# INDUSTRIAL PRODUCT DESIGN FOR ELDERLY PEOPLE IN INTERIOR SPACES

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**by**
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# ABSTRACT

Throughout the history of mankind, the aging concept has been one of the oldest and most significant concerns of all societies and individuals. In the contemporary world, increasing ageing of the population has globally created phenomena and priorities that affect life styles and world views of all people.

Demographic changes show the elderly population is the fastest growing part of the world's population, particularly in Japan, Europe and the USA. Therefore, populations become older and more disabled and these trends continue in the future. The aging process restricts the many physical and cognitive abilities of the elderly. Besides, most of elderly people continue to live their own households. Present products which for increasing aging population living alone have become inadequate to meet their changing physical, sensory and cognitive requirements during the aging process. For this reason, product design for elderly and its criteria which can be adapted to global needs of people to reach an optimal solution should be considered profoundly. Products which can respond many physical problems of elderly help them to accomplish the activities of daily living in interior spaces and act as a physical and cognitive assistive role in their lives.

This study aims to examine the domestic products which are being used by elderly people in interior spaces to make daily living activities more efficient and satisfying for them and reveal the criteria to reach a solution. These products aim to improve the independently living and the quality of life of elderly people and connect them to social life.

# ÖZ

İnsanlık tarihi boyunca, yaşlılık kavramı tüm toplumların ve bireylerin en eski ve en önemli meselelerinden birisi olmuştur. Toplumların evrensel olarak giderek yaşlanması, çağdaş dünyada, yeni bir olay haline gelmiştir ve tüm insanların yaşam tarzlarını ve dünya görüşlerini etkileyen öncelikler yaratmıştır.

Demografik göstergelere göre, yaşlı nüfusu tüm dünyada en hızlı artan gruptur, özellikle Avrupa, Amerika ve Japonya'da. Bu nedenle, toplumlar daha yaşlı ve daha engelli hale gelmektedir ve bu eğilimler gelecekte de artacaktır. Yaşlanma süreci, yaşlıların pek çok fiziksel ve zihinsel etkinliklerini kısıtlamaktadır. Dahası, pek çok yaşlı, yaşamlarını kendi mevcut özel mekanlarında sürdürmektedir. Gün geçtikçe artan yalnız yaşayan yaşlı nüfus için mevcut ürünler, yaşlılık sürecinde yaşlının değişen fiziksel, duyusal ve zihinsel gereksinimlerini karşılamada yetersiz kalmaktadır. Bu sebeple, bu ürünlerin tasarımlarının ve optimum sonuca ulaşmak için bu süreçte kullanılan ve evrensel gereksinimlere adapte edilebilen kriterlerin dikkatle ele alınması gerekmektedir. Yaşlıların iç mekanlarda karşılaşılacağı fiziksel sınırlamalara yanıt veren ürünler, onlara günlük yaşam aktivitelerini gerçekleştirmede daha yardım etmekte ve fiziksel ve zihinsel olarak yaşamlarında destekleyici nitelikte bir rol oynamaktadır.

Bu araştırma, iç mekanlarda yaşlıların günlük yaşam aktivitelerini yerine getirirken kendi kendilerini bağımsız olarak idare edebilmeleri için değişen gereksinimlerine bir çözüm bulmak ve yaşam kalitelerini artırmak amacıyla tasarlanan ürünleri inceler ve bu alandaki tasarım kriterlerini ortaya koymayı amaçlar. Bu ürünler bağımsız yaşamı ve yaşam kalitesini artırmayı ve onları sosyal hayata bağlamayı amaçlamaktadır.

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# CHAPTER 1

# INTRODUCTION

## 1.1. Definition of the Problem

The concept of ‘aging’ is variable and subjective depending on the person’s physiology, psychology, and his or her status or role in society as considered its time and environment. It is unknown when this variation will end up; because every development in medical area that causes new expectations for a longer life allows people to develop biologically. Accordingly, biological age becomes more important to feel ‘young’ or ‘old’ rather than chronological age.

Today, ageing has become one of the most important research topics due to structural changes in demographics all over the world, particularly in Japan, Europe, and the USA. The general trends in the number and proportion of the elderly are striking and continue to increase. In the contemporary world, the progressive ageing of the global population has created a new phenomenon and priorities that affect people’s life styles. Globally, in industrial nations, populations are getting older primarily because of the baby-boom that occurred after the Second World War. The generation born during the two decades after 1945, historically the largest cohort ever, has begun to enter its sixth decade of life and also has reached the traditional age of retirement. At the same time, in most countries, there are other important demographic tendencies such as increasing quality of life, medical developments to extend the life spans, and also decreasing amount of population due to continuing lower birth rates and declining mortality rates that will have additional effects on the aging in this century. In the early 1900’s, for example, the average life expectancy at birth in the United States was 47, today it is 76 and the fastest growing segment of the population are those over the age of 85. Present trends show that those over the age of 75, who generally require more care, will represent a larger percentage of the population than ever before. The developed countries face with many economic problems about the welfare institutions, social programs and medicare. Developing countries, in contrast, do not concern about

the aging. Briefly, aging is a universal fact that affects both developed and developing nations, including Türkiye.

The capabilities of older people differ from those ordinary people in terms of unique requirements. Elderly person surrounds a great diversity of physical and mental abilities, preferences and lifestyles. Each person gets a combination of all these characteristics properties at different levels. As far as age is concerned, the meaning of life and its quality might be changeable. Although today's medical system helps the elderly to lead a more active, more independent and healthy life by protecting them from early syndromes of aging, the old people are still easily impressed by physical, social, sensory, cognitive and financial changes rather than other age groups. Accordingly, the number of elderly and retired population is on the increase and elderly people represent a more selective consumer group, more highly educated and financially secure than past generations and have an active role in the society. However, they still have to cope with most of problems.

Elderly people can able to perform activities of daily living independently or with a low support, if an environment is designed with considering their functional competences. However, environmental changes can often cause negative social effects on the elderly. In some cases, they have to move from their own houses to a completely new environment because houses cannot allow them to live independently. Many products in interior spaces are still inconvenient to use for them. Most of them, for example, cannot use the doorknobs, faucets and taps or reach the shelves in the kitchens. They cannot use the bathtubs in the bathroom easily. Designing for elderly therefore acts as a role in limiting or promoting satisfaction in activities of daily living. Resent research indicates that general life satisfaction and even the health of older people may be related to design. Therefore, products have the potential to improve quality of their life.

Many groups such as children, disabled and elderly are often neglected in the design process. Moreover, designers generally tend to design for ordinary people, who are between the ages 18 and 55, have similar anthropometrics, physiology, attitudes, behaviours and lifestyles. These people have rarely arthritis, parkinsonism, or other diseases that are widespread among elderly people. However, there are other large sections of the population that require special care in the society. Many products that thought of as youth-oriented are still designed for the younger population, so that older market sector is ignored. If the physical and economic status of older consumers

improves, aging will become more and more acceptable. Moreover, the collective strength of the increasing number of older people will clearly encourage reluctant companies to manufacture products associated with physical and sensory impairments of elderly. Although large sections of the population are being excluded by industry approaches, design for elderly does not exclude to be used products and environments by younger people. On the other hand, by using the concept of Universal Design, designers acquire the ability and the responsibility for creating a better world for everyone, particularly elderly. As a result of demographic, economic and social changes, Universal Design is the most logical design approach to this issue because this concept aims to improve the independently living and the quality of life of all people if mainstream products meet their needs.

Consequently, in spite of the fact that aging is a natural process as much as being young, in modern societies it is considered as a troublesome period. The country is a remote place where the old ones feel alone and needy. As far as 10 % of our population is the elderly 65 and over, their expectations, satisfaction from life and problems should be seriously taken into consideration.

## 1.2. Aims of the Study

**1.** The primary aim of the thesis is to examine the domestic products which are being used by elderly people in interior spaces to make daily living activities more efficient and satisfying for them and to determine the support and information needs of elderly people. Considering this aim, the study focuses on the current design method.

**2.** Therefore, this research intends to fill the gap by analysing of the concepts, characteristics, and demographic tendencies, physical, sensory and cognitive changes of aging globally. This is because, physical, sensory and cognitive limitations interfere with their activities of daily living so that they become gradually depending.

**3.** Providing better living conditions in an environment for relatively independent older people helps to comprehend the importance of design for elderly and satisfaction the needs of them. Elderly people’s competences to maintain a good quality of life are often restricted by the inappropriate both macro and microenvironment. Design generally recommends devices such as wheelchair, walker or cane cannot navigate the cupboards and window catches that they cannot reach taps which they

cannot turn. Domestic products designed by designers with design approach features such as legibility, accessibility, adaptability and compatibility for elderly may form more convenient environment for them.

**4.** It is important to realize the key issue that how current design concept influences the ‘design for elderly’. ‘Designing for All’ is one of the main aims of design field and also in the means of design for elderly. It is a way to understand ‘how elderly people’s needs meet with domestic products according to the Universal Design principles and concepts’. By means of Universal Design principles, it can be created or developed an appropriate environment that adapts to people’s changing sensory and physical needs, and increases the competences of elderly who need assistance mostly and also enables the elderly to accomplish the activities of daily living in interior spaces.

**5.** Finally, to achieve an optimal solution for elderly people, incorporation of consumer demands for domestic products, the universal design principles and market is a way to reveal basic design criteria of an ultimate aim.

## 1.3. Method of the Study

The study consists of five chapters, considering the problems and aims are mentioned. The first chapter which is the introductory chapter contains the definition of problem, aims and method of the study.

In the second chapter, a general understanding and aspects of the elderly has been taken by considering the definition and classifications, concept, theory and characteristics. It continues with occurance of aging population and changing demographics tendencies in the world. After a brief explanation of social and family structure in Türkiye, changes of aging people are mentioned, and functional, sensory and cognitive aspects of the aging process that may directly influence design and affect the lives of elderly are discussed in order to understand their problems in daily living activities. In this chapter, literature review is the basic method to reach the accurate, demographic, and medical information.

The third chapter mentions about the assistive design aids, environmental support, and ‘Transgenerational Design’ briefly under the elder people and their relations with the environment heading. It begins with the definitions of impairment,

disability and handicap and reveals the relationship among them. After, assistive aids used by with a wide variety of people, and the requirement of assistance are discussed, environmental support and competence, and also personal and environmental characteristics, the classification of environmental regions and the distinction of environmental settings are explained. Finally, legibility, accessibility, adaptability, and compatibility that provide environmental qualities are defined to comprehend the 'Transgenerational Design', in other words 'Universal Design' or 'Design for All'. This chapter was formed by using documentation gathered by the literature review and observation.

The fourth chapter consists of a description of the main design concept that is the 'Universal Design' and its seven principles which are equitable in use, flexibility in use, simple and intuitive, perceptible information, tolerance for error, low physical effort, and size and shape for approach and use. Then, as a subtitle, a brief description of 'Anthropometric Data' on the elderly people is mentioned to consider the products within the physical limits accessibility. The last title is the application of Universal Design principles for interior spaces that make the products more accessible, usable and friendly to all users. Consequently, a door handle for interior doors is suggested as a design proposal.

