



**POLITECNICO**  
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SCHOOL OF DESIGN  
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# **Guidelines for inclusion of the Elderly population into smartphone design**

Master of Science Thesis

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## Abstract

The majority of the countries in the world are showing a strong increase in the number of elderly people in the population. The developed countries have a significant ageing population above 65 years old and it is still in rise. With present trends, the elderly population will be the majority of the world in few years. That means the ratio of the consumers too. In the other hand, world is experiencing an expansion in personal application of technologies like smart phones. However, there are very less smartphones, which were designed for inclusion of elderly consumers.

There are few companies, which sells smartphones with a tag “designed for elderly”. Those are smartphones with odd ascetics and strange features. It is proved to be not serving the need properly and create a feeling in elderly that they are old and out from the new technologies. Many of the existing research resources hint with this reality. Most of the smartphones are introduced with new technologies, shape, design and features, which are aimed to younger population. This business and design strategy is leading the elderly to be avoided from the technology boom.

In this paper, author addresses the demand for designing smartphones that will inspire elderly customers to buy and try. In addition, tries to formulate some guidelines for designing smartphones, with the inclusion of elderly in the target market. Since the elderly refers to many age categories, wellness and knowledge, it will be difficult to arrive at conclusions easily. This leads to streamlining the study only on the age limit of 70 to 80 years for not being at extreme trends of this population and to consider the bridge part between just elderly and very old elderly.

Through segmentation of available smartphones in the market, the problems that restricts elderly from using the smartphones and survey of selected elderly populations in Italy, the research is drawn into some conclusions about the design guidelines to include the elderly in to the smartphone consumers.

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# 1. Introduction



This research aims to address the demand for designing special smartphones for elderly customers and it suggest possible solutions for this problem. Through segmentation of available smartphones in the market and interview with selected elderly populations, it defines how to include them in the smartphone technology and benefit their daily life.

## 1.1. Problem Definition

There is huge trend of ageing population throughout the world. More and more people in the developed countries are using the smartphones. However, there is no smartphones that are uniquely designed for elderly people and even existing ones are irrelevant to make a solution. Many pre-existing researches by Cambridge University, Pew Research Centre-USA etc gives lights to certain main aspects of these problems. Still there is need of more understanding on this matter. There should be a strong strategy to make focus on designing technological products for the elderly. Also in a business motive, it will help according to future predication on population demographics.

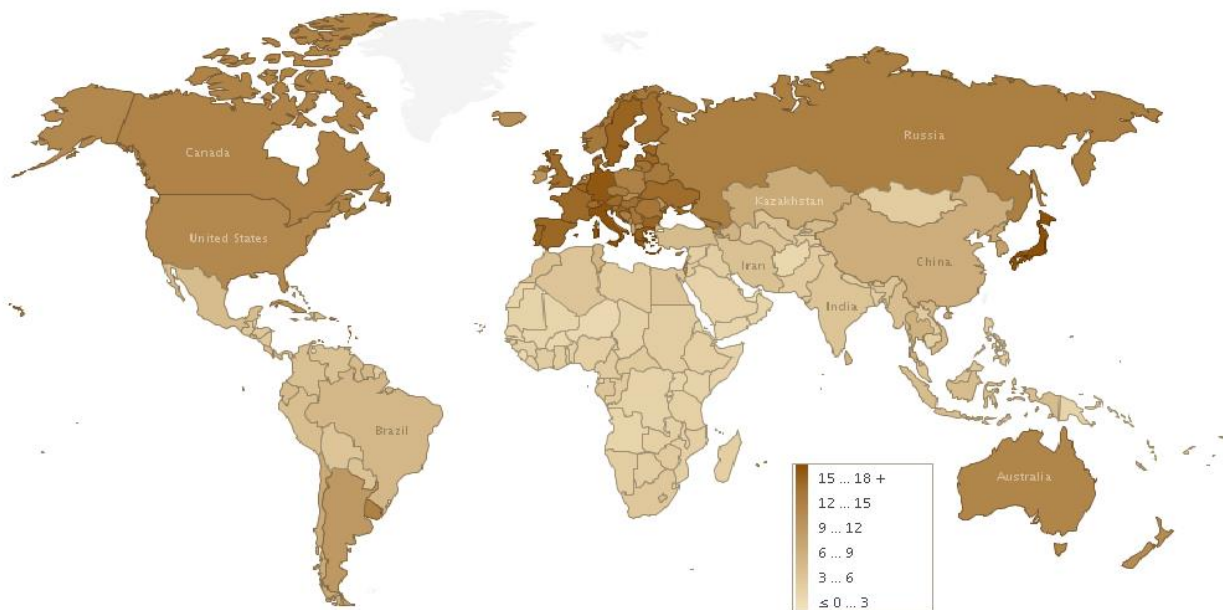


Figure 2. Ageing population distribution in the world

While it's true that those over the age of 65 are less likely to adopt and embrace new technologies, studies continue to show that older Americans are using new advances in communications to stay in touch more than ever before. In a Pew Research Center American Trends Panel Survey, conducted October 3 – 27, 2014, persons over the age 50 were most likely to identify their smartphones as providing “freedom” and “connectivity,” even higher than those in their teens! It's obvious that the power of staying in touch is driving this generation to use smartphones and tablets as it provides an easy and less expensive way of interacting with loved ones, especially over great distances.

The developed countries that have a significant ageing population above 65 years old and the expansion in personal application of technologies like smart phones are not linking both possibilities together. There are few companies, which focus on designing smartphones for

elderly. Rather, most of the smartphones are introduced with new technologies, shapes and features that are aimed to younger population with quick learning personality. This business and design strategy is leading the elderly to be avoided from the technology boom.

This creates a big question of how we can address this issue with in designing of smartphones and other smart devices. The lack of awareness about this need seems to be the basic drawback in strategic design planning of smartphone companies. Through this research, the author tries to find feasible solutions or guidelines to streamline the design of smartphone to be elderly friendly.

