Independent Living Consideration for Visually Impaired Users in Home Environment

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ABSTRACT

There have always been problems between visually impaired users and their interior space design and elements. The visually impaired dwellers still facing problems in completing their daily tasks and routine. With the huge existing numbers of visually impaired around the globe, and the flaws in home design; designers should consider the human inability while designing homes. This research attempts to give recommendations for better home design that lead to easier living and better interactions for visually impaired users in their home interior spaces and elements. The research question discusses: the difficulties the visually impaired users still have in their interior spaces, the necessary quality improvements in the living skills of the independent visually impaired users within their interior spaces, and the interior space suggestions that may make the daily tasks easier to achieve for the visually impaired dwellers. The main aim of this thesis is to create better orientation and interactions between the visually impaired dwellers and their interior home spaces. The visually impaired daily life difficulties and needs were understood and discussed from the results taken from twenty visually impaired participants, some of the participants are students in *Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu*, the only visually impaired school for children in Nicosia, and some other visually impaired participants around Northern Cyprus. Therefore, this thesis gives some suggestions in home for visually impaired dwellers who face problems and issues in achieving their daily life tasks, that may lead to independency and better orientation without needing help, these interventions allow the visually impaired dwellers to use other senses in orientations for themselves within their interior spaces.

Keywords: Interior Space, Visually Impaired User, Independent Living, Universal Design, Home Design.

ÖZ

Görme engelli kişiler, iç mekan ve elemanları ile ilgili sıklıkla sorunlar yaşamaktadırlar. Ev özelinde bakıldığı zaman, görme engelli kişiler günlük görevlerini ve rutinlerini ev içerisinde gerçekleştirmeye çalışırken de sorunlarla karşı karşıya kalmaktadırlar. Dünyada var olan görme engelli kişilerin sayısının fazlalığı ve yaşamakta oldukları evlerdeki sorunlar dikkate alındığında, araştırmacıların ve tasarımcıların bu konu üzerinde daha fazla çalışması gerekliliği ortaya çıkmaktadır. Bu tez kapsamında, görme engelli kişilerin iç mekanlarda daha kaliteli yaşam sürebilmeleri için çözüm ve öneriler sunulmaya çalışılacaktır. Araştırmada, görme engelli kullanıcıların iç mekanlarda yaşadıkları zorluklar; görme engelli kullanıcıların iç mekanlarda bağımsız ve kaliteli bir şekilde yaşayabilmeleri; ve görme engelli bireylerin iç mekanlarda günlük ihtiyaçlarını kolaylaştırmak adına iç mekan sorgulamaları, müdahaleleri tartışılacak ve önerilerde bulunulacaktır. Bir başka değişle bu tez çalışmasının temel amacı, görme engelli sakinler ile iç mekanlar arasında daha iyi oryantasyon ve etkileşim yaratmanın yollarını ortaya koymaktır. Görme engellilerin günlük yaşamları sırasında evlerinde karşılaştıkları zorluklar ve gereksinim duyduğu ihtiyaçlar, Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu öğrencileri (Lefkoşa'daki görme engelli çocuklar için bir okul) ve Kuzey Kıbrıs'ta bulunan görme engelli yirmi kişi ile yapılan anket çalışması yardımı ve literatür araştırması ile okunmaya ve tartışılmaya çalışılmıştır. Söz konusu okuma ve tartışmalar ışığında, görme engellilerin iç mekanlarda günlük yaşamlarını sürdürürken karşılaştıkları sorunları yardıma ihtiyaç duymadan, bağımsız ve kolay

yaşayabilmeleri için iç mimari müdahaleler önerilmektedir. Bu müdahalelerin, görme engelli sakinler için iç mekanlarda kaliteli bir yaşam sürdürebilmeleri adına diğer duyu organlarını kullanabileceklerinin altı çizilerek yapılabileceği de vurgulanmaktadır.

Anahtar Kelimeler: İç Mekan, Görme Engelliler, Bağımsız Yaşam, Evrensel Tasarım, Ev Tasarımı.

To My Family & Friends.

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I would like to show my gratitude to all my family who encourage me to complete my studies with their sacrifices and belief in my ability of doing this study. I would like to show my gratitude to all my friends' support who helped me and stood by me and continued to believe in me even through all the pressure and issues I experienced.

Therefore, this thesis is a small reward to all the visually impaired people around the globe, and to all the instructors, family and friends for their efforts and for their belief in me.

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Chapter 1

INTRODUCTION

Most architects nowadays attempt to provide suggestions in interior space comfort and satisfy the users, regardless of their disabilities or future needs. There has been a huge gap for visually impaired users between their daily tasks and expectations from the interior space in which they dwell. To understand the visual disabilities and visually impaired needs, we need to understand what they can observe from their environment, and what they can achieve within their normal daily tasks. Visual disabilities are defined as the inability to observe pictures and light from the environment. However, not all visual disabilities mean total blindness, some studies show that most of the people with visual disabilities can perceive small amount of light and blurred pictures of their surrounding environment (American Foundation for the Blind, 2008). Thus, visually impaired users need a universal and fair home design to put them in harmony with their interior spaces; which can possibly make their normal daily tasks easier to achieve. Universal and fair design can be achieved if we apply small effects within their interior spaces. Researchers argue that the elements of the design should be equitable, flexible, simple, and easy to use with the lowest physical effort, regardless of the user disabilities (Connell B., Jones M, … & Vanderheiden G., 1997).

1.1 Problem Statement

Nowadays, visual disabilities are a common issue around the globe. There are around 285 million people with sight disabilities (World Health Organisation, 2010). Most universities, schools, institutes, restaurants, and public spaces considering the visually impaired as customers in need of help. The problem is, most private spaces and houses are built with modern architecture approaches and standards, while designing homes, most of the architects have failed to consider the visually impaired and those with sight disabilities. The visually impaired are still facing problems in completing their normal daily tasks such as personal hygiene and kitchen skills. In spite of all the technology we have nowadays, they still cannot achieve their daily tasks like normal people. Being unaware of the abilities and inabilities of the visually impaired may create huge physical and educational delays, caused by the lack of interactions and achievements within their spaces, leading to low fitness rates and low educational levels (Lieberman, 2002). Not much research has been done attempting to make the visually impaired daily tasks in their interior spaces easily achievable.

1.2 Aim and Scope of the Study

The study's aim is not to build new houses and force the visually impaired user to choose them as their dwelling. The main aim of this thesis is to give suggestions for the visually impaired users within their existing interior space, to reach a high level of satisfactions and higher expectations with their daily tasks, routine, and better orientation. This study attempts to create stronger connections between the independent visually impaired users and their home interior space; these connections are possible by simple interventions, and to achieve these interventions we need to

put their other senses like feeling, touching, hearing, and smelling in use, instead of the sight sense the visually impaired have lost. Incorporating these interventions into the design will probably help the users with visual disabilities to achieve their daily tasks easily within their interior space. This research will help with future studies that attempt to create stronger connections between homes and the visually impaired dwellers' within their interior spaces.

Understanding the difficulties between visually impaired dwellers and their interior spaces, and the necessary quality improvements in the living skills of the independent visually impaired users within their interior spaces; formed a main research questions as:

- What are the interior space suggestions that may make the daily tasks easier to achieve for the visually impaired users?

1.3 Methodology

The method used in this research is explanatory; qualitative and quantitative. The findings of the literature review formed a reference structure in understanding visual impairment and the connections between the visually impaired and the home interior space, this reference structure helped the researcher in forming questions before giving them to the visually impaired participants. The answers were taken from twenty visually impaired children at *Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu*, the only visually impaired school in Northern Cyprus, and other visually impaired participants around the island, these participants were randomly chosen regardless the age and gender. Question forms target two types of participants, the first question form targets the visually impaired adults (Appendix a), while the second question form targets the visually impaired children (Appendix b).

Fourteen questions were given to the adult visually impaired participants, and eleven questions for the visually impaired children. The participants' answers and results helped this study to understand the participants' needs and expectations within their interior spaces. These answers opened a gate for this study to understand what makes it hard to achieve a daily task easily with no extra effort for the visually impaired. Twenty participants were chosen because of the limited ability of reaching more visually impaired participants, the data collected will be presented in charts and tables to create statistical data results. Both groups of participants (adults and kids) will be presented together with different tables and charts. Also, this research puts all the answers together in one table to make it possible to clearly understand the general visually impaired dwellers' needs, regardless of their age and gender.

This study field is huge, ranging from housing to understanding visual impairment. In order to narrow the focus of this study, the research will suggest some interactions between the visually impaired and their home interior spaces. The field study was hampered by many constraints on my role as a researcher. It took a longer period of time to collect answers from the participants to complete the research than it would take with normal participants. The first constraint was reaching the only school for visually impaired in Northern Cyprus (*Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu)*, and the difficulty in taking the answers from visually impaired participants. Due to their vision loss, the researcher was forced to explain each question to each participant individually with the help of school educators. The second constraint was the language barrier; it took more time to find a friend to help in translating the questions from English to Turkish since the researcher is not a

native Turkish speaker, and most of the participants were using Turkish as their mother tongue. Also, the researcher's knowledge of the Turkish language was not enough to be able to read and explain all the questions to the participants. Because of this, the researcher asked for the help of another native Turkish speaking friend to be present while taking the answers to explain all the questions to the participants individually. The final constraint was finding other participants outside the school. The limited sources in Northern Cyprus offered few choices beside the school (*Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu*), thus the researcher was forced to limit the participants to this school in addition to several other visually impaired individuals around Northern Cyprus.

1.4 Significance of the Study

This study may assist visually impaired dwellers and their families by allowing them to become more independent while performing daily tasks and routines in their home interior spaces. This study also may help to gain an in-depth understanding into visual impairment and blindness disabilities, including what the visually impaired can perceive and how can they interact, and their numbers compared to the total world population. This research may also help future studies related to visual impairment and interior space design.

1.5 Important Terms

- **Braille:** A way of reading, writing and communicating used by one who is blind or visually impaired with no need for any eyesight (Braille Works Blog, 2016).
- **Design's simplicity:** A design which is easy to understand regardless of the user's knowledge, concentration level, experience and language skills. Reaching this point successfully means removing any unnecessarily complicated elements at the

design, knowing the user's expectations, accommodating language skills and literacy, arranging the information required to understand the design by its importance, and providing feedback for the design (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997).

- **Equitable use:** A design should be useful and marketable equally for all users with their abilities or disabilities. Equitability in design means to provide the same design for all users with the same means identically and equivalently when possible to avoid separating and segregating any users, to provide safety, security and privacy equally for all users, and to make the design equally appealing to all users (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997).
- **Flexibility in use:** To accommodate individual abilities and uses by providing choices in how to use the object or design, such accommodating right or left-handed users, facilitating the user's precision work, and providing access to the user's adaptability (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997).
- **Functional limitation:** The lack of interactions between the user and their activities such as reading, being safe, self-care, etc. caused by low vision (American Foundation for the Blind, 2008).
- **Human behaviour:** The human's experiences within their lifetime, caused by the individual's culture, society, religious influence, etc. (Ajzen, Fishbein. 1999).
- **Human disability:** A measurement of individuals with physical or mental impairments which affect the individual's ability of completing daily life activities and cause delays in achieving them. Long term disabilities are those with range of twelve months and more (London's Global University (ULC), 2016).

- **Ill structured:** Problems routinely faced by the individual in their daily life. They can be social problems, political problems, and economical problems (Simon, 1973).
- **Independent user:** The ability to think or perform an action without the need for someone's help (Oxford Dictionaries).
- **Legal blindness:** The level of vision below 20/200 and 20 degrees or less. People who are diagnosed as legally blind still can perceive some light and vision (Brian, Wachler, 2015).
- **Low physical efforts:** A design can be useful and easy to use comfortably requiring the minimum amount of physical effort. The user should be allowed to use the design with a natural body position. They should be able to use the design with a reasonable operating force, avoid repetitive efforts, and keep the amount of physical effort to its minimum (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997).
- **Low vision:** Having some degrees of vision but is unable to do daily activities such as reading, watching television, being safe outside, etc. (American Foundation for the Blind, 2008).
- **Perceptible information:** A design should deliver necessary information effectively to the user regardless of ambient conditions or the user's abilities. The design provides this by using different modes like verbal, pictorial and tactile. This can be done by presenting the information with the legibility of receiving them, making the instructions or directions easy to understand, and providing different techniques usable by people with disabilities (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997).

- **The size of space:** The space provided to the users, regardless of size, posture, or mobility. The user should be able to use the design with maximum comfort and it should provide a clear sight of the important or dangerous elements, be comfortably reachable, provide variations in hand/grip sizes, and provide enough space for users with assistance or with assistive devices (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997).
- **Tolerance for errors:** A design should minimise danger and provide a step back in case of any consequences or mistakes. We can minimise errors and hazards by arranging the elements provided to the user and isolate the dangerous elements, as well as presenting the design with warnings on the dangerous elements that require vigilance and provide safe failure features (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997).
- **Vision loss:** Having seeing problems for individuals even while wearing glasses or contact lenses, as well as the individuals who are totally blind (American Foundation for the Blind, 2008).
- **Visual acuity:** A clinical measurement of an individual's ability to focus on small details like letters and symbols from a close distance. The measurement is 20/20; so if a normal person can see from 200 feet, the visually acuity can sight the same with 20 feet distance (American Foundation for the Blind, 2008).
- **Visual impairment**: Diagnosed as intensity of vision of 20/70 or less (140 degrees). Visually impaired individuals still perceive light and glare sensitivity, as well as light/dark environments (American Foundation for the Blind, 2008).

1.6 Structure of the Thesis

In the Introduction (**Chapter 1)**, the study states the problem and describes the aim and study objectives. The second part of chapter one will explain the methodology used for this thesis and the study limitations. Final part of the chapter shows the important terms used in this study and structure of the thesis. **Chapter 2** (Visually Impaired User Needs and Expectations) starts with a review of the literature which defines general human disabilities, to more specifically visual impairment and its prevalence in the world. All data statistically presented in the form of charts, pies and tables. Then, the chapter discusses the satisfaction level of the general user within their home. The chapter was ended with visually impaired users' expectations in their home spaces and general human behaviour. After studying disabilities and visual impairments and their prevalence in the world population, **Chapter 3** (Home Design Issues and the Visually Impaired Dwellers) will define universal design, the research starts with a general briefing of the visually impaired user's needs, followed by two case studies Batthyány László Institute by A4 Studio, and The Center for the Blind and Visually Impaired in Mexico City. The chapter ends with living skills of the visually impaired in their daily life routines. In **Chapter 4**, the thesis will talk about the field study, findings, results and proposals. At this chapter, the results will be presented as two parts: The first part will be statistical charts, pies and tables, and the second part is the findings and discussions. Difficulties faced by the visually impaired with regards to their home interior spaces are discussed from the answers taken by the twenty participants at *Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu*, a school for visually impaired children in Nicosia, Northern Cyprus. The study explains and compares the visually impaired users' needs and expectations

from their interior spaces and elements. The discussions and recommendations will take part in **Chapter 5**, which will show an overview of the study and a discussion of the results, followed by the recommendations and implications of this study for any further similar studies. Table 1 shows the main structure of the entire study.

Table 1: Structure of the thesis.

INTRODUCTION		
PROBLEM STATEMENT	AIM & SCOOP	METHODOLOGY
IMPORTANT TERMS	STRUCTURE OF THE THESIS	
	↓	
	THEORETICAL BACKGROUND	
	USER	**HOME**
DEFINITIONS	GENERAL DISABILITY & VISUAL IMPAIRMENT DEFINITIONS	HOME IN TERMS OF LIVING, FEELINGS & SENSES
NEEDS	VISUALLY IMPAIRED & GENERAL USER NEEDS AND EXPECTATIONS	INDEPENDENTLY USER LIVING NEEDS AND EXPECTATIONS
	↓	
DATA COLLECTION AND ANALYSIS		
QUESTIONNAIRES	SUGGESTIONS	FINDINGS AND RESULTS
	↓	
DISCUSSION OF THE FINDINGS		
OVERVIEW OF THE STUDY		
	↓	
RECOMMENDATIONS FOR FURTHER STUDY AND PRACTICE		
CONCLUSION	RECOMMENDATIONS	INTERPRETATION

Chapter 2

VISUALLY IMPAIRED USER NEEDS AND EXPECTATIONS

Chapter two presents the definitions of human disabilities including visual impairment, the chapter shows numbers and percentages of the people with special needs around the world compared to the world population in statistical numbers, tables and figures. Therefore, the chapter starts with general definitions of human disabilities followed by definitions of visual impairment. The other part of the chapter presents information about the user satisfaction in home, then explains about the visually impaired's needs and expectations in their home interior spaces. The end of the chapter discusses the definitions of human behaviour and its connection with the interior spaces.

2.1 Definitions of Human Special Needs and Visual Impairment

The United Nations studies found that one in ten people has some kind of disability. There are twenty-three different kinds and definitions of disability around the globe including the visual impairment (Brechin and Liddiard 1981). In 2017 The World Bank Group found that 15% of the world population are living with special needs, which is one billion people around the globe (The World Bank, 2017), and out of the one billion special needs individuals, 285 million are visually impaired, which means 4.25% of the world population are visually impaired (Mariotti, 2010). In 2011, the World Health Organisation published some random quotes from special needs individuals explaining their suffering and the problems they face in their daily life

routines: *Nael,* a person with special needs; explained in 2011 the cruel pain he faces in everyday life. He described the pain he experiences everyday:

> *Can you imagine that you're getting up in the morning with such severe pain which disables you from even moving out from your bed?"* He also described the pain he has while doing simple activities in normal daily life routine, and his inability to have a normal job because of his disability. He ended his story by talking about his family and child by saying: *"And finally can you imagine your little child is crying for hug and you are unable to hug him due to the pain in your bones and joints.?*

Ahiya, a hearing impaired person described his disability inside his community, and his struggle in taking the bus every day and using the same modes of transportation as the rest of society. His disability makes it harder to be like the other passengers. His hearing aid makes other passengers avoid sitting next to him and leads them to search for any other possible seat, while keeping the seat next to him their last option. Ahiya states:

> *People continue to embark on the bus. They look for a seat, gaze at my hearing aids, turn their glance quickly and continue walking by.*

He blames the community by saying:

> *Only when people with disabilities will really be part of the society; will be educated in every kindergarten and any school with personal assistance; live in the community and not in different institutions; work in all places and in any position with accessible means; and will have full accessibility to the public sphere, people may feel comfortable to sit next to us on the bus.*

Samantha is a mother with special needs, she has two children, and she explained the relationship between her, a special needs individual in wheelchair, and her kids as a typical *"Mummy"* and child relationship. Samantha said:

> *My life revolves around my two beautiful children. They see me as 'Mummy', not a person in a wheelchair and do not judge me or our life. I cannot get into the houses of my children's friends and must wait outside for them to finish playing. I cannot get to all the classrooms at school so I have not met many other parents. I can't get close to the playground in the middle of the park or help out at the sporting events my children want to be part of. Other parents see me as different, and I have had one parent not want my son to play with her son because I could not help with supervision in her inaccessible house.*

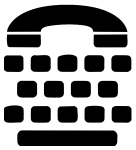
She described the low possibility of fully access their school because of the limitations in accessibility at schools, parks, shops and the eight-hour support of personal care after school. These issues between the visually impaired and the individuals with special needs and the community create difficulties and delays in completing simple tasks in daily life routine, these difficulties may effect the people around them like how Nael and Samantha explained, or might be caused by the community around like how Ahiya explained (World Health Organisation, 2010).

2.1.1 Definition of Human Disabilities

Human disabilities can have many physical causes and forms. General disabilities can be a result of car accidents, disease and many other possible injuries. Other causes of physical disability are conditions present at birth and old age illnesses. Disability does not necessarily mean a visible physical human change in the body; not all disabilities are visible or obvious such as heart conditions, arthritis, and epilepsy. Expectations and aspirations of people with special needs are exactly the same as most people, and the only difference is in the level of ease in which they are able to achieve their goals. people with special needs in general have the same concern, which is that they are asking to be thought about while building houses and public spaces (White, 1988). Human disability can be examined in terms of many

daily life routine factors such as reaching for/using the toilet, eating, drinking, getting in/out of bed, taking a bath, washing the hands/face, putting on shoes, dressing, hair brushing, and shaving (Harris ; Buckle, 1971). As the World Health Bank suggested, to help the special needs people around the world we need to take a few steps in making universal design of all majors. Thus, they suggest to improve public transportation services and accessibility, use universal design standards when making a design and remove physical barriers, improve the education systems and training for all kinds of disabilities, improve the accessibility of the public spaces such as building and roads, and provide clear and accessible information (World Health Bank, 2011). By helping the people with special needs in public and private spaces, the society used many signage on streets to show the opportunity of using these spaces or elements by the individuals with special needs. Many samples and signage we may or may not see yet on streets, in public spaces, and in indoor spaces (Table 2). These logos represent many disabilities to inform the public of the possibility of use. These symbols are: the symbol of accessibility, access to low vision, braille, sign language interpretation, a telephone typewriter (TTY), volume control telephone, live audio description and audio description for televisions, Videos and Films, assistive listening systems, accessible print, information symbol, and closed captioning (CC).

Table 2: Symbols of special needs.

Symbol of Accessibility		Live Audio Description	
Access to Low Vision		Assistive Listening System	
Braille		Large Prints	
Language Interpretation		The Information Symbol	
Telephone Typewriter (TYY)		Closed Captioning	
Volume Control Telephone		Live Audio Description	

The Symbol of Accessibility indicates a wheelchair man figure to show the opportunity for the users with special needs to be accommodated in places like parking spaces, public transportations and general public spaces. Access to Low Vision is a figure that shows a blind man crossing the road, and this figure can be used in zebra-cross streets and public spaces to show the opportunity of using to visually impaired individuals. Braille Symbol is a symbol used to show the availability of braille printed copies of books, magazines and other prints. Sign

Language Interpretation is a figure that indicates an availability of sign language for the deaf, which can be used in conferences, lectures, and television news or shows. Telephone Typewriter (TTY) is a symbol that represents a machine that translates the spoken sentences into written words. Nowadays TTY is known as text messaging and is available on all smartphones. Volume Control Telephones are special phones that offer a high volume control for hearing impaired users. Audio Description can be used by visually impaired users, this symbol indicates the availability of video description in movies and television series, which consists of voiceovers that describe the movements and events happening in television series or movie, beside the original dialog. An Assistive Listening System is a system that is used to isolate surrounding sounds to make hearing better and clearer for all users, especially hearing impaired users. This method is used nowadays to isolate surrounding sounds in conferences and meetings and for live translation of spoken words to other languages. Accessible print symbol indicates the availability of a printed version of a book, magazine or any other prints that written in huge font for users with visual inabilities. The Information Symbol is a symbol that can be used by all users, especially the special needs and visually impaired, this symbol leads the individuals to information and security desks and can be reached by tactile paving for the visually impaired. Closed Captioning (CC) is a method used in televisions and online videos to translate the voices and sounds to written words, this method known nowadays as subtitles; translates movies and foreign programs to other languages (Stanford University, n.d.).