The fifth chapter that is the conclusion includes the evaluation of the examination done in the fourth chapter, and so that it finds to respond to the question of 'how the elderly people's needs meet with the products according to Universal Design principles'. This study is formed by literature review and observation.

# CHAPTER 2

# HUMAN AGING, A LIFESPAN OF CHANGE

*"The art of living is the problem of finding*
*the right balance: old and new, art and utility."*
*Danish Proverb*

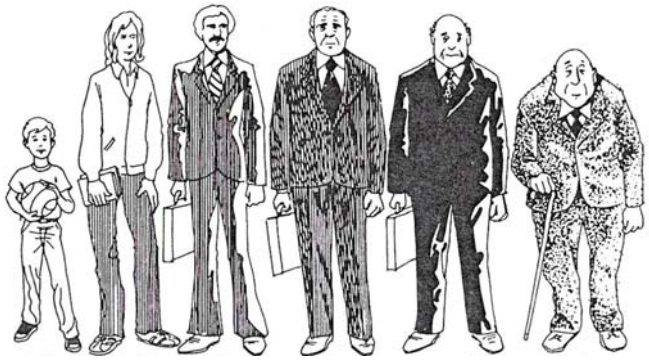
## 2.1. The Aging Process

The topic of aging is one of the oldest and most significant of all social discourses and influences all societies and every person. Aging is an inevitable process that is placed between birth and death for all walks of life in every culture. In some cultures aging is esteemed and thought to produce wisdom, in some it is ignored. According to Callahan (1987) the elderly were often attributed a high status in earlier and more traditional societies because of the idea that age conducted with is not only wisdom, but also a privileged ability to interpret the moral traditions of a society. Merrill (1973) states that viewpoints of Greek and Roman thinkers, Aristotle describes the aged as people having little left, however, Plato and Cicero felt that needs met successfully during younger years could be expected to continue satisfactorily in later life. Plato (427-347 BC) and Cicero claimed that aging was a personal process, mental and social changes could have occurred during that period and people have the ability (capacity) of being successful when they are old. This idea also accepted by modern gerontology. Callahan (1987) defines that Cicero, writing in 44 B.C., explains a different note. While the elderly people become less capable of physical effort, should increase their intellectual activity, and their principal occupation should be to support the young, their friends, and above all their country with their wisdom and sagacity.

Today, according to researchers and gerontologists there are many definitions of aging process but certainly definitions of old age have varied widely from time to time and place to place. Therefore, some of them are mentioned as in the following descriptions.

Aging can be identified as a process that contains some changes in personal appearance, functions and it also shows some differences from one person to another. This process which causes significant losses (Table 2.1) in the human organism can also be regarded as a contributor to the increasing value of lifetime. The aging phenomenon is a natural consequence of life. Here are some basic features of aging;

- Aging is universal and covers all humans
- Aging is an ongoing process
- Aging is in the essence of organism (Oktik 2000).



very young young youngish still young formerly young old

Figure 2.1 Changes in appearance over the Years (Source: Cox 1993)

Similarly, Carstens (1993) defines that, during the aging process, positive changes appear such as growth and maturity. All persons adapt to a series hidden and critical changes in social and functional roles, physical health, sensory acuity, and physical ability. Unfortunately, with the beginning of retirement, an aging person is considered valueless. Changes which slowly take place over the span of later years can be seen in (Table 2.1). These losses, however, do not take place as accurately for each age category, nor are they necessarily by anyone individual.

| **Losses:** | **Age** | **30** | **40** | **50** | **60** | **70** | **80** | **90** |
|---|---|---|---|---|---|---|---|---|
| ***Separation of children*** | | | | • | | | | |
| ***Death of peers*** | | | | | • | | | |
| ***Loss of spouse*** | | | | | • | | | |
| ***Motor output deterioration*** | | | | | | | • | |
| ***Sensory acuity losses*** | | | | | • | | | |
| ***Age-related health problems*** | | | | | | | • | |
| ***Reduced physical mobility*** | | | | | | | • | |

Table 2.1 The age-loss continuum (Reference: Carstens 1993)

According to Callahan (1987) increasing age is related to greater likelihood physical decline, reduced physiological reserve, and cognitive impairments. Clinically, these decrements increase notably after age 85.

Researchers, who have a more general approach to this issue, try to avoid defining it as a process after some certain ages. Moreover, they prefer to describe it as "changes in organism after reaching maturitiy". The senescence is a comprehensive concept as it has biological, psychological and sociological dimensions.

- **Biological Aging:** Structural and functional changes of the organs of the body and its systems with time.
- **Psychological Aging:** Transition in behaviours depending on life experience.
- **Sociological Aging:** Related to the changes of person's norms, expectations, status and roles in society in the lifetime (Oktik 2004).

Gerontologists conceive human aging as a continuous, complex, and dynamic process starting with birth and ending with death (Pirkl 1994). Ageing appears at the biochemical and cellular levels. One theory, he claims gradual cellular damage through gene mutation, protein degradation, or autoimmune processes cause aging. Another theory defines that aggregation of toxic substances, possibly from cell metabolism cause aging. Sloane shows to this theory's relation to brain cells, which can not replicate like the cells of most bodily organs. Cell senescence is still another theory. In this theory, cells are genetically programmed to age. As Sloane argues that this theory:

> "Genetically programmed decrements…could contribute to age-associated declines in T-cell function, to degenerative vascular disease, and to producing a finite limit to the human life span" (Pirkl 1994, p.31).

When it comes to define the aging it is not possible to find a single or universally accepted definition for it and no single theory sufficiently describes the aging. Therefore, aging has some priorities due to old people's personal characteristics, cultural norms, lacking of physical and psychological levels, and also social environment and environmental variables at micro and macro scales. For example, aging appears in advanced ages which are 65 or 70 in most modern societies whereas it exists in the middle ages that are 45 or 50 in developing societies. The concept of old age itself also emerges to be associated with the degree of modernization.

## 2.1.1. Definitions and Classification of Aging

"When do people become elderly" is a question that has included no clear answer over the years. Most demographic studies define the elderly in terms of some casual chronological age, usually 65. This definition presents a distorted view of aging.

A useable definition of elderly is that when the functional limitations tend to be associated with advanced age present a significant handicap to the individual in relation to his or her desired role in life. Accurately, this definition can include a wide range of ages and circumstances (Pirkl 1994).

Sağdıç (1997) categorizes the human life in three periods that childhood, adulthood, and elderly (Figure 2.2). Firstly, the most specific changes are appeared during the childhood: infant (0-2 years old), early childhood (3-6 years old), middle childhood (7-12 years old), and adolescence (13-19 years old). Secondly, the adult period consists of young adult (20-34 years old), adult (35-49 years old), and middle aged adult (50-64 years old). Thirdly, in the elderly period, important distinctions appear when compared with the adulthood. Sağdıç cited that Arber and Ginn (1993) classifies this period associated with chronological age as: "young elderly" (65-74 years old), "old elderly" (over 75), and "the oldest old" (over 85).

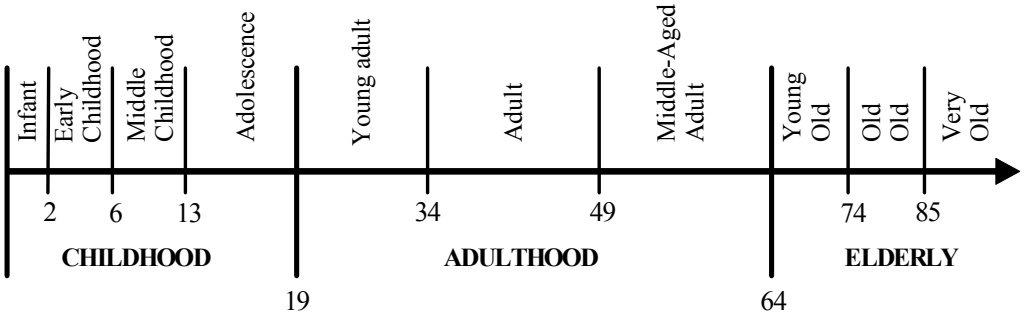



Figure 2.2 Phases of human life (Reference: Sağdıç 1997)

Similarly, Callahan (1987) states the elderly may be qualified as: the "young old" (65-74), the "old old" (75-84) and the "very old" (85 and over). According to the American Public Health Association also proposes the age classification as follows: (1) Infancy; up to 1 year, (2) Preschool period; 1 to 4 years, (3) School years: 5 to 14 years, (4) Adolescence:14 to 24 years, (5) Years of greatest activity: 25 to 44 years, (6) Middle age: 45 to 64 years, (7) Early period of old age: 65 to 74 years, (8) Old age: 75 years and over. The most pronounced features of this classification are the fact that

adolescence is raised up to the age of 24 and old age does not begin until age 75. Physiological development seems to be ignored in this classification when compared with the others.

Cowgill (1970) also defines the most common statistical definition that old age begins at 65, but Tufan (2002) argues that this definition for the aging is completely new, and agreed by twentieth century people and also including some problems. One day, for example, the age of 65 could be seen the starting point of youthful, retirement age could be 100 and consequently, the starting point of the agedness might be different.

Biological aging, on the other hand, appears nearly at 75 years old. 56 % of the old people 75 and older might not be able to do the daily activities. According to Evans & Rogers that physical activity is one of the basic functions that have been developed for mobility for an aging person. Therefore, the weakening physical capacity of a person is just an unavoidable result of biological aging. In functional capacity these changes cause cardiovascular, respiratory and metabolic troubles. This situation badly affects not only the person's physical performance but also his daily routine.

Eventually, little correlation exists between chronological age and physical capability. According to gerontologists that chronological age is not an accurate guide for assessing the likelihood of experiencing problems normally associated with becoming old. Such problems do not appear with regularity to all people at some predetermined chronological age. Each person ages at his or her own pace. This means that at any given age, one person may have an "old" heart and "young" eyes and another may have a "young" heart and "old" eyes. Even within the same individual, different bodily organs age at different rates. Not chronological age but functional problems define who is old. Nevertheless, problems normally related to old age can be occurred in younger populations. Therefore, while elder people have more functional limitations, impairments often attributed to "elderly" conditions are commonly experienced by younger people, many of whom are in worse physical condition than their older parents.

### 2.1.2. The Four Phase of Aging Process

If people perceive life as a process spanning a continuum stretching from birth to death, a variety of understanding of the aging process occur. First model as a popular

wisdom suggests that the functional capacity increases steadily from birth until person retire, at which time person becomes old, his or her functional capacity declines, and he dies. This analysis serves only to support the old myths and stereotypes and it ignores the realities of the aging process. The individual discords also appear between individuals as age increases. It can be seen in Figure 2.3.