## 1.2. Objectives

This research carries out an analysis of the affordances of mobile devices by elderly population. Through the analysis of the hardware and software design and of the functionalities, taken as an instance of various smartphone models, the paper analyses what types of design elements of these devices and its abilities, which are more or less required for being useful for the elderly. The research concludes by detailing the social habitus surrounding people of old age, which is fostered through the requirements for designing special smartphones to make them feel, included in the new technology race.

This research presents a conceptual and methodological framework for analyzing the requirements for designing smartphones in the context of increasing elderly population in the world. It try to define a smartphone as a finely designed consumer product for a targeted market. Therefore, it addresses the need to bring the elderly population inside that targeted market, which should bring care on certain changes in the brainstorming while designing new smartphones. To formulate those changes, the research goes into study on descriptions felt by elderly population when they see new technologies and concluding with the new conceptual approach, which should be taken care while designing new smartphones.

The important points of aesthetical form and interactive part of the smartphone design is to be considered in drawing guidelines for inclusion of elderly to the smartphone design. Thus it gives hope to bring inspiration in elderly for using smartphones and get benefited out of its technology.

## 1.3. Methodology

This research goes into various aspects about the smartphone and smartphone design, elderly people and their limitations, and it ends with suggestions on possible guidelines for designing smartphone to include the elderly customers.

This research starts with preliminary study about the very definition and design evolution of phones and smartphones as particular. This includes the hardware or aesthetical design and its changing identity over time, and the interactive part that contribute all the user experience and the technology feel of this product. The ergonomics and the physical features that define the smartphone is very interesting to learn. This gives us understanding about what the design of its hardware change the target consumers and their way of approaching it.

The study on present architypes of smartphones and existing special phones for elderly in the market gives wisdom categorise them into three Types. These types helps us to understand different form factors and aesthetical feel in the hands of the elderly. Detailing existing products that are already successful for our senior citizens, will be a step to look around and get inspired from other segments of the market.

We cannot omit the vast studies and researches about elderly people, their behaviours and needs from new technologies. This draws the attention into those data about the elderly. This will create a clear understanding about how much they are excluded from the new smartphone development as targeted customers. There are many things to understand from what the elderly are missing in this new age smartphones. As it is the best way to get informed is to listen, the research extends into a small survey among selected Italian elderly population. This survey open ups the interesting viewpoints from the untargeted potential customers. If we could incorporate those suggestions and develop it to the ideas in designing smartphones, this will lead to a bigger market and fell of inclusiveness for the elderly population.

With the gathered knowledge on smartphones and the elderly population, the research finalises with the possible guidelines or suggestions for product design of smartphones to include elderly as target customers.

## 2. Ageing Population: Elderly



The group of people who are at old age, much after middle age are called elderly. 65 years and above is called as Elderly in European union. The percentage of elderly are on rise in the world, especially in Europe. The decreasing fertility rate and increasing life expectancy attributes to this phenomenon.

## 2.1. World Elderly population ageing

According to United Nations Population Fund (UNPF-2016), the world is ageing rapidly. People aged 60 and older make up 12.3 per cent of the global population, and by 2050, that number will rise to almost 22 per cent. This trend is due to less births and increase in life expectancy. It is estimated that, by 2030, 19% of the US population will be over 65 - roughly the same proportion that currently own iPhones. And by 2050, there will be one retired person for every two that are in work. Ageing is a triumph of development: People are living longer because of better nutrition, sanitation, health care, education and economic well-being. Although an ageing world poses social and economic challenges, the right set of policies can equip individuals, families and societies to address these challenges and to reap its benefits.

