using full screen-smartphone (all iPhone) and 1 is using physical QWERTY keyboard-smartphone.

Television and mobile phones are irreplaceable devices for everyone, even for oldest people. All respondents have their own mobile phones, 82.35% of them watched television and use mobile phone at least one per day (almost more than 1). This survey result fits with similar survey in 2007 by University of Jyväskylä (by E. Jokisuu and M. Kankaanranta) to confirm that elderly are well-acquainted with these tiny devices (since 2007, mobile phones have been used by more than 90% Finnish seniors). This is a huge gap between Finland and other part of the world in seniors' mobile penetration; for example, the phone-ownership is only at 8.5% for people over 50 in Malaysia (Md. Nasir, H. Hassan and N. Jomhari, 2008). It will take developing countries many years to get similar level of informatics society as Finland.

Although mobile and television are well adopted by elderly, computers and internet get a relative low score in using frequency. For seniors over 80, computer is something they have never encountered (62.5%); or rarely used. For younger seniors (group 1 and 2), computer play a bigger role of their lives; 50% elderly in group 1 chose to use computers and internet more than television.

What people truly need from phones? It's surely depend on our individual opinion. Usually, people are too greedy so they tend to need a perfect device with satisfy everything they need. But what's their most desires, while the options are limited? The respondents were instructed to pick only top 3 wishes among many variety options.

It's quite amazing how some statistics between groups are similar:

Battery and data security are most common issues between group 1 and group 3
'Price concern' is only picked 2 times by group 3 elderly, who doesn't have much money and live in house-for elderly.

People over 65 definitely need a simpler, easier phone to use: 8 choices for 'easy to used'; 11 choices for 'bigger buttons'; 8 choices for 'big screen' from group 2 and 3.

Loosing phone was never a big worry for elderly because the high safety in Finland. Only 2 extra demands are written in free-to-fill are: both come from group 1 with the thirst to surf internet easier with their mobiles.

Table 4.2 : Quantity of choices

Problems	Number of choice		
	Group 1 (4 response)	Group 2 (5 response)	Group 3 (8 response)
Long battery	3	1	7
Cheap price	0	0	2
Easy to use	0	2	6 (describe mobile is too hard to use)
Hard to be broken	2	0	1
Good calling signal	2	3	3
Size of button	1	4	7
Hard to be stolen	0	0	0
Secure your data	3	1	3
Clear/big screen	1	4	4

There are also some different in how two main function of a phones – phones and SMS- are used: (3 seniors did not answer this question under free text)

- Group 1: 0-6 calls, 0-4 SMS
- Group 2: 0-4 calls, 0-3 SMS
- Group 3: 0-2 calls, 0-2 SMS.

One smartphone is not simple used for call only, so what lay beyond the basic needs? The interviewees did not need to actually use the functions, just what they wants from phones.

- For group 1: They need and believe almost every functions can be intergrated into the tiny devices.
- Group 2 and 3: Seniors are mostly confirm that they only need something which normal phones can provide such as: music, photos and keep touch with family. People over 65 don't expect to get much internet features from phones .

- From all feedback (17/18, 1 blank), elderly are heavily rely on mobile as a survival and health support device.

What is easy for elderly to use, or which display they like to use most? 8 different typographies and 3 layouts are listed in ‘sample text’ in order to understand the elderly’s opinions:

8 typographies have been used:

- Font: Times New Roman, Size: 10. (2 checked)
- Font: Arial, Size: 10. (3 checked)
- Font: Times New Roman, Size: 14. (11 checked)
- Font: Arial, Size: 12. (4 checked)
- Font: Times New Roman, Size: 16. (13 checked)
- Font: Times New Roman, Size: 16. Background: Gray: Darker 35%. (2 checked)
- Font: Times New Roman, Size: 20. (17 checked)
- Font: Times New Roman, Size: 16. Background: Black, Font: white. (3 checked)

3 layouts has been used: QWERTY, T9,Tiki Lab:

- Result:
 - Group 1: 75% choose QWERTY keyboards, only 25% choose T9.
 - Group 2: 20% choose QWERTY, 80% choose T9.
 - Group 3: 100% choose T9.
- None choose Tiki lab layout.

b) Discussion over result

Since considering the result collected from the survey, the first impression thing is about the age grouping. If we left out the effect of diseases and health problems since it was ‘somewhat difficult’ for interviewees to write down their health issues, the history affected heavily in grouping seniors. According to the category by A. Antikainen (2005), group 3 (over 80) can be related to who born before 1935, group 1 and group 2 can be related to who born after 1935.

The technology familiar gap between group 3 and younger is really clear (caused of lack of education, technology expert, health issues, war scant);

Group 1 and 2 can perform much better in term of health, technology expertise, etc.

This also led to a finding that: technology-age groups are heavily based on history of one country. E.g.: in Vietnam, where people just start adopting the advanced technology life, the techy-expertise of one 50 years old man can only similar to group 3 elderly in Finland. Finnish seniors in group 1 (below 65) have nearly similar abilities and experience in technology with youths. That why after this survey was analyzed; seniors in group 1 were going to be paid less attention.

Language: Although Finland has many elderly who familiar with English, mother tongue is still the best way for them to describe anything. In contrast with younger adult, who sometimes prefer English in expressing some technical term, elderly tends to afraid using something not completely familiar for them. It surprises me when received many answer in Finnish inside English questionnaire. Later I also found out that, most elderly prefer watching movies in Finnish dub over subtitles. The reason maybe not only there low speed of reading but also they feel more relax watching their own language. J. Abascal and A. Civit, (2001) also noticed in their 'I need help' scenario: when people - especially elderly-get problems, they will like to be answer in their own language. Therefore, creating a local-language variant for seniors should be considered as a must

Methods of getting information: Television is still in reaches mostly with elderly who doesn't have much relationship and social network left. Since 1980, G. Gerbner and L. Gross stated that television is the best wholesale distributor of image, culture, information for elderly. The older we are, the more we can gain benefit from television. Contrasting with youths, who prefer looking information actively; elderly would like to get information more passively. This may give out a solution that applications will show up information automatically instead of waiting users' search. Many healthcare applications also prefer sending automated or tailor messages to elderly instead of asking them searching information in internet (Z. Lv, F. Xia, etc. 2010; S. Hughes, 2003; senior life).

Battery: There was also a notice in why long-lasting battery is highly concerned among group 1 and group 3 people, but not group 2. The explanations are:

Group 1: People are more likely use mobile phone in their life, work, relationship

Group 2: After retired, people lost many connections in work and long relationship. Elderly mostly keep in touch with family member or relatives. With the reduction in 'connecting people', so the decrease in power consumption. Finnish elderly in this group mostly still have good health situation and can live independently.

Group 3: In elderly late life, people tend to be so afraid of their health and the reduction in memory. Elderly in this group are not really using mobile phone often but always afraid the battery will be out of battery. The main reason of this choice is because of the equivocal worry than actual need.

Similar explanation can also be used for 'data secure' issues: 75% elderly in group 1 and 37.5% in group 3 notice the need to protect their information, while in group 2 only 1 over 5 (20%) chose that option.

The price of phones is also not an important concern of people in Finland (only two check), except some people who over 80 years old- mostly live based on pension or support from government. This fact also confirms the elderly's economic situation found in literature research is correct. Furthermore, none of elderly afraid of phone stolen, this represents the safety in environment in Finland so elderly can feel really safe.

After many years of development, all mobiles are still too difficult for elderly. The options: 'size of button', 'easy to use', 'clear big screen' got the most choices (27 over 48 choices) among group 2 and group 3 elderly. That shows the main reason elderly avoid using mobile because it was too hard for them to use, not that they do not want to use.

Calling and SMS frequency also declined through ages. In group 3, most people just using phone phew time per week and 2 feedbacks choose not to use text message at all. Beside the influence from having less society connection, is there any other reason make people refuse to use text message? Some assumptions were given out for next step finding.

Elderly is more patients in reading than youths. (Carol M.Barnum,2011. p90)

Elderly feel difficult to read/ type message

It's hard for people to navigate, read message

According to the usability part result, some notations about typography were also appeared:

2 different popular fonts were used in the test: Time New Roman (serif) and Arial (san-serif)

The size of word is more important for reader than the font.

There was not much different between serif and san-serif fonts in small size; people cannot recognize the different in short and small text.

In size: 10, 2 people feel happy to read serif and 3 people chose san serif. This may because in the same small size, Arial has slightly higher height than Times New Roman.

In bigger font size: the likelihood were increased as the size increased respectively

- Font 12 – 4 choices
- Font 14 – 11 choices
- Font 16 -13 choices
- Font 20 - 17 choices

Don't make low contrast background.

- The text with background: grey darker 35% only got 2 choices even for size 16 fonts.
- White text overs black background also got similar low score. (only 3 choices)
- While similar text, size and font with black text/ white background got 13 choices.

This survey also gives a clearly evidence that, elderly in group 2 and 3 (12 over 13 response) prefer using the t9 keyboard than the QWERTY keyboard. However, people in group 1 prefer using the QWERTY (75%). This issue was left to be researched in later methods.

As the hypothesis of the researcher, the metaphor is a huge hidden challenger for elderly.

Elderly don't know what those symbols mean

The best well-known metaphor is music: got 13/16 feedback.

Two icons about music were placed as sample for research: Music and iTunes. It is still hard to explain why Music icon gets better recognized than ITunes's one (13 and 11).

Some familiar metaphor for developers can become some weird icon for elderly such as: mute (9 choices), play music (8 choices), camera (5 choices). If elderly don't know what these icons are about, do they dare to press and try those functions?

c) Limitation:

Although, I researched quite carefully and tried to do my best in design the questionnaire, this is still my first usability research survey. Some problems were only turned out after I got back the result. It was too late to change or redo the test. Some errors may affect the test result:

Some respondents don't pay attention to the instruction, for example: in mobile phone concern parts, some pick more than 3 options although there was a clear instruction to pick only 3.

Some people left some blank answers and it's hard to analyze those missing data. However, it's better to get blank data than fail data.

Some elderly may don't understand some technical term. E.g.: some elderly can misunderstand between 'data security' and 'personal security'.

Language barriers: since the survey was conducted in both languages. The translation and design of papers can cause some minor mistake in reading and understand the idea of the research.

Print color: As the survey was printed on papers in black and white, some image/ color of metaphor (such as record button – in red) can make people confuse when doing test.

Reading text in papers also different from mobile, but it's just impossible to give each elderly a mobile to read in each survey or ask them to do the survey on internet.

Have no warranty that people who do the survey really act the same as their answer. For example: one elderly in group 3 stated that he understands the flash symbol, but don't understand about light, music mute symbol.

Amount of the survey is also quite small (only 17 respondents), furthermore, the surveys were delivered through friends or friends of friends, some similar criteria can appear among respondent.

Researcher can't track the identity of seniors, so other unknown criteria may affect the result.

d) Question for further researches

As mentioned in the research framework, the questionnaire just gives a basic understanding and general demographic figures. Some limitation and errors from this step will be recalculated again in next steps. Some issues would be re-identified in interview part are:

Why people in group 3 are afraid of battery life while they don't have much use?

Why seniors prefer calling than SMS?

Which virtual keyboard elderly prefer most?

How they read information on mobile?

2. Interviews

As described in research framework, interviews were conducted after the questionnaires had been collected in order to identify the result from surveys and find the reason behind elderly's choices. In 5 elderly joined in the interviews, two of them had answered the papers survey in advance.

a) Result

In total, 5 interviews were conducted under the translation from Ms. Thuy (nurse in Metsonkoti – elderly house). With the help of Ms. Thuy, the interviews became really easy and convenient. She prepared the best condition for seniors in the interviews: have lunch, take bath, in good health condition and be prepared for an interview.

Finnish seniors are really shy and quite afraid to meet with strangers. In the beginning of first interview day, I meet Ms. A as the first interviewee. When I met her, the nurse was disturbed by

some other issues so I sat and talked with Ms. A for about 15 minutes in Metsonkoti's restaurant. I tried my best to get a conversation with her, it was really hard to talk with her and felt like there was a huge ice between us. After Ms. Thuy came back, the conversation continued unbelievably easier. Since the first interview, all the interviews were moved from reserved place: restaurant to interviewee's private rooms; as seniors feel more comfortable and relax in their own environment.

In all interviews, the questionnaire papers were served as the interview plan/ structure; however, in the beginning, seniors got much question about themselves than about technology used. It served as the 'ice breaker' to encourage seniors to tell more about their daily life.