Symbol of Accessibility	Symbol
	 Figure 1: Symbol of Accessibility, a disabled man on a wheelchair.
Uses / Examples	
 Source: Malone, T. (n.d.). Disabled parking [Photograph found in Torrens, Australian Capital Territory].	

Figure 2: Parking signage for drivers with special needs

Starting with the symbol of accessibility definition (Figure 1); the wheelchair symbol represents the accessibility of the individuals with wheelchairs and limited mobility, such as the accessibility to a public restrooms, entrances, phone cabins and parkings (Figure 2).

Access to Low Vision	Symbol
	 Figure 3: Symbol of Access to Low Vision, a visually impaired man figure.
Uses / Examples	
 Source: Backhaus, P. (2014, March 30). The sounds of everyday Japanese life.	

Figure 4: The symbol of a visually impaired with a cone used in public spaces.

Access to low vision represents a visually impaired or blind person figure with a cane (Figure 3), this symbol is used to show the other sighted users of the opportunity given to the individuals with low vision in paths and places such as

natural trails, scent in public parks, tactile street paths, and museum exhibition with arts that may be touched with a tactile tour (Figure 4).

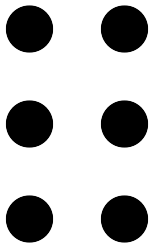
	Symbol
Braille	 Figure 5: Symbol of Braille, the main six dots used to form the language.
Uses / Examples	 Source: GettingHired Team. (2016, January 1). Celebrate World Braille Day on January 4th

Figure 6: Braille is the access between the visually impaired & education.

Braille symbol (Figure 5) represents the availability of a braille printed book, street signage and exhibition labelling that can be used by the visually impaired and vision inabilities' users (Figure 6).

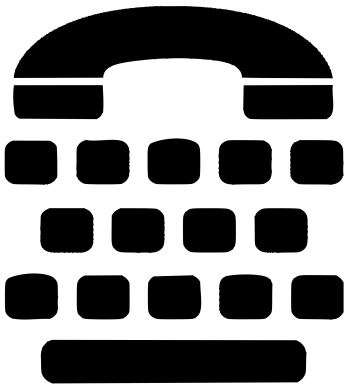
	Symbol
Language Interpretation	 Figure 7: Symbol of Language Interpretation, sign language for deaf.

Uses / Examples

Source: Signlangtv, RTP Bom Dia Portugal channel. Retrieved

Figure 8: Used to translate the spoken words at TV news to sign language.

Language interpretation symbol (Figure 7) indicates that the sign language for hearing impaired users is available, this can be used in lectures, tours, performances, conferences, and television news or programs (Figure 8).

	Symbol
Telephone Typewriter (TYY)	 Figure 9: Symbol of Telephone Typewriter (TYY).
Uses / Examples	

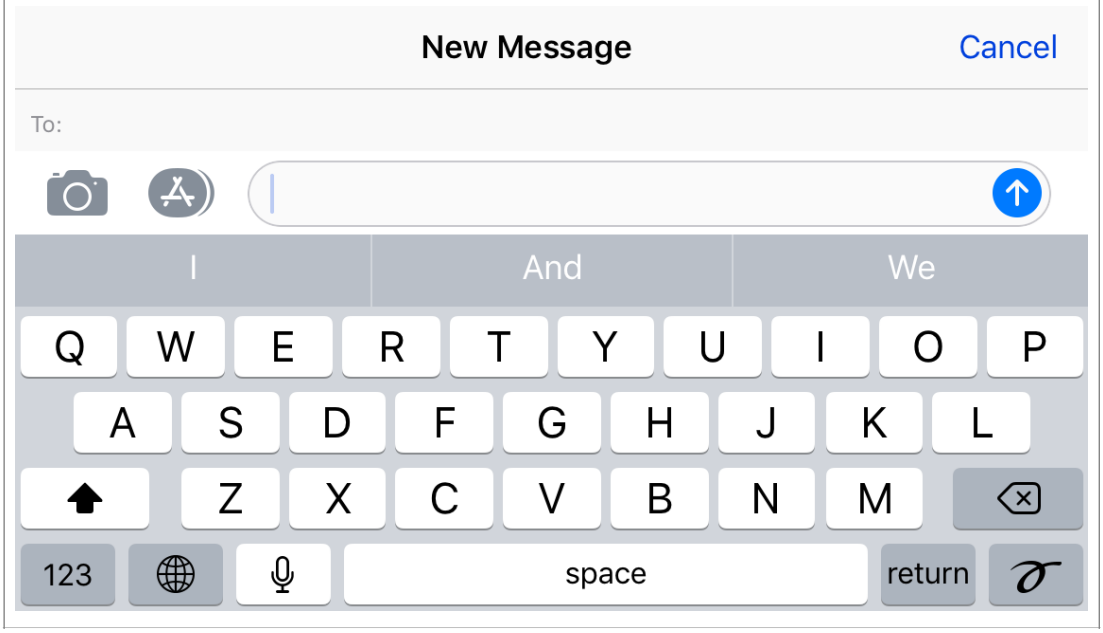


Figure 10: TYY or TT known nowadays as text message in smartphones.

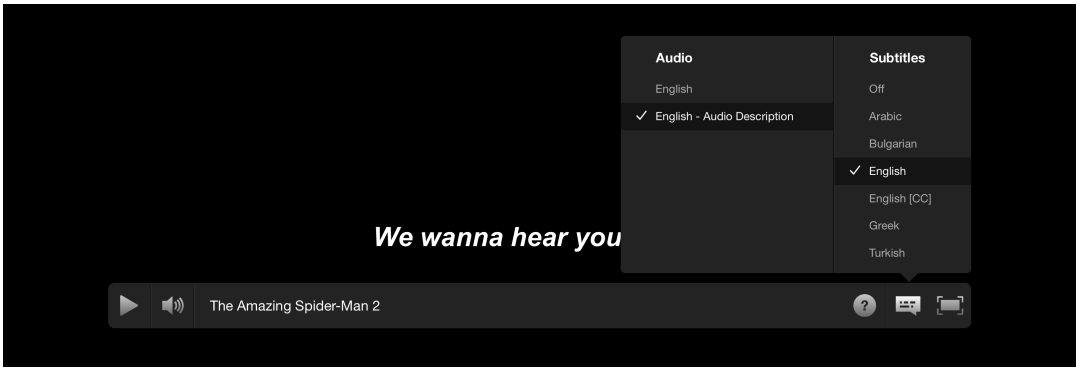
TYY (Telephone Typewriter) also known as TT (Text-Telephone) and TDD (Telecommunications Device for the Deaf) (Figure 9), this method used for the users with hearing impaired to make the communication more possible between the non-deaf and the deaf users by typing. Today's TYY is available for all individuals and known as text messages on all smartphones (Figure 10).

	Symbol
Volume Control Telephone	

Figure 11: Volume Control Telephone symbol, controllable phone volume.

Volume control telephone is a symbol that represents the possibility of using a high volume control used by the hearing impaired users (Figure 11).

	Symbol
Live Audio Description	 Figure 12: Live Audio Description symbol.
Uses / Examples	



Source: Netflix movies with english - audio description.

Figure 13: Netflix offers various movies and series with video description.

Live audio description symbol (Figure 12) shows the availability of having a video descriptions of many television series, programs and films for the visually impaired users, this also can be possibly used by the museums and visual art exhibitions . This method uses a real-time description of the events happening beside the main dialog in series and movies (Figure 13).

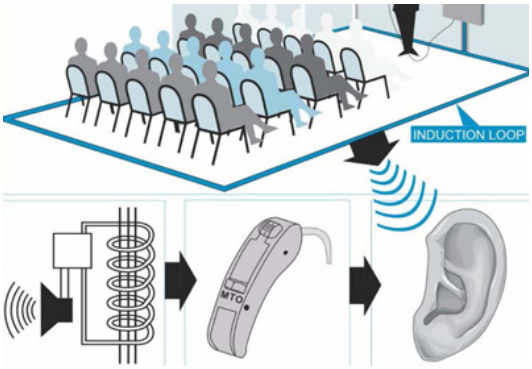
Assistive Listening System	Symbol
	 Figure 14: Symbol of Assistive Listening System.
Uses / Examples	
 Source: What Are Loops? (2016, August 10).	 Source: Headphones & Headsets - Microphones - Integrated Systems. (n.d.).

Figure 15: Devices used in conferences to isolate other unnecessary sounds.

Assistive listening system symbol (Figure 14) shows a method that uses the infrared, loop and FM system to transmit the sounds for the hearing impairment, this system may be available from the same audiovisual equipment suppliers that service conferences and meetings (Figure 15).

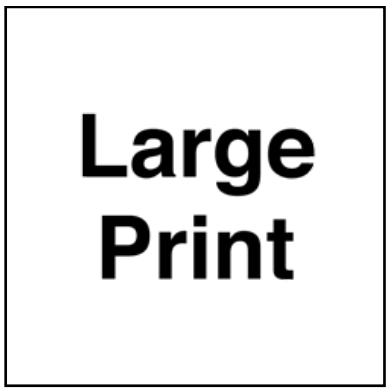
	Symbol
Accessible Print	

Figure 16: Accessible Print is a symbol, the availability of a large prints.

Accessible print is a symbol that represents the printed books, pamphlets, museum guides and theatre programs with huge letters for the users with vision inabilities (Figure 16).

The Information Symbol	Symbol
	 Figure 17: Information symbol, shows the place of the information desk.
Uses / Examples	
 Source: Induct Trade. (n.d.). ITPP1 Tactile guide stripe for the blind and for the visually impaired.	

Figure 18: Information & security desks should be accessible by all users.

The information symbol (Figure 17) is the most important symbol in public spaces for the user with special needs, it indicates the security and information desks; it can be used on signage or on floor tactile (Figure 18).

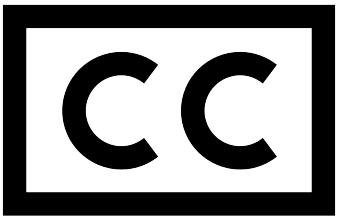
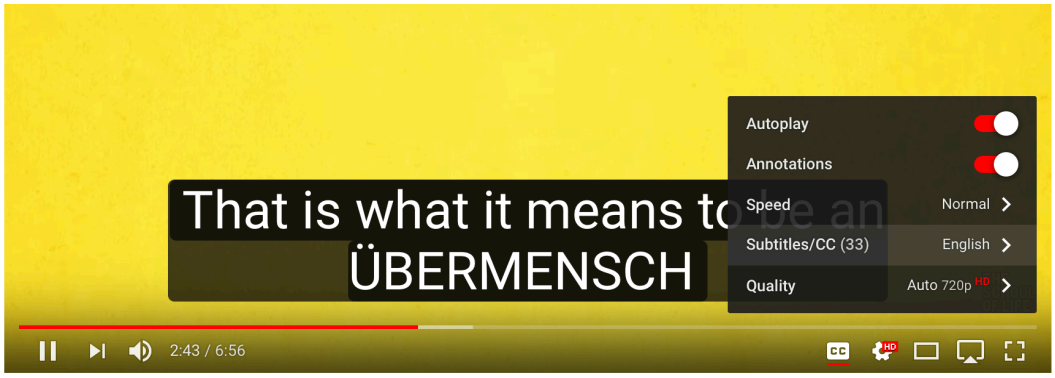
	Symbol
Closed Captioning	 Figure 19: Closed Captioning symbol.
Uses / Examples	 Source: The School of Life (Director). (2014, October 10). *PHILOSOPHY - Nietzsche* [Video file].

Figure 20: Used to help the users to read the dialogs in a movie, TV, & online.

The final symbol, Closed Captioning (CC) (Figure 19), indicates the possibility of using captions in televisions and videotapes. These captions can be used by individuals with hearing inabilities and deaf users by reading the captions at the bottom of the screen (Figure 20).

2.1.1.1 Numbers and Statistics of People with Special Needs Around the Globe

Global Burden of Disease and The World Health Surveys are two different studies gathered by The World Bank in 2016, these studies are about the people with special needs in the world population, both studies found different numbers with similarities in the average number of special needs individuals around the globe by their country's per-capita income. Global Burden of Disease analysed the prevalence of disability in the year 2004 around the world and found that around 978 million of the world population are considered moderate or severely disabled; which means 15.3% of world population, and around 185 million are severely disabled; which amounts to 2.9% of world population. Table 3 and 4show the percentages of severely disabled and moderately disabled individuals divided by the area capita income around the world (The World Bank, 2016).

Table 3: Prevalence rate of severe disability.

Serve Disability								
Gender and Age groups (years)	Rest of the world	High income countries	Low and medium income countries					
			Africa	Americans	South/East Asia	Europeans	Eastern Mediterranean	Western Pacific
Percent (%)								
Male								
0 - 14	0.7	0.4	1.2	0.7	0.7	0.9	0.9	0.5
15 - 59	2.6	2.2	3.3	2.6	2.7	2.8	2.9	2.4
≥ 60	9.8	7.9	15.7	9.2	11.9	7.3	11.8	9.8
Female								
0 - 14	0.7	0.4	1.2	0.6	0.7	0.8	0.8	0.5
15 - 59	2.8	2.5	3.3	2.6	3.1	2.7	3.0	2.4

≥ 60	10.5	9.0	17.9	9.2	13.2	7.2	13.0	10.3
All people								
0 - 14	0.7	0.4	1.2	0.6	0.7	0.8	0.9	0.5
15 - 59	2.7	2.3	3.3	2.6	2.9	2.7	3.0	2.4
≥ 60	10.2	8.5	16.9	9.2	12.6	7.2	12.4	10.0
≥ 15	3.8	3.8	4.5	3.4	4.0	3.6	3.9	3.4
All ages	2.9	3.2	3.1	2.6	2.9	3.0	2.8	2.7

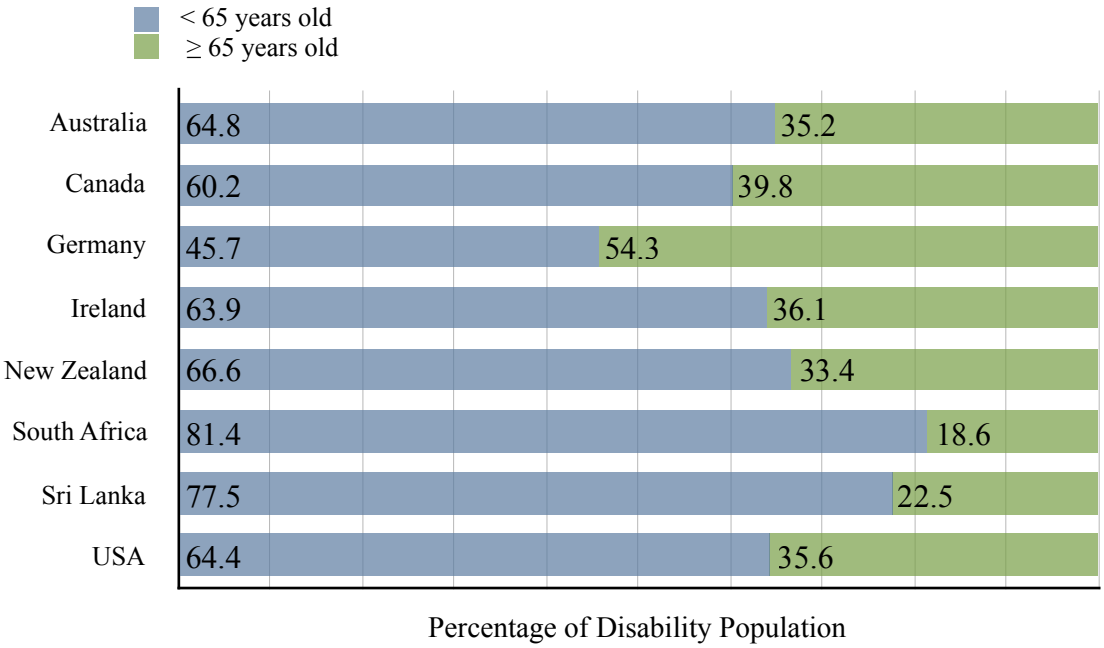
Table 4: Prevalence rate of moderate and severe disability.

Moderate and severe disability								
Gender and Age groups (years)	Rest of the world	High income countries	Low and medium income countries					
			Africa	Americans	South/East Asia	Europeans	Eastern Mediterranean	Western Pacific
			Percent (%)					
Male								
0 - 14	5.2	2.9	6.4	4.3	5.3	4.4	5.3	5.4
15 - 59	14.2	12.3	16.4	14.3	14.8	14.9	13.7	14.0
≥ 60	45.9	36.1	52.1	45.1	57.5	41.9	52.1	46.4
Female								
0 - 14	5.0	2.8	6.5	4.3	5.2	4.0	5.2	5.2
15 - 59	15.7	12.6	21.6	14.9	18.0	13.7	17.3	13.3
≥ 60	46.3	37.4	54.3	43.6	60.1	41.1	54.4	47.0
All people								
0 - 14	5.1	2.8	6.4	4.5	5.2	4.2	5.2	5.3

15 - 59	14.9	12.4	19.1	14.6	16.3	14.3	15.5	13.7
≥ 60	46.1	36.8	53.3	44.3	58.8	41.4	53.7	46.7
≥ 15	19.4	18.3	22.0	18.3	21.1	19.5	19.1	18.1
All ages	15.3	15.4	15.3	14.1	16.0	16.4	14.0	15.0

Source: Global Burden of Disease estimates, 2004

Based on World Health Surveys, it was estimated that in 2010 the world population included 5.04 billion people aged 15 or older, and 1.86 billion people aged 15 or younger with a total of 6.9 billion people worldwide. The previous study mentioned (Global Burden of Disease) found that the numbers of people with special needs aged 15 years and older is ~785 million to ~975 million, and over a billion people are considered disabled; which constitutes 15% of the total world population including children. The low income countries are those with 12,236 $/year or more per-capita, while the medium income countries are those with between 3,956 $/year and 12,235 $/year per-capita, and the low income countries are those with 1.005 $/year or lower. The rates are taken from the Gross National Income (GNI) at 2016 (The World Bank, 2016). As noticed, the countries with higher income have lower numbers in human disabilities, and the countries with medium and low income have higher human disabilities percentage.



Source: World Health Bank, 2011.

Figure 21: Numbers of disables around the world in percentages.

Figure 21 show the percentages of the people with special needs in the world population compared to their age taken in 8 countries; Australia 2003, Canada 2006, Germany 2007, Ireland 2006, New Zealand 2006, South Africa 2001, Sri Lanka 2001, and United States of America 2007.

A study from the International Labour Office in 2007 found that 16 of the 111 surveyed countries had no data about any employees with special needs. Table 5 shows the rate of employment between the special needs employees and normal employees in eighteen countries: Australia, Austria, Canada, Germany, India, Japan, Malawi, Mexico, Netherlands, Norway, Peru, Poland, South Africa, Spain, Switzerland, United Kingdom, USA, Zambia (World Health Bank, 2011).

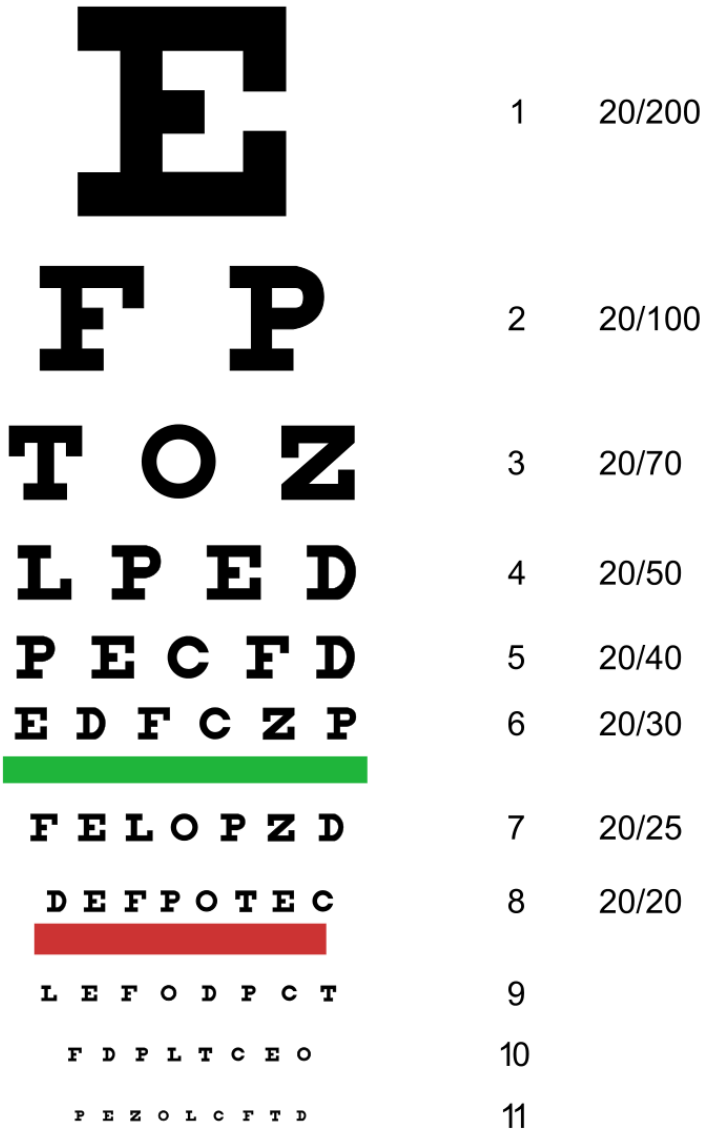
Table 5: Employment ratio in selected countries.

		Percent (%)		
Country	Year	Employees with disability	employment rate of overall population	Employment ratio
Australia	2003	41.9	72.1	0.58
Austria	2003	43.3	68.1	0.64
Canada	2003	56.3	74.9	0.75
Germany	2003	46.1	64.8	0.71
India	2002	37.6	62.5	0.61
Japan	2003	22.7	59.4	0.38
Malawi	2003	42.3	46.2	0.92
Mexico	2003	47.2	60.1	0.79
Netherlands	2003	39.9	61.9	0.64
Norway	2003	61.7	81.4	0.76
Peru	2003	23.8	64.1	0.37
Poland	2003	20.8	63.9	0.33
South Africa	2006	12.4	41.1	0.30
Spain	2003	22.1	50.5	0.44
Switzerland	2003	62.2	76.6	0.81
UK	2003	38.9	68.6	0.57
USA	2005	38.1	73.2	0.52
Zambia	2005	45.5	56.5	0.81

Table 5 shows the disables employment ratio in low-income countries; 58.7% males 20.1% females, for the high-income countries 36.4% males and 19.6 females, and all countries together with 52.8% males and 19.6% females employment ratio (World Health Bank, 2011). As noticed from Table 5, the special needs individuals employment ration is lower that the normal individuals in all the eighteen countries.