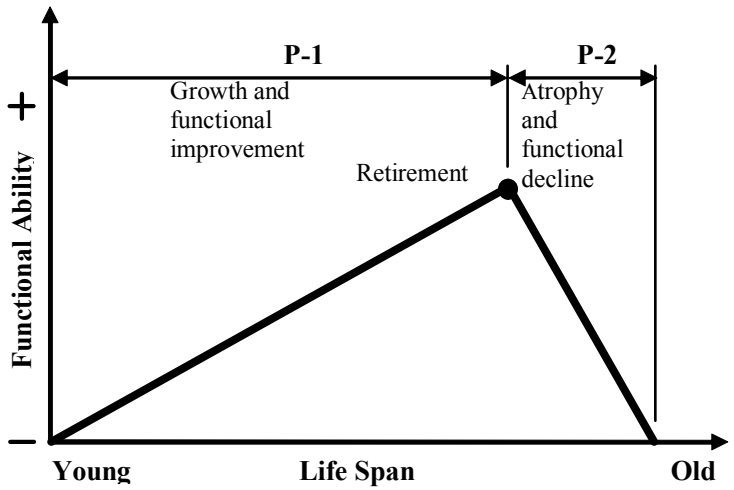



Figure 2.3 Popular conception of life span (Reference: Pirkl 1994)

Weisgerber (1991) proposes similar model that implies the various biomedical and environmental influences on aging the notion that life proceeds in two phases (Figure 2.4). Phase one consists of growth and functional improvement and phase two consists of atrophy and functional decline.

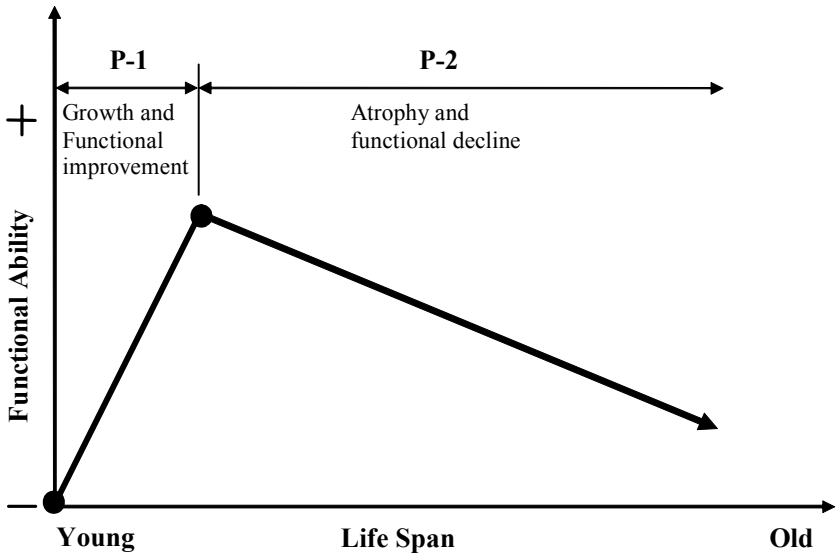



Figure 2.4 Model of two-phase of life span (Reference: Pirkl 1994)

A third model is offered by Weisgerber (1991), more complicated. It consists of four phases (Figure 2.5).

First phase is represented by line A-B, growing and functional improvement. It spans the years of the infancy, childhood, and formal education. Measured growth, rapid skill development, socialization, and structured learning are materialized in this period that defines the unique characteristics. Through this phase mind and body develop to make ready people for the challenges awaiting them in their adult years.

Second phase, a constant and nearly level period of adult productivity is represented by line B-C. Weisgerber (1991) defines that responsibility and accomplishment, and characterized by freedom of choice, independence, and self-sufficiency underscore the years and also it generally lasts well into retirement. This period surrounds the working years, is affected by a gradual decline in vital body functions at a rate of approximately 1% per year starting from the age retrogression begins.

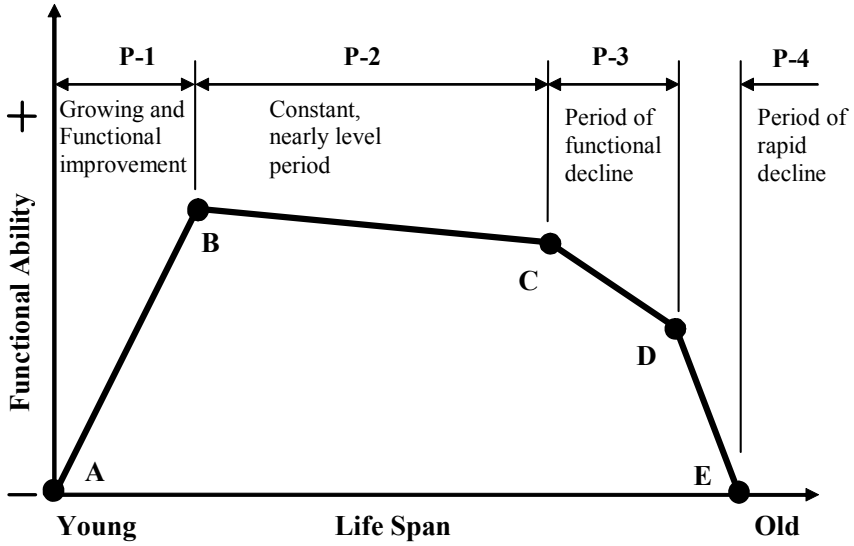



Figure 2.5 Model of four-phase of life span (Reference: Pirkl 1994)

Third phase, a period of functional decline is represented by line C-D. The restorative abilities progressively decline because the mechanisms of biological aging attack the body's physical and sensory health. Accordingly, functional declines cause by impairments in the motor capacity and perception produce corresponding loss in the faculty to perform the activities of daily living (ADL).

Last period is represented by line D-E, a rapid decline following the onset of aging manifestations. It starts at point of D. Changes caused by the decline associated

the already diminished capacity to remain active and maintain independence. It is important to notice that the location of point D, changes with each individual, appearing within a wide range of ages and a wide range of functional abilities (Pirkl 1994). Individual differences increase with age due to nongenetic factors, such as environment and life style Dahlman (1989). The bodily systems begin to atrophy, accelerating the deterioration of the biological processes until death occurs because of dropping the activity level. The location of point E also changes between individuals. Figure 2.5 shows the relationship of these phases.

Elderly people need more environmental support that becomes increasingly critical during Phase 3. Such support that amends for the progressive decline of the functional body, enables many elderly to remain independent and continue their normal ADL. Walkers, grippers, writers, dressers, squeezers, holders, supporters, clippes, turners and openers can be called "supportive devices" and are also marketed for use during this period. Most of them, however, lead older people to view themselves as sick or frail and expose them to such psychological and social stresses as frustration, lack of self confidence, and also lack of stimulation (Pirkl 1994). According to Regnier:

> "Many designs intended to address the physical limitations of the elderly, instead present and reinforce a stereotyped image. Some products are designed with an institutional image, associating them with a disability or nursing home environments. Such discriminating designs are rejected by all except those whose condition demands that which is immediately available" (Pirkl 1994, p.35).

An individual's inability to cope with environmental stresses can cause the body's defence mechanism. This unites one's condition and causes the premature arrival of critical support point (CSP). It is visualized as in the following Figure 2.6.

The range of usability to include elderly people and those with reduced functional abilities, as well as the young and able-bodied, however, are extended by transgenerational products. Such products are interested in human performance and comfort during the life span and contribute to optimizing health in later life. It is important that, the CSP can be extended by such products that lengthen the period of one's independence and life (Pirkl 1994).

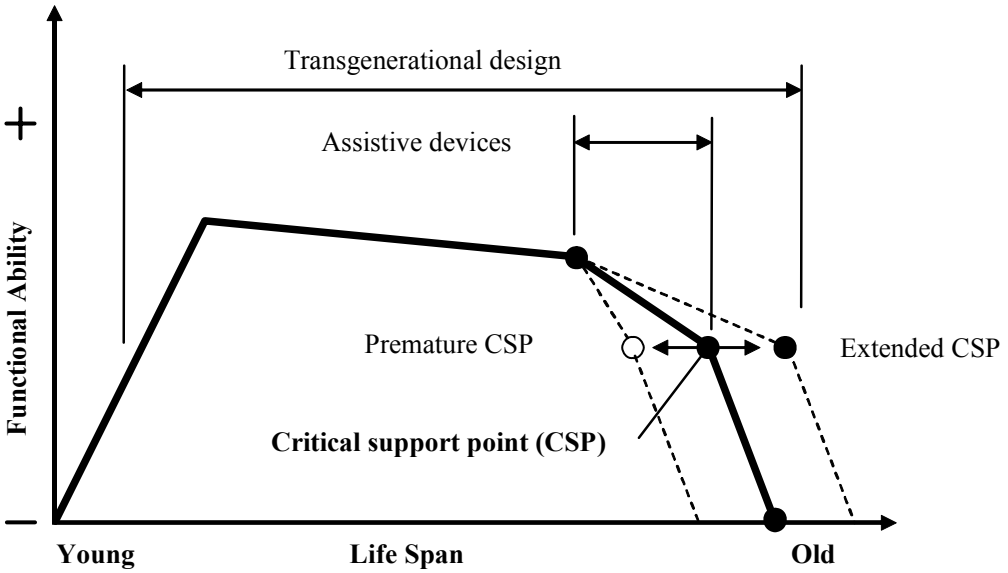



Figure 2.6 Critical support point (Reference: Pirkl 1994)

## 2.1.3. Characteristics of Aging Population

The elderly may not be placed in a stereotypical group. Thinking of the elderly as a homogeneous group is one of the most common errors about them. Although many people believe older people become more alike, the elderly get more dissimilar, with increasing age. Firstly, there is a great diversity among the elderly. Secondly, he states there is a forming classification about the characteristics of elderly groups. These characteristics thought are generally negative ones such as physical weakening, fragility, senility, and isolation.

In fact, diversity between the young and the old is less than among the elderly. Elderly people, a diverse and heterogeneous group, vary due to age, gender, race, experience, social group, culture and ability. First of all, age only is not an accurate clue of determining either personality or behaviour. Some people, for example, work actively until their nineties, whereas others retire half their age. Moreover, such diverse categories as full-time and part-time workers, the retired, middle-age couples, the elderly widow or widower living alone, the physically and socially active, and those with mild or severe disabilities are included by people ranges in age from 50 to 100 Allan (1981). Second, chronological age differs from physical age. A person who is chronologically old cannot be physically old. One may be “old” at 75, another may be “old” at 40 (Pirkl 1994). Therefore, chronological age may only be misleading to determine the aging process.

Consequently, reduced eyesight, hearing, arthritis, sprains, burns, and broken bones cause the feelings of helplessness and frustration. Product design is one of the most important areas that provide to solve the variety of functional limitations associated with normal aging.

### 2.1.4. Milestones of Aging Process

Confidence, self- indulgence, and immortality are common senses in the years of twenties. People leave their teenage image and continue to climb to the life. They also experience the courtship and marriage. The proportions of the values, abilities and the personality are defined in this time. Moreover, thinning hair and declining in near vision are the first signs of personal aging. It is also a time in which people mostly ignore their health and survival of all the ages. The most commonly threat about people's life is violent death such as motor vehicles, suicides, and homicides instead of health related causes. Furthermore, physical injuries with disabilities demolish the ambitious and aspirations (Pirkl 1994).