During the conversation, the elderly tended to talk a lot, especially about their past. Some common characteristics had been summarized:

All the interview get difficulties in remember new things but has amazing memory about their past. Some interviewees told exact day of the events appears in their childhood.

- One 93 year old elderly told correctly the day she got the scar in the war. That time she was only a teenager. This date was later checked in her injury papers.
- One 86 year old female remembers every birthday of her children and grandchildren. She also memorizes every time her children come visit her include the day and who visited.

Wars created scary memory for many elderly who lived in conflict times.

Except one elderly who worked in tax office, all interviewees are really lack of higher education. Mostly stop studying for nearly 70 years ago, from that time, no more education was provided for them.

As elderly live alone in care center, they really want to meet relatives more often.

In later phrase of interviews, elderly are asked how they handle electronic devices in their later life:

Television: The interview in elderly center just gave out similar result as questionnaires: seniors watch television every day. Each elderly owns a television inside their private

room; however they still prefer watching together in common room after meals. The remote control for television is a big challenge for some elderly. Seniors usually prefer asking help from nurse in order to select channel than using the remote control themselves. Some seniors only know the 'power off' button of the control. Even after many years of watching television, it is still unable for elderly to use the remote. During the interviews, some elderly were asked to show where the television controls placed; out of my expectation, they can remember exactly where they placed the control. They also remember clearly where they placed their watch, albums, mobile, and tracking alarm.

Alarm system: All elderly in Metsonkoti are tracked by small devices. Whenever elderly press the button, it will send a signal to display panel in center of the common room. The panel will show the identify number of the tracking devices, any nurse/ doctor see the signal will go to the room of elderly.

- The display panel is really simple and only can show the number of tracking devices on simple digital numbers. So usually, care-center personnel will come to elderly private room, but don't know the exact location of the senior.
- The tracking devices are attached to the elderly as a watch with only one button. So sometimes, elderly miss pressed the button and cause the false alarm.
- Once charged, the device can work from two week to one month. But there is no signal to indicate the power remaining in the watch; therefore some elder might not call help in some urgent case if the battery went out.
- The alarm will automatically be triggered if the device leaves out more 2 km from Metsonkoti.
- This alarm system gets many complaints from both nurse and elderly in this center.
- Some other nurses also told me that in other new elderly-house, they have more advance and better alarm system.

Alarm Clock: Alarm clocks are available in all elder's rooms. However, these clocks are rarely used by elderly here; some clocks even haven't replaced battery for a long time.

Banking and internet: Elderly also need to pay bills, which were delivered directly to Metsonkoti. The center's personnel will pay the bill for elderly. Interviewees also

described that, before coming to this center, they must go to bank's branches and ask help from staff to pay the bills.

Mobile phone: Since people have different kinds of mobile phone but they face some similar difficulties:

Call: all the interviewees responded that they are rarely using mobile phone because they don't have many contacts and they cannot use phone. They mostly used function of phones is to received incoming calls; some also can't call even call back when there is some missed calls.

"So what how did you handle the missed calls"- the interviewer asked
"Nothing, if this call is important, they will me call again" – the interviewee replied
Elderly usually complained about advertise calls, which really make them angry. Meanwhile, they also express that, they received less calls from families and really feel lonely deeply in their later life.

Contact list: During the interviews, elderly also asked about how they call people in there contact list. Only 2 elderly could open the contact list in their phones, the others need the help from nurse to call their relatives. Because the interviews were conducted in interviewee's room, I could ask them show how they using their phone. One elderly are prefer reading the written contact list in paper to navigating and search for contact in mobile phone. The regular phones are unreadable for her.

Message: In contradiction with younger people, short message service (SMS) are extremely rarely used by elderly. Although all interviewees don't have any vision impaired, they still can't or do not want to reading message in the tiny screen of phones. Usually they just ignore the incoming message; mostly because they also received too many advertisements through the message. Two of interviewees have never sent any message with their phones.

Camera: As mentioned above, two of five interviewees are answered the paper questionnaires in advanced. Both of them decided not to take pictures by phones' camera. But these options turned out that they chose these options just because their current phones have no camera.

In an interview with one elder in her room, she was very nice to talk about everything in her life, especially her family and relatives. She also showed me all the printed pictures of her family, house, cats, cup boards, curtains, etc. which she had captured by her camera before moving in Metsonkoti center. Her talk shows clearly how she's addictive to taking pictures; she took pictures of nearly every single thing in her previous house. She just stopped capturing image few years ago after her camera had been broken. Since then, no more images are recorded by her; the newest images in the album were taken by her relatives when they came visit her. It is hard to believe that she doesn't like taking pictures as written in her answer sheet.

While she was showing her relatives pictures, she can remember the appearance of her grandchildren, but cannot remember their names.

Application: No interviewees have ever used any other phone's functions than call and message.

Power: Although all interviewees used featured phones which usually have very long lasting batteries, especially when they don't use mobile that much. The elderly are really worry if the battery went out; although the nurse confirmed that she had never seen the phone's battery empty. All interviewees said that they charge their phones every night.

This fear can be explained as the elderly consider the phones as an important safety-support device; they do not want the phone's battery run out in emergency case.

Icons/ metaphor: The questionnaires' result is enough to show that, using even most familiar metaphor can become some strange symbols for elderly. The interviews help further discover the reason behind their choices.

- Music: Music symbol is the most well-known icons in the survey. When I showed interviewees the list of eight icons, some were eager to point the music icons and felt really sure that is about music; since they saw that symbol every day in television. However, only the music icon was understandable, other music control icons such as: mute, play, record cannot come out from elderly's memory.
- As expected, the phone and message symbol are also well understood.
- Flash: One elderly answered that she understands the meaning of the flash icon in camera; that's electricity and quite dangerous.
- How can elderly feel happy about the phone if they must spend a long time to discover these icons about?
- Other icons (record, mute, play music, etc.) also could not be recognized by any interviewees.

Although having bad health, and hard to live independently, elderly in this center have many needs and wishes:

Some have never flown on an airplane; one interviewee strongly expressed how she was encouraged when she saw planes on television.

Elderly really want to be listened: every day they just meet and work with other elderly and nurse, none want to listen and talk with them. Every day routine is just: wake up, eat, watch television, take a bath and go back to their room and watch television again. That may also be the reason, in the discussion with researcher, after the 'ice' had been broken; they kept talking continuously and freely.

Reading and writing: many elderly have lived in health care center for many years and rarely went out of the center. They only have some books, which brought many years ago when they were strong, or by relatives. Now, they mostly read newspapers, which ordered by staff. Two elderly also told that, 10 years ago, when they were stronger, they used to write a lot, but not now anymore because they have no more things to write, and must ask nurses to deliver their letter for them.

They want to study more about other things since they haven't get any extra education for many years. Although as in the literature research, Finland has a very good education system for elderly, but still cannot in the reach of all elderly.

They want to see pictures and information of their relatives; they nearly could not update any information since they came to this center. They only can get information when their relatives visit and bring pictures for them. The sad fact is: the frequency of visits reduced through the years they live in center.

During the interview, the questionnaire was received positive feedback because they all can read and complete the questionnaire in less than 10 minutes. Although there are still some difficulties in understand technology term, Ms. Thuy also helped explained the questionnaire.

b) Discussion over new finding

For a long times, all the programmers are taught to keep the interface as simple as possible for elderly to used. But just take the alarm system as an example; it's the simplest tracking device with only one button. The insane simplicity was criticized for many fail alarms and power's worry of elderly. Similar problems were also mentioned by Y. Roger, H. Sharp, Preece (2011, p59) ; even the if elderly tracked with better GPS tracking devices, system may also detect wrongly if the elderly choose to rest in some strange place and trig the fail alarm. Furthermore, tracking system also violates people privacy when every move is constantly being monitored. How can people live happily if they often find themselves slavishly under the GPS tracking? An image is worth a thousand words: that also what programmers studied from universities and books, but none tells: one image can cause thousand misunderstood. Interface metaphor was widely used by a lot of people, except 'aged ones'. Since the phones doesn't support pop-up message when mouse over an icons as computer. Seniors will find themselves suffering between pressing the button or not, they afraid the system will stop working if they miss press the buttons. The solution of this issue is extremely simple: replaces icons by words or icons with explanation below.



Figure 4.3: A sample of how metaphor can be combined with words (Facebook 6.0 Application on iPhone)

Elderly in Finland are really shy, they won't tell everything unless you are really closed to them. Elderly also don't want to show their children that they don't know some technical problems. Many elderly in Finland choose to call and ask technical support than ask directly their children at home.

Problems appear when people using the products; if researcher simply asks seniors the difficult in using phones; they cannot answer due to human ability to call back memories in short time. The most accuracy way is to observe their life for a long time, which is nearly impossible for technical person. During the interviews, the nurses helped me a lot in bring back elder's difficulties so they can tell about these problems.

Aged people have adapted some very strange methods to use phones: One people always hang the phone in her neck as a necklace. She does it to ensure she always keeps the phones with her. Although she still has very good memory, she still worries one day she will suddenly forget her memory and lost in some strange place. In that case, she will give her phones to someone nearby, so other can call to her relatives.

When I showed them how phone's camera work, they were really happy to use phones with bigger and lighter screen. At first signs, they were very eager to see how the phone works, however they were also really easy to give up when face difficulties.

c) Limitation:

All participated interviewees have least ability of taking care of themselves, and over 80 year old. Other elderly, who live independently, usually have better health and technology familiar. It will be ambiguous to characterize all Finnish elderly similar as interviewees; however if one applications can satisfy elderly in healthcare center, they will easily accepted by others.

Staff in health center must prepare a lot before the interview (health care, taking bath, eating), and this is the reason many centers are not willing for interviews. In second day, one elderly are get suddenly bad heath so the interviews were interrupted intermediately.

There may have some errors during translation; as Ms. Thuy is not IT personnel, some technology term in Finnish can cause misunderstanding for her and interviewees.

d) Result for next step.

If you want the elderly accept smartphones, it must serve well basic need first before moving to more advance applications. If the phones is too hard to call, too hard to read, is it a ‘mad phone’ not smartphone. In the limited amount of time of the research, the observation method would only test some possible improvement for elderly’s basic need.

3. Observation

Observation is the most time consuming methods but it returns many great discovers. Several small tests have been conducted to evaluate the usability features of some applications. The purpose of analysis is not the general usability of application itself but specific features of applications.

Two testers belong to group 1 and two others belong to group 2 elderly.

a) Reading test

Applications used: Messages and iBooks – both developed by Apple Inc.

Message: Message application is the default and only method to send and receive SMS in iPhone.

Specification:

Font: The ‘Messages’ application shares the same Helvetica font with other applications like: email, contact, calendars.

Helvetica font characteristics: (Typography, Web Design)

- San-serif type.
- high x-height: which makes it easier to read in smaller sizes
- Vertical or horizontal terminations on their strokes
- Much negative space surrounding the letters.
- Remain legible when in motion.

The default font size is 20pt. The setting of font sizes is not placed in the application but in phone's general setting.

In iOS 6.0 the setting can be configured in: Settings → General → Accessibility → Large Text → Choose the prefer text size.

Background: Apple used 3 different backgrounds to differentiate messages.

- Sent message: Light green back ground, left side
- Received normal message : white background, right side
- Received iMessage: light blue background, right side.

Testing: Participants were asked to read some sample messages by using application, and gave feedback after that.

Result:

Touch screen smartphone is easier to read than in feature phones, with bigger, higher solution screen.

Two participants less than 65 are happy with font size from 24 to 32 pt. One of them used iPhone 3 for many years but never know how to make the font size bigger. After the test, he also changed his iPhone's setting to 32pt font size.

Two participants in group 2 prefer reading in 32pt to 40pt.

None of participants want to read in small size (20pt) or too big size (48pt and 56pt).

Scrolling the text up and down also performed well by elderly with one minor issue.

During the test, sometimes elderly moved her finger to the top of the screen – which made the screen scroll back to the top/ earliest messages. They lose the reading comprehensive right after the miss press.

Discussion:

The scroll back to top can be disabled in iPhone setting. This accessibility and other multi touch features usually create more confuse than convenience for elderly.

Many organization and researchers recommend bigger fonts for elderly. However if the font size is too big, the tiny screen cannot display all the message at once, therefore elderly must scroll a lot to read the whole messages and stress the memory of readers.