2.1.2 Definition of Visual Impairment and Blindness

After understanding the general human disability, the research will discuss the visually impaired and blind needs. To understand the visually impaired, we have to understand what they can observe and see during their daily life, and we need to understand their difficulties in interactions with life activities and how they deal with them. If a person is completely blind it means they cannot observe any kind of vision or light forms. Research shows that only 15% of blind people can observe nothing from visuals and lights, and being legally blind means you may still see and observe small amount of lights with no clear vision. The perfect sighted person's vision measurement is 20/20, with the number twenty meaning having clear vision within 20 feet (6.096 meters). Having a vision issue measured as 20/200 or less means the person cannot have a full clear vision of objects placed 200 feet (60.90 meters) unless they come closer to 20 feet (6.096 meters) distance to have clear vision (Brian, Wachler, 2015). These measurements are based on the Snellen Chart (Figure 22). The Snellen Chart was developed by the Dutch ophthalmologist *Herman Snellen* in 1862. This chart is used until this day in measurements by ophthalmologists around the world (Snellen, 1873).



Source: Dahl, J. (n.d.). *Snellen chart* [Photograph found in Wikimedia Commons].

Figure 22: The human vision measurement as known in Snellen chart.

Legally blind conditions cannot be fixed with glasses or contact lenses at the ophthalmologist. Legal blindness' definition varies from one place to another around the globe. Some states in the United Stated of America count on the ability to drive a car safely on streets to measure legal blindness (Brian, Wachler, 2015). The definition of the visually disabled is people who have difficulties in the observation of visual information which requires sight around their environment. The definition

of legally blind comes from governmental rates; the word legal defines the disability of people for governmental benefits, caused by their visual impairment. Blindness is a broad definition, which ranges from limited sight in observing objects, to the ability to observe lights. Most of blind people can observe lights and have some light perception. A research study shows that most causes of blindness are diseases and less than 3% are caused by injuries (American Foundation for the Blind, n.d).

Based on American Foundation for the Blind; There are eight vision terms: vision loss, clinically diagnosed vision loss, self-reported vision loss, legal blindness, low vision, visual impairment, functional limitation, and visual acuity. The statistical terms are three: frequency, prevalence, and incidence. Starting with vision loss, it means having sight problems even while wearing glasses or contact lenses, as well as the individuals who are totally blind. Clinically diagnosed vision loss defined is by using eye exams or standard measurement tools with a specialist or ophthalmologist. Self-reported vision loss is determined on an individual basis based on the person's understanding of the loss in their visual abilities. Legal blindness is the level of vision below 20/200 and 20 degrees or less. People diagnosed as legally blind still can perceive some lights and vision. Low vision means having some degree of vision but being unable to do daily activities such as reading, watching television, being safe outside, etc. Visual impairment is diagnosed as intensity of vision 20/70 or less (140 degrees). Visually impaired persons still perceive light and glare sensitivity, as well as light/dark environments. Functional limitation is the lack of interaction between the user and their activities such as reading, being safe, self-care, etc. caused by low vision. Visual acuity is a clinical measurement of the ability to focus on small

details like letters and symbols from a close distance. The measurement is 20/20; so if a normal person can see from 200 feet (60.96 meters), the visually acuity can see the same from a 20 feet (6.096 meters) distance. As mentioned earlier, the statistical terms are frequency, prevalence and incidence. Frequency is the number of participants who have the same disability in a huge number in the same age. For example 25.2 million adults in The United States of America have loss of vision. As for prevalence, the word itself means "proportion", based on percentages and numbers; like 21.7% of participants at 75 years of age have loss of vision. Incidence is a measurement of individual participants taken during period of time; for example "every year more than 50,000 Canadians lose their sight" (American Foundation for the Blind, 2008). The visually impaired people can still access educational system and written words by the braille writings, it is the gate of the visually impaired and all users with visual disability to the educational system and social activities. Braille was discovered in 1821 by *Louis Braille* as a new reading system for military purposes to read in the dark. Subsequently, this method was altered to be used by the blind and all people with visual disabilities to give them the opportunity to access educational, economical, and social well-being (Al Said, 2010). It was widely used in Northern America at schools and universities, such as the Perkins School for the Blind in 1832. This school was the first school for the blind and visually impaired students, to be followed in 1852 by the Iowa Braille and Sight Saving School. In 1947, the American Printing House for the Blind admitted the importance of providing printed braille books to the visually impaired students in schools and all educational systems (Schroeder, 1996).

2.1.2.1 Numbers and statistics of Visual Impairment and Blindness Around the Globe

Extensive research was carried out by the World Health Organisation (WHO) in the years 1995, 2002, 2004 and 2010, in which they studied and evaluated global eye health conditions and attempted to show numbers and graphs of the huge number of the visually impaired and blind compared to the world population. Figures 23, 24 and Table 6 are based on evaluations in the year 2010 by the World Health Organisation. The numbers show that around 285 million are visually impaired, out of ~6,9 billion total world population; which means ~4.25% of the world population is visually impaired. Within the number of visually impaired individuals in the world population; WHO study shows that ~39 million are totally blind (~14%), and ~246 million (~86%) have low vision and can still perceive and observe amount of light and blurred images. The study showed that 80% of visual impairment cases are avoidable and can be cured. Figures 23 and 24 show the numbers of the visually impaired, blind, and low vision individuals compared to the world population (Mariotti, 2010).

Table 6: Approximate number of people with visual impairment, 2010.

Ages (in years)	0 - 14	15 - 49	50 +	**Total** (All Ages)
Population (In Millions)	1,848.5	3,548.2	1,340.8	~6,737.5
Blindness (In Millions)	1.421	5.784	32.16	~39.365 (0.58%)
Low Vision (In Millions)	17.518	74.463	154.043	~246.024 (3.65%)
Visually Impaired (In Millions)	18.939	80.248	186.203	~285.389 (4.24%)

Table 6 shows the number of visually impaired around the world; there are around 285 million visually impaired around the globe (4.24%).

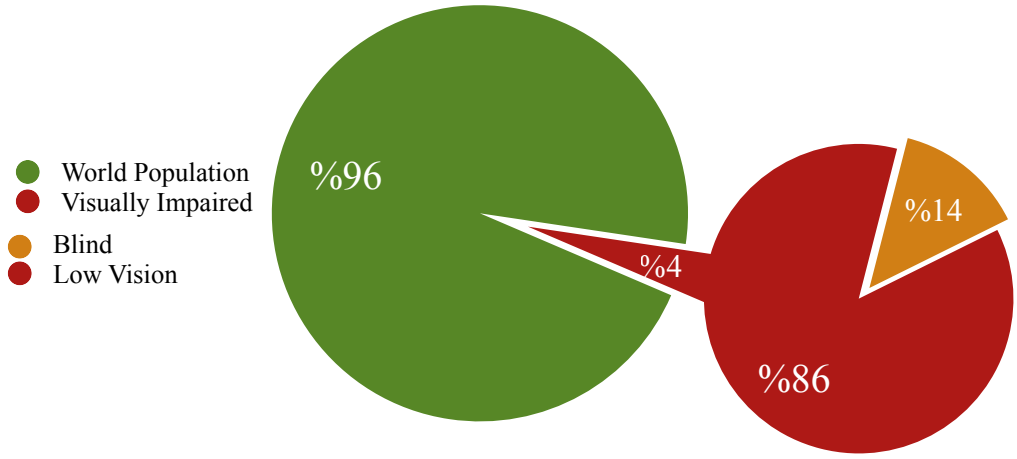


Figure 23: Percentage of visually impaired as it is in world population.

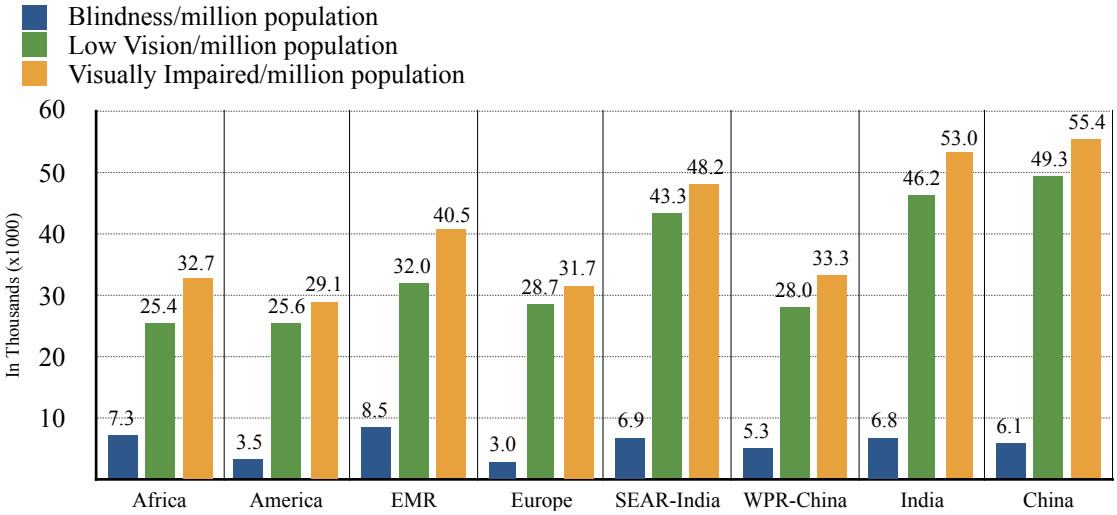


Figure 24: Numbers of blindness, low vision & visual impairment.

Wider studies from the same organisation (WHO) were conducted between the years 1980 - 2002, to show the prevalence of visual impairment and causes. WHO research study in 2002 gathered all the available data collected during years 1980 to 2002

about visual impairment and blindness in world population. WHO study presents the data available worldwide . Many countries around the globe didn't provide any data as WHO study shows. Starting from the **European Region,** the surveys covered around ~254,371 participants, while in the **Eastern Mediterranean Region** around ~82,527 participants were selected, the **Africa Region** with around ~312,560 participants, the **South-East Asia Region** covered around ~670,555 with ~404,381 participants selected only in India, the **Region of the Americas** (North and South) with around ~50,724 participants, and finally the **Western Pacific Region** presents ~3,768,139 participants with ~3,6674,125 only in China (Table 7) (Resnikoff, Pascolini, Etya'ale Kocur, Pararajasegaram, Pokharel, & Mariotti, 2004).

Table 7: Evaluation of visual impairment data.

Region	European	Eastern Mediterranean	Africa	South-East Asia	South-North Americas	Western Pacific
Year	1982 - 2001	1984 - 2001	1981 - 2001	1980 - 2002	1985 - 2002	1980 - 2002
Study Type*	PBS, Reg	PBS	PBS, Es	PBS	PBS, Es, Reg	PBS, Es
Level	Regional		National		District	
Sample Size	~254,371	~82,527	~312,560	~670,555	~50,724	~3,768,139
Average Age	All Ages					
Most Causes	Cataract ARMD	Cataract - -	Cataract Onchocerciasis Corneal Opacities	Cataract Retinal Disorders -	Cataract ARMD Glaucoma	Cataract ARMD Trachoma

*PBS Population-Based Surveys, Es estimate, Reg Register.

Source: Resnikoff, Pascolini, Etya'ale Kocur, Pararajasegaram, Pokharel, & Mariotti, 2004

Table 7 evaluates the visual impairment (blindness and low vision) data by regions, the table presents seven table rows which include all the data and numbers needed for any further studies using visual impairment and blindness criteria. From understanding the visually impaired numbers around the world and the most common causes of vision loss, the study concludes the age the individuals became visually impaired; most of people became visually impaired by sub-capsular cataract, this mostly hits the individuals with diabetes or by taking high doses of steroid medications, the other common cause of vision loss is the nuclear cataract, caused by ageing. Thus, many visually impaired lost their vision after period of lifetime with sight (Resnikoff, Pascolini, Etya'ale Kocur, Pararajasegaram, Pokharel, & Mariotti, 2004).

2.2 User Needs and Expectations in Home

This part of the study takes a part of a previous study done by the researcher *Jansen* at 2013 in Netherlands (*Why is Housing Always Satisfactory? A Study into the Impact of Cognitive Restructuring and Future Perspectives on Housing Appreciation*). This study focuses on the users' expectations and satisfaction in their houses and interior spaces. It shows numbers of participants taken from *House Buyers in Profile - in dutch Huizenkopers in Profiel* surveys. The other part discusses the visually impaired users' needs and expectations within their interior spaces and homes.

2.2.1 General User Needs, Satisfaction and Expectations

The study *Why is Housing Always Satisfactory? A Study into the Impact of Cognitive Restructuring and Future Perspectives on Housing Appreciation* focuses on the quality of residential units (houses) and the users' satisfaction. It inspects two psychological factors of living satisfaction: the first is cognitive restricting, and the

second is the future perspective. The hypothesis of cognitive restricting considers the dwellers who cannot change their suboptimal houses because of the low financial income. Researches show that these kind of dwellers are more satisfied and happy with higher level of appreciation in their houses. The second factor is the future perspective, its hypothesis discusses how dwellers have also high level of appreciation because of their future plans and hope of a new better situation. These can lead the dwellers to high levels of satisfaction and appreciation with their suboptimal dwellings. The study shows more details about twenty-three dwellers' aspects with their appreciation in their house/dwelling, from 0 (extremely unattractive) to 100 (extremely attractive). Based on these answers a weak impact was found in cognition restricting; suboptimal houses dwellers who have no future plan of moving to a new house are more satisfied and with higher appreciation for their current house. The participants were divided into four groups, the first group consists of the dwellers who have no future plans of moving and are satisfied with their current dwelling, while the second group consists of the dwellers who are satisfied with their homes yet have a future plan of moving to a new house. The third group is participants who do not live in their preferred home and are not satisfied with their living conditions but still have no future plan to move to a new house, and finally the fourth and last group involves the dwellers who are not satisfied with their dwelling conditions and have a future plan to move to a new dwelling (Table 9). The paper grouped the participants for future studies (Table 8) comparing the four groups and the level of their satisfaction in their homes.

Table 8: User satisfaction levels.

	No future aim to move	Future aim to move
Satisfaction *(Match)*	Group 1	Group 2
Dissatisfaction *(Mismatch)*	Group 3	Group 4

Source: S. J. (2013). Why is Housing Always Satisfactory? A Study into the Impact of Cognitive Restructuring and Future Perspectives on Housing Appreciation. Social Indicators Research, p. 359

The study shows that being satisfied and having a high level of happiness rate with a suboptimal house is due to low expectations and aspirations, *"I do not need that much,"* and their satisfaction with what they already have, *"what I have is good and fine."* Also, it is due to their attempts to make the best of the house they could not change. For any dweller, if they have a rough time believing in future changes, then satisfaction should replace the hopes, but if there is a contradiction between what they already have and their expectations about their preferred house; then dissatisfaction is more probable. That means not only the medium or high class dwellers are satisfied. Dwellers can be satisfied and happy with their living conditions in poor houses. As mentioned above, dissatisfaction results from high expectations and the comparison with the actual house. Some dwellers are able to decrease their dissatisfaction by moving to a new house, adjusting the house, or changing the idea of comparison and self-cognitions. The first two solutions (moving to a new house and renovating the house) are limited by financial issues and housing marketing. The third option/solution is the process of cognition adaption; such as, lowering their expectations and aspirations, *"I do not need that much."* With this considered, dwellers will be able to reach higher levels in dwelling satisfaction and happiness. That means house quality does not produce satisfaction and happiness,

cognition and perception do. Thus, dwellers might prefer what they already know and are satisfied with or are used to more than a new house even if their houses are in poor quality rate. Poor quality living and the rough situation of not being able to change the house to a new one might lead to satisfaction by believing that dwelling in this house can possibly be satisfactory by making the best of it, *"I cannot change the situation, so I will make the best of it"*; these lead to avoiding unhappiness and psychological complaints, so they lead to cognitive restructuring and satisfaction. Another factor that leads to dwelling satisfaction and happiness in earlier stages is believing in the future, "*It will soon be better." Bourne (1980)* describes family-mobility with three factors and stages as:

1. The starting baseline stage.
2. The short-term stage for progressive house adjustment in long-term changes.
3. Approximation of the perfect solutions.

Defining the first and second factors, these points are more like dynamic stages; depending on the long-term experience in house living and household changes; having experience at home will make dwellers aware of what they need and what they have. Third factor leads to satisfaction by achieving some approximation of the perfect solutions; not reaching the perfect solution, but being one step closer to it can leads to satisfaction. Previous research show that the dwellers who lived in reconstructed old houses might have been more satisfied and happy with their changes than their previous years of dwell; this explains the three stages mentioned earlier in satisfaction. Nevertheless, residents might show high residential satisfaction and happiness in their dwellings/houses even though nothing had happened yet.

Table 9: Number of participants & their average numbers.

	Match				Mismatch			
	No future aim to move in 2 years Group 1		Future aim to move in 2 years Group 2		No future aim to move in 2 years Group 3		Future aim to move in 2 years Group 4	
	*Avr.***	*n**	*Avr*	*n*	*Avr*	*n*	*Avr*	*n*
Living Room Size								
20-24m² (n = 115)	70.0	9	63.7	8	35.7	44	37.7	54
25-34 m² (n = 286)	69.9	93	69.5	84	48.2	57	54.9	52
35-44 m² (n = 256)	84.8	65	81.5	65	70.5	67	70.2	62
Number of Rooms								
1-2 rooms (n = 30)	80.0	1	/	0	43.3	12	37.6	17
3 rooms (n = 99)	81.1	22	80.0	22	51.4	22	43.8	33
4 rooms (n = 290)	82.0	64	81.5	57	72.7	76	65.9	93
Backyard Size								
5-8m² (n = 77)	61.6	16	58.9	18	39.5	21	33.7	22
8-12m² (n = 299)	73.2	101	73.2	77	49.8	67	51.8	54
13-17m² (n = 133)	83.8	33	79.7	16	74.5	49	62.3	35

Note: ***n**: Number of participants. **Match:** Satisfied with their homes.
****Avr**.: Average number. **Mismatch:** Unsatisfied with their homes.

Jansen, S. J. (2013). Why is Housing Always Satisfactory? A Study into the Impact of Cognitive Restructuring and Future Perspectives on Housing Appreciation. Social Indicators Research, p. 367

The researcher Jansen study attempts to discuss the cognition restricting *"I cannot change the situation, so I will make the best of it"* and future perspectives *"It will be better soon."* Describing these further, cognitive restructuring covers the dwellers with suboptimal house quality that believe in changes can possibly happen in their houses, so they attempt to make it a better place to dwell. The future perspectives cover the dwellers with suboptimal house quality and believe they can change the house situation in the near future (Jansen 2013). This research shows the connections between the dweller's satisfaction and their home condition, and connecting this to

the visually impaired dwellers and their satisfaction in home gives this research a gate to understand their connections between their needs and their financial issues. Thus, this thesis gives recommendation to the visually impaired dwellers regardless their financial issues, and more regard to the cognitive perspectives.

2.2.2 Visually Impaired User Needs and Abilities

The visually impaired people have the ability of understanding the geographical distances and configuration hierarchy. A study by *Kitchin (Tactile Reality: The Perception of Space in the Cultural Heritage for People with Visual Impairment)* grouped the low vision users into three, group one describes the congenitally blind (with no experience in vision caused by the loss of vision since birth) with the lack of the ability to recognise the environment and spatial organisation. Group two is about the people with visual disabilities and a cognitive ability of understanding the spatial concepts. They can still perceive information from the environment with some limitation caused by the vision loss and the huge utilisation of touching and hearing. The third group is about the visually impaired users who are able to understand and perceive their environment qualitatively and quantitatively. They can perceive enough information with no sight by using their other senses. Using hearing sense in interior spaces might help the users with vision disabilities; by sound they may not need vision to recognise the density of the space, which helps the sightless users understand the distance of the space they are in. The users with vision disabilities may use echo sounds as well. For example, they can perceive the space information by hearing footsteps and their echoes within the space. Another sense that was mentioned in this study is smell, which sense might help the visually impaired to recognising spaces, people, food, etc. Also, touch in most cases is the most familiar

sense employed by the users with visual impairment, as this sense may provide a huge variety for the brain to picture the object and recognise the surrounding environment by using braille tactile or any normal objects. Another factor in understanding the space with loss of vision is previous experiences with a specific space. For visually impaired individuals, it is easier to feel, touch, understand and recognise the spaces in which they have had a long experience in such as their private home or office (Andrade, Martins. 2015).

Another study from Université de Montréal in Canada shows that lights may boost brain activities during cognitive duties even for people considered as totally blind. Also, studies from Boston's Brigham, one of the best hospitals in the United States of America, and Women's Hospital in State of Louisiana found the same results which state that the brain can be more efficient with lights in cognitive tasks and duties,

> *We were stunned to discover that the brain still responds significantly to light in these rare three completely blind patients despite having absolutely no conscious vision at all. -Senior co-author Steven Lockley.*

Critical issues in vision do not block the brain from picturing the surrounding environment and observing lights. Brain activities still work the same like a sighted person. It can recognise night and day times with no sight needed, and it effects the visually impaired activities, mood, and cognitive tasks like any other person. A study by *Gilles Vandewalle* in *Belgium* found that blind participants are possibly able to recognise whether it is light or dark without vision, but only with their non-conscious brain. After spotting a light close to the participants' eye to check for any brain

activities, the results were positive. The brain responded to the light even with their sightless vision through the eye (Université de Montréal, 2013).

Visual Impairment usually hits the older in age, about 5% of older adults aged between sixty-five to eighty years old, and double the rate with adults aged eighty years old and older. The psychosocial consequences of visual impairment in older age leads to depression, debility in daily competence, and lack in leisure activities. The research *Everyday Competence in Visually Impaired Older Adults: A Case for Person-Environment Perspective* discussed wide spotlights to analyse its depth, yet more research is needed to support this area of studies. Furthermore, visually impaired users at their old age lose their connections between themselves and their physical environment. Table 10 and Figure 25 show answers of visually impaired users regarding the compensation efforts they take to finish their instrumental and normal activities of daily living.

Table 10: Categories suggested by *Bäckman & Dixon,* 1992.

Category	Examples
More Effort or Time	*"It takes much more time to dress myself but I can manage it alone."*
Use of Latent Skill	*"I use my fingers to notice when my cup is filled."*
Simplification of Behaviour	*"I only take frozen meals to manage cooking."*
New Behaviour	*"I learned in mobility training how to cross streets safely."*
Environment-Related Compensation Modes	
Prosthetics/Vision	*"I use magnifying glasses."*
Prosthetics/Mobility	*"I have to wear orthopaedic shoes."*
Prosthetics/Others	*"I use a tape recorder to send messages to other persons."*
Light	*"My son installed an additional light in the kitchen."*

Legibility	*"I keep a list of largely written phone numbers."*
Structure/Order	*"Everything must be in its right place to manage everyday life."*

Table has 10 categories developed with suggestions by *Bäckman, & Dixon* in 1992. The table shows the comments of visually impaired users when asked about having more effort or time in daily taska, use of latent skill, simplification of behaviour, new behaviour, prosthetics/vision, prosthetics/mobility, prosthetics/others, light, legibility and structure/order.