Percentage of the World Population Over 65, 1950-2050

Source: UN World Population Prospect, 2008

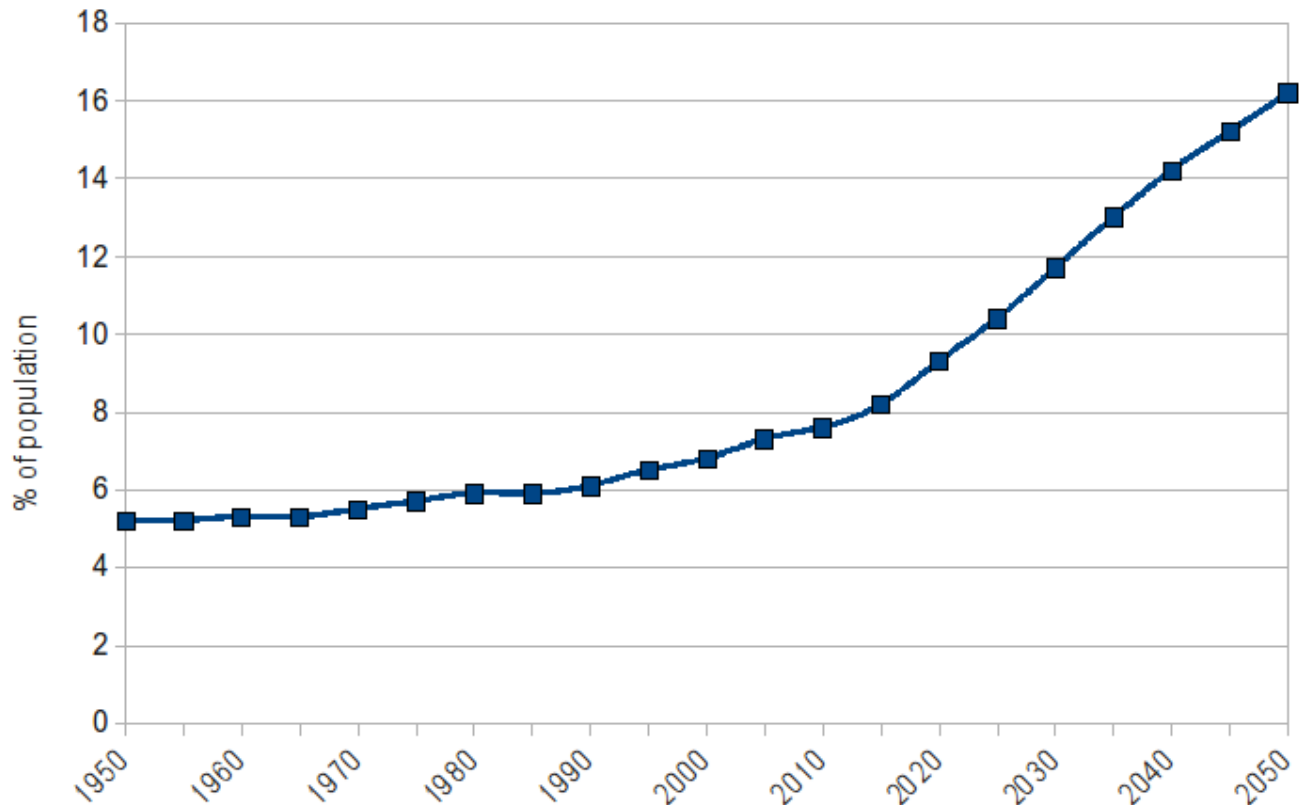


Figure 4. Percentage of the World Population over 65

There should be awareness about population ageing and the need to harness its opportunities and address its challenges. Steps are to be taken to provide a solid base for

policies and planning, that makes sure ageing issues are integrated into present developments and application of new technologies.

How we can define ageing is still a question. In a normal understanding, somebody above 65 years old can be called as senior citizen or elderly. But it can't be brought under a normative figure. In each country, there will be many cultural effects which creates difference in the signs of ageing. The elderly people in many cases try to adapt the young lifestyles and adapt new technologies without any huge effort. But in a normal society, the older age creates many problems of adapting to new things.

While the ageing process is different for everyone, we all go through some fundamental changes. Not all of them are what you would expect. For example, despite declining health, older people tend to be significantly happier and better at appreciating what they have. But ageing makes some things harder as well, and one of those things is using technology. It is found that there are some very tech-savvy older people around, but there is clearly a large cohort of people who feel excluded by technology. They find it a bit impenetrable. The technologies are not adjusted to fit them.

### 2.2.1 Italian and EU elderly population

Population ageing is a long-term trend which began several decades ago in Europe. This trend is visible in the transformations of the age structure of the population and is reflected in an increasing share of older persons coupled with a declining share of working-age persons in the total population. Each countries show different trends. The age of 65 is considered in EU as start of elderly.