IBooks: iBooks is not default installed in iPhone when manufactured. This requires a separate installation from users, however this application is recommended by Apple for reading eBook on iOS devices.

Specifications:

Setting is placed inside the application.

Only have 2 size : small or big fonts which do not have big difference

Users can choose one of seven fonts to read. (6 serif and only 1 san-serif type)

Themes:

- Light adjust
- White (black text, white back ground) Sepia and Night (white text, black background) themes.
- Book: turn pages by pressing to left or right side of the screen; Scroll: turn pages by moving finger up and down.

Testing: Some books in Finnish and English were installed in iBooks and read by elderly. The book is the one which they want to read most. When they were reading, observers changed the setting one by one and recorded the behavior and feedback of participants.

Result:

All seven fonts are good for elderly and some even cannot recognize the differences between fonts. Small and big font were also too similar, participant just lightly recognize these.

White theme is the best theme for people to read as it similar as reading on papers.

In the beginning of the reading, all four participants responded that Night themes just as easy to read as White themes. But in daylight conditions, after about 10 minutes of reading, two elderly started to feel eye strain and wanted to change back to white background, two other elderly did not feel any differences.

Navigation: switching pages by pressing left or right (book style) is more convenient and easier for elderly than moving finger up and down.

Discussion:

The research could not clarify the significant impact of typography on elderly. The reasons can be explained as seven fonts are well chosen by Apple Inc.

Under the concept of whether or not the white text on black background should be apply. Although two elderly did not feel well when reading in, it's still a hard debate:

- Recommend to use black background : American foundation for the blind, Aries Ardit (Light house international)
- Recommend not to use black background: Transio – a website and custom software development company(2008), Marta Eleniak (User Experience Architecter),
- Anthony (2011) suggested and explained that the black background is bad in day light condition but good in night condition due to the reflection of light wavelength. But how often the elderly will read books and use application before sleep?
- Jason Harrison (2002)- Post Doctoral Fellow, Imager Lab Manager – Sensory Perception and Interaction Research Group, University of British Columbia explained the reason why not to used white text on black:

“People with astigmatism (approximately 50% of the population) find it harder to read white text on black than black text on white. Part of this has to do with light levels: with a bright display (white background) the iris closes a bit more, decreasing the effect of the "deformed" lens; with a dark display

(black background) the iris opens to receive more light and the deformation of the lens creates a much fuzzier focus at the eye.”

- The background matter is highly important because it is the default setting of most popular phone operation systems: iOS, Android and Windows Phone. The main reason behind is because dark background consume less power than white background. Phones manufacturers are ready to pay off the readability of phones to get longer battery life; while elderly would pay anything for friendlier phones.
- When the battery life gets better, Apple Inc. slowly improves the UI into white background:

In the first and second generation of iPhone, users are only allowed to use black background. After the iOS 4 released, users now have the ability to configure the preferred wallpapers.

The keypad for calling application iOS 5.0 is white text over dark background, from iOS 6.0 it moves to white background.



Figure 4.4 : The iPhone keyboard in iOS 5 (left) and iOS 6 (right)

- Relying heavily on typography over black background is still the recommend in Window Phones style (previously called Metro style).
- Familiarity: As the ability to learn new things is related to people sustained experience (in chapter 2); black text over white background also make elderly feel similar as they are reading on papers.

b) Typing

Specification: four applications were used in the test, each application represented for one method of input.

Result:

QWERTY keyboard: For three over four testers, it was really difficult to type texts with QWERTY. The only exceptional was the participant belongs to group 1 and had used iPhone 3 in advance. In case of elderly who were using the smartphone with QWERTY physical keyboard, he just typed about few lines and refused to type anymore, he expressed that typing on touchscreen is too hard for him. Two remaining elderly, who were using feature phone had more patient in trying but must let the phone in considerably short distance to see the keyboard and type very slowly with some errors.

T9 keyboard: Since all participants have used the regular phones, typing in T9 keyboard did not require any time of learning from elderly. The buttons is bigger and easier for elderly to see and press, however it take elderly more time to press since many common characters need to press at least three times to display (such as C, F, I). As observation, elderly prefer typing slowly in T9 big keys to QWERTY small keys.

However, all four testers got issues with timeout problems, it's hard for elderly control whether pressing the word would input next character or moving to other character in the same buttons. For example: If elderly want to type the word: 'tool', they should press: 8-6-6-6-6-6-5-5-5, there are some possible errors can occur such as: 'tnnn5', 't6nlk', etc. Elderly constantly pressed backspace buttons to remove errors characters.

Different in symbol capital characters made the elderly who used iPhone 3 confused:

QWERTY keyboard by apple: when user wants to type the capital character, the capital buttons turn lighter.

T9 keyboard: when user wants to type the capital character, the capital buttons turn darker.

Tiki notes keyboard (T6): Although having a low feedback in questionnaire stage, this keyboard layout was highly expected before the observation as it presented a new solution of making typing easier with following specifications:

The buttons is big enough for the elderly to type without mistake. (only 6 main buttons for typing all needed characters)

Only need to press buttons two times for any character.

Always have 6 word suggestions for quick choose.

Despite of getting good feedback from customer in Apple application store, the actual result with elderly was significant low.

6 words propositions and possible word type suggestions flood the vision and concentration of testers. They don't know what to see when many thing display in the same time. The layout is also too new for anyone, no memory could be called back to support typing.

For people with good vision (all participants), they expected when they press the first level of keyboard, they could input the word directly. But the application quickly changed into level 2 layout and interrupted eyes' sight immediately. Users must spent time to view the application again, sometimes the layout got back to level 1 before the elderly could type anything.

In lowercase keyboard input, the buttons are also in lowercase. It sure provided testers on on-the-fly case feedback, but also made 2 elderly feel hard to distinguish similar input characters: ' i ' & ' j ' ; ' d ' & ' b ' & ' q ' & ' p ' ; ' n ' & ' m '.

Google handwriting- Google translates: This application only been tested by 2 elders because of its late release (19 September, 2013). However, this was proven is the best solution for input methods for everyone.

Specification: User can hand write the text in free style into a blank form area. The application will send the draws to Google server and received the converted texts back.

Result: The google handwriting is the best input methods for elderly in my research:

It is interesting with elderly: Both participants feel really like to test the handwriting than using virtual keyboards. They expressed the high enjoyment of free style writing during the text.

It is fun, let try creating some errors: after getting some good typing, two participants tried to write in extremely ugly handwriting font.

Less error: Just some errors are recorded in the input.

Nearly no learning require needed, testers only took few minutes to figure out the writing techniques.

Continuously improved: As the data is uploaded to Google server for analyzing, Google have the ability to constantly improve the AI of text recognition.

Weakness:

Handwriting is not the default input of Google translate application. To activate the handwriting, users must press the small, silly icon of handwrite (which for users, look like a worm). Thus, participants were navigated to the handwriting in advance to aim their concentrate in typing matter only.

Time out: The applications can handle quite well in English language the time out and auto spacing bar. But for participants, they don't know where they should stop writing the word. In beginning, testers usually tried to write the complete Finnish/ English words in small area, after the instruction of observer, they know they can write word one by one.

Finnish, personal name, uppercase: are 3 issues which were not very good in this application. Some Nordic special characters are not well recognized by application.

Personal names also create some problems to the conversation because they are not in the dictionary. Uppercase and lowercase are also not well distinguished.

Internet connection: The application requires uninterrupted internet connection with Google server. In some place like in rural area or in train where the 3G connection is not stable, the typing becomes unavailable.

Discussion:

'Stop autocorrect me please': autocorrect is often ignored by users, for non-English speakers, this is an even bigger nuisance than 3G reception or poor battery life (Jan Libbenga, 2008). Before conducting the typing test, I could also see how the elderly, who has iPhone 3, suffer with autocorrect. Therefore, the autocorrect was turned off in all typing tests. Even the word propositions get refused by elderly, they don't want any machine suggest what should they do.

The most challenge when using touchscreen is its lack of physical stability and tactile feedback (H. Nicolau, J. Jorge, 2012). Many people and participated elderly express the likelihood of blindly typing on regular keyboard. Although there is sound when pressing on keyboard, it's not enough for accurately pressing targets. In their first times using of touchscreen, elderly don't know how strong and how long they should press, double/triple press and errors while typing usually occurs.

While typing with both QWERTY and T9 keyboard, two elderly who have never used smartphone did not know how to type uppercase letter or number without personal instruction. Elderly is so afraid of the try and learn scenario, they don't want to press any key before knowing exactly what these keys about.

After getting the feedback from typing observation tests, further exploration about keyboard also gave out new findings: behind the simple keyboards is a highly developed artificial intelligence (AI).

- QWERTY - by Apple: has the best AI under there layout. Even when people turn off the autocorrect function, smart punctuation features still silently improve the texting ability of users (D. Pogue, 2007). Although we cannot see with our eyes, the 'landing areas' of the certain keys are changing continuously time base on probability.

For example, if we type the word 'tim' and let the finger around 3 keys: W, E, R. The AI will make the key E bigger without visible changes to avoid typing the word 'timw' or 'timr' but the correct word 'time'.

The arrangement of QWERTY cuts greatly the effectiveness of AI features. Some vowels such as 'u, i, o' and 'n,m', etc. were placed near each other, and reduce the possible of word predicting

- T9 – by Fastpad : which was developed by only Ben Lefevere , has nearly no AI under its layout. Although the T9 predictive text was long developed to reduce the miss press, none was implemented in Fastpad application.

Lowercase character is easier to read than uppercase in paragraph (J.Nielsen, 1993, p119). But if we ask people to read single key one by one, Capital characters is more distinguishable than normal character. As the miss read occurs mostly with TikiNotes (lowercase keys) but not T9 and QWERTY (uppercase).

During the typing test with Fastpad lite version, one tester accidently pressed the advertisement and switch out of the application. He immediately got lost and had no idea what should be do next. He explained his afraid of losing money in weird actions from phones. For profit purpose, many developers placed some advertisement in application; it just made the elderly feel more confusing and loose trust in application. Handwriting stands on top of the test as an easiest input method for elderly. Unless people really want to write in strange style, google can recognized well the Finnish special characters. Although some other languages (Vietnamese, Chinese, etc.) did not get the same level of recognition, the future of handwriting is auspicious. Because of having no specific layout, handwrite continuously gets inconspicuous improvement from Google's developers and users' data submissions.

Currently, handwriting can be injected into any application on Android phones but not in iOS phones. Apple Inc. does not allow any other universal keyboards but only the QWERTY itself.

c) Calling

The calling/ contact test is to analyze the result from interviews, when elderly can remember pictures of her family but not their names and seniors' contact list is just about 20 people.

Specification: Instead of displaying contact in lines: each contact for one line, Fliple displays in square areas. About 15 contacts can be displayed in one pages at once with the pictures and

names, thus provides the quick selection from users. The design of Fliple is similar to Windows Phones (WP), but Windows Phones still keep the list display contact.

Result and discussion:

Displaying contacts in square areas definitely improve the 'landing area' of one contact. The default contact by Apple creates too short and too wide area for each contacts, in the observation, all the participants only press on the left-side of the contact (where the text located), none press on the right-side. The default contact wastes big unused space in the screens, while mobile screens are so small that it's a sins to waste space (J.Nielsen, R. Budi, 2013, p52).

Because the test devices is researcher's phone, the pictures familiarity did not show the memory support of the images but making elderly feel more relax to choose contact to call. Besides looking in long contact lines, elderly can see the pictures/avatar of relatives. Some funny avatars created curiosity for elderly to press in. The contact of one person in Fliple also connected to Facebook, email, etc.; therefore it may make elderly learn more things after they get familiar with Fliple.

d) Other study while spending time with elderly

As stated in chapter 3, the official observation was conducted after the interviews had finished. The daily observations/ discussions had been happening even before the research actual conducted. Some case studies were recorded during the study.

Curiosity of using mobile: Some elderly have similar curiosity as children, when one senior first time see other using smartphone, they also want to try that new devices. But the QWERTY keyboard soon exhausted all his interest in smartphone. He was nearly unable to type anything with new smartphones; errors, miss type, autocorrect created him an unfavorable attitude with touchscreens. When later typing with handwriting, he also tried to make some silly writing style to see how the Google handwrite works.

Avoid using unnecessary applications: The younger people usually blame elderly in lack of using technology; but by just talking friendly with elderly, we may understand why they avoid the new things. Below is just modified discussion to illustrate how elderly don't want to use smartphone:

“Programmer: We made the to-buy-list application for elderly memory what to buy in market.