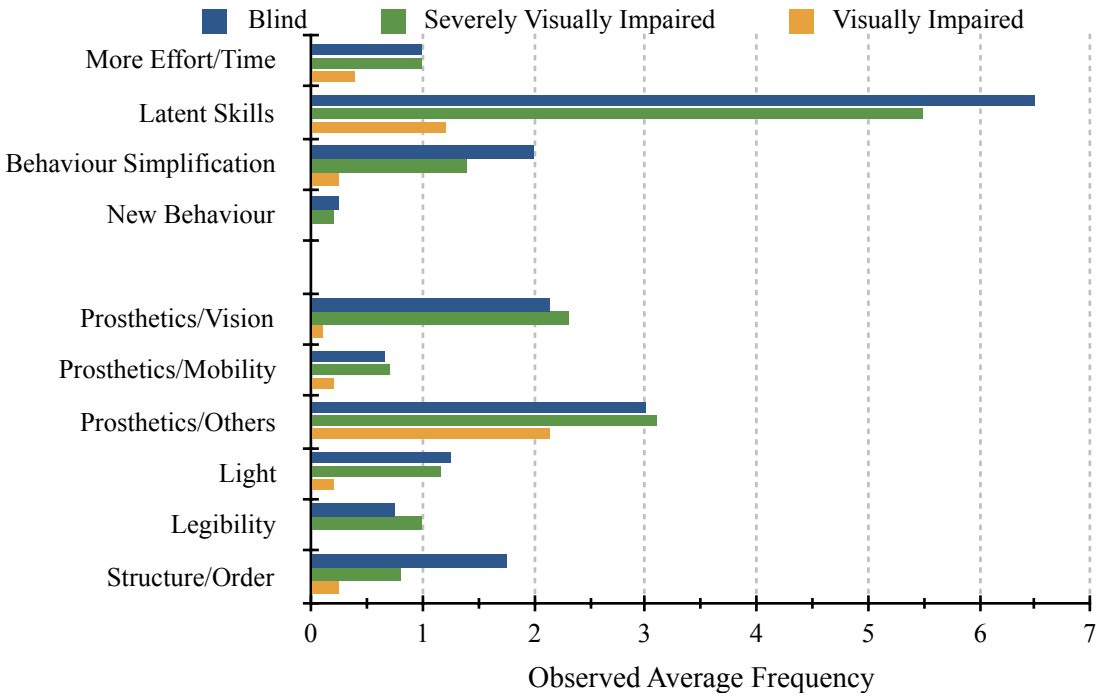


Figure 25: Compensation modes as process aspect of everyday competence.

The analysis part focuses on users' compensating efforts in their daily life routine. Figure 25 shows user's compensation events in life, 997 are blind older adults, 882 are severely visually impaired older adults, and 225 for the visually unimpaired older

adults. The study results show that both the visually impaired groups rely on skills like latent skills such as voice records or tactile/braille, these are made to simplify their activities, but the efforts create delays between the visually impaired and their conducting activities (Wahl, Oswald, & Zimprich 1999).

2.3 Human Behaviours Definition and Effects on Visually Impaired

The biologist Charles Darwin in his book *The Origin of Species in* 1859, expounded concatenations of natural selection proposed that the human beings around the globe whose anatomical, physiological, and behavioural characteristics have a higher chance of survival, can reproduce, and fit better in societies. Thus, if these characteristics continue, the next generations will have a higher rate of survival and reproduction in society (Darwin, 1859). Eventually, human behaviour is the result of human attitude through the experiences they gain in their lifetime. These experiences include the individual acts based on various reasons like genetics, social norms, core faith and attitude. Human behaviour can caused by definite attributes that produce various behaviours and human actions in each individual. These human behaviours are considered to be acceptable or unacceptable depending on the society and culture (Ajzen, Fishbein, 1999). Many studies of human behaviour field connect the physical environment with human aspects. Thus, interior designers and architects are participants in the field of human behaviour and the connection between it and its interior physical environment and elements (Altman, 1981). Recently, human behaviours have the ability of change with scientific developments, and this causes a danger, by controlling human behaviour and manipulating it (Biderman & Zimmer, 1961).

The human aspects are believed by the psychologist Irwin Altman to be behavioural mechanisms with psychological, emotional, and social needs. These aspects can be accomplished with many different concatenations by the user's needs and perception within intended levels. Therefore, interior designers and architects should consider the perceptual, cognitive, motivational and behavioural design process alongside the physical issues of design. All these considerations should come together before building a space or environment (Altman, 1981). To reach this design hypothesis, both researchers Krampen and Nasar suggest to consider some aspects such as the awareness of the user's surroundings, the sense of the surrounding space according to the user's perception, and the prediction of any possibility of different users (Krampen, 1997; Nasar, 1997). Visual impairment hits children eighteen years old and younger. Approximately twelve children are visually impaired out of each thousand children. This human inability affects young students negatively in terms of receiving information. Comparing to sighted students, visually impaired students receive information with levels of delay. Visually impaired and blind children have less incentive to engage and interact during activities that require more simulation and which are meant to be for sighted children like some sports, presentations, educational movies, etc. Furthermore, their human behaviour changes compared to other children. Besides the educational delays in receiving information and development, visually impaired students have another issue, which is related to physical interactions, this lack of interaction cause some delays between the visually impaired and the physical activities, which explains the lower levels of fitness compared to sighted students. Furthermore, the same study shows that 84% of the visually impaired participants have physical limitation in some types of physical

activities. All these numbers show the physical and psychological delays and their different the affects in human behaviour and the visually impaired interactions with their surrounding environment (Lieberman, Wilson, & Kozub. 2002).

2.4 Summary of the Chapter

To understand human disability and visual impairment, this chapter expounded the definitions of both inabilities. Human disability is defined by physical or mental impairment in an individual. This impairment delays the individuals from doing their daily routines like other users. Human disability defines a person who has been disabled for twelve months or longer. Visual impairment is defined by a sight range of 20/70 or less. Visual impairment can be measureed by Snellen chart; as shown in Figure 22, made by *Herman Snellen* in 1862. Some of visually impaired individuals can still possibly observe some amount of light and blurred pictures. This chapter concludes that there are around 978 million people out of the world population who are considered moderately or severely disabled. 15.3% of the world population (The World Bank, 2016) and around 285 million are visually impaired, amounting to 4.25% of world population (Mariotti, 2010). These statics and numbers of human disability and visual impairment around the globe confirm the need for design interactions throughout the design process which allow these individuals to perform daily living activities and routines more efficiently. Nevertheless, human experiences throughout life, affect the individuals and their living experiences, and human disabilities affect the user with special needs behaviour in their interior spaces and home. These limited human behaviours at home limit the users with special needs in terms of the amount of possible physical effort needed as well as their interactions within their interior spaces and home (Lieberman, Wilson, & Kozub. 2002).

Chapter 3

HOME DESIGN ISSUES & THE VISUALLY IMPAIRED DWELLER

3.1 Living Skills of the Visually Impaired Dwellers

To understand which living skills the visually impaired needs, Hazekamp and Huebner categorised them in their study as: personal hygiene and self-care, clothing and dressing, housekeeping, meal preparation and eating skills, social communication and financial management, using electronics and phones, writing skills, time arrangements and organisation (Hazekamp, Huebner 1989). These tasks are easier for sighted children since they learn by observing adults doing them, and it is for this reason that they learn most of these skills without being taught (Lewis, S., & Iselin 2002). The definition of disability in the community is refused in independent living movement because this definition adds limits to the people with disability and lowers their ambitions. In view of the fact that the people have been putting the special needs users outside of the community since a long time ago, in society they are known by their disability, not their aspirations and expectations. Thus, the people with disabilities are asking for normal positions in society equal to any other participants. They have the ability to run toward their own rewards, take their decisions and they also have the right to take risks independently. Most of the responsibilities from the special needs were taken by society, and this creates obstacles and limits to their daily life achievements. The users with special needs are demanding that society stops classifying them by their medical condition, and starts

giving them more responsibilities. Independent living is a right for all individuals regardless of their disability, not a given gift to the special needs from the society (Brisenden, 1986). The visually impaired and users with visual inabilities want the normal rights that any sighted and normal user has. They are not asking for total independence from society, but to be amalgamated with society. They do not ask for special needs or special approbation, but rather for equality in treatment (McKinley, 2006). The low independent skills of the visually impaired in their daily lives are caused by the low rate of employment of people with vision inability (DeLaGarza & Erin, 1993), wherefore nowadays' curriculum and education had been focused on daily life living skills for the visually impaired (Hatlen, 1996). A study in 2002, (*A Comparison of the Independent Living Skills of Primary Students with Visual impairments and Their Sighted Peers: A Pilot Study),* shows a comparison between ten sighted children and ten visually impaired children under eighteen year old, in which the study interviewed both sighted and visually impaired participants (Lewis & Iselin, 2002).

Table 11: Comparison between 20 sighted & visually impaired children.

		Visually Impaired	Sighted
Personal Hygiene	Teeth Brushing	10	10
	Taking a Shower	5	10
	Brushing Hair	3	8
	Wash Cloth / Towel Hanging	9	7
	Applies Band-Aids to cuts	1	7
	Using Alarm Clocks	2	4
	Using Watches	2	7
Kitchen Skills	Using a Knife	0	8
	Drinking From a Glass	7	10
	Preparing a Sandwich	2	9
	Using Cabinets	5	10
	Using Refrigerator	7	10
	Opening Bottles	6	10
	Using a Toaster	1	8
	Using a Can Opener	1	3
	Using Microwave	0	9
Indoor Skills	Clearing Dishes from Table	8	10
	Making Their Bed	3	8
	Tiding Up Their Bedroom	8	9
	Putting Toys in Place	9	8
	Sweeping	4	8
Outdoor Skills	Ordering Food	6	8
	Going to a Bus Stop	2	9
	Going to Neighbour's House	4	10
	Crossing Streets	1	7
	Opening Car Doors	7	10

Source: Lewis, S., & Iselin, S. A. (2002). A Comparison of the Independent Living Skills of Primary Students with Visual impairments and Their Sighted Peers: A Pilot Study 339-341

The results of the study show that the sighted participants are capable of completing 84% of their daily tasks independently, and the visually impaired children are

capable of completing only 44% of their daily tasks independently. Table 11 shows the study's results in visually impaired and sighted children's abilities in completing some of their daily living skills independently (Lewis & Iselin, 2002).

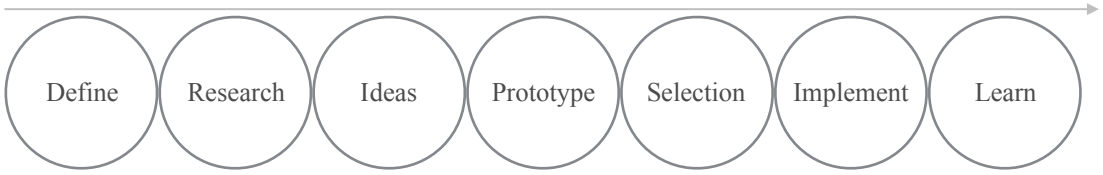
3.2 Designing a Home

The word *Home* has many definitions, the first definition of *home* is the place where the individual lives permanently. The other definition of *home* is the a family or individual that occupies a permanent dwelling (Oxford, n/d) . In the article *Longest Way Home*, Dave described a home as *"where the heart is"*, the writer of the article added, *"Wealth, it would seem, does not define home"*, and explained the need of all humans to have a place to call home no matter the income, race, religion and beliefs. You will always call one place "home" and return to it after a long voyage (Dave, 2017).

3.2.1 Definition of Universal Design

Universal and inclusive design procedure consists of seven steps: defining the design, research, ideas, design prototype, selection, implementation, and learning (Figure 26). The design starts with defining the user's needs and problems, because understanding the target's needs creates better solutions in design. The next step of the design process is to research for any possible information about inclusive designs, examples, the history of the design issues and the user's background. The next step is creating and giving the ideas to the users regarding their needs and expectations, and the following step is prototyping the design idea to present to the client or user. After the designers present their design ideas, the client should select one of the best designs to deliver the final design and start implementing the project. Learning from the design given to the client helps the designers improve their

experience and performance. These improvements are considered in future design processes for the designer (Ambrose & Harris, 2010).



Source: Ambrose, G., & Harris, P. (2010). *Design Thinking*. Switzerland: AVA Publishing.

Figure 26: Design process according to *Ambrose & Harris*.

Many factors lead us to inclusive and understandable design, and designing a good interior design, we do not need to include only the procedure of design process, but also the results. To help making the design usable and easy to understand, the final result of the design should come under the definition of universal design; we need to understand the terms and factors that make a design fair to all humans regardless their disabilities. Universal Design is one in which the design elements are easily usable by all users, and to the greatest extent possible (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997). The main seven principles of universal design are seven as shown at Table 12 and the next figures are:

- **Equitable-Use:** defined as the need for the design to be useful and equally marketable for all users with their abilities or disabilities. Equitability in design means to provide the same design for all users with the same means identically and equivalently when possible to avoid the separation and segregation of any users, to provide safety, security and privacy equally for all users, and to make the design equally appealing to all users (Figure 27).

Figure 27: Sliding doors at the entrances that are convenient for all users.

All users should be able to use the design of sliding doors like any normal users in shopping centres and public spaces. For example, as can be seen in Figure 27, design of the electronic doors with sensors should be used regardless of the user's age, status or abilities.

- **Flexibility in Use:** to accommodate individual abilities and uses by providing choices in how to use the object or design, like accommodating right or left-handed users, facilitate the user's precision work, and provide access to the user's adaptability (Figure 28).

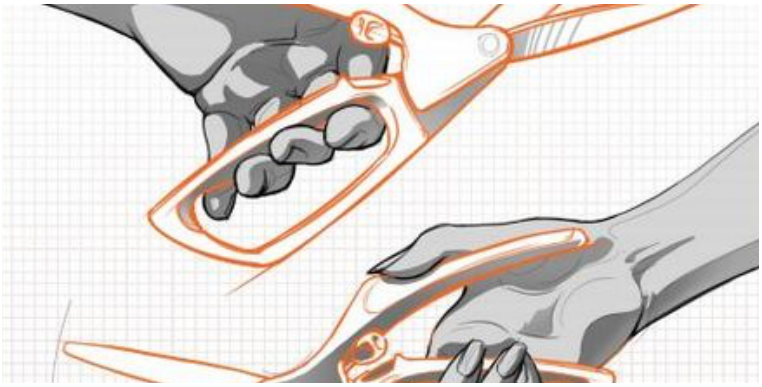


Figure 28: Scissor uses for right and left handed users.

The design should be usable by all, regardless of their abilities and preferences. For example, scissors can be used by both right-handed and left-handed users.

- **Design's Simplicity and Intuitively:** this means making the design easy to understand regardless of the user's knowledge, concentration level, experience and language skills. Reaching this point successfully means removing any unnecessarily complicated elements of the design, knowing the user's expectations, accommodating language skills and literacy, arranging the information required to understand the design by its importance, and providing feedback for the design (Figure 29).

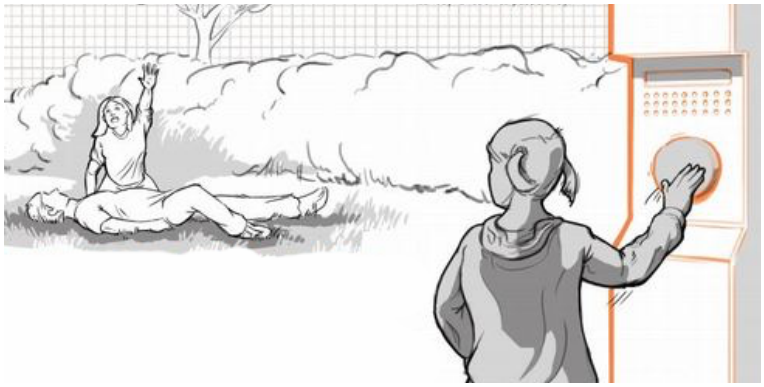


Figure 29: Eliminate unnecessary complexity.

The design of an element or a device should be easily understandable with a standard method or presentation, user-friendly and does not require special talent, skill, level of education, language, or experiences. For example, indoor fire alarms can be used by any user regardless of their age or ability.

- **Perceptible Information:** the design should deliver the necessary information effectively to the user regardless of ambient conditions or the user's abilities. The design provides this by using different modes like verbal, pictorial and tactile. It must present the information with the legibility of the one receiving it, make the instructions or directions easy to understand, and provide different techniques usable by people with disabilities (Figure 30).

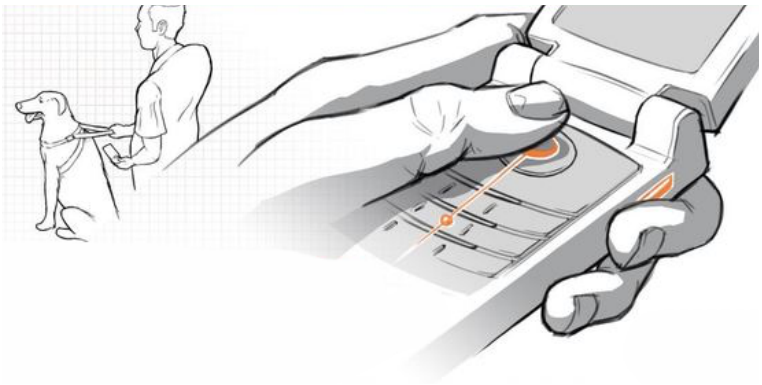


Figure 30: Instruction manual of electronics usable by any user.

The design should lead the user to its important information regardless of the user's abilities or age, like nowadays cellphones are usable by the visually impaired and it is easy to reach the important information needed.

- **Tolerance for Errors:** the design should minimise danger and provide a step back in case of any consequences or mistakes. We can minimise errors and hazards by arranging the elements provided to the user and isolating the dangerous elements, presenting the design with warnings on the dangerous elements that require vigilance and providing safe failure features (Figure 31).

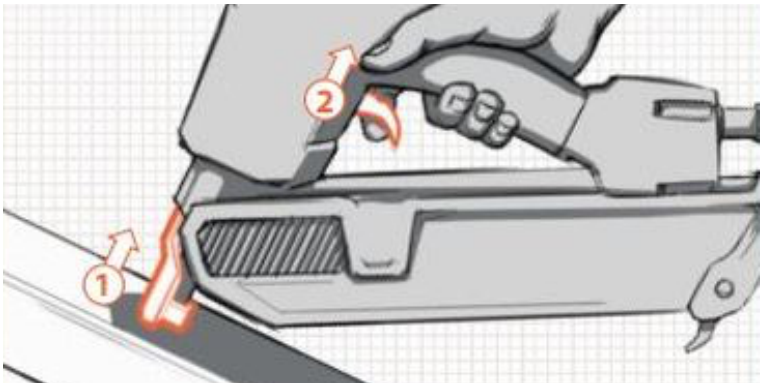


Figure 31: A design that gives a possibility of a step back *"undo"*.

The design should give the possibility of taking a step back in case of any mistake, like a nail gun in which the user will have an option to remove the nail and install a new one.

- **Low Physical Effort:** the sixth point states that the design should be useful and easy to use comfortably with the minimum amount of physical effort. The user should be allowed to use the design with a natural body position. They should also be able to use the design with a reasonable operating force, avoid repetitive efforts, and decrease physical effort to its minimum (Figure 32).

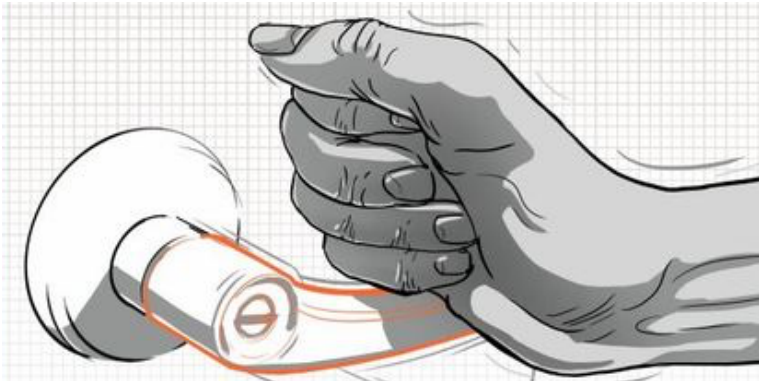


Figure 32: The lowest physical effort needed to use a door handle.

The design should be used by all users with the lowest effort needed regardless of their age and abilities. A door handle as an example should be used by all users with the least effort.

- **The Size of Space:** this is the space provided to the users, regardless of their size, posture, or mobility. The user should be able to use the design with maximum comfort, and the design should provide a clear sight of the important or dangerous elements, be made comfortably reachable, provide variations in hand/grip sizes, and provide enough space for users with assistances or with assistive devices (Figure 33).

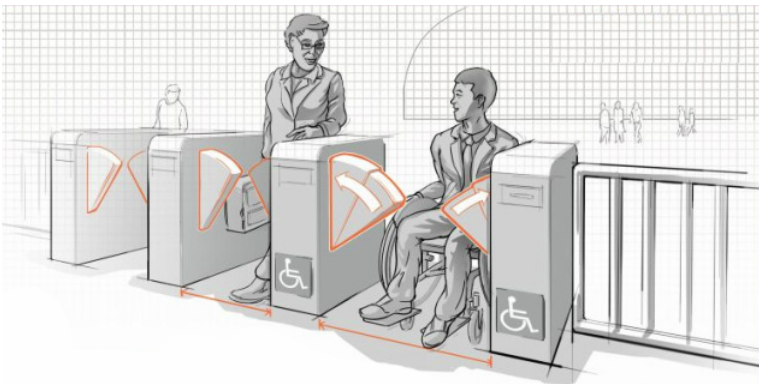


Figure 33: A checkpoint at the entrances to train stations, airports, etc.

There should always be a pathway and special entrances for the users with special needs like a wheelchair, which allow users with disabilities to pass through in a manner equal to any other user.

Table 12: Examples of each principle in Universal Design.

	Principles	Examples
1	Equitable Use	• Sliding doors at the entrances that are convenient for all users. • Integrated, dispersed, and adaptable seating areas in places like sports saloons and theatres.
2	Flexibility in Use	• Scissors uses for right and left handed users. • The ATM machines that has visual, tactile and audible feedback, trapped card opening and a palm rest.
3	Simple and Intuitive Use	• Eliminate unnecessary complexity, Arrange the important information and provide a feedback. • Use different languages to guide the user and know their expectations.
4	Perceptible Information	• A sidewalk or escalator in public spaces. • Instruction manual of a table, sofa, etc. with no drawings or texts.
5	Tolerance for Errors	• Like the car key, it maybe usable at both sides into the key-hole. • The "undo" feature at the computer's editing software with no penalty.
6	Low Physical Effort	• Lever or loop handles on doors. • Touchable lamp operated with no switches.
7	Size and Space for Approach and Use	• Mailboxes, dumpsters, snacks machines, etc. • The checkpoints at the entrances to train stations, airports, etc.