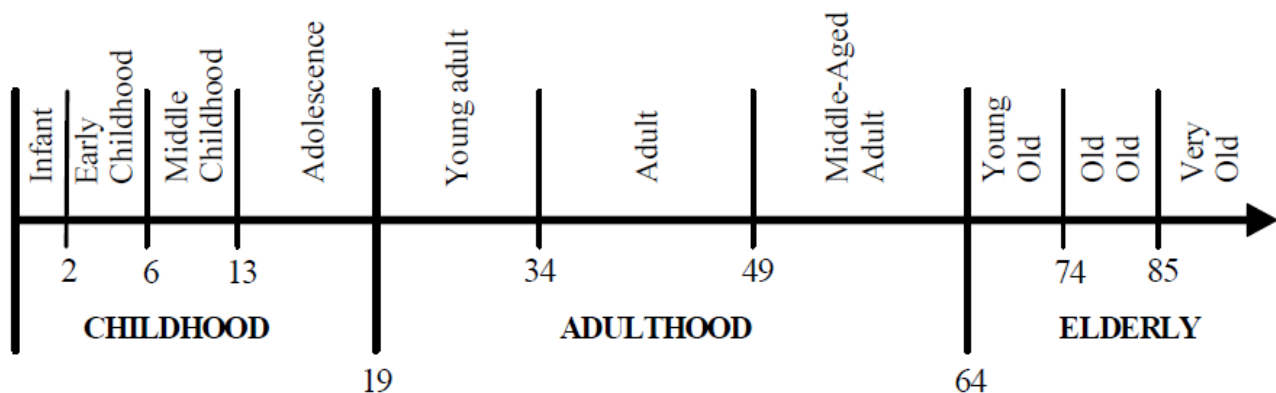


Figure 5. Phases of human life

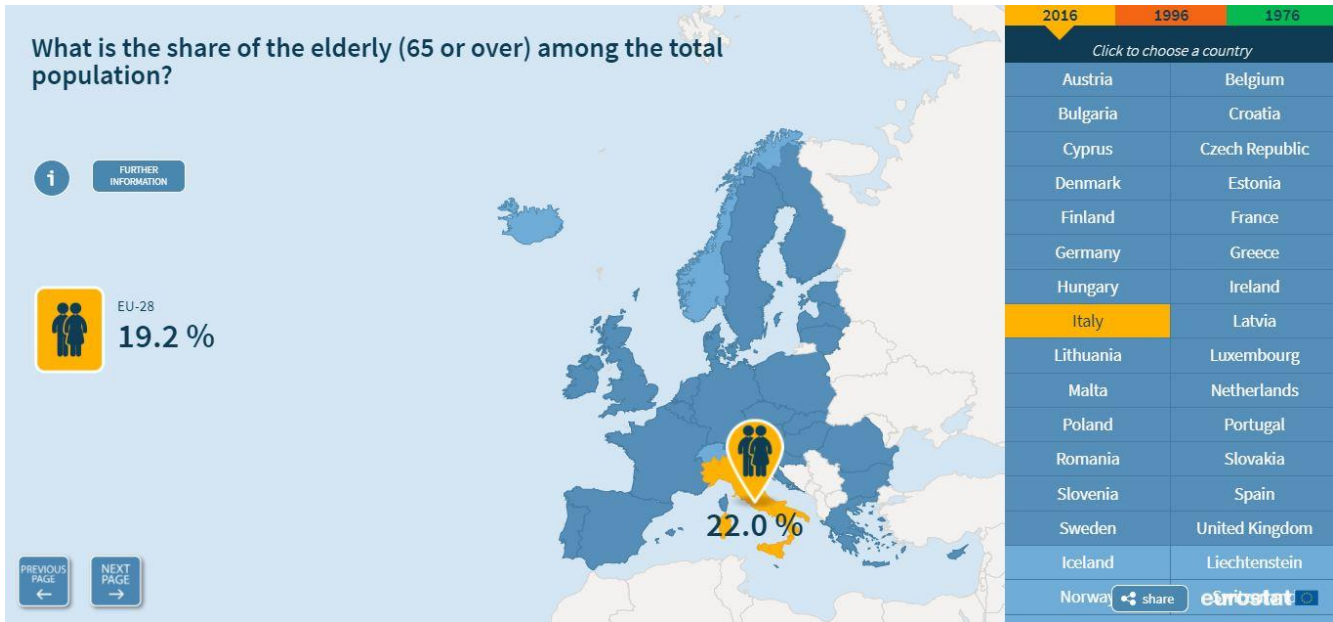


Figure 6. Share of elderly in Italy.

The 22% of the population in Italy is already elderly people. Out of those, many are still active with their capacity economically and physically. According to this, each age groups are further divided inside elderly. Those who are 65 to 74, 75 to 84 and 84 to above. The age group of 75 to 84 will be the middle group who are in a transition from young older to very older. We mostly consider this age group for our discussions in this research. Even though normal Italian Elderly is expected to live 20 more after reaching 65, It will be a time when they start showing physical and mental limitations.