Elderly: We used to write it on papers for many years, and it is fine.

Programmer: Smartphone has the public transportation applications with GPS tracking, you just need to specify the destination and follow the GPs signal and recommend transportation.

Elderly: I can read that information from the schedule paper (which was glued on house's door) of my favorite bus, furthermore I prefer using the papers map than a GPS electronic map. The electronic map on phone is considered too small and too difficult for me to use.

Programmer: You can use phones to go to internet and search for information.

Elderly: I can get all information I need from television, and why you use mobile that much? I can see you using mobile all the time, on the bus, at home, while eating, etc.

Programmer:”

Elderly's need come suddenly: In one case of Mr. K who has been using physical keyboard smartphones for many years, he only knew how to use call and read message. In 2012 Christmas, his granddaughters gifted him Finnish audio books recorded in CDs. He really loves that gift but he could not sit on the computer all day to listen to the audio. He must learn to use his mobile as a music player. After getting all the audios converted into mp3 and installed by me, he learnt and started using the mobile's music player of mobile really quickly with only little guidance needed. After finishing all the audios, he started listening to other music on phone at night before sleeping.

Do not ask people search applications in nickel market: This is the only one elderly which have been using iPhone 3 for many years. He got the phones from his company, and used it every day.

However he have never ever installed any applications or updated his operating system. He don't even know the email or password to install applications on his phones, he used his phone just as a regular phone without ever connecting the phone to computer. The only functions (out of call and messages) used are calendar and alarm. He indicated that he doesn't need any other applications until others installed some other applications on his phone. This issue also reported by many of my friends' parents/grandparents, who have smartphone but never installed or used any applications.

Smartphone can replace computer for elderly: Having a small screen, mobile creates many difficulties for elderly, however the small screen also increase greatly the discoverability and simplicity of that tiny devices. During the observation, asking elderly to find an icon/ applications on phones is many times easier on computers.

One example is the using of Danske Net bank to pay the bill

By computer: Open computer (take a long time to turn on old computers) → Open web browser → type the website of bank address → Click to → Waiting for loading java (if there were java installed) → A pop up will appear to ask whether the user allow the script to run → Another pop up asked whether they trust the website → They fist type the bank account and password → After that they will need to type the security number before can start doing transactions

By phone's application: Turn on the phone (1 second) → Open the application (much easier to find the Application icons on phone than the web browsers) → Type in the security number to pay bills.

Mobile phone is different with other devices since it means for personal use only (Appendix A). The users only need to type the bank account and password the first time they log in to Net bank. They only need to provide the security number in case they want to do some transactions. Without security number, users still can see their financial statements.

V. Value studies

Until now, only a considerable small number of researches about smartphone usability have been conducted for elderly, however there were many other researchers aim for everyone. Definitely, elderly is not completely different from youngers, therefore general usability studies can still be applied for seniors with some attentions and modifications.

As mentioned in chapter two, usability is unmeasurable so no usability point is absolutely good or bad. Furthermore, people are ready to overcome small difficulty if the application is really interesting for them. This chapter will list some best studies in mobile usability; the developers will decide how to apply into their own application.

1. Recommendations

This part will include some studies which are highly recommended for developers to follow.

a) **Something is wrong with smart phone approaching methods in Finland:**

According to MOPTAM (J. Biljon, P. Kotzé, 2007), social influence (SI) takes the initial influence of mobile acceptance for one people. But in Finland and other developed countries, how the elderly get smartphones is just not very convenient.

A senior independently walks into a phone store; well this is not the joke yet. The sale clerk is patient and good enough to explain and demo how the smartphone can be used, that is a bigger joke. The biggest joke is the elderly get home with an uncharged, blank mobile phone (Laurie Orlov, 2013). How do you expect elderly can plug the smartphone to computer, register an account (may even need to visit Apple website to download iTunes, if he bought an iPhone), go to Apple store (Internet application store, not Apple store in shopping centers) to buy applications. In the end, almost elderly will end up with no extra applications in their phones (just similar to the participant in the observation tests), and they will tell us that they don't need any other functions except call and messages.

Solution:

Most of the case, elderly gets the phone from family members as a gift. So if you want to gift your grandparents a smartphone, you should think about what is their need and ability and configure the phones in advance.

Default setting is just for everyone, not special users. Some recommendation configurations are:

- Increase font size (24-32 pt.) as in the interview's result.
- Adjust the light screen.
- Install some applications for elderly (health applications, music, games, Facebook, etc.)
- Remove some unnecessary applications, or move it to less visited area.
-

Society training: there were many programs and projects to improve the ICT/ computers awareness and adoption for elderly in Finland (as researched by Helena Blažun, 2013, p 58). However, society paid no attention to train elderly how to use phones maybe because it was considered too easy to use by policy makers. With the same amount of training, elderly can achieve much better result with smartphones than with computers, because touch screen requires nearly no learning times from elderly to be familiar(chapter 2 and Appendix A).

Developers: It's no use for developers to create outstanding applications if it is not installed in customers' phones. But what if the developer's application is lucky enough to be adopted by elderly, it's important that the application must have a proper usage instruction. As many usability gurus recommended, we should not ask the users to read any instructions before act (J. Nielsen, R.Budiu, 2013, p84; Carol, 2011, p87), but elderly are different. Elderly weren't willing to take the chance of making a mistake, so they would prefer reading the instruction before using the apps. They are great readers; make use of it (Carol, 2011, p91).

A study from developing countries (Vietnam): In Vietnam, high-income senior citizens are also really interested in smartphone; they want to live with newest technology while having little or no expertise in computers. For them, buying a smartphone is much easier than searching and install applications. The solution is simple, they just need to bring their mobile to any phone's retailer/store, tell which songs, games, and applications they want and got the job done. In Finland, the price for installation maybe higher because of the high salary and elderly will not ask much help from others (independent culture), but the need of similar supporting services is definitely here. Elderly will get lost in hundreds thousands of applications in market just to find a suitable one for themselves.

b) Studies from the research

3 research methods return some confirmed value studies that can be applied directly to your designs

Elderly received information more passive: don't ask elderly to search information from your application but give them suggestions. E.g.: Instead of waiting users to search for a song, just let them hear some song first and decide song to download/ add to play list later.

Visual impair is a seriously problem for most elderly but not Finnish 'silver age'. In my research, I couldn't find any elderly with visual issues, so some critical reading test weren't conducted. Later reading confirm that overall rate of visual impairment in Finland is low, only more than 10% of person 75 year old or older had visual impartment (Arja Laitinen, 2009, p88). So when creating applications for Finnish seniors, the typographic priority can be lowered to achieve other important values.

Although having good eyes condition, elderly still prefer the bigger than default font size (around 24-40pt). Too big font size will dramatically decrease the reading comprehensive and force readers to navigate more to read the messages.

"Speak the user's language": It's highly necessary to develop applications in native language for users.

Battery reflex more the worry of users than the actual need of power. There should be a power alert inside application to reduce the customer's concern. Elderly wouldn't feel safe to use your application if they lost track of remaining battery.

The size of the screen is important for users, however the phone must not too big to carry with elderly everywhere(the case of elderly hangs the phone as a necklace)

People want big buttons: the sizes of keys in QWERTY keyboard are too small for most elderly to type. Developers should find some other ways to improve the typing experience for this special user group.

T9 is more familiar than QWERTY for elderly to use. However, Apple does not allow developers to integrate any other global keyboards except the Apple default QWERTY keyboard; this policy lefts iPhone out of improvement options for elderly. To type text in T9 or T9note (T6), user must type in the developer's applications first then copy and paste to other applications (it's just too complicated). Meanwhile, Android and Windows Phone allow developers integrate other global keyboard into applications. This allows more modification for applications can be made.

Do not use icon/ metaphor without any description: Even the most familiar icon can cause misunderstood for seniors. The practice of Facebook 6.x (Figure 5.4) is good case to include description with icons.

The golden guideline to create website for elderly: "more text than images" may be not accurate with calling applications. Since elderly usually don't have much contact, they feel happier to press into their family's images to call them than their name text.

Texts in all capital letters are harder to read. However, in single word, capital letter is easier to distinguish and cause fewer mistakes than lower case. The case of T9note keyboard is an example where users continuously misread and miss press the buttons. The reason is, people mind read the words as whole, not as single character one by one, the lower case provide better links between words, meanwhile the upper case give more separately feeling.

Complex and hidden gestures must be reduced: Touch screens only have two signal states: finger up and finger down, no left or right fingers as mouse, no mouse hover state. So in order to perform complex tasks, complex gestures have been used without any

guidance for users. In case of iOS 6.0: elderly most well-known complex gesture is the zoom functions by stretching 2 fingers. They usually have no idea about:

- Touching top screen will go back to top of pages
- What if they touch 3 fingers in the same times
- How to copy and paste text
- What is the difference between touching a links and hold it for few seconds.
- Swipe the finger from top to bottoms will open the notification center

Just take a short list (not full yet) of sample gestures by Apple in below figure (5.7), how many gestures do you really know. For experienced users, it's is easy to undone the mistaken gestures, for aged users, they would be suffered. Therefore, keeping the complex gestures out of application is the necessary improvement for applications.

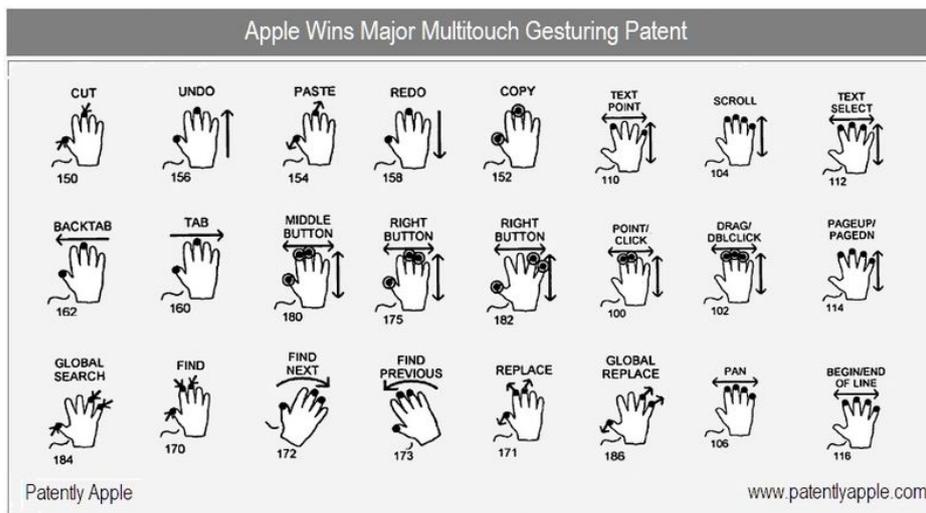


Figure 5.5: A scary list of Apple's licensed gestures (Source: patently Apple)

Country security: People don't really worry to lose phones in Finland, some security methods can be lowered down.

History of one country is important as it reflects the society demographics and people's familiarity with technology.

c) Other practices

Early registration must die:

“One of the most important guidelines for mobile apps is to avoid making user pass through a registration screen as the first steps.” (J. Nielsen, R.Budiu, 2013, p81)

Asking users register before using the applications proves the commitment and worth of application for user. Sadly, this is what many developers are thinking and just wrong. Typing on smartphone is a nightmare for everyone (not only elderly), forcing users go through a long process of registration is an example of “take before you give” where user must pay expensive effort without any perceived benefit.

Another form of early registration is push notification to ask for permission. Users must hardly decide whether the applications can do some access/ rights with no idea about the applications itself.



Figure 5.2: Early permission request before users use application

The application would allow user do as much functions as possible with guest account or with a ‘unique identify number (UID)’. Only required least amount of typing in very special case, reduce some unnecessary steps. For example: Some application only need user to fill username, email and password only one time, no retype email or password, no email verification needed.

Make the button obviously clickable:

With touch screen, we no longer have the ability to leave the mouse on a links/ buttons and wait for a small pop up appear/ or the cursor change into a hand symbol. Don't make user think about whether or not they should press the buttons.