Grey hair and changing hairline present to coming the years of thirties. After 35 years old, people begin to recognize their individual limitations and the idea of immortality is left. Work life and career gain priority due to financial issues about family, job and home in these years. Regular eating habits and lack of exercise invite injuries and diminish the youthful resistance to disease. Injurious life style components like smoking, alcohol, drugs, and stress also tend to blight heath and well-being. Some of chronic diseases, such as bronchitis and hypertension begin occurring, however, they tend to get active later years.

Forties are the years in which people pass from young-middle to middle adulthood. People become aware of life's finite limitations and their own mortality. It is a time of adjustments that people begin to consider past and future expectations. This frequently leads to the familiar "mid-life crisis". People incline their focus from pursuing specific goals to exploring their inner self.

> "Internal unrest and frustration may bring dramatic life style turbulence, which can influence threats of cancer, heart disease, accidents, cirrhosis, cardiovascular diseases, and suicide" (Pirkl 1994, p.39).

By age 40, most of people need glasses and all have osteoarthritic changes visible in radiographs of the cervical spine. People's values and attitudes that are accepted during thirties and forties slowly begin to change in fifties. They become less irritable and their outlook becomes more philosophical. Joy, sorrow, tenderness, and affection are more common feelings than hatred, anger, and self-pity. Health problems begin to restrict some activities. Obesity, heart disease, cancer, cardiovascular disease, accidents, and cirrhosis are the main diseases. Fifties are the years in which the first signs of Alzheimer's and Parkinson's are appeared.

One of the most important events is retirement that defines the decade of the sixties. The U.S. Social Security Act of 1935 accepted 65 as its year for "normal" retirement that continues today, however the retirement age continues to decrease with the time (Pirkl 1994). Although people between 65 and 70 years have some potential losses and limitations, they are happier than in any younger group as they get certain advantages such as, more independence, fewer responsibilities, less concern about daily inconveniences.

Elderly people who live their seventh, eighth, and ninth decades cope with variable losses in health, mobility, independence, material possessions, memory capacities, and sensory capabilities. When people live longer, the chance of activity of daily living (ADL) will reduce. The elderly are prevented by physical impairments and at least one chronic disease. Their limited mobility restricts their natural autonomy and accommodations. It is a time that bereavement and loneliness become common senses. When physical impairments decrease the ADL and the sense of independence, sensory impairments, particularly loss of hearing, may affect the social interaction and cause the sense of isolation among the elderly in these years (Pirkl 1994).

### 2.1.5. Occurance of Aging Population

Nineteenth century was a period in which everything was in transition. In this century, humankind had so many differences in all field, however, there was a world of difference in opinions. As a human being, people questioned the real meaning and the aim of their existence in community, their environment and general awareness climbed. Up to the beginning of the twentieth century, appropriate conditions to supply a long life were not in existence in any part of the world. In Germany, in which life span is the

highest nowadays, average life span was under 50 a hundred years ago. When twentieth century started, economic, political, scientific and social improvements had already altered either the framework of the senescence or Europe (Tufan 2002).

Throughout the twentieth century, although senescence was not considered as an illness, it was quite similar to disability. In the following years, it was regarded as a phenomenon and it took place in social issues. Together with the validation of retirement pensions, people started to consider the senescence on a special period of life depending on age and it has been begun to define by the calendar (Tufan 2002). The body's cells may be genetically programmed to age. Toxins may cause human aging by damaging the cell's gradually over time. Although there is not a single theory, Sloane proposes a useful rule of thirds for considering functional declines in elderly against the old understanding of aging: 1/3 due to disease, 1/3 to inactivity (disuse), and 1/3 caused by the aging process itself (senescence) (Figure 2.7).

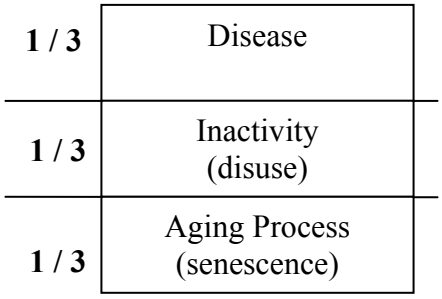



Figure 2.7 Rule of thirds for considering functional declines in older people
(Reference: Pirkl 1994)

At the same period, in Europe a growing movement was observed among social life, industry, and science. French revolution and industrial revolution, spreading the education to all walks of life, educational campaigns against illiteracy, improvement of the microscope, and prohibition of child workers affected the social life from the eighteenth century to the nineteenth century. Family life has differed from large traditional ones to nuclear family type. As a consequence of birth control, the percentage of young generation in overall population has noticeably decreased and the number of the old has increased due to the longer life span. Being old, already considered as an individual happening, has become a social phenomenon.

In addition to the achievements in medication, chemistry, physics, pharmacology and biology, industrial revolution, which completely changed social life, the changing

conditions of work life, and technological developments have caused life span to become longer by leaps.

**Developments in Medical Area**

The most important factor of having a longer life was the medical developments in nineteenth century. Having invented microscope in 1590, Jansen made a major breakthrough in medical treatments and biology. However, scientists did not comprehend its importance until the late 1600s, when Leeuwenhoek first used it in biology and medicine. In nineteenth century, scientist's opinions about the illnesses completely changed due to the discovery of bacteria and they had the opportunity to cure or prevent bacterial infections. The discovery of X-ray by Röntgen in 1895 marked the start of a new progress in medicine (Temel Britannica).

Seeing that the life span has become ten years longer on average since the invention of antibiotics, the significance of the improvements on living a longer life in nineteenth century can easily be understood (Tufan 2002).

**Industrial Revolution and World Wars**

The invention of steam engine, in the second half of eighteenth century, has been one of the most important technological developments, and it could also be considered as a symbol of industrialization. In Europe some major developments in economy were achieved and a new era, called "Industrial Revolution", started after the invention of steam engine. In this process, prohibition of employing child labours caused the number of children in society to decrease and conversely the older population got increased gradually.

On the other hand, Europe, in industrialization process, was greatly in need of raw materials that brought fierce economical competitiveness and caused World War One and World War Second to break out. Nowadays, negative effects of World Wars and the loss of young people in wars have been realized. In Europe one of the reasons of having an older population might be the loss of young people in wars. Having been greatly affected by the loss of young generations in wars, industrialized countries have been the domain of the elderly.

**Industrialization and Urbanization**

In nineteenth century both London and Paris were the biggest cities in Europe. They got over populated during the industrialization period. The principal reason of the population growth in these cities was the migration from villages where people could not make money. Industrialism caused the old people to be isolated from the rest of the community then, because in factories physically strong workers were needed. It was almost impossible for the elderly to find an appropriate position for themselves in society. By the nineteenth century, London and Paris, growing 5 and 4.6 times bigger respectively, became the two important big cities of Europe. On the other hand, irregular growth of the cities affected the older people badly.

## 2.2. The Increase of Aging Population

In the past, the average life expectancy at birth was less than 18 years, most people did not age when they died. Infectious diseases, accidents, violence and many other risks often brought life to an early close. Businesses did not care about the "mature market". Arthritis, heart disease, and Alzheimer's were not major health-care concerns because earlier societies did not get old enough for aging related to conditions to emerge. If one survived childhood, the chances of living into one's 60s, 70s and 80s were not impossible (Dychtwald 1999). The aging period was different either in terms of time and consideration. Today, most people can expect to live longer than did past generations.

Callahan (1987) states increasing life expectancy in the U.S.A. was dramatically constant until the twentieth century. In 1900 there were 3.1 million people over 65, and 4.1 % of the population. Between 1900 and 1984 the number increased eightfold, to 28 million, and 11.9 % of the population. The older generation itself became older: between 75 and 84 group (8.6 million) was 11 times as large as the same group in 1900, and the number of those 85 and older (2.7 million) was 21 times as great. Dychtwald (1999) indicates that throughout the past 1000 years, life expectancy has increased from an average of 25 to 47 at the beginning of the twentieth century, and today increased to 76 rapidly. According to the U.S. Census Bureau, by 2035 some 70 million people, of whom 60 million will be elder boomers, will be age 65 and older (Figure 2.8). This is a number more than twice the current population of Canada.

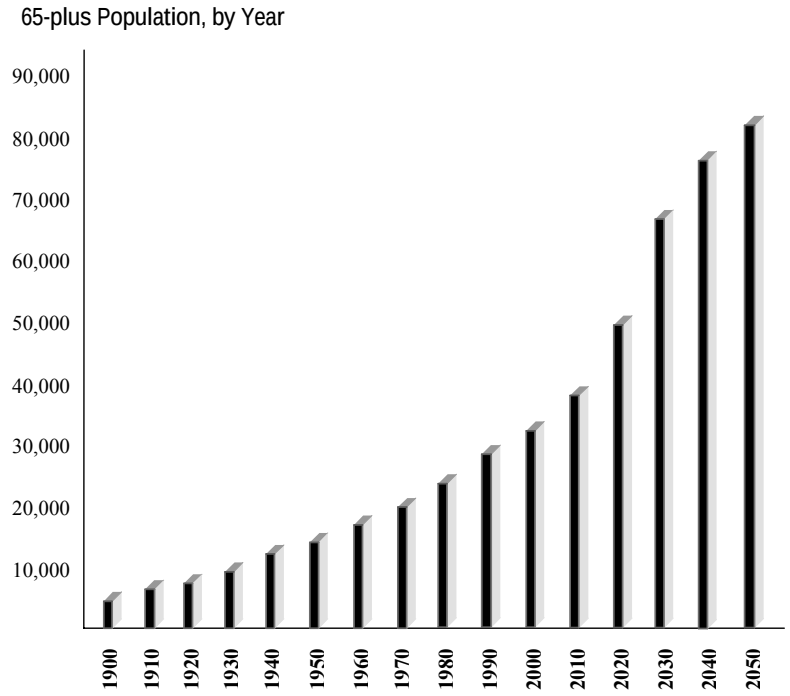



Figure 2.8 U.S. Population age 65 and older
(Reference: Dychtwald 1999)

The United Nations expect that by the year 2050, there will be nearly two billion people in the world 60 years and older which is a number equal to the current combined populations of North America, Europe, and India. Today, according to the U.N.'s Population Division, 1 of every 10 persons living is age 60 or older, but by the year 2050, that ratio will double to 1 of 5 (Dychtwald 1999). And this age shift is reconfiguring the older population segment as well.