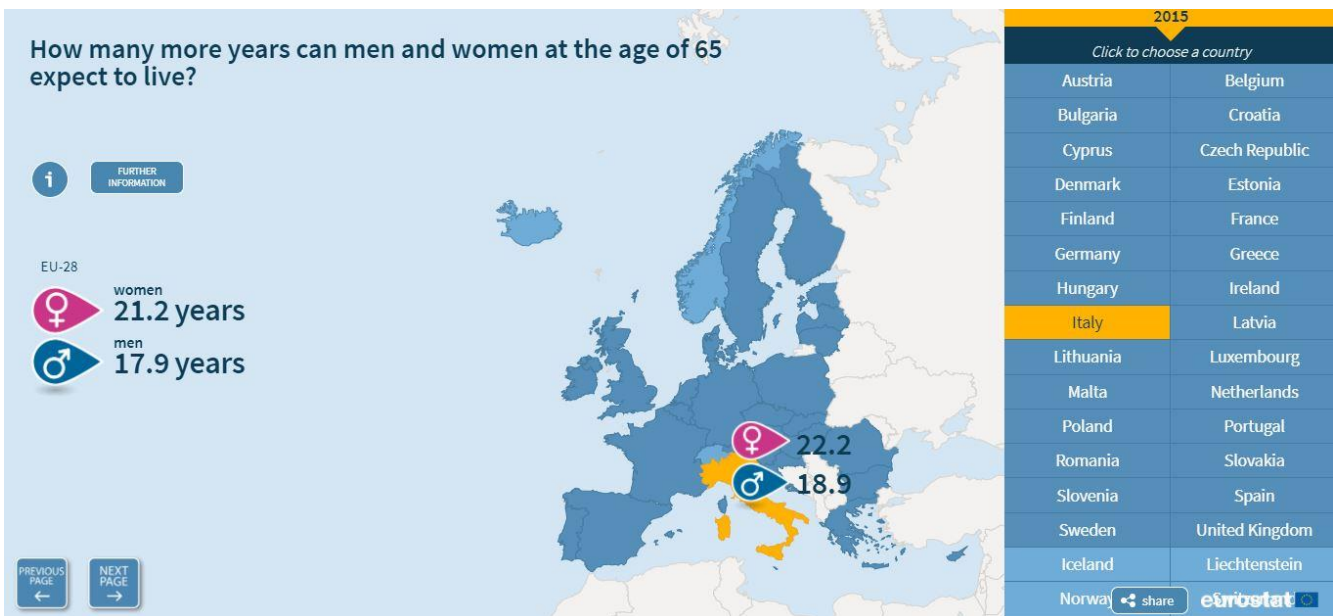


Figure 7. Life expectancy of Italian elderly population

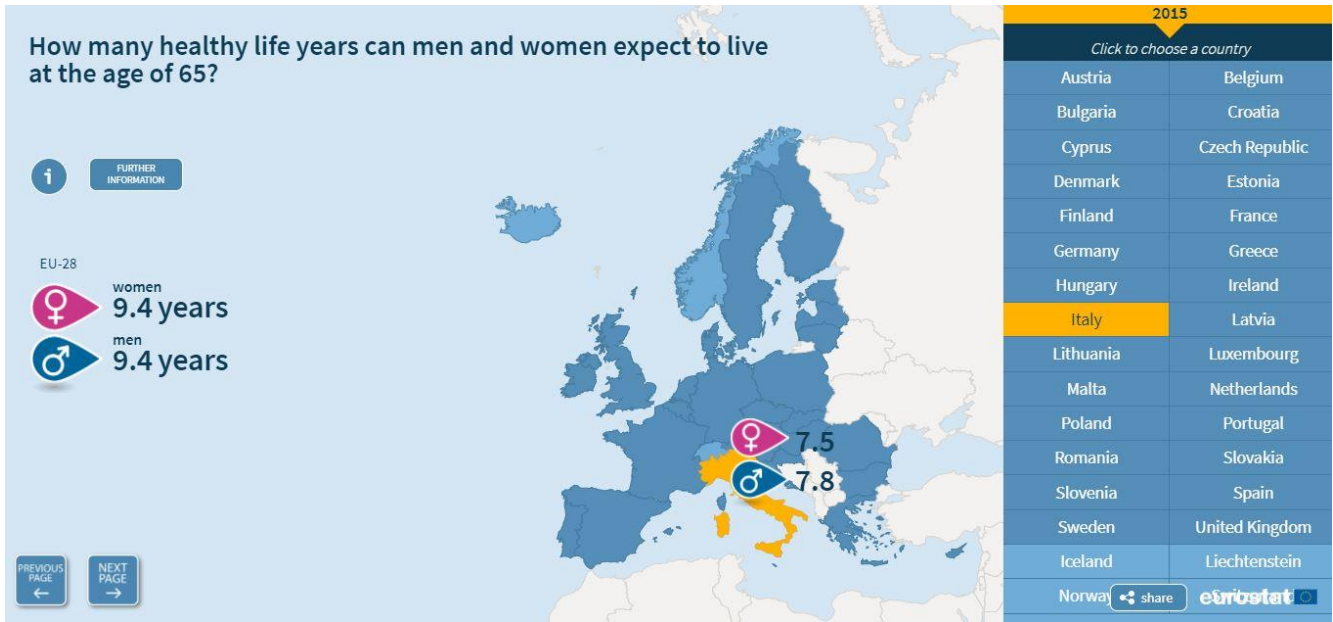


Figure 8. Healthy life in Italy after 65 years

According to Eurostat statistics, the Italian Elderly population is rather healthy for another 9 years after they reach 65. It means that 74 will be an age of transformation. 65 years seems to be still young old category and after 80 seems to be very old category. To be fair, we can consider our study over the population inside 70-80 years that falls under the transition between two age groups inside the elderly.

## 2.2. Limitations of Elderly to use Technology

Many medical researchers have proved that the functional limitations will increase according to the age. Though there could be exemptions and variation between each senior, there will be a common trend of functional limitations induced according to time.

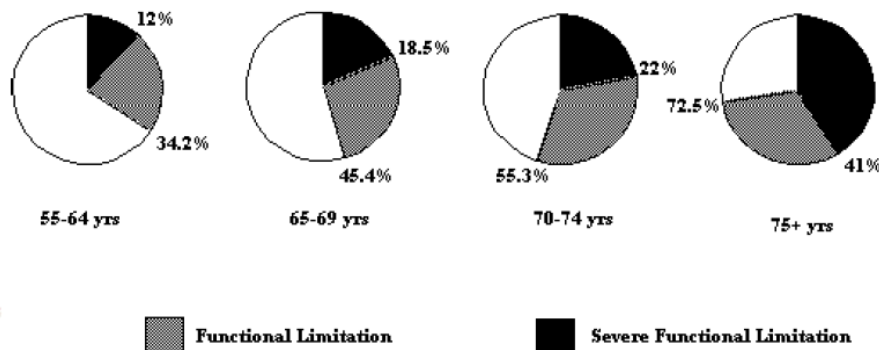


Figure 9. Functional limitation charts according to age

Although the ageing process is different for everyone, we all go through some fundamental changes. Not all of them are what you would expect, like weak and sick. For example, despite of declining health, older people tend to be significantly happier and better at appreciating what they have.

However, ageing makes some things harder as well, and one of those things is using technology. The main challenges or limitations the elderly face while getting older are,

### 2.2.1. Vision And Hearing

From the age of about 40, the lens of the eye begins to harden, causing a condition called “presbyopia.” This is a normal result of ageing, which makes it increasingly difficult to read text that is small and close. Colour vision also declines with age, and we become worse at distinguishing between similar colours. In particular, shades of blue appear to be faded or desaturated.

Hearing also declines in predictable ways, and a large proportion of people over 65 have some form of hearing loss. While audio is seldom fundamental to interaction with a product, there are obvious implication types of content.

### 2.2.2. Motion Control

Our motor skills decline with age, which makes it harder to use different devices in various ways. For example, during some researchers testing at a retirement village, they met an 80-year-old who always uses the mouse with two hands. Like many older people, she had a lot of trouble hitting interface targets and moving from one thing to the next.

In the general population, a mouse is more accurate than a finger. However, in their testing, they have seen older people perform better using touch interfaces. This is consistent with research that shows that finger tapping declines later than some other motor skills.

### 2.2.3. Experience With Technology

Many elders are reluctant towards new technologies and they consider that it does not belong to them. Generally, when we are designing interfaces, we are working within a certain kind of technology. Moreover, it is easy to assume that everyone knows how that scaffolding works. However, people who did not grow up with technologies might have never used the interface elements we take for granted. Is a scrollbar a good design for moving content up and down? Is its function self-evident? These are not questions, most designers often ask. However, the success of your design might depend on a thousand parts of the interface that you cannot control and probably are not even aware of. Some well-designed technological devices functions well with elders if it makes them feel native.

According to these researches by Pew Research Centre-USA, response time for icons on an Apple screen is 0.7 seconds, but the over-65s have a response time of about one second. 80% of older people we interviewed, would need someone to help walk them through the process of setting up a new smartphone. And tests suggest that if an older person has a slight tremor, it can be registered on a device as a swipe rather than a touch.

As many people think that it is just natural for older people's brains to slow down as they age, but that is not always true. At least in some situations, 70-year-olds may have response times similar to those of 25-year olds. But surprisingly there are many other reasons. Older people don't want to make any errors at all, and that causes them to slow down. We found that it is difficult to get them out of the habit, but they can with practice. They were also afraid of using smartphones because of their glassy finish which tends to show that it breaks quickly.

Ian Hosking, an expert in design for the elderly at the University of Cambridge's engineering design centre, believes we need to get the basics right first.

"There are some very tech-savvy older people around, but there is clearly a large cohort of people who feel excluded by technology. They find it a bit impenetrable," he says.

According to these researches, response time for icons on an Apple screen is 0.7 seconds, but the over-65s have a response time of about one second. And tests suggest that if an older person has a slight tremor, it can be registered on a device as a swipe rather than a touch.