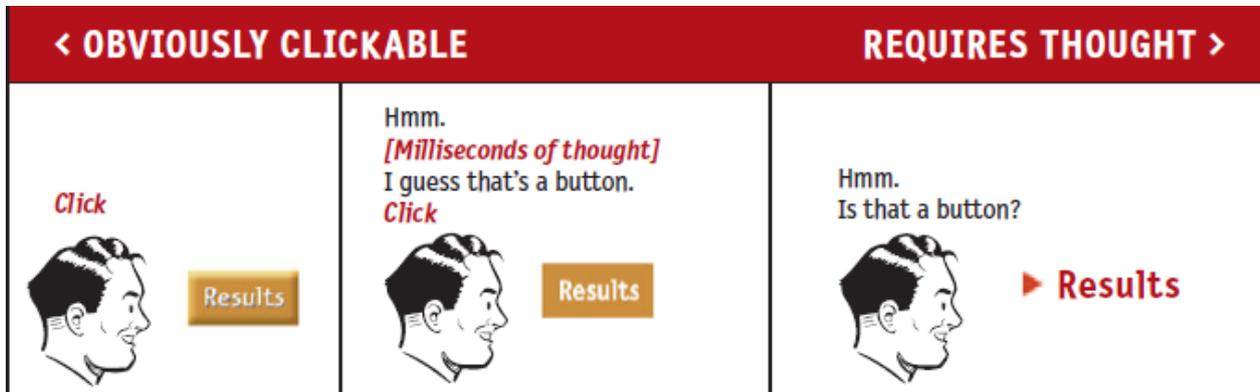


Figure 5.3: Make buttons more clickable (Steve Krug, 2006, 14).

Rule of thumb:

Mobile is only a tiny device so most users only want to handle the phones by only one hand and pressing with only 1 thumb fingers , however today smartphone screen is usually bigger than comfortable reaching zone by thumb now.

Rule of thumb was first mentioned by Luke Wroblewski in his book 'Mobile First' (2011) with a simple graphic explain the key criteria for placing functionality. Since the smartphones are keep getting bigger (iPhone, Samsung Galaxy), most used buttons are in favorite to place in lower position. E.g.: the changing of Facebook applications from version 5 to 6 in 19 April 2013. Until its 6 version, Facebook decided to move from PC-like design to follow the 'rule of thumb' where all the popular buttons are place in the bottom, some other less popular buttons are placed on top to prevent miss pressing (For example: close button).



Figure 5.4 : Areas of iPhone 4 and 5 where people can easily reach by thumbs (Luke Wroblewski)

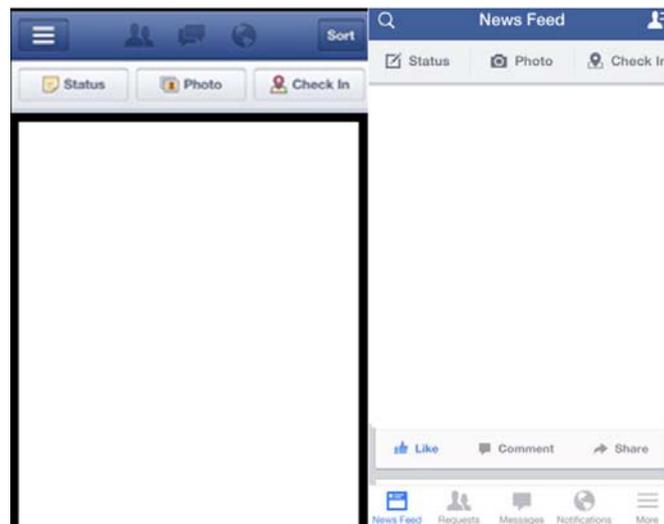


Figure 5.5: Different between Facebook application buttons location 5.x.x (left) and 6.x.x (right)

2. Dilemmas

Some usability features are not completely good or bad, it's the developers who will adjust the balance of applications.

a) Advertising or not

The elderly extremely rarely search and install applications by themselves. How much the probability that they will pay for an application before actually using it? None or very low. Advertising on an application is ‘nobody wants but everyone needs to do’, except you create applications for big companies.

The problem is more challenge in case of older users; they are easier to get lost with navigations. In the typing test with Fastpad lite version (T9), participants are completely get lost by touching in ads area and be redirected to applications store.

So if the advertisement is inevitable, make it less painful for elderly:

It's better to open the popup ads pages inside your applications first than jump out of your application at first press.

Place the ads in separately areas to avoid miss press. Do not expect to get the money from miss press actions by elderly; they will quit using your application before you can get a second penny.

b) Black or white

Whether or not to use the white text on black background (or blue/ green/ brown background), it was left for developers to decide. Although in my observation tests, two over four participants provided bad result from reading in ‘night themes’, the quantity of my research’s observations is still not big enough to against the heavy-weight recommendation by American foundation for the blind, Light house international, Window Phone guidance. Furthermore, the power saving of dark background is undeniable, so I rest my case in developer’s choice.

c) How much simplicity is simple enough

Simplicity is good. However the result of alarm system in Metsokoti health care center proved that too simple devices can cause really bad misunderstood. No general guide can draw the line between too complex to use and too simple to make mistake.

The runner up application in Android Smart Accessibility Awards 2012 -Fontrillo is a brilliant design with high simplicity and fun to use. Everything in this application is just so simple and carefully measured for elderly. The SOS buttons is placed in red color to get attentions and in top area and to avoid miss touch. Even if the elderly miss touch the button, there will be some period for them to cancel the SOS request.



Figure 5.6 : Fontrillo applications for elderly (Fontrillo)

Another lesson of making to keep things simple for user is to reduce the shortcut and unnecessary button and navigate. Bill Moggridge (2007) created a sample of how to make the remote control better for elderly. Sure it seems like a humor at first look, but it is really a brilliant solution for elderly.



Figure 5.7: Helping elderly using remote control by reducing a lot of buttons and adding the note for buttons (Bill Moggridge, 2007)

d) Security or ease of use

As mentioned in chapter 4 about the absolute advantages of using mobile e-banking in comparison with PC:

- No waiting time for PC to turn on.
- Always connect to internet.
- Always in people's pockets.
- No need to loading Java (In case of Dankse Bank)

Furthermore, with smartphone, customer can also buy stuffs online or replace cash/ credit cards to pay for food from market (Google Wallet- currently not available in Finland yet). Under the view of IT personnel, when compare between paying by a credit cards and mobile phone: Mobile is definitely more secure than credit cards.

If your card is stolen, they just need 4 digit PIN code to steal your money.

If your phone is stolen: First they must by pass the mobile PIN, then the purchasing application's password, then your card's information.

However, in a survey over 1000 adults in United States conducted by National Cyber Security Alliance (Andy Steingrueb, 2013), smartphone's payments were never trusted by users for:

69% of Americans believe storing information on their smartphone is unsafe.

Personal computer (PC) was seen as the safest option to for accessing Web (62%) versus smartphone (6%)

Under the trust when paying: 84% respondents prefer paying by cash, 69 % prefer by credit cards while only 18% prefer paying by mobile.

Newer security technologies such as fingerprint identification (53 percent) and retinal scans (45 percent) are believed to be able to replace password.

Only 34% people using PIN code to lock their phones

This is clearly that Americans are not trust in smartphone and country's security, thus many steps of security check should be provided. However in Finland, people live in much better security environment (with none of 17 respondents afraid of losing phones- questionnaire result), is it necessary to apply tons of security check for elderly?

Let take the case of application installation on iOS:

If senior wants to install an application, they need to remember account's email and password which are extremely hard to create and remember (password must come with many complicated conditions: length, capital characters, number, etc.). Even for experience users, they still feel hard to fill the password field correctly with tiny keyboard, especially when the password text will soon become asterisk symbols (*) for security purpose; no review or error check can be performed. Meanwhile in Android devices, users just need input the google account password only one for lifetime using. Since mobile is for private user (none share the mobile as tablet and PC), is it necessary to input long password to install long passwords?

On the other hand, it also notices that, elderly rarely have their phone locked by PIN code and lack of security knowledge with computer. Therefore, they are more likely to become the victim of Internet frauds. As the result, they need more protection from developers and phone manufacturers. Balancing between security and ease of use is a difficult task needs to be carefully measured.

e) Size of buttons:

As the lack of necessary measure and tracking equipment, this research was unable to identify how big the buttons should be for elderly. Some guidance from phone's manufacturers can be taken as guidance for further research:

Apple Inc.: Recommend a minimum target size of 44 *44 pixels

Apple keyboard: 320 pixels for 10 keys per row, there for a standard portrait keyboard should have about less than 32 pixels width. Even the Apple keyboard doesn't fit their recommendation size.

Nokia: Suggested the size should be no smaller than 1cm *1cm square (28* 28 pixel)

Another research by Massachusetts Institute of Technology in 2003 (K. Dandekar, B. I. Raju, M. A. Srinivasan, 2013, p 4) found that the average width of the finger index of adult is about 16-20mm (45-57 pixels), which is much bigger than both Apple and Nokia's recommendation.

For elderly who are usually suffered from tremor, the needed size of buttons should be bigger than average people. However the buttons must also not too big for all necessary objects can fit in one page to avoid fragment in reading.

iPhone (English):

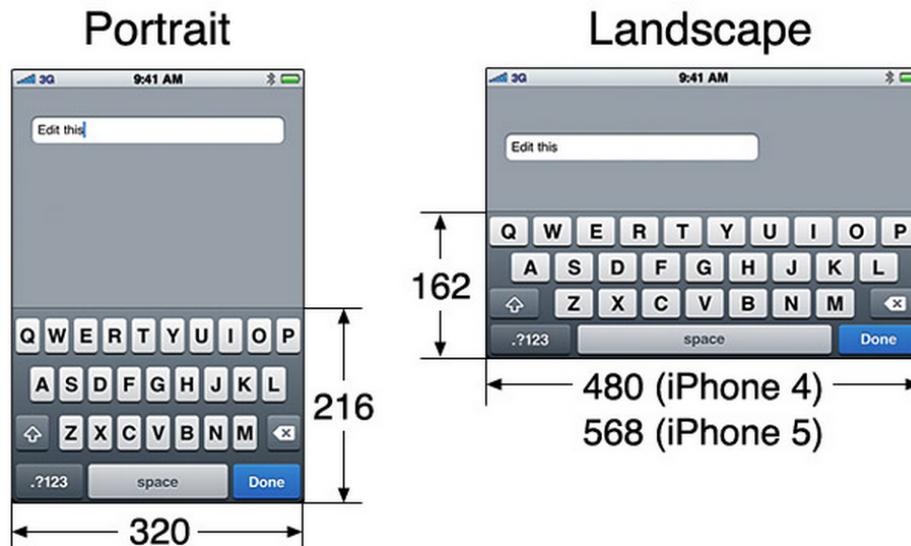


Figure 6.8: iPhone keyboard size (Kira, 2013)



Figure 5.9: Index average finger size. (Anthony T, 2012)

f) Hidden the controls?

Another difficulty only happens for elderly is the auto-hide control when watching movies and reading books. This study was taken as an extra point when observation the elderly when reading the iBooks applications. The similar result can be seen while people watching movie on YouTube application.

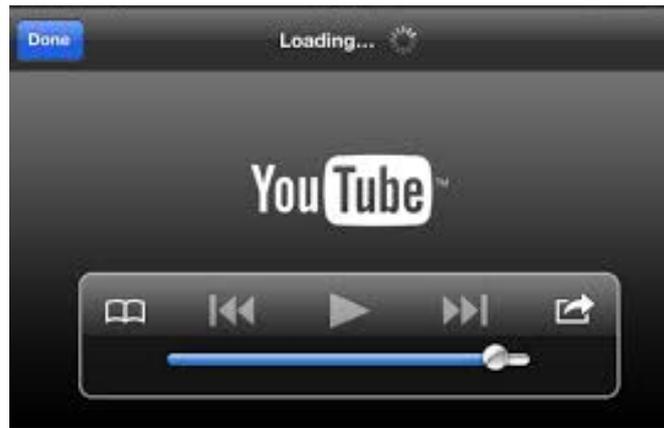


Figure 5.10: The controls will automatically hide when user watches movie.

The auto-hidden control is definitely really convenient for users to enjoy the full text or video. But after watching, elderly is hard to turn the navigation back on. The different between in touching to turn pages, turn on the control panel or miss touch is really hard to separate.

g) Application or mobile-site

Internet access has been the need and right of everyone in Finland since July 2010 (Yle (4)). The survey result also reports that only 6 over 18 haven't used internet yet. It will be wonderful for seniors if they can surf the internet on phone with equal or even better experience than computer.

This part does not mention about full-website which will never get substantial mobile use. This part will help developers answer the most trivial question by themselves: whether the application or mobile site is better for their customers.