According to Coleman et al. (1991) the fastest growing age group among the elderly are those 85 and older that called the "very old" or "oldest old". This group alone will more than quadruple from 3.25 million to 15.3 million, increasing from 10 % of the over 65 population in 1990 to 22 % in 2050. The U.S. Bureau of the Census projects that between 1990 and 2050 the population will increase by 19.8 %, growing from 250.4 to 299.9 million whereas the population of those 65 years and older will increase by 117 %, from 31.6 million to 68.5 million. Table 2.2 represents the alternatives projections of 65 and over and 85 and over of the U.S. population.

| | 1980 | 1990 | Middle Series mortality 2040 |
|---|---|---|---|
| ***Population (thousands)*** | | | |
| ***Age 85+*** | 2.240 | 3.254 | 12.834 |
| ***Age 65+*** | 25.549 | 31.559 | 66.989 |
| ***Percentage of 65+ Population*** | | | |
| ***Age 85 and Over*** | 8.7% | 10.3% | 19.2% |

Table 2.2 Alternative Projections for the 65+; and 85+; 1980, 1990, and 2040 (Reference: Regnier 1994)

Similarly, the aging populations of Western societies have also been increasing over the last 85 year. This increase in Western European countries has begun nearly 20 years before from the United States. Moreover, the population of those 65 and older in England, Germany, France, and Sweden was already at 14 to 15 %, by the mid 1970s. On the other hand, the United States is not estimated to reach the 14 % level before the years of 2000. At the same time, projections show that Western Europe will have hit the 20 to 25 % and some nations such as Sweden and Japan can estimate their 65 and older populations to increase to over 25 % during one decade after 2000 (Pirkl 1994). Today, the most serious currently population is in Europe and Japan. Cowgill (1970) states all of the "aged" populations are in Europe. They range from Switzerland with 10.6 % 65 and over to Monaco with 19.9 % whereas the countries Canada, Australia, and U.S. are classified as "mature" populations appear to include the more youthful of the highly developed nations.

There were only 131 million people of age 65 and over in 1950 (WEB_1, 2005). Their number had more than tripled and was reached 420 million, 6.9 % of world population in 2000 (WEB_2, 2005). Between now and 2025 the number will more than double again, and by 2050, the 65 and over population will grow nearly 1.4 billion people (WEB_1, 2005). These estimated numbers of the 65 and older people are visualized in Figure 2.9.

Although world population continues to grow, in the last couple decades the rate at that it has grown has begun to steadily slow and will likely continue to decline through the beginning of the twenty-first century and beyond. It can be seen in Table 2.3. and Figure. 2.10.

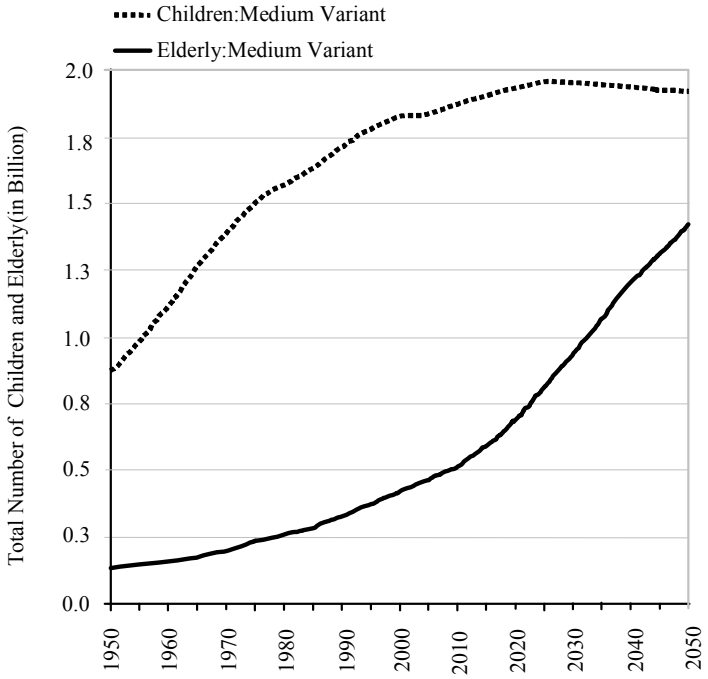



Figure 2.9 Total number of children (15 years and under) and elderly (65 years and older) (Reference: WEB_2, 2005)

| | **1750** | **1800** | **1850** | **1900** | **1920** | **1940** | **1960** | **1980** | **1990** | **2000** |
|---|---|---|---|---|---|---|---|---|---|---|
| ***World*** | ***2.9*** | ***4.4*** | ***5.1*** | ***6.3*** | ***7.3*** | ***10.4*** | ***13.8*** | ***18.9*** | ***17.8*** | ***16.2*** |
| ***Europe*** | 3.4 | 5.8 | 7.0 | 8.2 | -10.2 | 7.5 | 5.6 | 6.5 | 3.5 | 3.7 |
| ***United States*** | -0.8 | 14.7 | 17.2 | 17.8 | 17.9 | 16.3 | 20.6 | 19.7 | 19.7 | 18.3 |
| ***Oceania*** | 0.0 | 0.0 | 0.0 | 22.0 | 17.4 | 13.3 | 18.3 | 18.1 | 12.3 | 14.3 |
| ***Africa*** | -0.5 | -1.1 | 1.1 | 4.7 | 8.8 | 14.5 | 18.2 | 26.7 | 29.5 | 27.3 |
| ***Asia*** | 3.7 | 4.6 | 4.4 | 4.5 | 11.4 | 10.0 | 13.8 | 19.9 | 17.6 | 15.2 |

Table 2.3 World Population growth rate (%) (Reference: Ergene 1996)

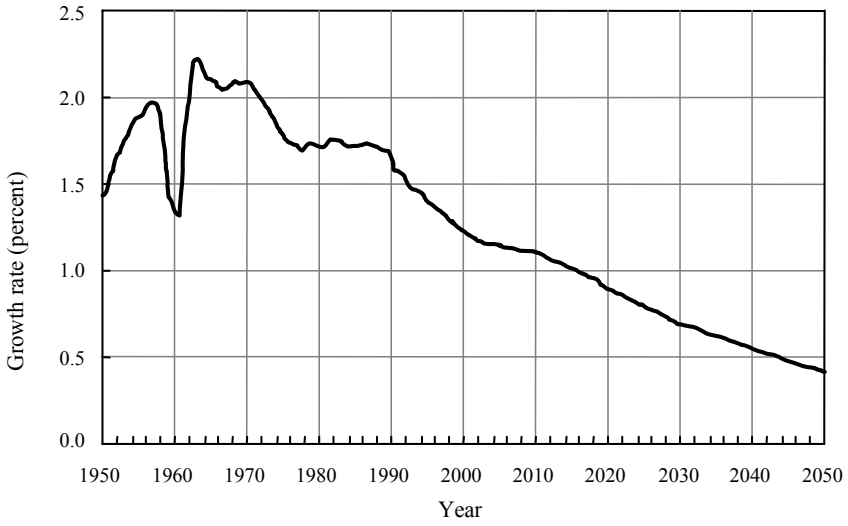



Figure 2.10 World Population Growth Rate: 1950-2050 (Reference: WEB_1, 2005)

The age structure of age population will continue to change. It is accurately seen that from 1998 to 2025 the world's 65 and over population will have doubled while the world's 15 and under population will grow by 6 %, and the number of 5 and under children will increase by less than 5 % (WEB_3, 2005). Demographic trends vary widely in different regions of the world. Most of the more developed countries will have aging and population declines in both birth and death rates, while developing countries will continue to have increasing populations. Consequently, world population get older during the next 25 years.

### 2.2.1. Increasing Life Expectancy

Having a longer life is a phenomenon of the twentieth century and more usually in industrialized societies. All the modernized nations of the world are developing from youthful to mature societies in the twenty-first century. This increase could also be explained with the lifetime expectations. The expression of "lifetime expectations" means how long a person lives. In developed countries, people expect to have a long lifetime as people could live longer there.

Twentieth century has been a turning point for lifetime expectations. In Germany, from 1901 to 1910 lifespan was 44.8 years for male people, 48.3 for female people. In 1987 the ages increased to 71.8 years for males and also the ages increased to 78 years for females. In the U.S.A between 1929 and 1931 life expectancy was 59.8 years for males and 61.1 for female people, and also in 1984 it raised to 76 years for males and 78.3 for females (Callahan 1987). In 1950 the average life expectancy for Japanese males was 58 years, and for females 61.4. Today, Japanese is the nation whose expectation is the highest with 75.6 years for males, and 82 years for females. In one generation, the life expectancy of Japanese has increased by more than 30 %. Although Japanese seniors currently contain 15 % of their society, forecasts show that by 2025 that number will increase to 25 % (Dychtwald 1999). Nonetheless, this expectation is below 70 in Azerbaijan, India, Iran Islamic Republic, Egypt Arab Republic, Pakistan and Russian Federation. As come to Türkiye, the average lifetime expectation was 65.58 years during 1985-1990 according to SIS (State Institute of Statistics), but it is 68.55 years by the period of 1995-2000 and in 2002 it is 70 years (Table 2.1). Probably, it will reach the level of developed countries due to the high quality health services, and

life standards.The relationship of population indicators in selected countries is represented in Table 2.4.

| | Population | Average annual population growth rate (%) | Population density | Life expectancy | Under mortality rate (%) |
|---|---|---|---|---|---|
| | 2003 | 1990-2003 | 2003 | 2002 | 2002 |
| ***Turkey*** | 70.7 | 1.8 | 92 | 70 | 41 |
| ***USA*** | 291.0 | 1.2 | 32 | 77 | 8 |
| ***Germany*** | 82.6 | 0.3 | 237 | 78 | 5 |
| ***Australia*** | 19.9 | 1.2 | 3 | 79 | 6 |
| ***Austria*** | 8.1 | 0.3 | 97 | 79 | 5 |
| ***Azerbaijan*** | 8.2 | 1.1 | 95 | 65 | 96 |
| ***Belgium*** | 10.3 | 0.3 | 342 | 79 | 6 |
| ***Bulgaria*** | 7.8 | -0.8 | 71 | 72 | 16 |
| ***Czech Republic*** | 10.2 | -0.1 | 132 | 75 | 5 |
| ***China*** | 1.288.4 | 1.0 | 138 | 71 | 38 |
| ***Denmark*** | 5.4 | 0.4 | 127 | 77 | 4 |
| ***Finland*** | 5.2 | 0.3 | 17 | 78 | 5 |
| ***France*** | 59.7 | 0.4 | 109 | 79 | 6 |
| ***India*** | 1.064.4 | 1.7 | 358 | 63 | 90 |
| ***Netherlands*** | 16.2 | 0.6 | 479 | 78 | 5 |
| ***United Kingdom*** | 59.3 | 0.2 | 246 | 77 | 7 |
| ***Iran Islamic Republic*** | 66.4 | 1.5 | 41 | 69 | 41 |
| ***Ireland*** | 3.9 | 0.9 | 57 | 77 | 6 |
| ***Spain*** | 41.1 | 0.4 | 82 | 78 | 6 |
| ***Sweden*** | 9.0 | 0.3 | 22 | 80 | 3 |
| ***Switzerland*** | 7.3 | 0.7 | 186 | 80 | 6 |
| ***Italy*** | 57.6 | 0.1 | 196 | 78 | 6 |
| ***Japan*** | 127.2 | 0.2 | 349 | 82 | 5 |
| ***Canada*** | 31.6 | 1.0 | 3 | 79 | 7 |
| ***Colombia*** | 44.4 | 1.8 | 43 | 72 | 23 |
| ***Hungary*** | 10.1 | -0.2 | 110 | 72 | 9 |
| ***Egypt Arab Republic*** | 67.6 | 1.9 | 68 | 69 | 39 |
| ***Norway*** | 4.6 | 0.6 | 15 | 79 | 4 |
| ***Pakistan*** | 148.4 | 2.4 | 193 | 64 | 101 |
| ***Poland*** | 38.2 | 0.0 | 125 | 74 | 9 |
| ***Portugal*** | 10.2 | 0.2 | 111 | 76 | 6 |
| ***Romania*** | 22.2 | -0.3 | 96 | 70 | 21 |
| ***Russian Federation*** | 143.4 | -0.3 | 8 | 66 | 21 |
| ***Saudi Arabia*** | 22.5 | 2.7 | 10 | 73 | 28 |
| ***Tunisia*** | 9.9 | 1.5 | 64 | 73 | 26 |
| ***Greece*** | 10.7 | 0.4 | 83 | 78 | 5 |

Table 2.4 Population indicators in selected countries
(Reference: Turkey's Statistical Yearbook 2004)

In underdeveloped countries in Africa and Latin America, moreover, it is below 50 years. Callahan (1987) notices that by 2050, it is estimated that males will have a life expectancy of 79.8 years and females 83.6 years in the U.S.A. The life expectancy could, accurately, be much greater.