All the points in Table 12 are for both special needs and normal users. The principles of universal design does not cover all criteria of designing, rather, only globally usable design. There are many other important factors to follow while designing, such as aesthetics, safety, cost, gender and cultural appropriateness (Connell, Jones, Mace, Mueller, Mullick, Ostroff, … & Vanderheiden, 1997).

3.2.2 Definition of Home in Terms of Dwellers' Memories and Feelings

To understand the visually impaired and their experiences as human beings, we need to dig deeper beyond the medical facts. Regardless of the vision inability, feeling the connection between the interior space and the outside world is important to reach humans' daily life achievements and routines (Pallasmaa, 2005). Memories and

places simultaneously create everyday life, and together with memories, they create places out of space. Having knowledge of streets, spaces, buildings, and events may create memories and a sense of belonging to the space. We can reinforce our senses with our memories and feelings through the background and history of our experiences within the space (Tuan, 1979). The researchers *Hoelscher and Alderman* argue that experiences might possibly involve not only long-term experiences, but geographical places, monuments, buildings, and public spaces. This approach may create memories and feelings in a place without having long-term experiences within the space (Alderman, Hoelscher, 2004). Visually impaired people may easily recognise the space in which they are dwelling, as opposed to new spaces they have no experience with. Connecting this approach to visual disabilities, the dwellers may fail to spot new spaces compared to the spaces they have long-term experience in; for example, the private spaces they are dwelling in compared to other spaces they are not familiar with (Baker, 2012). *Pallasmaa* discussed a different definition of home related to the untouchable feelings in a home, not the physical elements of the interior spaces of a home. Most architects nowadays design dwellings as an architectural manifestation of space, structure, and with everything in order, which makes the dweller unable to be more subtle, emotional and diffuse aspects of homes. As a result, students still get their education as architects to design houses, not homes, and the loss of empathy and passion in modern dwellings is noticeable, as most of nowadays' architecture has become self- referential and autistic. The word home is different than house; when we say home, we feel protection, warmth, love, care, and childhood memories. The dwellers may change their house a few times, but will still have one space they will always remember, feel safe in, and call home

instead of house. Thus, home is the place where we feel relaxed, safe, and where we can rest in peace and dream with no disturbance. In some cases, home has become a public place, and public places have become homes. These cases are rare, for example, *Louvre Palace* was a private home and a castle, which over time became a museum. Connecting this approach to the visually impaired users and their experiences, feeling safe and independent in a home is one of the goals that any user should reach while living in their private space regardless of any abilities or disabilities (Pallasmaa, 1995).

3.3 Interior Spaces for the Visually Impaired

This part of the thesis discusses the designers' problem solving in home design and two case studies for institutes made for the visually impaired and users with visual inabilities. *Batthyány László Institute* by A4 Studio, and *The Center for the Blind and Visually Impaired* in Mexico City. The end of this part explains the independent living of the visually impaired users in their homes.

3.3.1 General Home Design Problems and Problem Solving definitions

As *Ambrose* and *Harris* argued, the design user should be considered by the designer, whether the user with special needs, visually impaired, or old may impact the designers and their design (Ambrose & Harris, 2010). *Roozenburg*, *Eekels* & *Meijers* explained design underestimation in which the design problems are always underestimated in two ways: The first is that the design can never complete the design description in term of needs, requirements and intentions, and the second is that the design has never been enough as a form (Roozenburg & Eekels, 1995 ; Meijers, 2000). Both of these underestimations lead to a gap between the design problems and design solutions and this gap leads to the belief of a lower possibility

of solving the design problem. The philosopher and professor in urban planing *Donald Schön* described design as *reflective practice*. *Schön* believed that the design constituent is underestimated by the designers and the misunderstanding of the nature of human design activities, which both lead to design problem and design flaws (Schön, 1983). A research done by *Dorst* in 1997 shows impacts in *interpretive behaviour of the designer*. Since the design in general is problem-solving; the design needs to be controlled and explained to the client or target. S*ubjective interpretation* became an important term in the designing phase where the designer's problem is ill-structured by the designer. Whenever the freedom of choice or design is given to the designers, they should figure out their own perception of the problem and explanations to be able to proceed to the design process. This kind of freedom of choice creates confusion for students and designers; and in turn this confusion creates extra time in considering the kind of problem they are confronting in the early stages of designing and problem solving (Dorst, 1997). Nonetheless, problem solving in the design process depends on the designer's experience and the level of skills of design problem solving (Dreyfus, 2003).

3.3.2 Case Studies with Interior Space Design for the Visually Impaired

Batthyány László Institute for the Blind by A4 Studio in Budapest, the capital of Hungary, was founded in 1898. The institute provided shelters and homes for all kinds of children with any disadvantages like blindness, visually impairment, disability, and mental retardation. Most of the children staying in this institute are orphans who have no place to call home. The institute supports them until they reach the age of eighteen and then let them go without knowing the hardness they could face with their disabilities in their future. A4 studios had a concept of keeping these

children who reach the age of eighteen and more and have no shelter or a place to dwell, and so an bridge built connecting the old existing building with the new extension. The extension was built by the architects *Géza Kendik*, *Zoltán Papp*, *Orsolya Maz*a, *Viktória Dóczy* and *Sándor Gombár,* It contains five floors with common spaces used as activity and dining rooms placed at the ground and first floors. The rest of the floors are used for private spaces as bedrooms. The aim A4 studios followed was creating simple, user friendly, and safe interior spaces. The interior spaces and corridors were provided with natural sun light with some perforated metal sheets to reduce the sun rays in the summer as shown in Figure 34.

Source: Kendik, G., Papp, Z., Maza, O., Dóczy, V., & Gombár, S. (2015, July 31).Batthyány László Institute for the Blind / A4 Studio. Retrieved February 28,2017, from www.archdaily.com/771020/batthyany-laszlo-institute-for-blinds-a4-studio

Figure 34: Perforated metal sheets.

These sheets were placed on the exterior facade of the building with a large glass surface. The architects made these sheets with a concept of braille subtitles that say: t*rust, home, shelter, and love*. Everything designed in and out of the institute had a

reason and concept, for example, the windows they designed with different shapes and sizes in each room to help the kids' orientation (Figure 35), since some of the visually impaired users can see blurred images, therefore, they can figure out which room it this, or if this room is their correct destination or not by observing the sun light coming from the outside into the interior space.

Source: Kendik, G., Papp, Z., Maza, O., Dóczy, V., & Gombár, S. (2015, July 31).Batthyány László Institute for the Blind / A4 Studio. Retrieved February 28,2017, from www.archdaily.com/771020/batthyany-laszlo-institute-for-blinds-a4-studio

Figure 35: Different windows shapes and sizes.

Another concept was added to the building on the exterior facade as sheets. These sheets were designed with a concept of Rubik's cube and flames, known in Hungary and Azerbaijan as traditional motivation. In this institute they used universal design that can be useable by the user, which featured the size and location of the window in each room, the natural lighting by making the blinds feel different levels of warmness in each room, and braille subtitles on main exterior facade presents blurred pictures for the visually impaired kids (A4 Studios, 2015).

Another center for the blind was built in 2001 in Mexico City, Iztapalapa. *The Center for the Blind and Visually Impaired* was built as part of a program created by the city government, providing services for the visually impaired and blind who exist in a huge numbers in the population of Iztapalapa. The 14,000 square meter building's plan can be read as layers, the first layer showing the entrance with stretched parallel strips including administrative offices, cafeterias, and a utility area. The second layer contains a store, a sound and touch gallery, and five workshops for art and crafts, while the third layer includes all the classrooms with a garden view, and a private courtyard, and finally, the last layer includes volume differences in heights, a library, a gymnasium/auditorium, and a swimming pool. In this project they used the spaces and lights for the interior spaces to allow the visually impaired users to recognise the space they are entering; in addition to flat roofs with different space densities, light intensity and material weight added on floors such as concrete, bricks, steel and glass. The center aims to allow the visually impaired/ blind users to experience and use all their other five senses. The designers used a water channel leading to the heart of the center (Figure 36), so the user can be orientated by using the sound of the water to reach the heart of the building.

Source: Center for the Blind and Visually Impaired / Taller de Arquitectura-Mauricio Rocha. (2011, August 10). Retrieved February 24, 2017, from www.archdaily.com/158301/center-for-the-blind-and-visually-impaired-taller-de-arquitectura-mauricio-rocha

Figure 36: Water channel leads to the center.

Also, the sense of touch was used by the designers by adding hand height tactile horizontally and vertically on walls to guide the users to their required destinations and allow them to identify their location in rooms and corridors as shown in Figure 37.

Source: Center for the Blind and Visually Impaired / Taller de Arquitectura-Mauricio Rocha. (2011, August 10). Retrieved February 24, 2017, from www.archdaily.com/158301/center-for-the-blind-and-visually-impaired-taller-de-arquitectura-mauricio-rocha

Figure 37: Hand height tactile.

The third method used by the designers is the sense of smell, individuals can recognise their exterior spaces by smelling special fragrant plants and flowers, and these smells provide orientation for the users to keep them aware of their location within the complex. The landscape architect *Jerónimo Hagerman* made these exterior spaces much easier to recognise, and more useable by the visually impaired and blind. He achieved this aim by putting their other senses they have at work instead of the one sense they've lost, and this was the aim of this center as well; to make it possible for the users with special needs to be more independent (Taller de Arquitectura-Mauricio Rocha, 2011).

3.4 Summary of the Chapter

A study (*A Comparison of the Independent Living Skills of Primary Students with Visual impairments and Their Sighted Peers: A Pilot Study*) interviewed twenty children about their ability to complete their daily tasks and living skills independently, and the results show that sighted children are capable of completing 84% of their daily tasks independently and the visually impaired children are capable of completing only 44% of their daily tasks (Lewis & Iselin, 2002). The visually impaired are not asking for full independency in living from society, but rather for the right of being amalgamated with the society as normal participants (McKinley, 2006).

Design problems are underestimated by designers and architectures, and designers need to consider the design problems as existed problems they are seen by the designer. Design problem-solving is different in skill from one designer to another. These differences are caused by the range of the designer's experience (Dorst, 2004). *Batthyány László Institute* and *The Center for the Blind and Visually Impaired* are institutes and centres for the user with visual impairment and blindness. Both these case studies provide easier access and living methods by design changes and interior space elements changes (A4 Studios, 2015 ; Taller de Arquitectura-Mauricio Rocha, 2011).

Chapter 4

FIELD STUDY

As stated in the introduction and the literature review in the difficulties between visually impaired dwellers and their interior spaces, and the necessary quality improvements in the living skills of the independent visually impaired users within their interior spaces; lead us to the main research question:

- What are the interior space suggestions that may make the daily tasks easier to achieve for the visually impaired users?

This thesis used explanatory research method, qualitative and quantitative. The participants were chosen from *Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu*, the only school for visually impaired children in Nicosia, Northern Cyprus, and some other visually impaired around the island. Participants were chosen regardless their age or gender. The answers were taken from nine visually impaired children beside their school's principle which is a visually impaired as well, the students' age range was six years old to eighteen years old. Another participant was a visually impaired student in Eastern Mediterranean University, and the rest of the participants are dwellers around Northern Cyprus. Because of the difficulties in language and communication with visually impaired children, the questions were given with explanations for each participant individually, with both English and Turkish language. This study choses the explanatory method owing to the fact that

the analytical results are all numerical in charts and tables. The data was collected in the summer of 2017 at *Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu* in Nicosia and around Northern Cyprus. The results helped to understand more the visually impaired participants' needs and their connections with their interior spaces.

4.1 Questions and Summary of Results

The research data collection tools consist of questionnaires; adults above eighteen years old with fourteen questions (Appendix a), and children below eighteen years old with eleven question (Appendix b). Both question forms were formed after understanding the visual impairment and the visually impaired needs from data collected from the literature reviews. Both forms asked for the age, gender, occupation, and the number of family members in their house and other questions about the dweller satisfaction and needs. Moreover, most of the questions ranged from "Strongly Agree" to "Strongly Disagree".

4.1.1 Study's Questionaries

The participants question form includes 14 questions (Appendix a):

(1) The first question asked about the participants and their home interior spaces and elements satisfaction in terms of use.

(2) The second question is the ability of accommodation within their home spaces.

(3) The third question asked about the ability to complete their daily routine and tasks independently.

(4) The fourth asked the participants about the possibility of moving to a new house and the reason behind it.

(5) The fifth question is about the need to live alone independently and the reason why.

(6) The sixth question asked about the hard and easy spaces within their interior spaces.

(7) The seventh question asked about which space they call a comfort zone to relax in.

(8) The eighth question is for any suggestions which could be done to facilitate the use of their interior spaces to make them easier in terms of use.

(9) The ninth question is about the home age and their years of living in it.

(10) The tenth question is about any existing memories and feelings within their current dwelling.

(11) The eleventh question is about whether or not their financial income is enough in terms of living.

(12) (13) (14) The remaining three questions are about any other suggestions and comments.

Questions **(4)**, **(5)** and **(11)** were removed from the question form for the eighteen years old participants or below (Appendix b).

4.1.2 Summary of Results

The answers were various as noticed (Table 13 and 14) and so many suggestions were taken from twenty visually impaired children and adults. When the researcher asked the participants about their home satisfaction in terms of use, ten participants were strongly satisfied, nine of them were satisfied, and only one participant was strongly unsatisfied (Figure 38). The second question was about the participants' abilities to accommodate themselves in their interior spaces, in which ten of the participants strongly agreed, and the other participants agreed with the exception of one who disagreed (Figure 39). Third question asked about the participants' abilities to following their daily routine and indoor tasks independently, in which nine participants answered as strongly agree, nine agreed, one participant disagreed, and the other one strongly disagreed (Figure 40). The answers to the question, "If there will be any possibility to move to a new house, will there be any aim to do it" were as follows: one participant strongly agreed, which was explained by the need of a better house to help him in his life as visually impaired individual, three agreed with the same reason of needing a new dwelling for better visually impaired needs, three of the participants disagreed, and five strongly disagreed, the researcher passed on this question for children visually impaired participants (Figure 41). The fifth question was about if the participant would like to live alone in home and the reason why, to which children passed the question, four answered as yes, and eight of the participants preferred to stay with their family and answered as no (Figure 42). The next question was about their hard and easy spaces to use in their home interiors, the answers were various with some similarities as follows: nine answered with the personal bedroom as their easy space, and three answers with the living-room. Four

participants agreed that the kitchen is the hardest space to handle in their interior spaces, and six participants found no hard spaces in their home (Figure 43). In question eight, the participants were asked about their comfort zone in their home, and the answers were not so different; eleven participants answered with the bedroom, nine with the living-room, and one answered with their closed safe balcony (Figure 44). The next question was about the house age and the years they have been living in, as shown in Table 14, nine of the participants did not know the age of their current house, four participants said that their house is ten years or older, and seven said their house is ten years or newer. When asked about their years of living in their current house, seven answered with ten years or more, and the other thirteen answered with ten years or less (Figure 45). The next question was about the existing of any family feelings and memories and compared to their yeas of dwelling; eight of the participants strongly agreed, six agreed, five disagreed and only one participant strongly disagreed (Figure 46). The survey's last question was about the family income and their satisfaction in terms of needs: the participants below eighteen years old and younger were excluded from this question, two participants had a high income, one low, and the rest of the participants were on average rate (Figure 47).

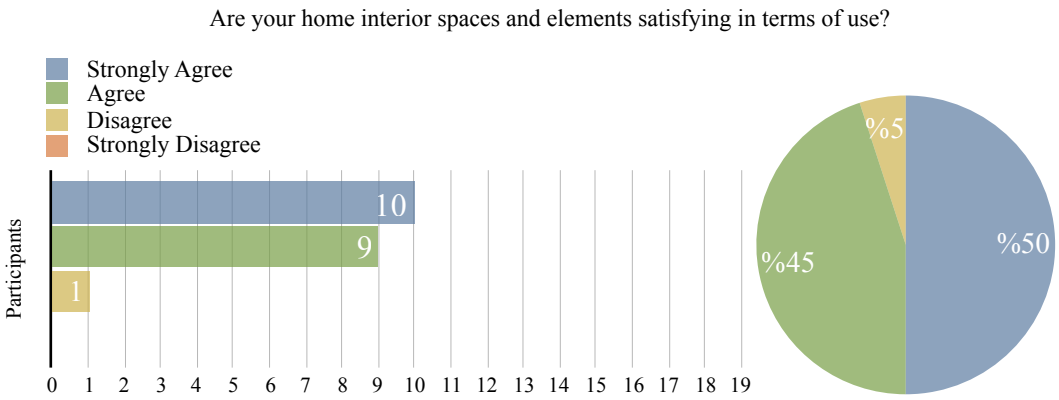


Figure 38: Answers about participants' home space satisfaction.

When the participants were asked about their satisfaction in their interior spaces in terms of use, 50% of the participants strongly agreed , 45% agreed, 5% disagreed and 0% strongly disagreed.

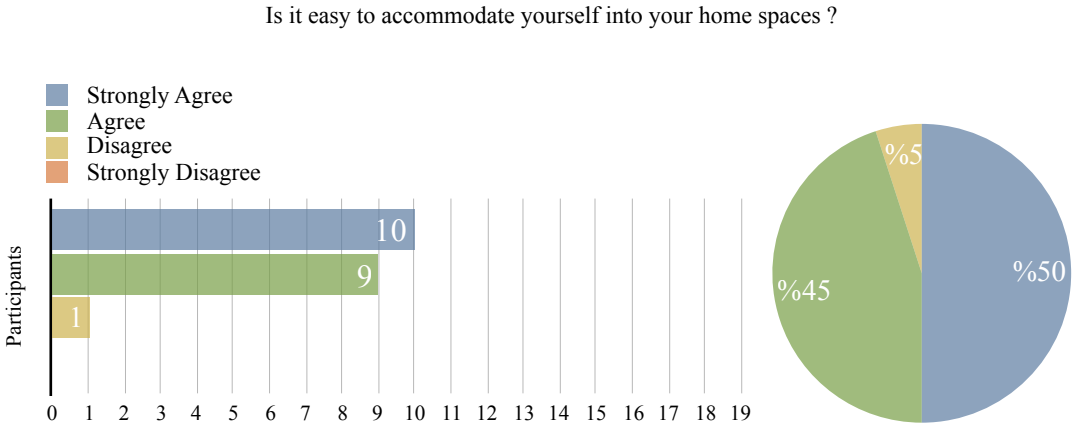


Figure 39: Answers about participants' ability of home space accommodation.

When the participants were asked about their ability to accommodate themselves into their home interior spaces, 50% of the participants strongly agreed, 45% agreed, 5% disagreed and 0% strongly disagreed.

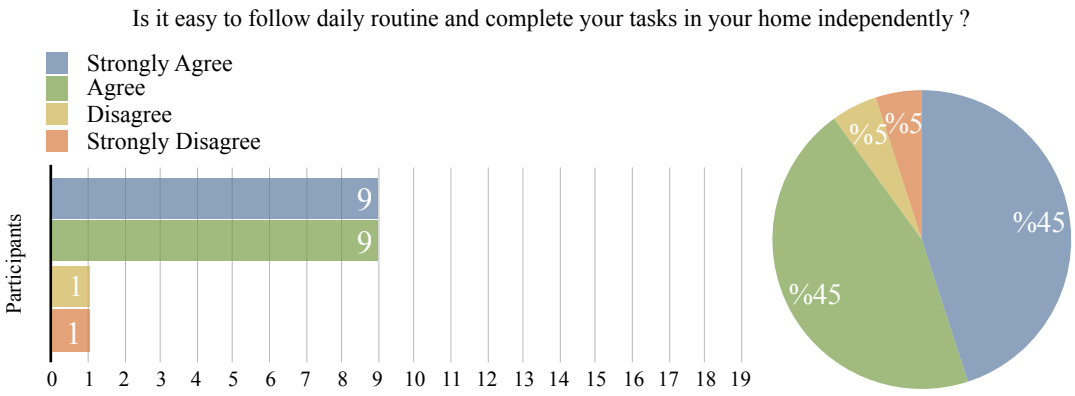


Figure 40: Answers about participants' ability of being independent.

When the participants were asked about their ability to complete their daily routine tasks independently, 45% of the participants strongly agreed, 45% agreed, 5% disagreed and the 5% left strongly disagreed.

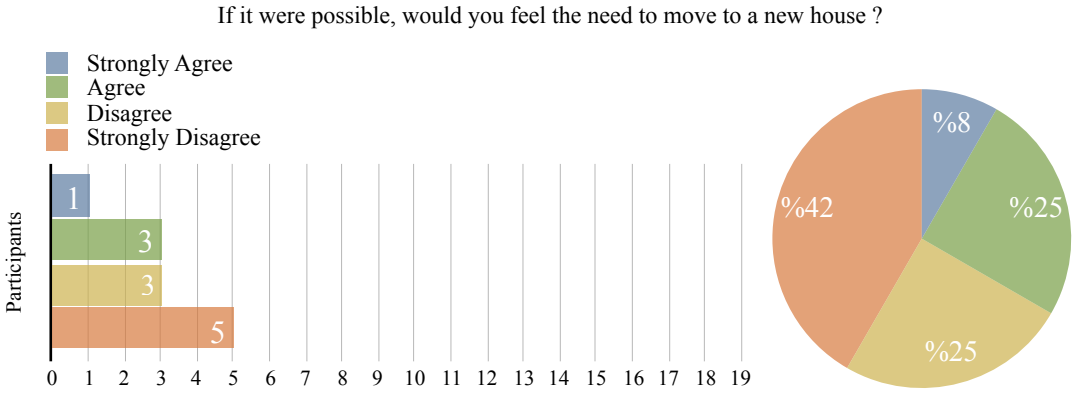


Figure 41: Answers about participants' needs of moving to a new house.

When the participants were asked about the possibility of moving to a new house if needed, only 8% of the participants strongly agreed, 25% agreed, 25% disagreed and 42% strongly disagreed.

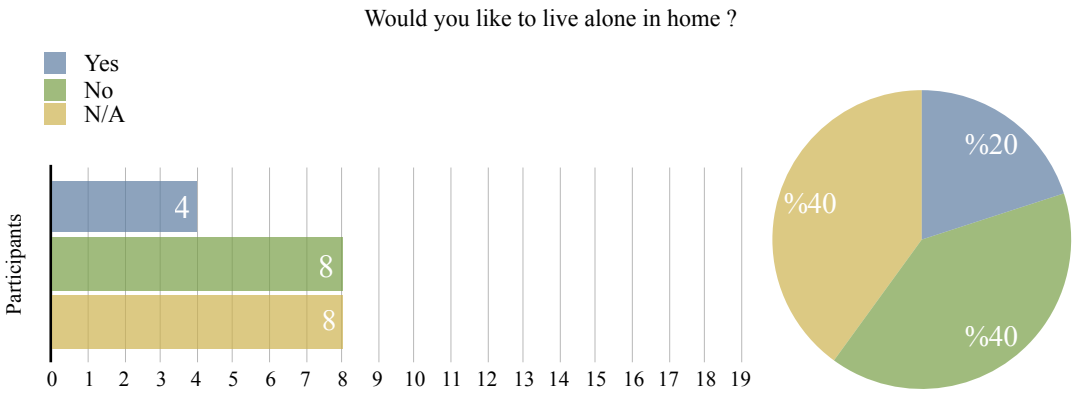


Figure 42: Answers about participants' needs of living alone.