"Many people think that it is just natural for older people's brains to slow down as they age, but we are finding that is not always true," said Roger Ratcliff, professor of psychology at Ohio State University "At least in some situations, 70-year-olds may have response times similar to those of 25-year olds. "Older people don't want to make any errors at all, and that causes them to slow down. We found that it is difficult to get them out of the habit, but they can with practice," said Gail McKoon, professor of psychology at Ohio State.

# 3. Smartphone



The Oxford English Dictionary defines the smartphone as “Originally: any of various telephones enhanced with computer technology. Later chiefly: spec. a mobile phone capable of running general-purpose computer applications, now typically with a touch-screen interface and Internet access”.

## 3.1. Smartphone: Smarter than just a phone

### 3.1.1. Smartphone Definition and Evolution

The Oxford English Dictionary defines the smartphone as “Originally: any of various telephones enhanced with computer technology. Later chiefly: spec. a mobile phone capable of running general-purpose computer applications, now typically with a touch-screen interface and Internet access”. While the word smartphone may initially appear to be a mere combination of the words “smart” and “phone”, in fact, the word “smart” functions more as a modifier of “phone,” indicating the device’s evolution over time. While the process to make a phone call on a smartphone is very different than on its antecedents, particularly on a device like the rotary telephone, the ultimate method of mediation has not changed very much. To this end, the Oxford English Dictionary’s definition of phone simply reads “A telephone apparatus; a telephone receiver or handset”, a definition that could still define the smartphone today. As such, the smartphone is still a phone, although the low level of importance that manufacturers usually place upon the smartphone’s ability to call other phones suggests that the changes in mediation that define the smartphone lie in its “smart” features.

Going backward to the history of the “phone”. It is popular in the world since Alexander Graham Bell invented it. It gave a communication revolution. Later the phone became portable or moving which was called “mobile phone”. When the mobile phone started having many functions, which are “smart”, and so it was started to be called “smartphone”. There was many characteristics change and evolution in functions during this journey of development. These changes gave a different outer feel, user interface and overall redefinition (Figure 6).

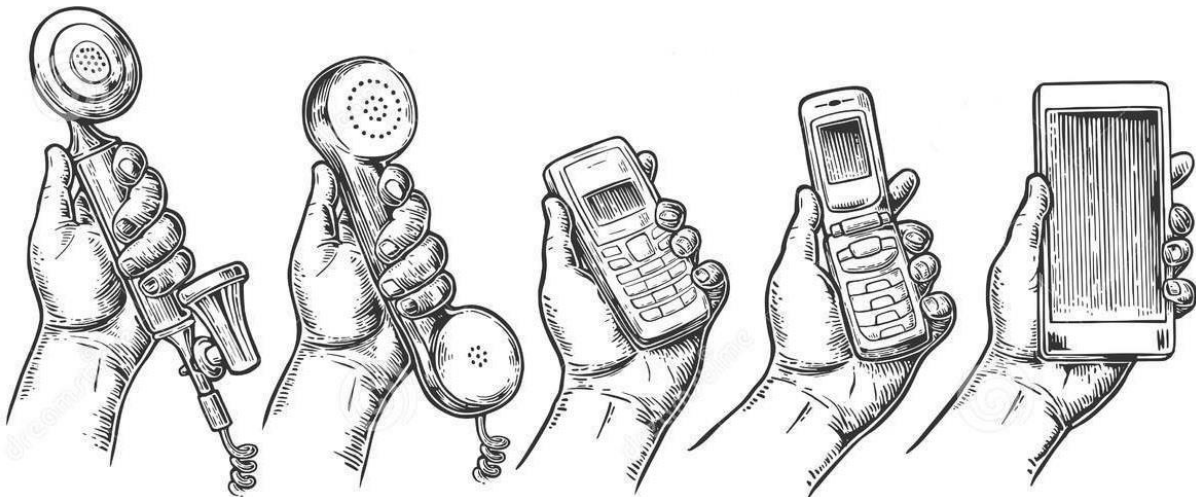


Figure 11. Evolution of phones

The smartphone has more difference between old type of simple phone. But it has less difference between mobile phone. The phone as a machine, the mode of communicating or commanding with the machine is different in mobile phone and smartphone.

The Oxford English Dictionary has a number of definitions for the word smart, but perhaps most appropriate is “Of a device or machine: appearing to have a degree of intelligence; able to react or respond to differing requirements, varying situations, or past events; programmed so as to be capable of some independent action: containing a microprocessor, designed to act or respond to conditions in a more sophisticated way than is typical” ( “Smartphone, N.” Oxford English Dictionary-Feb. 2014)

To make a design analysis, we should start with its description and subdivision of its components with its attributes. We can analyse about the three components of what is meant to be in smartphone. The configurative component results in smartphone as a phone with a hardware (screen, buttons, plastic/metal case, internal electronics) and the software (operating system and applications).

### 3.1.1.1. Hardware of Smartphone

The hardware is the area which the customer touches perceive during the usage. The various screen sizes attribute to its different configurations. The clarity of the screen gives the smartphone more value and better user interface. Buttons or touch sensitive areas are replacing the function of switches in older machineries. The plastic/metal case which covers everything inside and make it a self-contained object. The finish of the outer case gives visual and touch aesthetics. Internal electronics which contains many electronic components decides the speed of computation and response time. The smartphones are sold with these figures of electronics represented outside to be chosen by the customers.

### 3.1.1.2. Software of Smartphone

The software is the virtual part of the smartphone. It consists of an operating system or OS which controls everything and many applications or Apps which can be installed and used by every user. The OS makes significant role in the looks of the user interface, its responses and processing of the data communication. The availability of different customized Apps made the smartphone an object with personalised device. (Pew Research Centre’s study-2015)

### 3.1.2. Present Day Smartphone Trends

The smartphones in the market is becoming more similar to each other with its architecture, user interface and outer looks. They all have a rounded edged flat thin plate design (Figure 12). The hardware of these phones have similar aesthetics these days. The companies which designs them tend to follow a similar path of design philosophy.