At the same time that decreasing fertility rate is also an important factor increasing the population of elderly people. While people are living longer, fertility rates in the U.S., Europe, Japan, and other modernized nations decrease because of having fewer children. According to Carl Haub, who is a demographer at the Population Reference Bureau in Washington, DC that population decline due to low fertility is a new phenomenon unlike previous declines due to catastrophic events such as the World Wars. In the U.S., the fertility rate is approximately 2.1 down from 3.8 during the 1950s and early 1960s. In the Europe, the fertility declined around 1965 almost simultaneously in every country. The Italian fertility rate which is the lowest level ever recorded in any society recently dropped to fewer than 1.2 children per woman. Italy also became the first country which is followed thereafter by Germany, Greece, and Spain to have more people over the age of 60 than under the age of 20 (Dychtwald 1999).

According to Cox (1993) in the modern cycle, there is a permanent reduction of the death rate. It appears to drop from about 35 or 40 deaths per thousand to about 8 to 12 and remains at this lower level. The continuity of this transition from high death rates to low death rates and a subsequent similar transition in the birth rate cause the demographic transition. The most notable feature is the transition from high death rates and high birth rates to low death rates and low birth rates. At the beginning both rates are high and the cycle begins to fall. Eventually, the death rate begins to level off because it reaches a quite low level. This demographic transition is visualized in Figure 2.11. Fertility and mortality continue to reduce in most world regions, and both have reached levels unprecedented in human history.

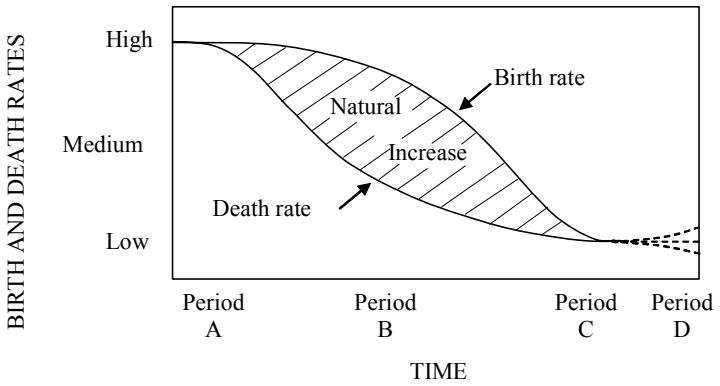



Figure 2.11 The demographic transition (Reference: Cox 1993)

On the other hand, Callahan (1987) states the possibilities of longer lives: (1) prolongs the opportunity for gathering social, psychological, and biological experiences;

(2) maximizes a person's opportunities to complete or to change the role charges of early and middle life, for example, to change jobs, marriage partners, or educational plans, and to take on new roles in the later years; (3) prolongs a person's relationships to others, such as spouse, parents, offspring, and friends; (4) rises the potential structural complexity of a person's social networks, for example, friendship, community as all members survive longer. All these consequences of longevity, people now have many opportunities to accumulate experience, to exercise new and expanded options, to respond to social change.

Although longevity has brought many benefits and delights to lives of many elderly, Callahan (1987) argues that it has caused still some problems. Firstly, prolonged experience may be misery as well as pleasure, the changing of marriage partners may cause loneliness, and the complexity of the life might be a burden rather than liberation. Secondly, there are large numbers of people in chronic illnesses, such as, Alzheimer disease, permanently disabled by arthritis or dementia or stroke, have joined some new fears to the elderly. The success of medical care, can save lives in unimaginable ways, has produced a sharp increase in chronic illnesses. Lives are saved, but lives will be sick until death finally happens. The great killers of the elderly are heart disease, cancer and stroke that have yet to be cured. With increasing longevity, not only do they emerge, but also do other diseases as well.

Great progress has been made in lengthening the life expectancy is not incidental. Longer life span has been inevitable as a result of infectious disease control, social developments in work life, a higher level of education, scientific and technological developments accordingly urbanization and new medical and rehabilitation techniques have become more widespread. As a result of urban life, faster decrease of both fertility and death rates in industrial nations gives special importance to investigate the relations between life expectancy and elderly. An extended life span means considering the stages in life, and possibilities of life, in new ways. Not only are the facts of life changed, but also the meanings related with them.

### 2.2.2. Sex Ratios of Aging Population

The greater life expectancy of females of course causes to result a greater number of females in the older population. Pirkl (1994) explains the sex ratio (the

number of men per 100 women) varies over the human life span. While people get older, woman population begins to increase greater than man population. At the beginning, there are 105 male births for every 100 female births. When women arrive their third decade (age 20-29) the number of males and females equalize. According to Cowgill, for the population of 65 and over, the ratio increases to 130.3, or an excess of 31 females per 100 males (Cowgill 1970). From then on, woman population sharply increases. As people reach the "old old", the difference between female and male ratio becomes more pronounced. When people approach 85 years, the sex ratio is nearly 50 men to every 100 women, or about one male for every two females. Figure 2.12 shows the relationship between ratios of males and females.

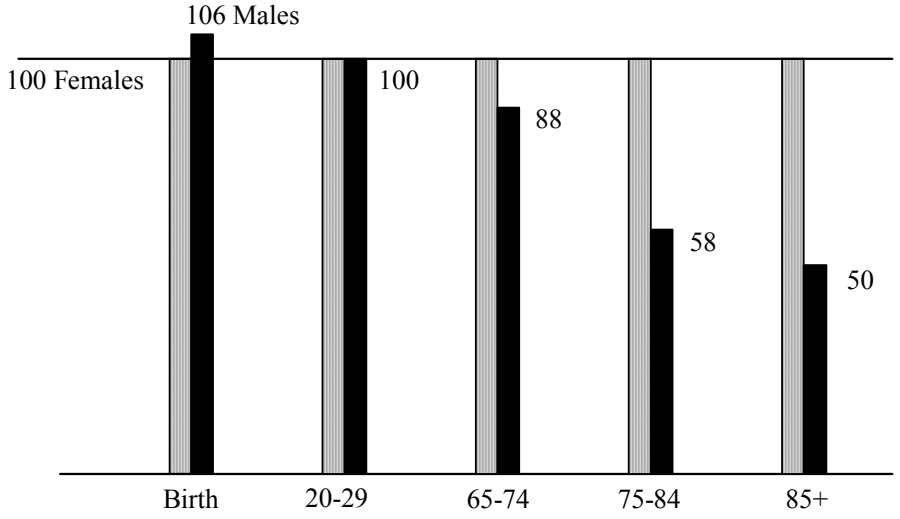



Figure 2.12 Sex ratio over the life span
(Reference: Pirkl 1994)

Not only populations get older, but also they become predominantly more female in later life. Therefore, particular needs of older female may become more important, designing and marketing products for elderly.

## 2.2.3. Demographics of Aging in Türkiye

As all over the world, it has been observed that the older population has been growing due to the medical developments and the longer lifespan in Türkiye. Dispersion of elderly population is seen in Table 2.2. According the statistics in our country, there are 7.656.436 old people and it is about 10.85 % of the population (Oktik 2004).

| Age | Male | Female | Total | Population Rate |
|---|---|---|---|---|
| 60-64 | 941.219 | 1.050.533 | 1.991.752 | 2,82% |
| 65-69 | 770.973 | 879.638 | 1.650.611 | 2,34% |
| 70-74 | 676.931 | 867.028 | 1.543.959 | 2,19% |
| 75-79 | 422.027 | 689.958 | 1.111.985 | 1,58% |
| 80-84 | 179.868 | 283.733 | 463.601 | 0,66% |
| 85-89 | 107.606 | 220.452 | 328.058 | 0,47% |
| 90-94 | 91.416 | 222.149 | 313.565 | 0,44% |
| 95- | 73.901 | 179.004 | 252.905 | 0,36% |
| **Total** | **3.263.941** | **4.392.495** | **7.656.436** | 10,85% |
| Total Population of Türkiye | | | 70.534.746 | 100% |

Table 2.5 Dispersion of elderly population (Reference: Oktik 2004)

When the population growth rate of Türkiye is examined by years, it is seen that the population growth rate which was over 20 % after year 1945 showed a significant decrease after year 1980. While the annual population growth rate was 24.9 % in 1980 and 1985 period, it decreased to 18.3 % in 1990 and 2000 period and showed a decrease approximately 27 % in the last twenty years (SIS, 2000). Figure 2.13 represents the annual growth rate of population.

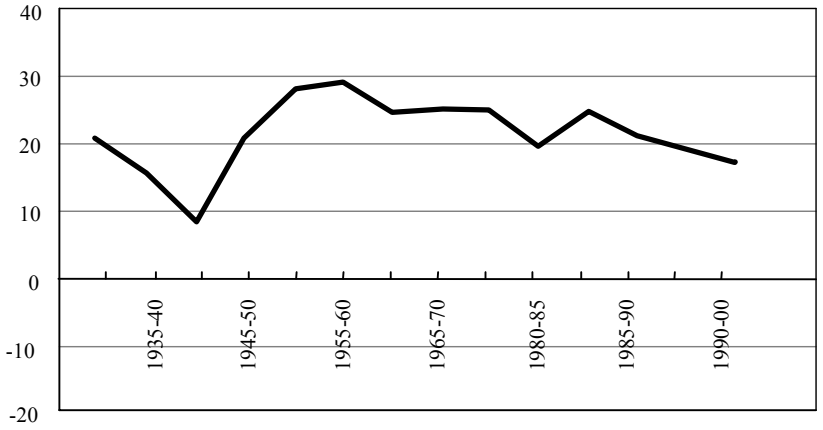



Figure 2.13 Annual growth rate of population (Reference: SIS 2000)

In Türkiye, which can mostly younger population, before 1990's percentage of the elderly was 5 %, but this percentage reached to 7.14 in 1990's census. By 2025, this percentage will probably have been 15 % (SIS 1995). Thus, the increase in the number of the elderly could be inevitable due to the percentage of younger generation, urbanization and decreasing birth percentage because of inheriting lesser land.