When the participants were asked if they would like to live alone independently, 20% of the participants answered as yes, 40% answered as no, and the other 40% gave no answer and children were excluded.

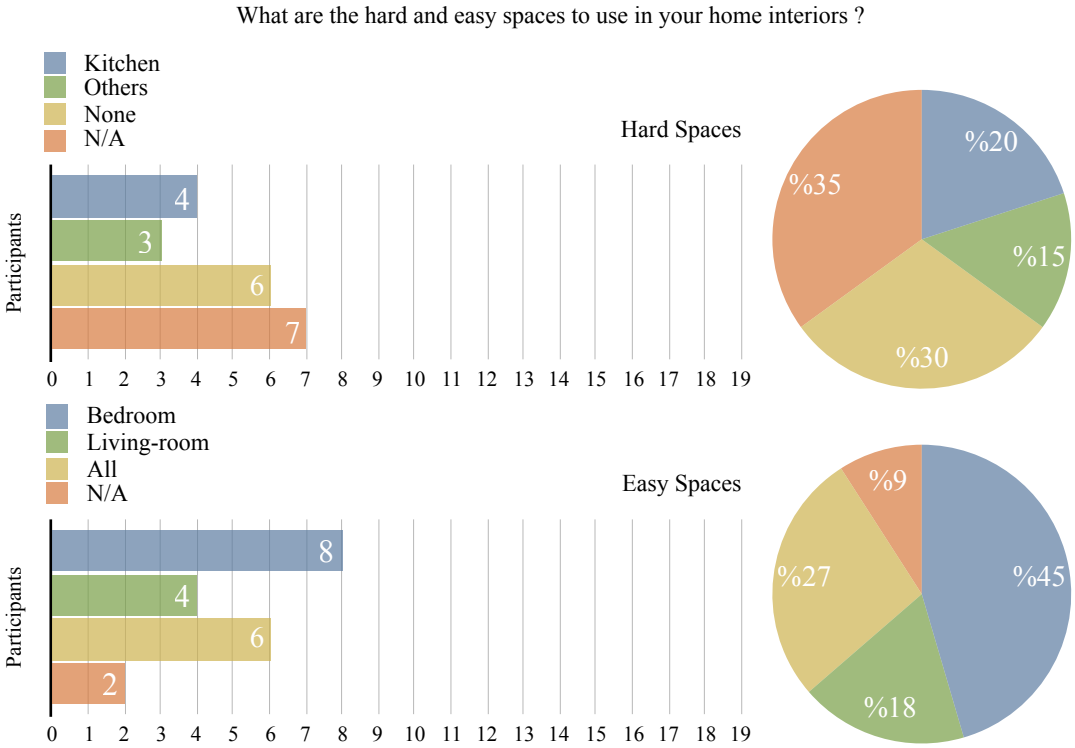


Figure 43: Participants' hard and easy interior spaces and elements in home.

When the participants were asked about their hard and easy spaces in their homes , many answers were similar as: 20% of the participants answered with kitchen, 15% pointed on other interior spaces, 30% had no hard spaces in their homes, and 35% gave no answer. As easy space, most of the participants with 45% said that the bedroom was the easiest space to handle, 18% answered with the living-room, 27% answered with all interior spaces are easy and 9% gave no answer. Only six participants have no hard spaces and consider all home as easy to handle.

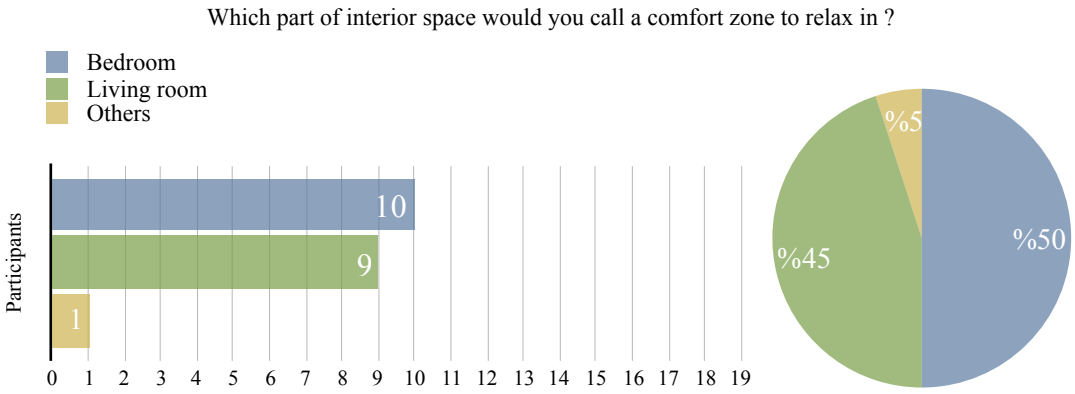


Figure 44: Participant's comfort zone in their home spaces.

When the participants were asked about their comfort zone space in their homes, 50% of the participants answered with the bedroom, 45% answered with the living-room, and the 5% left gave other different space.

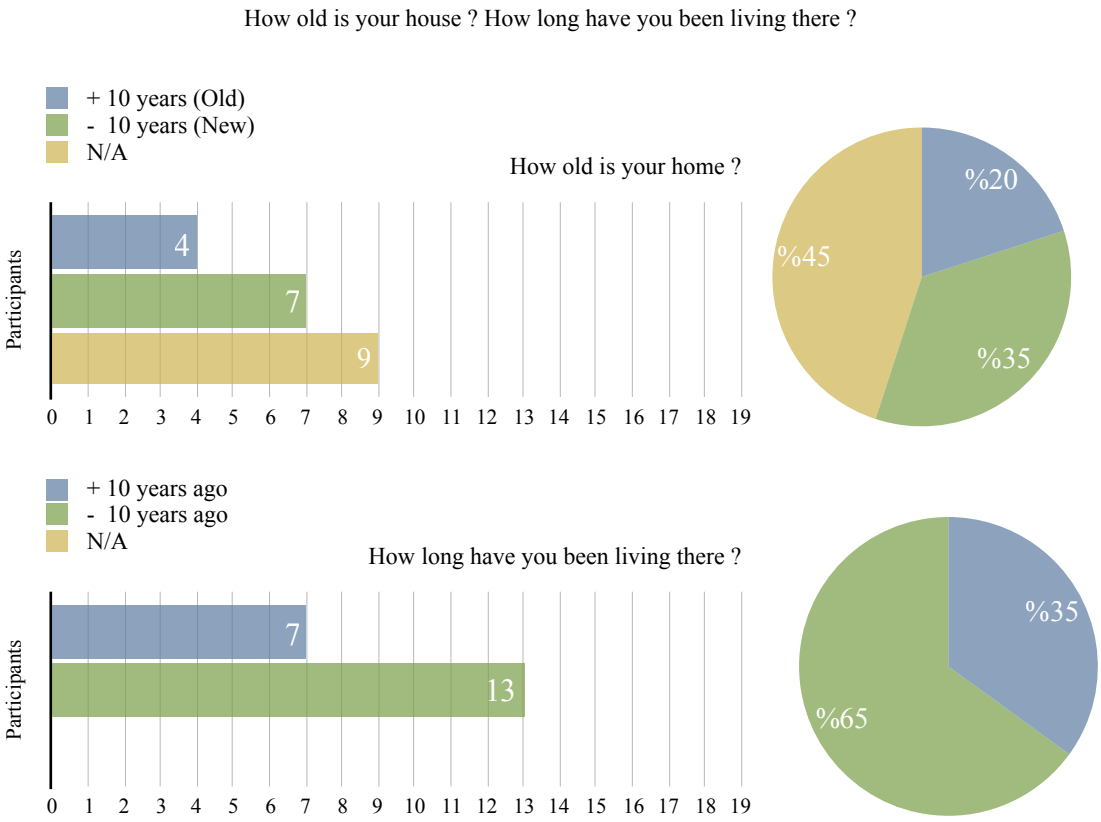


Figure 45: Participant's house age and the years of living.

When the participants were asked about the age of their home, 20% of the participants have old houses aged ten years or older, 35% have new houses aged ten years or less, and 45% gave no answer or they do not know the age of their homes. When they were asked about the years of living, 35% of the participants lived ten years or more in their current home, and the other 65% of the participants have been living in their current home for ten years or less.

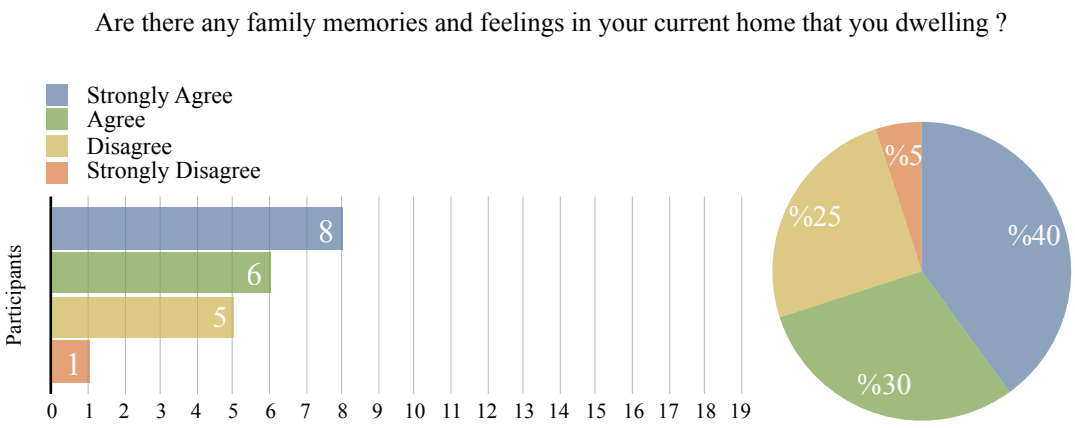


Figure 46: Answers about participants' memories & feelings in their home.

When the participants were asked about the existing of any family memories and/or feelings in their current home they dwell, 40% of the participants strongly agreed, 30% agreed, 25% disagreed, and 5% strongly disagreed.

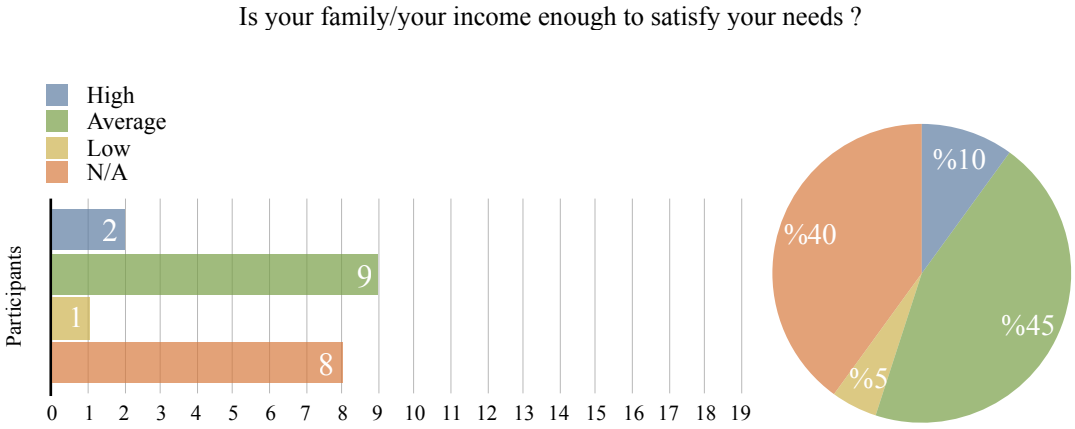


Figure 47: Participants' income/salary.

When the participants were asked about their satisfaction in their income in terms of daily needs, only 10% of the participants answered as having a high income, most of the participants with 45% have average income, 5% have low income, and the 40% gave no answer or were excluded as children .

4.2 Visually Impaired Difficulties With Their Home Interior Spaces

When mentioning the easy spaces in a visually impaired user's life, most of the participants answered with the bedroom and living-room. These two spaces havein common as easy spaces and interior space comfort zones. When the participants were asked about the difficulties in their interior spaces, the answers were various with some similarity. However, most of the participants agreed that there is no hard space in their home, but when it comes to the hardest part of the house, most of the answers were the kitchen, the participants described it as a *"dangerous space"*; a threat caused by the elements and items inside the house; such as sharp corners and items, hot electronics and dangerous movable elements. The closet, cabinet and wardrobe were also hard to manage as some of the participants described, these threats were caused by the changeable and unorganised items inside the cabinets. One suggestion given by a few participants was to install permanent interior furniture and elements, which may help them memorise the interior spaces and the elements' locations. Interior stairs and unorganised or zigzag walls were also cause a daily life achievement delays. One more factor that causes difficulties for the visually impaired as one of the participants said:

> *I am living by myself in a university dormitory, I can manage all the daily tasks and achievements easily, and the reason of this might be staying in the same dormitory even before losing my vision, it became my home. However, the only thing that bothers me in my interior space is the sharp corners in furniture, they hurt!. Another thing I cannot control is the electronics; I can never guess if the lights are on or off until I start feeling my eyes being dry and itchy, and I can never guess if the air conditioner is on or off until I feel the room temperature changes to hot or cold. Also, picking things from floor is too difficult, as much as putting and arranging them on my studying desk. Anything movable in my interior space is hard to manage, everything else is easy to manage and fine for me.*

These answers show why visually impaired users still have difficulties in their interior spaces. Table 13 shows the participants' answers when asked about their easy spaces, hard spaces and comfort zones within their interior space, and compare them with the ability of achieving their living skills independently. Seven of the participants strongly agreed with the ability of independent living, eight participants agreed with the ability of independent living, two disagreed and two strongly disagreed. After taking the answers and putting them together in tables (Table 13 and 14), the researcher noticed that the ability of independent living is more connected to the age of the participant and the long experience with their interior spaces.

Table 13: Results of visually impaired participants.

Queue	Age	Occupation	Hard Interior Spaces	Easy Interior Spaces	Comfort Zone	The Ability of Independent Living
1	64	Retired Civil Servant	Zigzag Corners	Livingroom, Bedroom, Corridors	Bedroom	Strongly Agreed
2	28	-	Stairs	N/A	Livingroom	Agreed
3	32	Civil Servant	Balcony, Kitchen	Livingroom	Bedroom	Agreed
4	21	Student	Stairs	Corridors	Livingroom TV Room	Strongly Agreed
5	24	-	Livingroom	Bedroom	Bedroom	Strongly Agreed
6	30	-	-	All	Livingroom	Strongly Agreed
7	14	Student	-	All	Balcony	Agreed
8	15	Student	-	Bedroom	Bedroom	Strongly Agreed
9	11	Student	Stairs	N/A	Livingroom	Disagreed

10	15	Student	-	All	Livingroom	Agreed
11	18	Student	Bathroom	Bedroom	Livingroom	Agreed
12	8	Student	Kitchen	Livingroom, Bedroom	Bedroom	Disagreed
13	24	Student	Steps and Stairs	Bedroom Personal Room	Bedroom	Agreed
14	16	Student	-	All	Livingroom	Strongly Agreed
15	14	Student	Walls	-	Bedroom	Strongly Disagreed
16	28	Teacher	-	Bedroom	Bedroom's Sofa	Strongly Agreed
17	6	Student	Some Space Furniture	Furniture	Bedroom	Agreed
18	19	Student	Kitchen	N/A	Bedroom	Agreed
19	34	Student	Tables/Desks	Bedroom	TV Chair	Agreed
20	26	Student	Kitchen	Bedroom	TV Room	Agreed

When the participants were asked about their hard and easy spaces in their interior spaces, 20% of the participants answered with kitchen, 15% pointed on other spaces, 30% had no hard spaces in their interior spaces, and 35% gave no answer. As easy space, most of the participants with 45% said that the bedroom was the easiest space to handle, 18% answered with the living-room, 27% answered with all interior spaces are easy and 9% gave no answer (Figure 43). When the participants were asked about their comfort zone space in their homes, 50% of the participants answered with the bedroom, 45% answered with the living-room, and the 5% left

gave other different spaces (Figure 44). When the participants were asked about their ability to complete their daily routine tasks independently, 45% of the participants strongly agreed, 45 agreed, 5% disagreed and the 5% left strongly disagreed (Figure 40). There is a strong connection between the visually impaired ability of independent living and the participant age, all the visually impaired participant who disagreed or strongly disagreed were children below eighteen years old or younger. Thus, the more experience and age of living as visually impaired gives higher opportunity of independent living as visually impaired in home.

4.3 Independently Home Living Skills of the Visually Impaired

The answers taken show that only few numbers of participants who preferred to move to a new house to live independently. The participants who preferred to stay in their current house with their family explained this with the possibility to be independent with their daily living tasks and achievements with no need for any help from a family member, even while living with them. Thus, most of the participants prefer to stay in their current home with their family, and that does not mean being dependent on them in doing their daily tasks. These answers approved what McKinley wrote in his study *Literacy in the lives of the blind* in San Francisco, USA in 2006. McKinley found that the visually impaired are not asking for full independency from society and family, they are simply asking to being integrated into society. Therefore, the research needs to know about whether or not they still have difficulties while living independently, and since a few answered as they have difficulties in managing their daily life tasks, the research still need to give recommendations for less difficulties which participants mentioned previously in order to make their daily life tasks easier and faster to achieve.

4.4 Home Conditions and Visually Impaired Users Satisfaction in Terms of Use

Comparing the participants' answers with each other, satisfaction results were found as shown in Table 14. The table shows the connections between the visually impaired user satisfaction, age of home and years of living, number of dwellers, and the existence of feelings and memories in the current home they are dwelling. Results show that from twenty participants, only one participant was not satisfied with his/ her home conditions, eight were satisfied, and ten were very satisfied with their home and the living conditions. As shown in Table 14, the visually impaired dweller's satisfaction is strongly connected to their home condition and age. Home condition is connected to financial status and income, and years of living is connected to their memories and feelings. After analysing the data collected from the answers, the findings show that the interior space satisfaction of the visually impaired dwellers in terms of use is connected to the memory, feelings, years of dwelling, and the income.

Table 14: Results of visually impaired home satisfaction in terms of use.

Queue	Age	Number of Dwellers	House Age in years	Years of Living	Income	Memories and Feelings	Users Satisfaction	Future Aim of Moving to a New House
1	64	3	42	42	High	Strongly Agreed	Strongly Satisfied	Agreed
2	28	N/A	N/A	20	Average	Strongly Agreed	Satisfied	Disagreed
3	32	4	N/A	6	Average	Strongly Agreed	Satisfied	Strongly Disagreed
4	21	5	≅ 7	7	Average	Agreed	Strongly Satisfied	Strongly Disagreed
5	24	6	N/A	9	Average	Agreed	Satisfied	Agreed
6	30	2	Old	4	Average	Strongly Agreed	Strongly Satisfied	Strongly Disagreed
7	14	5	4	4	-	Disagreed	Strongly Satisfied	-

8	15	4	N/A	15	-	Agreed	Strongly Satisfied	-
9	11	4	N/A	11	-	Agreed	Satisfied	-
10	15	4	6	6	-	Agreed	Strongly Satisfied	-
11	18	5	Old	13	Average	Strongly Agreed	Strongly Satisfied	Agreed
12	8	4	New	3	-	Disagreed	Satisfied	-
13	24	3	8	8	Average	Disagreed	Satisfied	Strongly Agreed
14	16	6	N/A	13-14	-	Strongly Agreed	Strongly Satisfied	-
15	14	5	N/A	2	-	Disagreed	Unsatisfied	-
16	28	2	6	2	High	Strongly Disagreed	Strongly Satisfied	Strongly Disagreed
17	6	4	N/A	3	-	Agreed	Strongly Satisfied	-
18	19	3	N/A	19	N/A	Strongly Agreed	Satisfied	Disagreed
19	34	1	10-15	5	Average	Strongly Agreed	Satisfied	Strongly Disagreed
20	26	2	3	3	High	Disagreed	Satisfied	Disagreed

When the participants were asked about the age of their home, 20% of the participants answered as having old houses aged ten years or older, 35% have new houses aged ten years or less, and 45% gave no answer. When they were asked about the years of living, 35% of the participants lived ten years or more in their current home, and the other 65% of the participants have been living in their current house for ten years or less (Figure 45). When the participants were asked about the existence of any family memories and/or feelings in their current home they dwell, 40% of the participants strongly agreed, 30% agreed, 25% disagreed, and 5% strongly disagreed (Figure 46). When the participants were asked about their satisfaction in their income in terms of daily needs, only 10% of the participants have high income, most of the participants with 45% have average income, 5% have low

income, and the 40% left gave no answer (Figure 47). Finally, when the participants were asked about their satisfaction in their interior spaces in terms of use, 50% of the participants strongly agreed , 45% agreed, 5% disagreed and 0% strongly disagreed (Figure 38).

4.5 Suggestions from Visually Impaired Dwellers for Better Home Living Skills

This thesis will discuss all the suggestions taken from the twenty participants and gather them together to understand the difficulties they have in their interior spaces. A few participants suggested building a special interior space for the visually impaired, which includes balanced closets and wardrobe in the bedroom and a good design of the shower in the bathroom. Other participants suggested to stop using so much furniture and to use more fixed furniture so they can easily memorise spaces. In terms of changing the existing home design or designing a new house, some participants suggested building straighter corridors and less zigzag corners, and to avoid using different floor heights, such as stairs and floor level differences. One of the participants suggested finding a solution to the interior electronic elements, such as the air conditioner and lamps. Another suggestion was to add different materials and textures on floors and walls, which may help the visually impaired users guide themselves in their interior spaces by feeling the texture differences on floors and walls, or by hearing their footsteps due to the material changes on interior floors. These solutions, as the participants explained, may lead to better and easier orientation within the interior spaces, and a better orientation leads to better living skills and more daily achievements. These suggestions and answers taken from the visually impaired participants opened a gate to answer the research question “what

are the interior space suggestions that may make the daily tasks easier to achieve for the visually impaired users?", these suggestions will be discussed more at the next part of this study.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

The method used in this thesis is explanatory, qualitative and quantitative methods. Using questionnaires, with the data collected and results, the research presented the answers in statistical numbers and percentages as charts and tables, with some explanations and comments from the participants. Most of the participants were selected from a school located in Nicosia *(Rauf Raif Denktaş Görme Engelliler Özel Eğitim Okulu)*, and some were taken from visually impaired dwellers around Northern Cyprus. However, before developing the questionnaires, the definition of visual impairment and the visually impaired's needs were explored through the review of the literature, which helped to form the questions and the expectations of the participants. After forming the questions, they were separated into two forms, one for the visually impaired adults and another form for the visually impaired children (Appendix a and b). All the participants had Turkish language as their mother tongue, thus the questionnaires were translated to Turkish to present them in two languages Turkish and English. In this chapter, the research with the help of the participants should answer the research question: what are the interior space suggestions that may make the daily tasks easier to achieve for the visually impaired users.?