Table 5.1: Applications vs Mobile site

	Application's advantages	Mobile site's Advantages
Comparison	<p>Average user get better success rate than mobile site 74% to 64% (J.Nielsen, R.Budiu,2013, p34)</p> <p>No limit in optimization, mobile</p>	<p>Price will be higher because of more platforms to develop.</p> <p>Searching information on multiple websites is easier than switching</p>

	<p>site need to obey browsers' rules. Can access to other data (location, time, etc.) with only first use permission</p> <p>Usually simpler than sites because only few functionalities of website are developed inside application. (E.g: there is no extra information about Dankse Bank except the currency and transfer money info)</p> <p>It faster to run on native apps than mobile's browser, also the downloading time needed to load repeated objects on browser.</p>	<p>between applications.</p> <p>Harder to find some less popular information, which are usually left out of the application for simplicity purpose.</p> <p>Do need to download application for first use.</p> <p>Do not need to share the revenues with app store owners.</p>
<p>Recommendations</p>	<p>Although Mobile site has some advantages but for this special user group, application is really stronger:</p> <p>Typing on mobile browser usually cause elderly a lot of panic since no custom keyboard can be applied; the text fields are jumping around; the keyboard continuously pop up and on, etc.</p> <p>Elderly also usually get old smartphones with slow processor speed from family; those old phones would take hours to load pages.</p> <p>Seniors also use search far less than other generations whom first stop for information is a search engine. Elderly slowly type the full address into the address bar.... one mistake, they must retype again. It is easier for elderly to select an application's icon.</p> <p>As seniors don't have the habit to read information/ news from internet (most prefer television and newspapers), applications can eliminate most unnecessary stuff for users.</p>	

3. Remaining issues

Although three research methodologies have been applied, as J.Nielsen 2000 stated that: ' 4 users only reveal 75% problems' many issues are still haven't discovered yet. Furthermore, it is

much challenge to research the aged users because it's hard to ask their opinions about something they rarely used. In many researches about mobile usage for elderly, researchers only based on questionnaires' result which has been proved with much inaccuracy in this research.

For example, it's nonsense to ask old respondents about 'how important mobile return error messages' in the scale from 1 to 5 (P. T. U. Villaseca, 2010) while many of respondents never ever used a smartphone before.

Additionally, the lack of previous experience with smartphone/ technology from target group user also hinders the research progress. Researcher can't just simple give a touch screen phone for interviewees to try and ask their feedbacks. It takes a long time for them to use and discover issues slowly.

Some of unsolved questions are:

Typography: Since all 4 participants in observation tests and 5 in interview tests are all have good visual condition and the differences between fonts are not clear enough to distinguish without high-end tracking devices. It may not be a very important for quick reading but for pro-long duration, it can cause the eyes' strain for users.

Black or white background: With only 2 over 4 participants reported some unclear problems with white font on black background, this goal is also failed to meet sufficient evidences to get a conclusion. Many other previous reports bring too many contradictions to each other's (Chapter 4) however no specific statistic was represented. Developers definitely need more trustworthy recommendations than some writer's personal experience.

Navigation: Some assumption about the navigation of mobile is placed in beginning of the research, however each phone's operation system has its own navigation way. It's hard to measure the navigation for each style while getting elders try the smartphone was a huge success.

User's need: since the size of the research, not every need can be listed in a small questionnaire without leaving respondents in a super long questionnaire.

4. Who knows the future?

Before I tried Google handwriting, I absolutely did not believe people machines can read my horror handwriting, thing that sometimes even my friends couldn't. There might be some huge improvement has been implemented, but haven't published yet. Some following assumptions for future mobile are only listed here if you want to take a bet in tomorrow.

a) Tactus keyboard:

“What if buttons could morph out of the surface of your devices?” Tactus Technology. Although the touchscreen is very exciting and more nature for user to type, people are still suffer from typing by their ‘butter fingers’. Not only elderly but every user once wished to blindly type on touchscreen again as they used to do with T9 physical keyboard. It's not a fiction to see how Tactus Technology developed a microfluidics keyboard to pop up the physical keyboard as you wish and hideout when you don't need anymore.

"The vision that we had was not just to have a keyboard or a button technology, but really to make a fully dynamic surface." "So you can envision the entire surface being able to raise and lower depending on what the application is that's driving it." said cofounder Micah Yairi.



Figure 5.11: Tactus uses microfluidics to make physical keys bubble up from the surface of a touch screen (Tactus technology)

b) Wechat:

What if the typing is too difficult for users and the voice recognition is never good enough to translate the voice to text. Why not just send the messages as plain voice?

Wechat was developed by Tencent in China in 2011 with the extra function than other message application: hold-to-talk voice messaging. As August 2013, 100 million international users and 300 million registered China's users are using this application. It's not a new thing but let see as it a potential solution to help elderly eliminate the need of reading and typing on phone.



Figure 5.12: WeChat application allow users send voice message instead of typing text (Wechat)

VI. Conclusion

This final chapter is to finish the whole study. The first part is the discussion on the result, framework and progress of the research from the initial point of research. The second parts will list some limitation, difficulties and opportunities I get during the research. The last part will finalize the application of result and further possible research.

1. Result, framework and progress of the research

Although, I have studied many graphic design and usability courses such as: human computer interaction, usability, prototyping, Windows phone develop, website develops and participated in Student conference about ‘aging friendly’ in Maribor (Slovenia), this research still challenge me with many new problems. Many unpredicted issues and changes have been occurred during the process. The planned schedule was updated many times to adapt the change during the research.

Result:

The search was conducted under three main popular usability research methodologies to reveal the needs of elderly in smartphone. However, all three methodologies was not included in plan since the beginning.

In the initial stage of the research: The researcher only wants to focus on phone’s design without paying much attention to the targeted users’ psychology and ability. Later, I found out that ‘usability’ is belonged to ‘Human Computer Interaction’ field- you cannot only work on computer without working with people.

Middle state: The result from first observations and questionnaires revealed many untold study which was not expected from the initial stage. The researcher must select only some of most common issues for further research. The new opportunity to get interviews with elderly in Metsokoti is totally out of expectation.

Later state: huge amount of data collected. How to analyze, explain and summarize is consumed much time than expected. Although the contradictions inside results from 3 methodologies were predicted, the explanation for these differences required much effort than the testing.

Final state: many less important studies were left out from the report while not all the expected goals are found. Only the most valued and confirmed results are listed in previous chapter (5).

During the research, I also got many distrust in questionnaire method; since the result are really hard to be confirmed and verified. There was no guarantee that respondents understand the questions or answer as they really used. Usability is not only about questionnaire or reading books; it's about living with the target users. Without spending times with users, developers will never know what they truly need.

Internet has a huge information silo. IT personnel can nearly find everything from internet but must spend times to carefully verify the accuracy of information. I mean no offense but the example of Martha V. Shelton's article (2012) about 10 best applications for seniors based on her master of financial and economic background is just wrong. How do the elderly need some applications such as: GasBuddy (to find cheapest gas in immediate are), Magnifying Glass with Light (to make the phone work as a magnifying glass). Sadly her article belongs to top 10 results when search with key words 'mobile applications for elderly' on Google.

Many studies showed the benefit and outstanding of smartphones over dinosaur phones, but why elderly still refuse? The case of my retired usability teacher, who switched back to normal phone after using smartphone, she also refused to use Facebook because she doesn't want to publish her personal life on internet? No technology or improvement can change personal skeptical idea.

Framework:

Initial stage: The planned framework only includes observation methodology with some quick-built prototyping applications for elderly. Later, the first version of questionnaire was created for quick analyze the demography trends in Finland.

Middle stage: The final version of questionnaire and the chance of getting interviewees with more elderly in Health care center influenced the framework of the research. The quick-built prototypes were left out of the research to be replaced by completed applications on the application store in the observation tests. From this point, the 3 step-methods was finally developed, the later steps support, confirm or verify previous steps.

Final stage: All 3 methodologies work out as good as expected with only minor modification in selecting the applications for the observation tests.

Progress of the research:

Planned: The thesis took much longer time to complete – 11 months, although the original schedule was only 4 months.

Reason for prolonged time:

The main reason is the modification of the framework to achieve better result from research.

Questionnaire modification:

The questionnaire was modified from first version to final version to more suitable for elderly.

There were also some discontinues when waiting friend to translate questionnaire from English to Finnish.

The delivery and getting back the feedback also took a lot of time for the researchers. Furthermore, because of some feedback was written in Finnish, I also need to wait the help from other friend to properly summarize the data.

Interviews: The interviews are not in the original plan; after getting help from Ms. Thuy, the interviews arrangement must go through the agreement of center's head officer. Then it took a long time before arranging the suitable time for interviewees, interviewers and translator to work together.

Disruption in research: During the research, I must come back to my home countries 2 times. The first time took 1 month after the first version is finished; the second time took 3 months after most of the questionnaires were conducted. Among all the chapter had been written, chapter 4 (data analyze) was the hardest and required the longest time to complete. This was mostly because of finding the most reasonable explanation for differences between methodologies and user's choices.

2. Limitation, difficulties and opportunities

Limitation of the research:

Lack of equipment: Some usability tests require a lot of expensive testing equipment such as eye tracking, better voice recorders and lab conditions for observation tests.

No financial support.

Elderly is hard group users to research. You cannot simply ask elderly to try something they don't want or about their opinion about a technology product they have never used.

Difficulties:

Language barrier: Since I am not good in Finnish, most of the translation and interviews must be done with the helps from friends. It causes the much delay in research's progress.

This difficulty was predicted since the beginning of the research but it took more time than planned.

Disruptions during the research: As the research was discontinued 2 times because of my travel back to Vietnam, when I come back, many new things and ideas were expanded. Some sample changes are: iOS version from 5 to 6 and to 7; new iPhone with fingerprint detection; Google Handwrite, etc.

Opportunities:

I was been in Finland quite long before travelling to Vietnam, Singapore, Malaysia and some other Europe countries during the research. It helps distinguish more about the differences in elderly's living and health condition. Many issues are unimportant in Finland can be considered highly important in other countries: price of phones, security, approaching methods.

The supports of many friends and elderly contributed greatly to the success of this thesis. Without the participations of elderly in all three tests, this work would stand only as the summary of previous researches, no new founding can be achieved.

3. Application and suggested further researches:

Applications of the researches:

This research's result is not only can apply for elderly but also for everyone. If elderly can use the phone easily, so everyone. Why challenging people with difficulties while we can make life easier.

Why must spend a lot of time and effort to research and develop a dedicated application for seniors in a small country like Finland (the population is only about 5.4 millions)?

- Every country is so different that one study in this country cannot be applied for others. For example: Japanese's keyboard and language maybe not fit with (H. Umemuro, 2004)

- Finland is a developed country; soon the rest of the world will get similar level of ICT society. Result from research in Finland may be applied in all other countries soon without much modification.
- Because of later adoption of technology and shorter life expectancy of developing countries; studies from group 3 (over 80) in Finland can be similar to younger group (from 55-80) in other countries.

Further researches:

Until my research finished, there still haven't got any well-known researches about smartphones for elderly in the home of Nokia Company. Only some general researches about dinosaur phones were conducted in Tampere and Helsinki University with mostly quantitative methods.

With many limitation and difficulties, four issues were left out as mentioned in Chapter 5: typography, background, navigation, user's need. It would be nice for me to continued working on these finding in further study.

The size of questionnaire feedbacks is also quite small. Therefore, the data would become more reliable if the survey was carried on larger amount of survey.

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Appendix A: Smartphones vs. Computers vs. Tablets

Nowadays, smartphones and tablets and computers (PCs, Macs and laptops) are the most popular electronic devices and the main difference between them consists into their physical dimension. Although smartphones and tablets only arrived in the market for few years (around 2007) but the popularity of those small and mobilized devices soon outsold the long-time-development of computers (Gartner report, June 2013). Having too fast development, smartphones and tablets paid expensive prices in user experience when first designs had horrible designs and received bad feedbacks from users as they have no previous study in usability. Understand the differences and similarities of these devices can help developers know what should be re-applied from previous computer-usability study and what should not.

There are some differences between the reports of Adobe and Monetate about the traffic of these devices on internet. However, the common points were showed very clearly.

- Computer by far is still the most popular devices in our digital lives; however, the rise of smartphone and tablets is considerable. Consumers are starting to rely heavier on their mobile devices, making either smartphones or tablets become their distinct needs (Monica Ho, 2013).