The change in the age and sex structure of the population by cohorts can be defined in details with the population pyramids. It in approximately the last fifty years can be explained by examining the population pyramids of the years 1955 and 2000. The most

important characteristic of the population pyramid of Türkiye of the year 1955 is that the population at childhood ages (0-9 years of age) was high by then. This situation shows that fertility had been high level. The population at old cohorts decreases rapidly due to the mortality rate being high for both females and males at these ages. The number of females is more than the number of males at old ages, because females live longer than males. The population pyramid of the year 1955 shows the age structure of the situation that the fertility and mortality levels are high. Another important characteristic of the population pyramid of the year 1955 is that the cohort who is in the "35-39" age group in year 1955, born in the war period before the Declaration of the Republic, has less population than the younger and the older cohorts. This situation results from the fertility level being low in the war period. Figure 2.14 shows the population pyramid of 1955 and 2000.

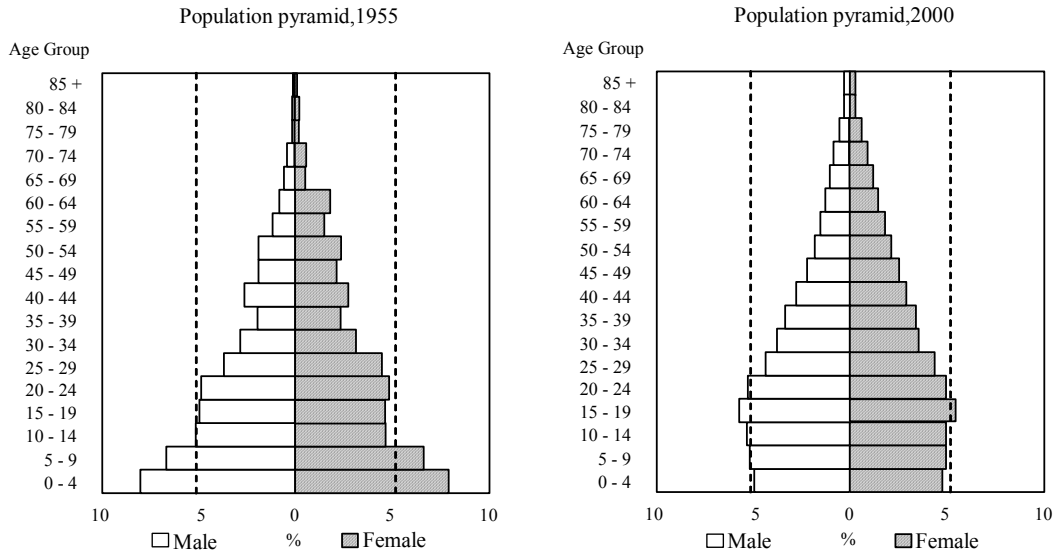



Figure 2.14 Population pyramids, 1955 and 2000 (Reference: SIS 2000)

The population pyramid of Türkiye of the year 2000 has a very different structure from the population pyramid of the year 1955. The most important characteristic of the population pyramid of the year 2000 is that the population sizes of the cohorts who younger than age 15 while age decreases. Such type of population pyramid is seen on situations that the fertility rate has been decreasing. The decrease in population of the older ages is slower and regular than that of it in year 1955 due to the decrease in mortality rate is another important characteristic of the population pyramid

of the year 2000. Generally, the population pyramid of the year 2000 demonstrates a similar structure with that of the developed countries.

There have been significant changes in the growth rates due to age groups. The population of older age groups increased faster than the average of Türkiye while population growth rates at young age groups decreased in the last years. Total population was divided into three groups which are "0-14", "15-64" and "65+" in order to examine the changes in population growth by age groups in 1935-2000 period. . "15-64" age group are called as "producers" because they are contribute to the production. Population at "0-14" and "65+" age groups stated as "youth" and "elderly" respectively and these two groups are accepted to be economically dependent population. The relationship among the age groups is seen in Figure 2.15 (SIS 2000).

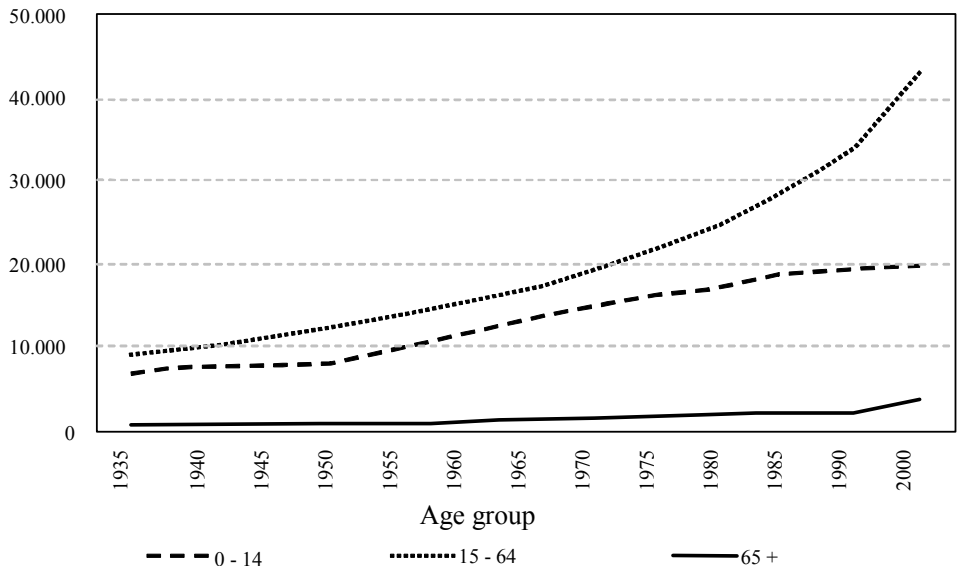



Figure 2.15 Population by age groups, 1935-2000 (Reference: SIS 2000)

When the period from 1935 to 1970 is examined, it is seen that population growth rates of youth and producers were high and population growth rate of elderly population was lower than other groups. In this period, the population size of elderly did not show any significant change, while the population sizes of youth and producers increased in parallel with each other. The population sizes of producers and youth increased 2.2 times and the population size of youth reached approximately from 7 million to 15 million and the population size of producers reached approximately from 9 million to 19 million. It is generally seen with respect to the previous period that population growth rate of youth decreased and population growth rate of producers

increased in 1970-1990 period. In 1970-1990 period, annual growth rate of producers was 29.1 % and that of youth population was 14.2 %.

It is examined that population growth rate of youth approached to zero, that of producers remained at the same level and the elderly has the highest population growth rate in 1990-2000 period. The annual growth rate of population was 46.8 %, while it in Türkiye was 18.3 %, 24.3 % for producers and 2.4 % for youth populations. Population size of youth approached approximately to 20 million and nearly stabilized in this period. Population size of producers approached approximately to 44 million and population size of elderly approached approximately to 4 million. It is guessed that this increase in the population size of elderly will keep on also in the next years (SIS 2000). Table 2.7, Figure 2.16 and 2.17 show the expected demographic indicators.

| | **2005 2010** | **2010 2015** | **2015 2020** | **2020 2025** | **2025 2030** | **2030 2035** | **2035 2040** |
|---|---|---|---|---|---|---|---|
| ***Total fertility rate*** (per woman) 2.33 | 2.18 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | |
| ***Gross reproduction rate*** (per woman) | 1.137 | 1.063 | 1.024 | 1.024 | 1.024 | 1.024 | 1.024 |
| ***Net reproduction rate*** (per woman) | 1.080 | 1.017 | 0.986 | 0.991 | 0.997 | 1.00 | 1.00 |
| ***Mean Age of childbearing*** | 27.1 | 26.5 | 25.8 | 25.8 | 25.8 | 25.8 | 25.8 |
| ***Crude birth rate*** (%) | 19.5 | 17.5 | 16.6 | 16.3 | 15.8 | 15.1 | 14.4 |
| ***Births*** (000) | 1.472 | 1.406 | 1.401 | 1.438 | 1.448 | 1.434 | 1.413 |
| ***Expectation of life at birth*** (year) | | | | | | | |
| ***Total*** | 69.33 | 70.06 | 70.90 | 71.73 | 72.61 | 73.41 | 73.41 |
| ***Males*** | 67.06 | 67.77 | 68.57 | 69.36 | 70.19 | 70.92 | 70.92 |
| ***Females*** | 71.72 | 72.47 | 73.35 | 74.22 | 75.15 | 76.03 | 76.03 |
| ***Crude death rate*** (%) | 7.1 | 7.3 | 7.5 | 7.7 | 8.1 | 8.6 | 9.6 |
| ***Deaths*** (000) | 537 | 581 | 628 | 682 | 746 | 823 | 940 |
| ***Infant mortality rate*** (%) | | | | | | | |
| ***Total*** | 34.4 | 30.1 | 25.7 | 21.4 | 17.2 | 15.0 | 15.0 |
| ***Males*** | 38.4 | 33.6 | 28.8 | 24.0 | 19.3 | 17.0 | 17.0 |
| ***Females*** | 30.3 | 26.4 | 22.6 | 18.7 | 14.9 | 12.9 | 12.9 |
| ***Population increase rate*** | 13.5 | 11.0 | 9.6 | 8.6 | 7.6 | 6.4 | 4.8 |
| ***Mid-year population*** (000) | 75.338 | 80.099 | 84.347 | 88.272 | 91.922 | 95.209 | 97.924 |

Table 2.6 Demographic indicators, 2005-2040
(Reference: Turkey's Statistical Yearbook 2004)

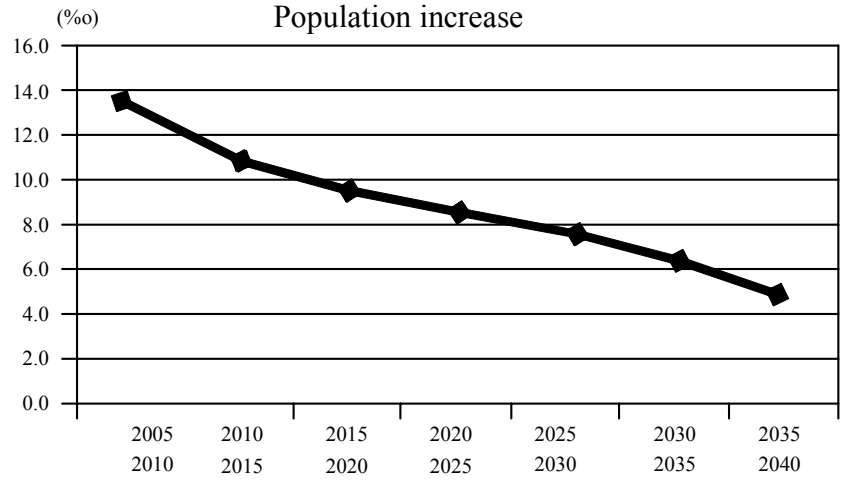



Figure 2.16 Population increase rate, 2005-2040
(Reference: Turkey's Statistical Yearbook 2004)