5.1 Conclusions and Recommendations of the Study

The results of this study show that most of the visually impaired users have difficulties in achieving their daily task unlike sighted users. Moreover, visually

impaired users have difficulties in interactions with their interior space elements. This thesis attempts to give suggestions for the visually impaired users to become more efficient in using other senses and making their daily life skills and routine better and easier to achieve. As shown in Table 15 and Figure 48, and concluding the questionnaires and the literature review; this study concludes that the visually impaired should be given bigger chance to use the other senses (Touching, Hearing, Smelling and Feelings):

Table 15: Suggestions for visually impaired users in home.

Senses	**Usage of senses**	**Effects**	**Results**
Touching	Hand height braille tactiles	Each room with different tactile	Users can recognise rooms easier by different unique wall tactile
	Floor textures	Feeling the floor tactile texture	Users will recognise each room by the floor texture differences
Hearing	Floor materials	Hearing their footsteps	Users can recognise their space by hearing differences in footsteps
	Interior water fountains	Gives each room its own identity	Users can recognise each room by the sound of the water drops & fountains
	Interior water channels	Lead the users to their destination	Users can follow the water channel sound to reach their destination
	Movement sensors	Warn the users about the danger	Users can recognise they are in dangerous zone by passing by sensors
Smelling	Special fragrant and perfumes	Gives each room its own identity	Users can recognise rooms by their different smells for each room
Body Feeling	Different temperatures	Gives each room its own identity	Users can recognise each room by feeling the differences in heat
Light Feeling	Different light values	Gives each room its own identity	Visually Impaired can recognise each room by the light value of each room

(1.) The sense of touch by adding different hand height tactile with braille writings at the each room and corridors to give each space its identity.

(2.) Change the floor texture or material of each room so they can recognise the rooms from the material changes with the sound of their footsteps or by feeling the tactile texture with their feet.

(3.) Special decoration elements such as interior water fountains or channels. These fountains will help with indoor orientation by hearing the sound of water. The water channel will guide the visually impaired to the correct direction. These water fountains and channels can be cleaned by special devices like the one used in fish aquariums.

(4.) Use their sense of hearing by adding movement sensors which warn the visually impaired users inside their homes whenever they enter a danger zone in their indoor locations such as kitchens or bathrooms.

(5.) The sense of smell by using special fragrances, perfumes to give each room its own special smell.

(6.) Human body heat feelings may also be used by adding different temperatures to each room, which can be achieved by designing different window sizes or adding different sheets on windows to allow the sun-rays to enter in each rooms with different values. The windows sheets also control the amount of sun-rays the visually impaired user may observe as blurred pictures; they can recognise the space by the amount of light in their rooms.

More recommendations were taken from the twenty visually impaired participants. Some of these recommendations were about using fixed furniture in their interior home spaces, many participants explained that by the difficulties of handling their moving elements and closets/wardrobes. Also, removing any sharp interior elements will prevent any injuries. Another participant recommend to remove any confusions in wall designs; designing a home with less zigzags and more straight walls will help the visually impaired dwellers in their orientation within their home spaces. One of the participants complained about the electronic difficulties; the participant explained this as he said:

> *It is hard for me to guess if the air conditioner is on or off, hot or cold, by then, its too late and the room is extremely cold or extremely hot. It is also hard to guess if the lights in my room are off or on, the only way I can guess is by having my eyes burnt and dry.*

All the recommendations mentioned previously in Table 15 are gathered together as one scheme (Figure48). The scheme shows the connection between the visually impaired dweller and their home design, and how can the previous recommendation improve this connection between the dweller and home.

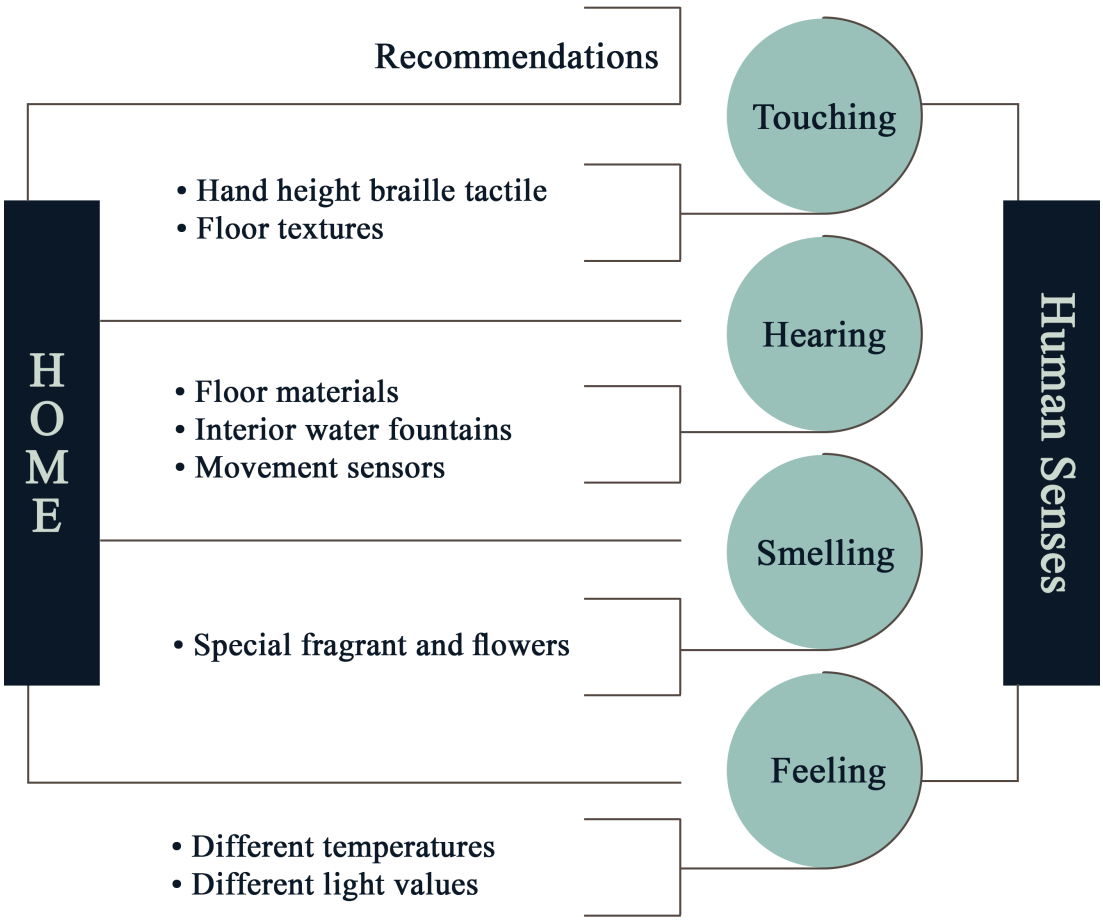


Figure 48: Recommendations connect the human senses with home.

Figure 48 highlighted suggestions give a bigger chance for the visually impaired dwellers to create stronger connections, these connections should lead the dweller to a better living skills and easier interactions with their interior spaces and elements

5.2 Implication of the Study

The results of the study indicate that there is a need for some changes in the visually impaired's interior spaces. Applying these changes improve the visually impaired users' achievements in their daily life tasks, and may also improve their living skills in safe and comfortable environment. This study answered the main research questions:

- What are the interior space interactions and changes we can take to make the daily tasks easier to achieve for the visually impaired users?

Generally, to achieve a better home design in visually impaired dwellers' homes; the designer should consider the universal design while designing a home. Starting with the reasons that make the visually impaired users' life difficult within their interior spaces, these difficulties in accomplishing their daily tasks within their interior spaces are caused by random elements and designs built with no further expectations from the designer of any dwellers with special needs. It is possible to improve the visually impaired user's quality of living in their home by recommending some interactions and understanding their needs and expectations (Table 13, 14).

5.3 Implications for Further Studies

The field of this research is huge. In this research both definitions of home and visual impairment were combined to give suggestions for the users with vision inability. The huge field of home, universal design and visual inabilities has a low amount of research done which combines them together, and there is a lack of research that attempts to give recommendations for the visually impaired in their interior spaces. More research needs to be carried out because of the need of finding more recommendations in interior spaces that may provide a better living for the visually impaired dwellers.

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APPENDICES

Appendix A: Questions Form (Adults)

Name / Isim : .....

Age / Yaş : .....

Gender / Cinsiyet : ☐ *Male / Erkek.* ☐ *Female / Kadın.*

What is your job? /Ne iş yapıyorsunuz? : .....

Number of Family Members in your House : .....
Bu Evde Yaşayan Aileniz Kaç Kişiden Oluşuyor

- Are your home interior spaces and elements satisfying in terms of use?
- Evinizin iç mekanı ve ilgili unsurları kullanım açısından tatmin edici mi?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- Is it easy to accommodate yourself into your home spaces?
- Ev içerisindeki mekanlarda kendi kendinize kolayca yaşayabiliyor musunuz?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- Is it easy to follow daily routine and complete your tasks in your home independently?
- Evinizde bağımsız bir şekilde günlük rutin işlerinizi tamamlayabiliyor musunuz?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- If it were possible, would you feel the need to move to new house? Why?
- Eğer mümkün olsaydı, ileride yeni bir eve taşınmak ister miydiniz? Neden?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

.....

- Would you like to live alone in home? Why?
- Evinizde yalnız yaşamak ister miydiniz? Neden?

☐ *Yes* | *Evet* .....
☐ *No* | *Hayır* .....
.....

- What are the hard and easy spaces to use in your home interiors?
- Evinizin iç mekanlarından kullanım açısından zor ve kolay alanlar nerelerdir?

☐ *Hard* | *Zor* .....
☐ *Easy* | *Kolay* .....

- Which part of interior space would you call a comfort zone to relax in?
- Evinizin hangi köşesi sizin için dinlenmek için en rahat alandır?

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- What could be done to facilitate your use of your independent interior space?
- Evinizde yalnız/bağımsız olarak yaşamayı kolaylaştırmak için ne yapılabilir?

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.....

- (a.) How old is your house ? (b.) How long have you been living there?
- (a.) Eviniz kaç yıllıktır ? (b.) Burada ne kadar zamandır yaşamaktasınız?

(a) .....

(b) .....

- Are there any family memories and feelings in your current home that you are dwelling?
- Şuan yaşadığınız evde aile ile ilgili anılarınız/hatıralarınız ya da duygularınız var mı?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- Is your family income enough to satisfy your needs?
- Aile geliriniz yaşamınız için yeterli mi?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- Do you have any suggestions to help you to live in your current home independently?
- Eviniz için yalnız/bağımsız yaşamanızı kolaylaştıracak önerileriniz var mı?

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- Any more suggestions to make your home a better place to dwelling?
- Evinizi daha iyi bir ev yapmak adına beklentilerinizi göz önünde bulundurarak ne önerirsiniz?

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- Other comments:
- Diğer yorumlar:

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Appendix B: Questions Form (Children)

Name / Isim : .....

Age / Yaş : .....

Gender / Cinsiyet : ☐ *Male / Erkek.* ☐ *Female / Kadın.*

What is your job? /Ne iş yapıyorsunuz? : .....

Number of Family Members in your House : .....
Bu Evde Yaşayan Aileniz Kaç Kişiden Oluşuyor

- Are your home interior spaces and elements satisfying in terms of use?
- Evinizin iç mekanı ve ilgili unsurları kullanım açısından tatmin edici mi?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- Is it easy to accommodate yourself into your home spaces?
- Ev içerisindeki mekanlarda kendi kendinize kolayca yaşayabiliyor musunuz?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- Is it easy to follow daily routine and complete your tasks in your home independently?
- Evinizde bağımsız bir şekilde günlük rutin işlerinizi tamamlayabiliyor musunuz?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- What are the hard and easy spaces to use in your home interiors?
- Evinizin iç mekanlarından kullanım açısından zor ve kolay alanlar nerelerdir?

☐ *Hard* | *Zor* .....
☐ *Easy* | *Kolay* .....

- Which part of interior space would you call a comfort zone to relax in?
- Evinizin hangi köşesi sizin için dinlenmek için en rahat alandır?

.....
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.....

- What could be done to facilitate your use of your independent interior space?
- Evinizde yalnız/bağımsız olarak yaşamayı kolaylaştırmak için ne yapılabilir?

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- (a.) How old is your house ? (b.) How long have you been living there?
- (a.) Eviniz kaç yıllıktır ? (b.) Burada ne kadar zamandır yaşamaktasınız?

(a) .....

(b) .....

- Are there any family memories and feelings in your current home that you are dwelling?
- Şuan yaşadığınız evde aile ile ilgili anılarınız/hatıralarınız ya da duygularınız var mı?

☐ *Strongly Agree* | *Kesinlikle Katılıyorum*
☐ *Agree* | *Katılıyorum*
☐ *Disagree* | *Katılmıyorum*
☐ *Strongly Disagree* | *Kesinlikle Katılmıyorum*

- Do you have any suggestions to help you to live in your current home independently?
- Eviniz için yalnız/bağımsız yaşamanızı kolaylaştıracak önerileriniz var mı?

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- Any more suggestions to make your home a better place to dwelling?
- Evinizi daha iyi bir ev yapmak adına beklentilerinizi göz önünde bulundurarak ne önerirsiniz?

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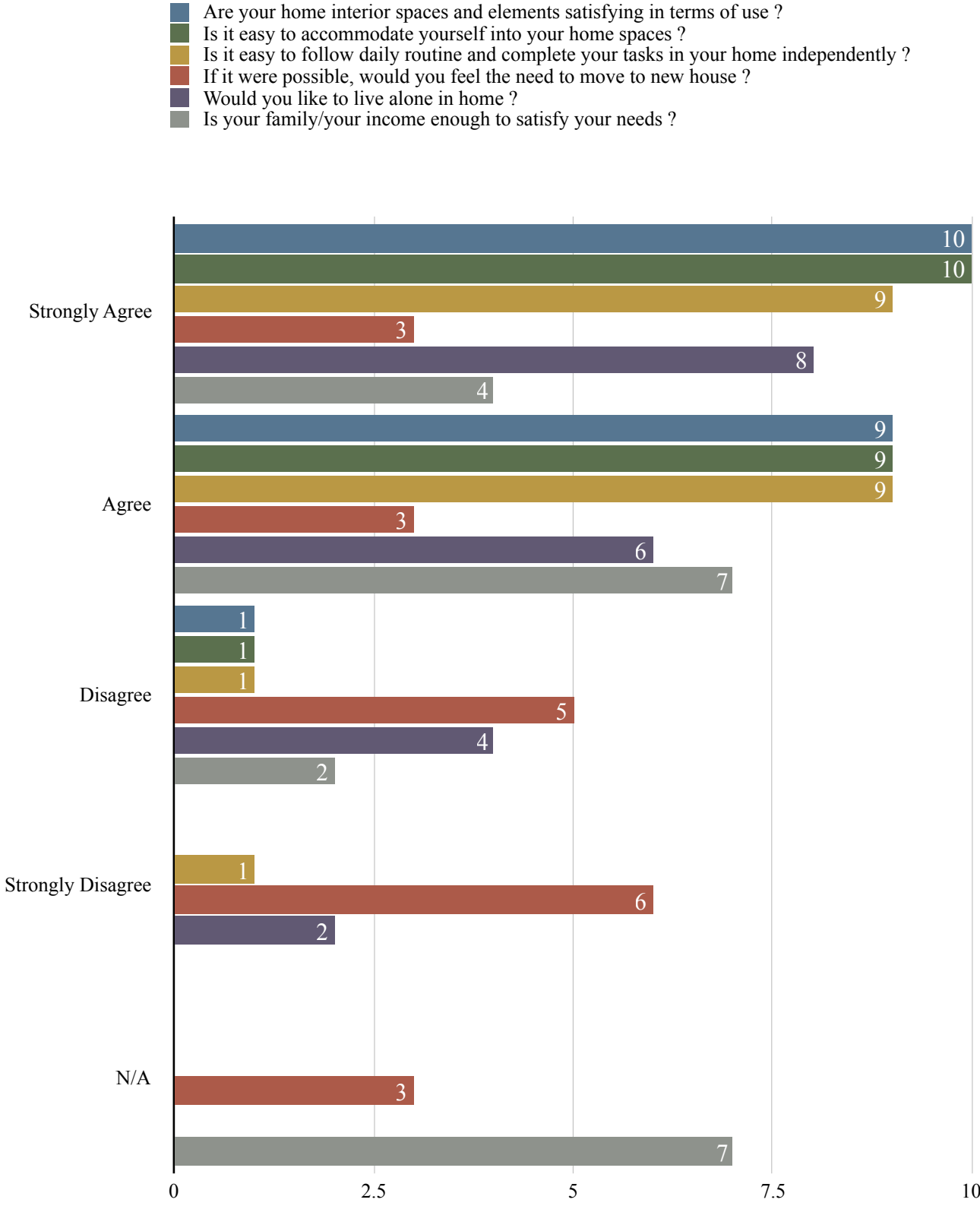
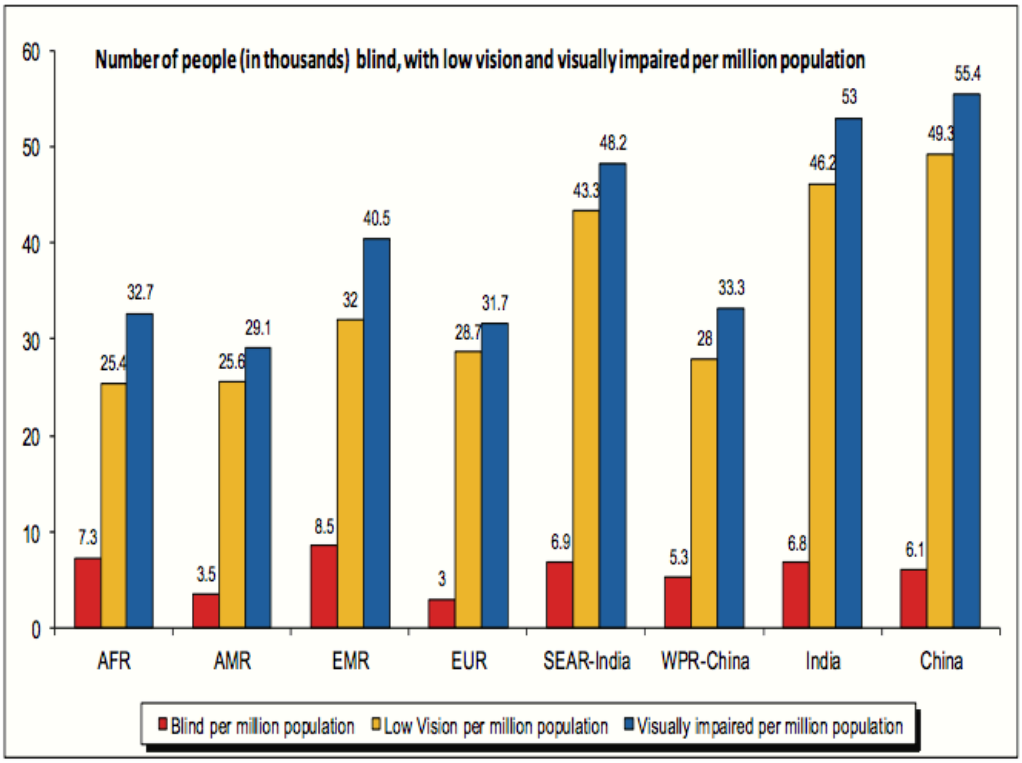
- Other comments:
- Diğer yorumlar:

Appendix C: Surveys and Questionaries Answers

The research surveys and questionaries' answers (taken from 20 participants).