Figure 12. Present Architype of Smartphones

In her article “I Phone, I Learn”, Anne Balsamo argues that the smartphone’s ability to respond to the user’s unique desires has engendered a deep-rooted connection between the user and the smartphone. She states, “Apple launched a product that is implicated with in a matrix of cultural changes that concern not simply how we communicate but also how we live, play affiliate, work, and learn in a digital age” (Balsamo, 252).

Smartphone interaction is nowadays part of everyday human behaviour and an activity which involves speaking, listening, touching and performing other tasks, in order to communicate. Interactivity converts a system into a communication medium by eliciting user interaction with the interface. One of the main goals of a mobile phone interface is to relate phone functions and operations to elements of interaction that are performed well (e.g. sounds and visual elements). Mobile interfaces use icons to represent the functionality required by users in performing their tasks. Since visual aspects, such as graphics and icons, are essential elements of user-device interaction, they are used extensively in interface design on the assumption that visual icons are capable of transcending language barriers and of presenting meaning in condensed form (Caplin-2001), (Gittins-1986), (McDougall et al.-2000). These virtual world of user interface is evolved over time and it requires a skilled user to understand the functioning of this modern systems (Figure 3)



Figure 13. Evolution of smartphone

### 3.1.3. Smartphones Marketed for Elderly

There are in fact couple of manufacturers who makes and market smartphones or just mobile phones with a tag “designed for seniors”. Few of them worth mentioning. AN American company called GreatCall, produces phones called jitterbug. They make two versions, one is a flip Smartphone and another a minimum function with typical Smartphone design. This company provides even call on service assistance, a customer care to help elders with anything they need from booking a doctor to asking direction to many other things. But this phone is not there in any other countries and it lack some main functions of smartphones that seems to be underrated with lesser options than a regular phone.



Figure 14. GreatCall jitterbug

These days, there are publicities like below (Figure 10.), which is seen in Italian electronic store “Unieuro”, which market special smartphones for elderly. These seems to be flip phones with custom big fonts and icons. This seems to be good than nothing. But still these phones lack the features which are there in normal smartphones and it seems to be custom built rather than inclusion of elderly population in its design.



Figure 15. Unieuro publicity newsletter from March 2018



Figure 16. Brondi Smartphones for seniors

### 3.1.4. Main Smartphone types available in the market

Studying present markets, there are choices that an elderly can make to buy a smartphone. The different options are,

- *Type 1: Typical smooth slate type Smartphone-* All phone manufacturers are moving towards this direction of design, where there is a smooth body with screen occupying 90% of the front surface. It will have a button in some cases, a fingerprint reader and obviously photo camera in the back and the front. This phone input will be fully touch screen and the characters to type will appear on the screen.



Figure 17. Smooth slate type smartphone

- *Type 2: Flip open Smartphones-* An old tradition of mobilephones with a flipping screen and with proper typing keys. This type of phones will be lightweight, easy to store and ergonomic in hand. This will have two photo cameras, small display screen for notifications when the phone is in closed condition.



Figure 18. Flip smartphones

- *Type 3: Big button Smartphones*- These are smartphones, that still carry big buttons for input interface. They have limitations of having smaller screen, as it uses 50% of front surface for type keys. They also comes with photo cameras and little more thicker size with overall dimensions.



Figure 19. Big button smartphone

### 3.2. Other possibilities in Smartphone design

There many types of old mobile phone designs which the phone manufacturers forgot these days. Some of them are slide up kind of design, which includes a screen that slide upward and thus exposing the typing keys below it. There was twist phones, where we can twist the phone to access the photo camera of other features in convenience.



Figure 20. Other types of mobile phone designs

These are some other possibilities in smartphone design, which is not seen quiet often. They can provide more surface to hold in the hands of elderly or people with disabilities.

# 4. Interviews and Research



## 4.1. Objective

Through segmentation of available smartphones in the market and survey of selected elderly populations, this research intends to find how to include them in the smartphone technology and benefit their daily life. Many ideas are developed by listening others. In this research, the author decides to hear from few elderly people to understand better, how they feel about smartphones and what their opinions about presently available solutions in the market.

The main intention is to show them three types of Smartphones available in the market and ask them about what they think on it. Since it will be hard for them to fill a form for us, the survey went like an interview with face-to-face talk. The outcome from this interview help in conclusion of this research with possible guidelines for inclusion of elderly customers in the smartphone design.

## 4.2. Subject of the Interviews

The interview is followed by a questions chart, which include the following questions,

- What is your name, age and nationality?
- What was your previous profession?
- Do you know Smartphone?
- Do you own one Smartphone?
- Which phone are you using?
- Did you learn to use yourself?
- Do you have a mail id?
- Do you have a Facebook account?
- Are you using WhatsApp?
- Is it easy to use your Smartphone?
- Is it easy to hold the Smartphone?
- Is the icons of Smartphone readable?
- Would you prefer to have a new phone Type 1?
- Would you prefer to have a new phone Type 2?
- Would you prefer to have a new phone Type 3?
- Your suggestions about what do you think Smartphone designed for you.

### 4.3. Participants

All the elderly helped with the interview were pensioners from a small village called Novate Milanese in Milan, Italy. They live a very calm life of a village and often travels to nearby city centre of Milan. They are well informed about new technologies and some are proficient users of internet, while few of them are still amateur in using it. The age range of these participants are from 68 to 80.

### 4.4. Results

The interviews opened up a book of information about what the elderly thinks about the Smartphones and especially about the existing smartphones in the market. The main insights from the interviews and research can be summed and pointed like this,

- The elderly are much curious than before to explore the new smartphones and its possibilities.
- They feels that the new smartphones are very easy to fall from their hand and they have a sense of fear to use it freely.
- Even in the new age technological years, they still require some help to learn how to use many functions in the smartphone.
- They have interest to be active in social media, at least to know about their loved ones or to be connected.
- Type 1 phone(Smooth plate) makes the majority to feel that its fragile in their hands and the apps and its functions are too much.
- Type 2 phone(Flip open) is more acceptable design by majority of the elderly. They expressed a feel of better hold in their hand and it expresses portability.
- Type 3 phone(big buttons) is seems to be satisfying for few of those who just use phone for calling. Others felt it like a solution from the past and without any advantage of new technological advancement.
- They expressed the feel of holding modern phones with its texture and shiny surfaces, looks like it does not belong to them.
- They like to see normal smartphones that are suited for them, rather than specially designed phones for them.