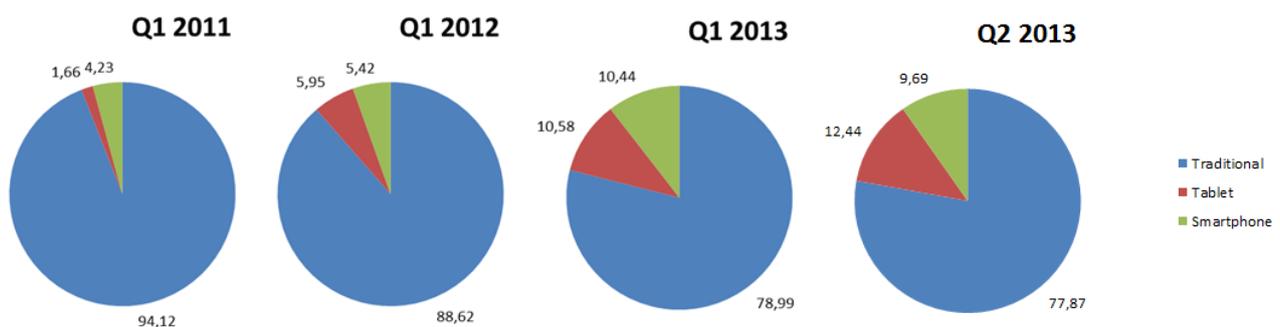


Figure 8.7: Devices share of website traffic. Source: Monetate

- In 2011, computers still have the best conversion rate among 3 kinds; however in 2012 the tablets reached the same rate as computers. In 2013, tablets are predicted to have the best conversion rate among all devices (Adobe). Conversion rate is not only a good metrics to calculate the profit come from devices but also how easy and convenient people get when using these.
- Tablets returns most average order values (AOV). AOV for tablets in 2011 was 123\$ compared to 102\$ and 80\$ for computers and smartphones, respectively (Consultancy).

- Smartphone is the most popular devices but returns quite bad conversion rate and web traffics stats.

	Conversion Rates by Device	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013
OVERALL	Traditional	2.85%	2.80%	2.90%	2.35%	2.56%
	Tablet	2.53%	2.43%	2.56%	2.27%	2.54%
	Smartphone	0.82%	0.77%	0.86%	0.84%	0.96%

Table 3: Conversion rates by devices. Source Monetate Q2 2013

1. Smartphone vs. Computer

Behind the difference in economics values, there lies the main usability point of view between too distinct devices:

a) Readability

According to the Cloze test which was conducted by 3 professors R. I. Singh , M. Sumeeth, J. Miller ,2011 in University of Alberta, Canada under ten popular websites: eBay, Facebook, Google, YouTube , Microsoft, MySpace, Wikipedia, Yahoo, etc..

It's is 108% harder to understand information when you reading on mobile-size screen than desktop-size screen. The result is clear

- Mobile size: 18.93% comprehension score.
- Desktop size: 39.18% comprehension score.

These numbers confirm that, reading on mobile phone is double time more challenging than reading on a computers. Thus people cannot scheme and scan the long text with these small devices.

The reason is criticized for 2 reasons:

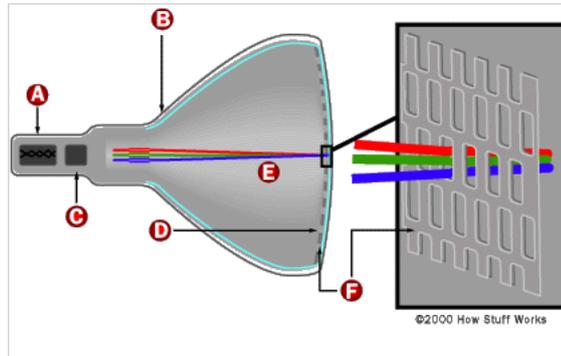
- User can be distract at any time, by our natural, we don't read long paragraph word by word. Thus user must depend on their highly fallible memory when trying to see the big picture with the viewable space.
- In some pages, scrolling to other parts of the content is compulsory to understand the context. Which cause serious problems for reader:
 - Take more time, thus corrupting short-term memory.
 - Divert attention from reading to secondary task- scroll/ navigate the page. And the finger is much bigger than the mouse, usually create obstacle during reading on mobile screens.
 - Brain must work harder to reacquire the previous location of the page.

This is an example of how the application "How stuff works" differs from PC to mobile:

How Television Works

by Marshall Brain

Share 198 Like 417 Tweet 9 +1 30 Page 3 4 5 6



Inside a CRT

As you can see in the drawing, there's not a whole lot to a basic cathode ray tube.

There is a cathode and a pair (or more) of anodes. There is the phosphor-coated screen. There is a conductive coating inside the tube to soak up the electrons that pile up at the screen-end of the tube.

However, in this diagram you can see no way to "steer" the beam -- the beam will always land in a tiny dot right in the center of the screen.

That's why, if you look inside any TV set, you will find that the tube

is wrapped in coils of wires. On the next page, you'll get a good view of steering coils.

- A Cathode**
- B Conductive coating**
- C Anode**
- D Phosphor-coated screen**
- E Electron beams**
- F Shadow mask**

Figure 8.8: How stuff work - On PC screen

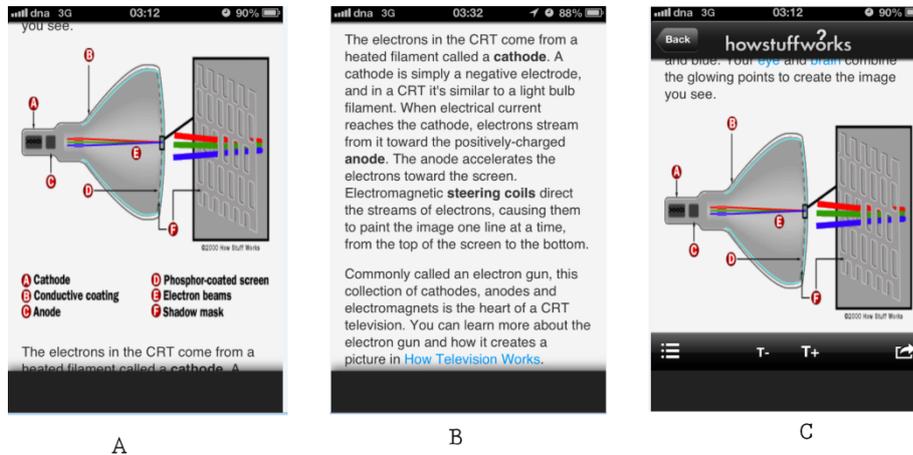


Figure 8.3: How stuff works app version 1.3 on iPhone 4/4S

In Figure 8.1 A and B, readers are required to scroll up to read the explanation with lead to lack of information about the image. When we miss touch the screen like in figure C, the navigation control will appear which will further reduce the viewable space, and make many distract for reader. Above all, after all the updated, they still leave unknown-purpose black area in the bottom of the screen for no reason.

b) Butterfingers input:

If you are a new user of smartphone, it will be a huge challenge when moving from precise mouse and big size key board into a 216*320 pixels (default size for iPhone) virtual keyboard. It was a painful experience for everyone to operate GUI widgets such as buttons, hyperlink, etc. with their big fingers. How many errors should we make before getting familiar with the QWERTY key board on our devices?

c) Download and handling speed:

Above all, computer is still much faster than smartphone in speed. It will take forever for your phone to download movie, music or high definition image with GPRS connection, although it may get little faster with 3G or 4G connections. Processing the high definition videos and tasks is still the heavy burden for the newest smartphones and furthermore and also draw out the little power of your phone quickly.

d) Un-optimized website and text:

Until now, almost website are still adjusted for desktop usability, they don't even spend a cent on understanding mobile-concept and access. Even smartphones were outsold PCs since 2011 (C. Taylor, 2012), but a lot of company and developer still couldn't see the need of change in their product's design. An un-optimized website is nearly un-readable for mobile users. Some company also spend loads of investment for separate applications but keep their website display like mess in mobile phone – usually people reaches the website before they downloading an applications.

The first two differences are the principal problems; making the mobile phones little bit bigger or improving in multi touch sensors will not able to eliminate to obstacles mobile users get. The last two differences will hopefully be tempered down in the future, but it will take many years for smartphone to become as fast as PCs.

In the end, mobile will never ever the same with desktops. So as a developer, stop dreaming about applying desktop's usability to mobiles or your customer will be left with whacky illusions.

2. Smartphone vs. Tablet

Moving from smartphones to tablets seems like a small step – a bigger size smartphone. Although many design mobile's recommendations are still true for tablets, many are not.

If we ask most of the people, what are the differences between tablets and mobiles? More particularly, iPhone and iPad, the answers almost are

- First of all, It looks like 4 iPhones combined
- Secondly, it's sure heavier.
- That's all.

Under the interaction design perspective, iPad should not be treated as a scaled-up iPhone.

Although applying the iPhone smartphone design into tablet is a low-price solution, it can lead to the waste of available screen spaces and malfunction of some features. There are some important differences should be consider when designed an application for iPad

- Screen: The first and biggest differences can be seen at first size, the text on the normal website can be read easily without any zoom or modification. As long as there is no complicated tasks, tablets doesn't need an optimized designed for websites.
- Input: although having a bigger screen, tablets share the same input method with smartphone - fingers. Tablet does need a bigger input area when some command need during using the application.
- Personality: Except for those who live alone, tablet usually becomes a shared device between family members and guests. For more convenient for users, smartphone applications only require one time log in before using the applications, and maybe or rarely the users will be asked to log in again. What if the tablets application inherits the same policy? Will your information be secured as in smartphone?
 - Some application just never has time-out, which means once you log in, your account will bind to the device forever. What will happen if some guest can borrow your iPad and see your personal data freely such as Facebook application
 - Occasionally, some users maybe never know how to install an application or remember their application log in password. This happens more often in elderly case when their spouse usually does the installation and register, when others log in using others accounts, owner tends to impossible to remember the password log-in.
- Mobility: People don't carry tablet all the times. It's still too big and heavy to place into pockets. It leads to one big difference between how people using smartphone and tablet: People usually use one had (mostly only thumb finger) to handle mobile but they must use 2 hands for tablets (one only to keep tablet and full other hand to control). More mistake and gestures can be easily created or accidently created during the handle of tablets

- Discoverability: Because the screen size of tablet is about 4 times bigger the smartphone. People can take 4 times longer to find some items in tablet. The small screens provide the concentrate views and easier navigation.

Appendix B: Questionnaire version 1.0

QUESTIONNAIRE ABOUT SMARTPHONE FOR ELDERLY (version 1)

(Your answers will provides a better support for elderly in Finland

You don't need to answer the entire question.)

- Age group (Please check in suitable field):

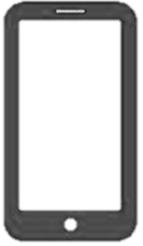
55-65	65-75	>75

- Gender : Male Female
- How do you live now
 - Alone
 - With children
 - In healthcare center
- What is your major before retired/now: _____

SECTION A: GENERAL QUESTION

- 1) What phones have you used (can be more than 1 options) :

Regular phones	Feature phones	Smartphone/Full-screen phone
Keyboard 0-9	Full keypad: A-9	Full touch screen

		
Continue in section B	Continue in section B	Continue in part C

2) What phone are you using now? _____

3) How frequently you use the following technology?

	Never	Once per week	More than once per week	Once per day	More than once per day
Television					
Computer					
Internet					
Email					

4) Do you think smartphone can help you in?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Keep in touch with family / friends : phone, SMS, watch new pictures from them					
Surf internet can help improve					

knowledge: know more about the world					
Live independently: less depend on helps from others, can even take care of others.					
Take pictures and videos by mobile phone					
Participate in society activities: volunteer, elderly clubs,					
Get information when travel : map, find my location when get lost,					
Get information when go shopping:					
Medical support such as : medicine reminder, blood, sugar, heart rate checking.					
Know more about my pets : how to raise them, what food they like, medicine for pets					
Have more friends : through internet, have the same hobby					
Handle financial: e-banking, pension, salary, pay invoice					
Entertainment in life: music, game, film, newspapers					
Emergency situation: fast call 112, locate current position, SOS					
Everything in we need					

SECTION B: FOR PERSON WITH NORMAL PHONE

What concern you most when buying a smartphone/ full screen phone?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Smartphone is expensive					
Battery is much shorter					
Easy to be broken					
Easy to be stolen					
I just need call and message, don't need other applications					
Too complicated to use					
Security matter in smartphone					
I don't feel comfortable with touch-screen					

What are other reasons make you don't like smartphone?