Appendix D: Reworked Tables and Figures From Other Researches and References



Mariotti , S. P. (2012). Global Data on Visual Impairments 2010. Geneva, Switzerland: World Health Organization. Vol 12.01. Page 3

Table 2. **Global estimate of the number of people visually impaired by age, 2010; for all ages in parenthesis the corresponding prevalence (%).**

Ages (in years)	Population (millions)	Blind (millions)	Low Vision (millions)	Visually Impaired (millions)
0-14	1,848.50	1.421	17.518	18.939
15-49	3548.2	5.784	74.463	80.248
50 and older	1,340.80	32.16	154.043	186.203
all ages	6,737.50	39.365 (0.58)	246.024 (3.65)	285.389 (4.24)

Table 3. **Number of people visually impaired and corresponding percentage of the global impairment by WHO Region and country, 2010**

		Blindness	Low vision	Visual Impairment
WHO Region	Total population (millions)	No. in millions (percentage)	No. in millions (percentage)	No. in millions (percentage)
Afr	804.9 (11.9)	5.888 (15)	20.407 (8.3)	26.295 (9.2)
Amr	915.4 (13.6)	3.211(8)	23.401 (9.5)	26.612 (9.3)
Emr	580.2 (8.6)	4.918 (12.5)	18.581 (7.6)	23.499 (8.2)
Eur	889.2 (13.2)	2.713 (7)	25.502 (10.4)	28.215 (9.9)
Sear (India excluded)	579.1 (8.6)	3.974 (10.1)	23.938 (9.7)	27.913 (9.8)
Wpr (China excluded)	442.3 (6.6)	2.338 (6)	12.386 (5)	14.724 (5.2)
India	1181.4 (17.5)	8.075 (20.5)	54.544 (22.2)	62.619 (21.9)
China	1344.9 (20)	8.248 (20.9)	67.264 (27.3)	75.512 (26.5)
World	6737.5 (100)	39.365 (100)	246.024 (100)	285.389 (100)

Mariotti , S. P. (2012). Global Data on Visual Impairments 2010. Geneva, Switzerland: World Health Organization. Vol 12.01. p. 5

Table 2 Group composition for testing the hypotheses of cognitive restructuring and future perspectives

	No intention of moving	Intention to move
Lives in preferred housing situation (match)	Group 1	Group 2
Does not live in preferred housing situation (mismatch)	Group 3	Group 4

Jansen, S. J. (2013). Why is Housing Always Satisfactory? A Study into the Impact of Cognitive Restructuring and Future Perspectives on Housing Appreciation. Social Indicators Research, p. 359

Table 3 Socio-demographic characteristics of respondents living in a suboptimal housing situation (n = 1,074)

Age	n = 1,032
Mean (SD)	51 (13)
Household type	n = 1,032
Single	133 (13 %)
Couple without children <18 living at home	393 (38 %)
Couple with children <18 living at home	448 (43 %)
Other	58 (6 %)
Number of persons in the household	n = 1,032
Mean (SD)	2.8 (1.3)
Monthly net income[a]	n = 883
Mean (SD)	€ 2,693 (1,150)
Education	n = 1,009
Primary/lower vocational education	186 (18 %)
Secondary education	383 (38 %)
Higher vocational education	347 (34 %)
University	67 (7 %)
Other	26 (3 %)
Gender	n = 1,054
Female	550 (52 %)
Paid work	n = 1,031
Yes	702 (68 %)

[a] Two respondents with a standardized score >5 (i.e. a monthly net income >€ 10.000) were omitted from the analyses because they are extreme outliers

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Table 8 Mean appreciation scores for numerical aspects of the dwelling situation

	Match				Mismatch			
	No intention of moving within 2 years (1)		Intention to move within 2 years (2)		No intention of moving within 2 years (3)		Intention to move within 2 years (4)	
	Mean	n	Mean	n	Mean	n	Mean	n
Size living room								
20 m^2/less than 25 m^2 (n = 115)	70.0	9	63.7	8	35.7	44	37.7	54
30 m^2/25–34 m^2 (n = 286)	69.9	93	69.5	84	48.2	57	54.9	52
40 m^2/35–44 m^2 (n = 259)	84.8	65	81.5	65	70.5	67	70.2	62
Number of rooms								
2/1–2 rooms (n = 30)[a]	80.0	1	–	0	43.3	12	37.6	17
3/3 rooms (n = 99)	81.1	22	80.0	22	51.4	22	43.8	33
4/4 rooms (n = 290)	82.0	64	81.5	57	72.7	76	65.9	93
Backyard size								
5 m/less than 8 (n = 77)	61.6	16	58.9	18	39.5	21	33.7	22
10 m/8–12 (n = 299)	73.2	101	73.2	77	49.8	67	51.8	54
15 m/13–17 (n = 133)	83.8	33	79.7	16	74.5	49	62.3	35

[a] Not analyzed statistically, due to low frequencies

Jansen, S. J. (2013). Why is Housing Always Satisfactory? A Study into the Impact of Cognitive Restructuring and Future Perspectives on Housing Appreciation. Social Indicators Research, p. 366

Table 8 Mean appreciation scores for numerical aspects of the dwelling situation

	Match				Mismatch			
	No intention of moving within 2 years (1)		Intention to move within 2 years (2)		No intention of moving within 2 years (3)		Intention to move within 2 years (4)	
	Mean	n	Mean	n	Mean	n	Mean	n
Size living room								
20 m^2/less than 25 m^2 (n = 115)	70.0	9	63.7	8	35.7	44	37.7	54
30 m^2/25–34 m^2 (n = 286)	69.9	93	69.5	84	48.2	57	54.9	52
40 m^2/35–44 m^2 (n = 259)	84.8	65	81.5	65	70.5	67	70.2	62
Number of rooms								
2/1–2 rooms (n = 30)[a]	80.0	1	–	0	43.3	12	37.6	17
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10 m/8–12 (n = 299)	73.2	101	73.2	77	49.8	67	51.8	54
15 m/13–17 (n = 133)	83.8	33	79.7	16	74.5	49	62.3	35

[a] Not analyzed statistically, due to low frequencies

Jansen, S. J. (2013). Why is Housing Always Satisfactory? A Study into the Impact of Cognitive Restructuring and Future Perspectives on Housing Appreciation. Social Indicators Research, p. 367

Table 2: Coding Scheme for Modes of Compensation

Category	Example
Person-Related Compensation Modes	
More Effort or Time	"I take much more time to dress myself but I can manage it alone."
Use of Latent Skill	"I use my fingers to notice when my cup is filled."
Simplification of Behavior	"I only take frozen meals to manage cooking."
New Behavior	"I learned in mobility training how to cross streets safely."
Environment-Related Compensation Modes	
Prosthetics/Vision	"I use magnifying glasses."
Prosthetics/Mobility	"I have to wear orthopedic shoes."
Prosthetics/Other	"I use a tape recorder to send messages to other persons."
Light	"My son installed an additional light in the kitchen."
Legibility	"I keep a list of largely written phone numbers."
Structure/Order	"Everything must be on its right place to manage everyday life."

Wahl H.W., Oswald F., & Zimprich D. (1999). Everyday Competence in Visually Impaired Older Adults: A Case for Person-Environment Perspective. *The Gerontology Society of America, Vol 39,* p. 143

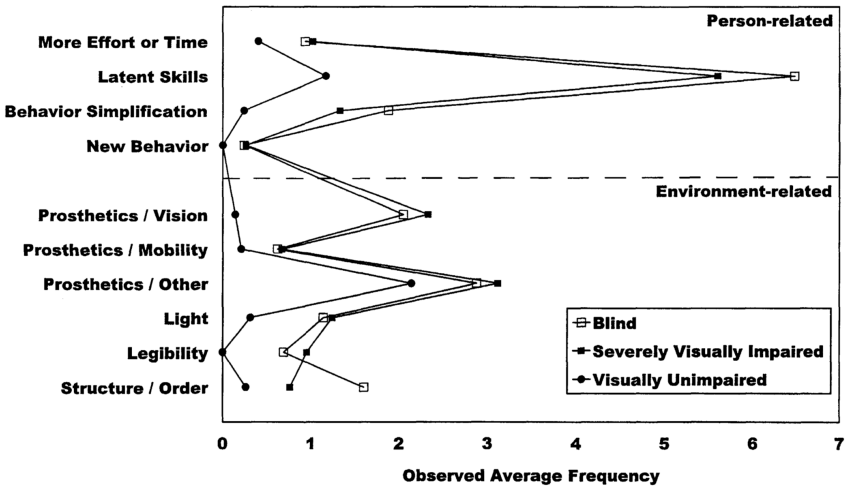


Figure 2. Profile of compensation modes as process aspect of everyday competence.

Wahl H.W., Oswald F., & Zimprich D. (1999). Everyday Competence in Visually Impaired Older Adults: A Case for Person-Environment Perspective. *The Gerontology Society of America, Vol 39,* p. 146

Table 1
Parents' reports of children's personal hygiene skills.

	Visually impaired children			Sighted children		
Personal hygiene	Yes	SWH[a]	No	Yes	SWH[a]	No
Brushes teeth	10	0	0	10	0	0
Applies toothpaste	5	1	4	10	0	0
Puts soap on a washcloth/washes	7	2	1	10	0	0
Hangs washcloth or towel	9	0	1	7	2	1
Fills bathtub/turns on shower	3	3	4	8	2	0
Bathes/showers	5	1	4	10	0	0
Dries self	6	1	3	10	0	0
Washes hair	2	5	3	8	0	2
Dries hair with a towel	4	1	5	9	1	0
Uses hair dryer	1	1	8	3	2	5
Brushes/combs hair	3	5	2	8	1	1
Applies Band-Aids to cuts	1	1	8	7	2	1
Uses alarm clock	2	0	8	4	0	6
Uses watch	2	1	7	7	0	3

Note: $X^2 = 39.46$, $df = 2$, $p = .01$*.
[a] SWH = Sometimes with help.

Lewis, S., & Iselin, S. A. (2002). A Comparison of the Independent Living Skills of Primary Students with Visual impairments and Their Sighted Peers: A Pilot Study p. 339

Table 2
Parents' reports of children's kitchen skills.

	Visually impaired children			Sighted children		
Kitchen skills	Yes	SWH[a]	No	Yes	SWH[a]	No
Spreads with a knife	1	4	5	10	0	0
Cuts with a knife	0	2	8	8	1	1
Drinks from a glass	7	1	2	10	0	0
Serves self from a serving bowl	1	1	8	9	0	1
Prepares a sandwich	2	2	6	9	0	1
Requests a snack	10	0	0	7	0	3
Gets food items from a cabinet	5	1	4	10	0	0
Gets food from the refrigerator	7	3	0	10	0	0
Pours from a half-gallon container	2	2	6	9	0	1
Pours from a gallon container	2	0	8	7	0	3
Pours dry ingredients	4	2	4	10	0	0
Opens packages—chips	4	2	4	10	0	0
Opens milk cartons	2	2	6	10	0	0
Opens bottles	6	1	3	10	0	0
Uses a toaster	1	0	9	8	0	2
Gets utensils/plates	9	0	1	10	0	0
Peels bananas	5	2	3	9	0	1
Peels oranges	0	1	9	5	2	3
Gets a drink from the sink	7	0	3	10	0	0
Requests items for a meal	10	0	0	10	0	0
Makes requests when shopping	7	0	3	8	0	2
Uses a can opener	0	0	10	3	2	5
Cooks with a microwave oven	0	5	5	9	0	1

Note: $X^2 = 111.91$, $df = 2$, $p = .01$*.
[a] SWH = Sometimes with help.

Lewis, S., & Iselin, S. A. (2002). A Comparison of the Independent Living Skills of Primary Students with Visual impairments and Their Sighted Peers: A Pilot Study p. 340

Table 3
Parents' reports of children's home care skills.

	Visually impaired children			Sighted children		
Home care skills	Yes	SWH[a]	No	Yes	SWH[a]	No
Sets the table with nonbreakable dishes	6	3	1	10	0	0
Sets the table with breakable dishes	6	2	2	10	0	0
Clears the dishes from the table	8	0	2	10	0	0
Vacuums	4	1	5	7	2	1
Makes the bed	3	3	4	8	0	2
Changes the bed linen	0	2	8	0	7	3
Tidies up own bedroom	8	0	2	9	1	0
Puts toys in the proper place	9	0	1	8	1	1
Empties wastebaskets	3	0	7	9	0	1
Sweeps	4	1	5	8	1	1
Washes dishes by hand	2	2	6	4	1	5
Dries dishes	2	1	7	3	1	6
Puts dishes/silverware away	1	3	6	9	0	1
Loads the dishwasher	1	1	8	5	1	4
Runs the dishwasher	1	1	8	1	0	9
Takes out the trash	1	0	9	8	0	2
Cleans counters	3	2	5	3	1	6
Completes assigned chores	6	0	4	9	0	1
Puts groceries away	3	3	4	9	0	1
Cleans own spills	5	2	3	9	1	0
Waters plants	1	2	7	5	2	3

Note: $X^2 = 21.96$, $df = 2$, $p = .01$*.
[a] SWH = Sometimes wtih help.

Lewis, S., & Iselin, S. A. (2002). A Comparison of the Independent Living Skills of Primary Students with Visual impairments and Their Sighted Peers: A Pilot Study p. 341

Table 4
Parents' reports of children's community skills.

	Visually impaired children			Sighted children		
Community skills	Yes	SWH[a]	No	Yes	SWH[a]	No
Orders fast food for self	6	0	4	8	0	2
Opens condiments	1	0	9	5	0	5
Fills cup of soda from a fountain	0	3	7	8	0	2
Travels to a bus stop	2	1	7	9	0	1
Travels to a neighbor's house	4	1	5	10	0	0
Travels around the block	1	1	8	6	0	4
Travels across the street	1	0	9	7	1	2
Opens car doors	7	0	3	10	0	0
Closes car doors	7	2	1	10	0	0
Unfastens own seat belt	8	2	0	10	0	0
Fastens own seat belt	7	2	1	10	0	0

Note: $X^2 = 47.46$, $df = 2$, $p = .01$*.
[a] SWH = Sometimes with help.

Lewis, S., & Iselin, S. A. (2002). A Comparison of the Independent Living Skills of Primary Students with Visual impairments and Their Sighted Peers: A Pilot Study p. 341

Table 2.1. Disability prevalence rates for thresholds 40 and 50 derived from multidomain functioning levels in 59 countries, by country income level, sex, age, place of residence, and wealth

Population subgroup	Threshold of 40			Threshold of 50		
	Higher income countries (standard error)	Lower income countries (standard error)	All countries (standard error)	Higher income countries (standard error)	Lower income countries (standard error)	All countries (standard error)
Sex						
Male	9.1 (0.32)	13.8 (0.22)	12.0 (0.18)	1.0 (0.09)	1.7 (0.07)	1.4 (0.06)
Female	14.4 (0.32)	22.1 (0.24)	19.2 (0.19)	1.8 (0.10)	3.3 (0.10)	2.7 (0.07)
Age group						
18–49	6.4 (0.27)	10.4 (0.20)	8.9 (0.16)	0.5 (0.06)	0.8 (0.04)	0.7 (0.03)
50–59	15.9 (0.63)	23.4 (0.48)	20.6 (0.38)	1.7 (0.23)	2.7 (0.19)	2.4 (0.14)
60 and over	29.5 (0.66)	43.4 (0.47)	38.1 (0.38)	4.4 (0.25)	9.1 (0.27)	7.4 (0.19)
Place of residence						
Urban	11.3 (0.29)	16.5 (0.25)	14.6 (0.19)	1.2 (0.08)	2.2 (0.09)	2.0 (0.07)
Rural	12.3 (0.34)	18.6 (0.24)	16.4 (0.19)	1.7 (0.13)	2.6 (0.08)	2.3 (0.07)
Wealth quintile						
Q1(poorest)	17.6 (0.58)	22.4 (0.36)	20.7 (0.31)	2.4 (0.22)	3.6 (0.13)	3.2 (0.11)
Q2	13.2 (0.46)	19.7 (0.31)	17.4 (0.25)	1.8 (0.19)	2.5 (0.11)	2.3 (0.10)
Q3	11.6 (0.44)	18.3 (0.30)	15.9 (0.25)	1.1 (0.14)	2.1 (0.11)	1.8 (0.09)
Q4	8.8 (0.36)	16.2 (0.27)	13.6 (0.22)	0.8 (0.08)	2.3 (0.11)	1.7 (0.08)
Q5(richest)	6.5 (0.35)	13.3 (0.25)	11.0 (0.20)	0.5 (0.07)	1.6 (0.09)	1.2 (0.07)
Total	11.8 (0.24)	18.0 (0.19)	15.6 (0.15)	2.0 (0.13)	2.3 (0.09)	2.2 (0.07)

Note: Prevalence rates are standardized for age and sex. Countries are divided between low-income and high-income according to their 2004 gross national income (GNI) per capita (*36*). The dividing point is a GNI of US$ 3255.
Source (*37*).

The World Bank (2011). *WORLD REPORT ON DISABILITY*. Malta: World Health Organisation. p. 28

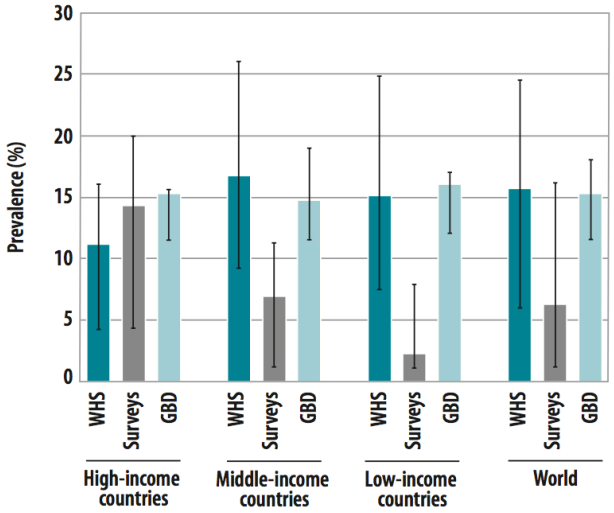
Table 2.2. Estimated prevalence of moderate and severe disability, by region, sex, and age, Global Burden of Disease estimates for 2004

Sex/age group	Percent							
	World	High-income countries	Low-income and middle-income countries, WHO region					
			African	Americas	South-East Asia	European	Eastern Mediterranean	Western Pacific
Severe disability								
Males								
0–14 years	0.7	0.4	1.2	0.7	0.7	0.9	0.9	0.5
15–59 years	2.6	2.2	3.3	2.6	2.7	2.8	2.9	2.4
≥ 60 years	9.8	7.9	15.7	9.2	11.9	7.3	11.8	9.8
Females								
0–14 years	0.7	0.4	1.2	0.6	0.7	0.8	0.8	0.5
15–59 years	2.8	2.5	3.3	2.6	3.1	2.7	3.0	2.4
≥ 60 years	10.5	9.0	17.9	9.2	13.2	7.2	13.0	10.3
All people								
0–14 years	0.7	0.4	1.2	0.6	0.7	0.8	0.9	0.5
15–59 years	2.7	2.3	3.3	2.6	2.9	2.7	3.0	2.4
≥ 60 years	10.2	8.5	16.9	9.2	12.6	7.2	12.4	10.0
≥ 15 years	3.8	3.8	4.5	3.4	4.0	3.6	3.9	3.4
All ages	2.9	3.2	3.1	2.6	2.9	3.0	2.8	2.7
Moderate and severe disability								
Males								
0–14 years	5.2	2.9	6.4	4.6	5.3	4.4	5.3	5.4
15–59 years	14.2	12.3	16.4	14.3	14.8	14.9	13.7	14.0
≥ 60 years	45.9	36.1	52.1	45.1	57.5	41.9	53.1	46.4
Females								
0–14 years	5.0	2.8	6.5	4.3	5.2	4.0	5.2	5.2
15–59 years	15.7	12.6	21.6	14.9	18.0	13.7	17.3	13.3
≥ 60 years	46.3	37.4	54.3	43.6	60.1	41.1	54.4	47.0
All people								
0–14 years	5.1	2.8	6.4	4.5	5.2	4.2	5.2	5.3
15–59 years	14.9	12.4	19.1	14.6	16.3	14.3	15.5	13.7
≥ 60 years	46.1	36.8	53.3	44.3	58.8	41.4	53.7	46.7
≥ 15 years	19.4	18.3	22.0	18.3	21.1	19.5	19.1	18.1
All ages	15.3	15.4	15.3	14.1	16.0	16.4	14.0	15.0

Note: High-income countries are those with a 2004 gross national income (GNI) per capita of US$ 10 066 or more in 2004, as estimated by the World Bank. Low-income and middle-income countries are grouped according to WHO region and are those with a 2004 GNI per capita of less than US$ 10 066 in 2004, as estimated by the World Bank. Severe disability comprises classes VI and VII, moderate and severe disability, classes III and above.
Source (*36*).

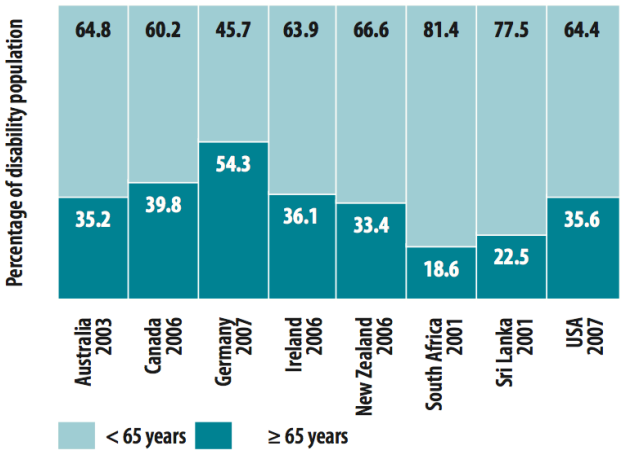
The World Bank (2011). *WORLD REPORT ON DISABILITY*. Malta: World Health Organisation. p. 30

Fig. 2.1. Global disability prevalence estimates from different sources



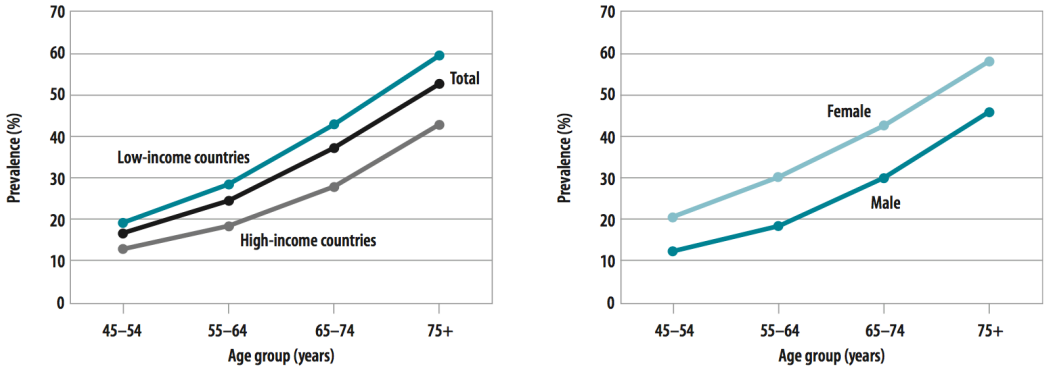
The World Bank (2011). *WORLD REPORT ON DISABILITY*. Malta: World Health Organisation. p. 31

Fig. 2.3. Distribution of ages within disability populations



The World Bank (2011). *WORLD REPORT ON DISABILITY*. Malta: World Health Organisation. p. 35

Fig. 2.2. Age-specific disability prevalence, derived from multidomain functioning levels in 59 countries, by country income level and sex



The World Bank (2011). *WORLD REPORT ON DISABILITY*. Malta: World Health Organisation. p. 35

Table 8.1. Employment rates and ratios in selected countries

Country	Year	Employment rate of people with disabilities (%)	Employment rate of overall population (%)	Employment ratio
Australia[a]	2003	41.9	72.1	0.58
Austria[a]	2003	43.4	68.1	0.64
Canada[a]	2003	56.3	74.9	0.75
Germany[a]	2003	46.1	64.8	0.71
India[b]	2002	37.6	62.5	0.61
Japan[a]	2003	22.7	59.4	0.38
Malawi[f]	2003	42.3	46.2	0.92
Mexico[a]	2003	47.2	60.1	0.79
Netherlands[a]	2003	39.9	61.9	0.64
Norway[a]	2003	61.7	81.4	0.76
Peru[c]	2003	23.8	64.1	0.37
Poland[a]	2003	20.8	63.9	0.33
South Africa[d]	2006	12.4	41.1	0.30
Spain[a]	2003	22.1	50.5	0.44
Switzerland[a]	2003	62.2	76.6	0.81
United Kingdom[a]	2003	38.9	68.6	0.57
USA[e]	2005	38.1	73.2	0.52
Zambia[g]	2005	45.5	56.5	0.81

Note: The employment rate is the proportion of the working age population (with or without disabilities) in employment. Definitions of working age differ across countries.
Sources: a (*38*); b (*8*); c (*39*); d (*7*); e (*40*); f (*41*); g (*42*).

Table 8.2. Employment rates, proportion of disabled and not disabled respondents

Individuals	Percent					
	Low-income countries		High-income countries		All countries	
	Not disabled	Disabled	Not disabled	Disabled	Not disabled	Disabled
Male	71.2	58.6*	53.7	36.4*	64.9	52.8*
Female	31.5	20.1*	28.4	19.6*	29.9	19.6*
18–49	58.8	42.9*	54.7	35.2*	57.6	41.2*
50–59	62.9	43.5*	57.0	32.7*	60.9	40.2*
60 and over	38.1	15.1*	11.2	3.9*	26.8	10.4*

Note: Estimates are weighted using WHS post-stratified weights, when available (probability weights otherwise), and age-standardized. * *t*-test suggests significant difference from "Not disabled" at 5%.
Source (*43*).

The World Bank (2011). *WORLD REPORT ON DISABILITY*. Malta: World Health Organisation. p. 238