By brainstorming above the responses, the conclusion will be a need for transgenerational design of Smartphones, which is easy to use, hold, and take advantage of technologies for our elderly population

## 5. Other elder friendly products



There are many products and devices which are already serving the elderly population in a satisfying manner. Those products bring us ideas about the ergonomics and usability aspects of design.

## 5.1. Normal Products

There many products which suites for elderly and remained always successful in the market. It is worth looking for inspiration from those products. Simple objects like walking stick also shows us many aspects of design for elderly. Many of those products are well accepted by the elderly and they use them often.



Figure 23. Normal products

## 5.2. Special Products

Many special products are developed to support elderly with limitations for movement and capacities. Those products show many features that help the usability for elderly. The products which are made for disabilities and

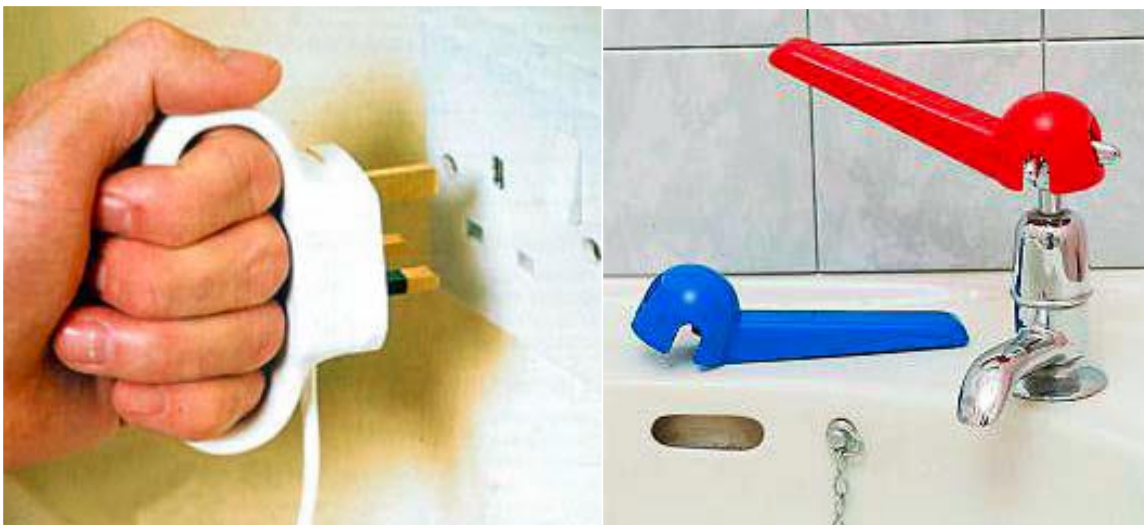


Figure 24. Special Products

## 5.3. Common properties of elderly friendly products

The products specially designed for elderly has many common properties or design elements in common.

### 5.3.1. Aesthetics and Ergonomics

The Shape and look of each products affect its acceptance for elderly population. The main peculiar feature we can notice in it is a multi-surface design, where the product can be holded with support from more than one angle. This helps the elderly to keep the products safe without falling down.

### 5.3.2. Interface and feel

The interface of the successful elderly products is very simple and clear. It makes the application of the product an easy task for an elderly.

## 6. Conclusions



There is in fact a huge need for including the elderly into the target market of the smartphone design. They feel excluded in its design by many means. The hardware and software design could help them to make benefit of this new technology.

## 6.1. Possible solutions

The research concludes with the findings of the possibilities to include the elderly as target customers while designing new smartphones. It requires a coordination between hardware design and software part of it. A Universal design concept should be developed in smartphone design for including everyone.

## 6.2. Guidelines for inclusion of the Elderly into smartphone design

The guidelines for inclusion of the Elderly into smartphone design will be primarily focused to a transgenerational design. It is a design ideology where we should design products, which can be used by different generations and even by people with limitations. It could be equally much updated according to the new technologies and seems to include everyone as the target customer. The guidelines formulated for Inclusion of Elderly into smartphone designs are,

- Design a smartphone with multi-surface body (like flip up, slide up or twist designs), where the grip to the hand is more and better hold during its use.
- Functions and buttons to be made very simple, but it does not mean omitting any good features.
- The weight of the smartphone should not be too less, so that it will not be stable in hand.
- Surface finish to be made with more grip and different classic material textures.
- The software response time and the applications speed to have control feature for adapting according to the person.
- The screen size should be adequate and the fonts must be larger or adjustable easily.
- Only necessary icons appear in the interface.
- There should be some designs which look vintage and feel technology inside.

# 7. Limitation&Recommendation



## 7.1. Suggestions and Open Discussions

This research addresses mainly on a small part of big issue related to smartphone design. It purposefully omits in depth study of many subjects like software and graphical user interface. The population, which was interviewed and studied, belong to rather urban village, where the people are more informed on the technologies. The problems may change according to different elderly populations. It will be difficult to draw a very specific guideline for designing for elderly all over the world. For example, May be in different country and region, where the people are less technologically exposed, the main challenge might be to bring them in confidence to use the technology at even lower level.

There are many studies about medical conditions of elderly worldwide. Those researches will have many other things to speak and enlighten. That might lead into thinking about many different peripheral devices connected to the smartphone that can help the elderly. This research can be extended into many other new technological products. After many years, the smartphone technology can also change and a new communication device can take over. In that occasion, the same approach should be applied to that product to make elderly friendly designs.

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