I want to use smartphone for my daily life:

Yes Maybe No

SECTION C: FOR PERSON WITH SMARTPHONE

How you feel when using smartphone/ full screen phone:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel satisfy with my smartphone than regular phone					
Touch-screen helps me type faster and more accurate					
I can do more thing with my touch screen					
It's easy to learn new things with smartphone					
I know well about necessary applications on my phone.					
It's easy to install new applications					
I like to find new applications					
I feel safer when using smartphone					
I don't worry about phone battery					
I can do more things with smartphone.					
I can have better social life					
I can take care of myself better					
Smartphone can adapt almost everything I want					
I can call and message easier with smartphone					
If I lost my phone, I feel my data is protected					

What do other things you like when using smartphone?

I want to come back with normal phone: Yes Maybe No

How do you need mobile in daily life?

Thank you for your value time.

Appendix C: Questionnaire Final English

ELDERLY IN FINLAND WITH MOBILE DEVICES

Dear sir/madam,

I'm student of Haaga Helia University of applied science. I am conducting a research to understand more about how elder people using mobile phone today. It would take you no longer than 10 minutes of your time. Your respond is really important for us so we can make mobile phone friendlier for elderly in Finland.

All of your information in anonymous and remain confidential.

You are free to leave blank questions you don't likely to answer.

We are very appreciating and thank you for your precious time to do this response. You can email me at a0903726@myy.haaga.com

A -PERSONAL INFO

- How old are you?

50-64

65-79

Over 80

- How do you live now?

○ Alone

○ With children

○ With your partner

○ In health care center

- What is your jobs now/ before retired:
-

B – MOBILE PHONE AND LIFE

5) What phones have you used (you can choose both of them) :

Regular phones <input type="checkbox"/>	Smart / Full-screen phone <input type="checkbox"/>
Keyboard 0-9	Full touch screen
	

6) What phone are you using now? _____

7) How frequently you use the following technology?

	More than 1 per day	1 per day	Few per week	Few per month	Never
Television	<input type="checkbox"/>				
Computer	<input type="checkbox"/>				
Mobile	<input type="checkbox"/>				
Email	<input type="checkbox"/>				
Internet	<input type="checkbox"/>				

Please check what you concern when using mobile phone? (Up to 3 choices)

Long battery <input type="checkbox"/>	Cheap price <input type="checkbox"/>	Easy to use <input type="checkbox"/>
Hard to be broken <input type="checkbox"/>	Good calling signal <input type="checkbox"/>	Size of button <input type="checkbox"/>
Hard to be stolen <input type="checkbox"/>	Secure your data <input type="checkbox"/>	Clear/big screen <input type="checkbox"/>

Do you have other concern when using mobile phone?

How often do you call per day? _____

How often do you use SMS per day? _____

Do you think mobile phone can help you when? (You can add more idea in last lines.

	YES	NO	I don't know
Listen to music	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Take pictures and videos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
See pictures of family's members	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Keep in touch with family members	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Buy stuffs in market	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use online banking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Participate in society's activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Get information when travel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Get more knowledge from internet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Take medicine based on the schedule	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Make you feel safer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C- USABILITY TEST

Which of those texts you feel easy read? You can all the text you feel easy to read.

This is the test text. <input type="checkbox"/>	This is the test text. <input type="checkbox"/>
This is the test text. <input type="checkbox"/>	This is the test text. <input type="checkbox"/>
This is the test text. <input type="checkbox"/>	This is the test text. <input type="checkbox"/>
This is the test text. <input type="checkbox"/>	This is the test text. <input type="checkbox"/>

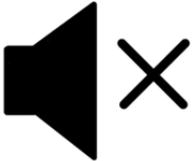
Which of these keyboards, you feel most familiar?







Do you understand the meaning of these symbols? Check the symbols you understand.

 <input type="checkbox"/>	 <input type="checkbox"/>
 <input type="checkbox"/>	 <input type="checkbox"/>
 <input type="checkbox"/>	 <input type="checkbox"/>
 <input type="checkbox"/>	 <input type="checkbox"/>

!! Thank you for your valuable time!!

Appendix D: Questionnaire Final Finnish

IÄKKÄÄMPIEN IHMISTEN MATKAPUHELIMEN KÄYTTÖ SUOMESSA

Hyvä Herra/Rouva

Olen Haaga Helia Ammattikorkeakoulun opiskelija ja teen selvitystä iäkkäämpien ihmisten tämänhetkisestä matkapuhelimen käytöstä.

Kyselyyn vastaaminen kestää alle 10 minuuttia. Teidän mielipiteenne on tärkeä tulevien matkapuhelinmallien kehityksen kannalta. Tavoitteena on tehdä matkapuhelimen käytöstä entistä sujuvampi kokemus.

Kyselyyn vastataan nimettömänä ja vastausten sisältö säilyy luottamuksellisena.

Kaikkiin kysymyksiin ei tarvitse välttämättä vastata.

Kiitän kyselyyn osallistumisesta ja ajastanne.

Voitte lähettää sähköpostia minulle osoitteeseen. vuongvietlinh@gmail.com

A -Perustiedot

- Ikäanne?

50-64

65-79

Yli 80

- Asumismuoto

○ Yksin

○ Lasten kanssa

○ Kumppanin kanssa

○ palvelulaitos

- Ammattinne tällä hetkellä / ennen eläkkeelle jääntiä:

B – MATKAPUHELIN JA PÄIVITTÄISKÄYTTÖ

1) Millaisia puhelimia olette käyttäneet (voitte valita molemmat) ?

Tavanomainen matkapuhelin <input type="checkbox"/> Näppäimet 0-9	Äly/ kosketusnäyttöpuhelin <input type="checkbox"/> Koko näytön kosketuspuhelin
	

2) Mitä puhelinta käytätte tällä hetkellä? _____

3) Kuinka usein käytätte seuraavia asioita?

	Enemmän kuin kerran päivässä	kerran päivässä	Vähemmän kuin kerran viikossa	Kerran kaksi kuukaude ssa	En käytä lainkaan
Televisio	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tietokone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Matkapuhelin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sähköposti	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internetti	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Olkaa hyvä valitkaa mikä on mielestänne tärkeimmät seikat matkapuhelimen käytön kannalta (valitkaa enintään 3):

Pitkä akunkesto <input type="checkbox"/>	Halpa hinta <input type="checkbox"/>	Helppo käyttöisyys <input type="checkbox"/>
Kolhujen kesto <input type="checkbox"/>	Kuuluvuus <input type="checkbox"/>	Näppäinten koko <input type="checkbox"/>
Puhelimen hankala varastaminen <input type="checkbox"/>	Tietojen turvallinen säilyvyys <input type="checkbox"/>	Näytön iso koko ja selkeys <input type="checkbox"/>

Onko teillä muita tärkeitä seikkoja käytön, joita ei oltu listattu?

Kuinka usein soitate puhelun? _____

Kuinka usein kirjoitate/ vastaanotatte teksiviestin?

Voiko matkapuhelin mielestänne auttaa seuraavissa tilanteissa? (Voitte kirjoittaa lisätilanteita viimeisille riveille)

	KYLLÄ	EI	En tiedä
Musiikin kuuntelu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Valokuvien otto ja videokuvaaminen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kuvien katselu; Sukulaisten ja perheen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yhteydenpito; perheeseen ja sukulaisiin	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Tavaroiden ostaminen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pankkipalvelujen käyttö	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Harrastusten ja aktiviteettien löytäminen; niihin liittyvien yhteystietojen ylläpito	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

Matka-aikataulujen hankkimen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tiedon hakkimen internetistä	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lääkkeiden oton muistutus / aikataulut	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Turvallisuuden tunteen lisääminen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C- KÄYTETTÄVYYS

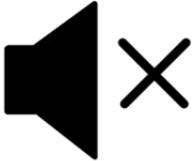
Mitkä alla olevista teksteistä on mielestänne helppolukuista?
Voitte valita kaikki.

This is the test text. <input type="checkbox"/>	This is the test text. <input type="checkbox"/>
This is the test text. <input type="checkbox"/>	This is the test text. <input type="checkbox"/>
This is the test text. <input type="checkbox"/>	This is the test text. <input type="checkbox"/>
This is the test text. <input type="checkbox"/>	This is the test text. <input type="checkbox"/>

Mikä seuraavista näppämistömalleista on tutuin teille?



Ovatko seuraavat kuvakkeet ja niiden tarkoitus tuttuja? Merkitkää ne kuvakkeet joiden tarkoituksen tiedätte.

 <input type="checkbox"/>	 <input type="checkbox"/>
 <input type="checkbox"/>	 <input type="checkbox"/>
 <input type="checkbox"/>	 <input type="checkbox"/>
 <input type="checkbox"/>	 <input type="checkbox"/>

!! Kiitoksia ajastenne ja vastauksistanne!!

Appendix E : Result from questionnaire

There are 35 interview sheets was printed and delivered (20 in Finnish and 15 in English). In the end, I get back 17 responds (13 Finnish and 4 English).

Aged groups:

50-64 (Group 1)	65-79 (group 2)	Over 80 (Group 3)
4	5	8

Living condition

Living condition	Number
Alone	4
With children	1
With partner	6
In health care center	6

Profession

Professional	Number
Related to computer/ technologies	8
Somewhat related(teachers,	3 (2/6 over 80)
No technical background	6 (over 80 group – 4/6 people)

Only 3 responds from group 1 and 1 respond from group 2 are in English (4 total). The rest are in Finnish. Among those who choose to answer in English questionnaire, during the answer, all of them answer free choice / text fill question by Finnish.

Mobile phone acquainted:

Regular phones	Smartphone/ full screen
15	2
2 using smartphone with QWERTY keyboard.	all in group 1

Use of technology:

	More than 1 per day	1 per day	Few per week	Few per month	Never
Television	9	5	3	0	0
Computer	6	1	3	2	5
Mobile	10	4	3	0	0
Email	5	2	2	2	6
Internet	6	1	2	2	6

Interviewees are asked to check what concern them most when using mobile phones. There's an instruction stated that they can choose up to 3 choices to point out their priority.

However I got 1 blank answer in these fields and 3 answers are filled with 4-5 answers. (All the mistake are belonged to group 3, over 80)

Problems	Number of choice		
	Group 1 (4 response)	Group 2 (5 response)	Group 3 (8 response)
Long battery	3	1	7
Cheap price	0	0	2
Easy to use	0	2	6 (describe mobile is too hard to use)
Hard to be broken	2	0	1
Good calling signal	2	3	3
Size of button	1	4	7
Hard to be stolen	0	0	0
Secure your data	3	1	3
Clear/big screen	1	4	4

Number of calls /SMS per day:

	Group 1	Group 2	Group 3
Call	0-6 per day	2-4 per day	Few per week
SMS	0-3 per day	Few per week.	None

User need with mobile phone. I got 1 blank answer sheets, 1 haft complete also from group 3.

	G 1	G2	G3
Listen to music	All Y	3	6
Take pictures and videos	All Y	4	3
See pictures of family's members	All Y	3	5
Keep in touch with family members	All Y	5	5
Buy stuffs in market	All Y	All N	All N
Use online banking	All Y	All N	All N
Participate in society's activities	All Y	All N	only 1 Yes
Get information when travel	Only 1 no among 4	All N	All N
Get more knowledge from internet	All Y	2	4
Take medicine based on the schedule	All Y	1	5
Make you feel safer	All Y	All Y	All Y
Total response	4	5	8

Visible text:

2 blanks answers

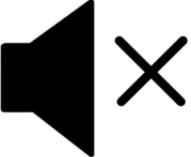
This is the test text. 2	This is the test text. 3
This is the test text. 11	This is the test text. 4
This is the test text. 13	This is the test text. 2
This is the test text. 17	This is the test text. 3

Most familiar keyboards:

Keyboard layout preferred	G1	G2	G3
QWERTY	3	1	0
T9	1	4	8
Tiki lab	0	0	0

Interface Metaphor:

Received 3 blanks fill (2 state that they have no idea, 1 no response)

 5 (all G1 and 1 G2)	 None
 1 from G3?	 4from G1, 1 from G3?
 13	 11
 9 (all G1 and G2)	 8 all G1 and 4 G2.