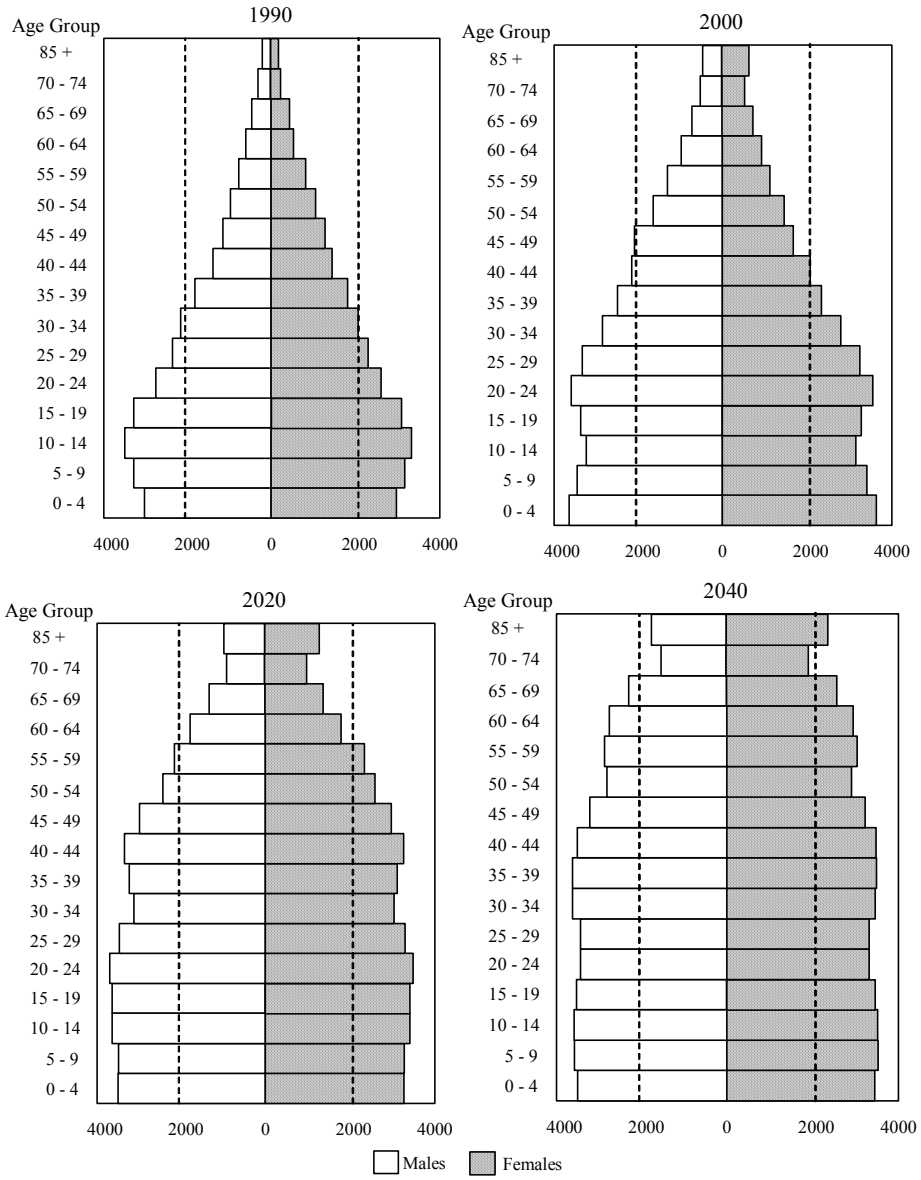



Figure 2.17 Age Pyramid, 1990-2040 (Reference: Turkey's Statistical Yearbook 2004)

## 2.3. Social Structure in Türkiye

Industrialization and development of technology have caused some changes in society. Particularly, the elderly people have been more influenced than the other groups of society. The urbanization phenomenon exists as a result of economic and social changes. Although tradition still has widespread in Türkiye, the industrialization phenomenon also has been an active role on the people, in terms of living style, values and norms in this translational period.

In the last five decades Türkiye has experienced this social change. Geographic mobility of the rural population to urban areas as a result of industrialization can be defined as "urbanization". Although this is a very rare situation in other countries, it is encountered in the big cities of the western and southern regions of Türkiye. A significant increase in the proportion of city population is seen after year 1980 in Figure 2.18.

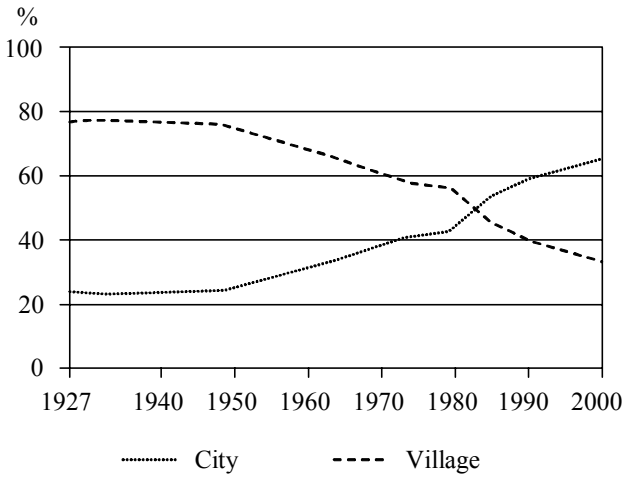



Figure 2.18 Proportion of city and village population
(Reference: SIS 2000)

In agricultural community as soon as people were settled they tended to have larger families as the necessity for farming. The state of having much more life experience and guiding the young generation to find out the most appropriate ways to fight with the nature caused the elderly to have a higher status in society. On the other hand, male old people as being the landowner gained higher status in society. It is still the same as in today's agricultural communities. The elderly has been affected by urbanization, the generation gap and nuclear family type.

With a new social structure the nuclear family has occurred different roles, tasks and power to all groups of society as compared the traditional family. New family structure has reduced the power of elderly in the society. This phenomenon is seen in most of urban elderly families in recent years. For an elderly the economical strength, physical health and the existence of wife or husband help to carry on his social relations successfully.

From sociological view, the greatest dilemma of the elderly is the loss of their status in society such as being parents, wife and husband, friends and also having low income due to the retirement, this group is facing with loneliness, disengagement and alienation. As it is stated by Anspaugh, for many years positive norms and values of society have been based on younger population who are considered as a kind of guarantee for sustaining the society, but this situation possibly causes to reduce old people's respectability (Oktik 2004).

In developed countries, many researches on changes in family ties, as a consequence of modernization, and on the life qualities of the elderly have been done. In contrast the same issues have not been given enough importance in researches yet, in non-developed and developing countries. In our country, senescence which is one of the strategies for development is considered as just a matter of their health and retirement. Moreover, in small cities and rural areas this subject is quite neglected. It is inevitable that the elder who are not very good at agriculture because of getting older, will expose to poverty and loneliness especially after the migration of younger population to bigger cities. On the other hand, old people living in big cities could have the similar problems due to the family relations in transition, cold and repulsive environment in cities, too. Industrialism and urbanization, which are the effective factors of social revolution, could be seen easier for young generation, but the elderly may find it hard to adapt themselves to new values and norms of society. Moreover, it might cause disagreement, and conflict between generations. For the old ones, especially living in elderly houses, these situations seem more problematic (Oktik 2004).

As mentioned above, the elderly people are negatively affected by urbanization and industrialization in our country. Besides they have to face some troubles in adaptation period to the new cultural values and experiences which leads them to the dissatisfaction. People's behaviours and attitudes towards the elderly have always been changeable depending on "society and time". The old people have a higher position and status in some periods but time to time they have been the most neglected group of

people. Respect and sympathy that old people have in daily life is always based on their social level in the community they belong to, their sex and personal property.

Nowadays, in modern societies, being young and physically attractive seem to be more appealing, however, the attitudes towards the elderly have been in transition recently. Despite the fact that the old people will not probably be able to get the some status as the ones in ancient society, their number, all over the world, is still increasing. Increasing number of the elderly caused them to gain much political power and with this power, they might form "a powerful political impact group". This issue is also available information for today's western communities. Considering the number of old politicians in the last 40 years, it is quite possible to see the same "powerful political impact group" in Türkiye, too, although it has a younger population, and its institutional system is not well-established yet, and the pressure of powerful groups is very limited in its political system.

Overall, changes in social and functional roles tend to diminish elderly people's self-confidence and control over their lives, and reduce social networks and economic security. Social and environmental variables such as retirement and lack of exercise accelerate the aging process. Consequently, changes in the family structure and work roles, reduced income, and also increasingly smaller range of activity are the major social and functional role changes. In modern society, for example, having quite similar traditional family ties, nuclear family type causes the caring homes for old people to be widespread.

### 2.3.1. Family Structure in Türkiye

Family is the oldest and most lasting institution in all societies. With the effect of industrialization and urbanization, family structure has begun to change from the type of traditional family to the notion which is called "nuclear family" type. Economic independence, possession conditions, the professions of the members of family, and also cultural developments have influenced the family structure. Although nuclear family involves a couple and their unmarried children, seem to have some traditional characteristics (Kaya 1994).

Family is an issue of great importance to all elderly people. Sociological researchers have declared that grand parents have always had strong relations with their

children and grand children. Retirement, aging and diseases forced the grandparents to get along well with family members. The survival of the elderly who might not have anybody to care for them is quite difficult compared with the ones who live together with their children. This is because meeting the needs of the elderly could be hard for them even if they are very simple and daily (Oktik 2004).

Developments in technology, which caused industrial revolution, changed not only the means of production but also caused some social changes consequently. During this transition, women's productivity has an economical dimension and children's and old people's positions in family life have changed. Children used to work in rural areas; however, migration to big cities, increase of educational opportunities for children moved them to consuming position from production and also put them in the central place of the family as a lovely object. At the same time, the old people who used to have a great status in the traditional family due to the land possession and collective production faced with the danger of losing their power as a result of individual income and urbanization. It could be supposed that, today along with industrialization, old people are faced with some difficulties as a result of cultural changes, modern education system, urbanization, increasing number of the elderly, migration, replacement of the traditional family with nuclear family, decreasing value of land, which is regarded as a symbol of status (Oktik 2004). This situation causes them to feel isolated, in other words, they lose their participatory feelings in social and financial areas. It is quite possible for the elderly that they may feel severe isolation due to loss of physical, social, economical and psychological areas.

## 2.4. Changes of Aging People

The process of aging brings many physiological and psychological changes that influence the functioning of the elderly and his interaction with the environment. One of the most significant results of these diseases is to make them dependant and unable in their daily activities. Real aging is stated by the body's loss of reserve or ability to maintain its balance. Figure 2.19 depicts the limitations of activities of daily living according to age period.

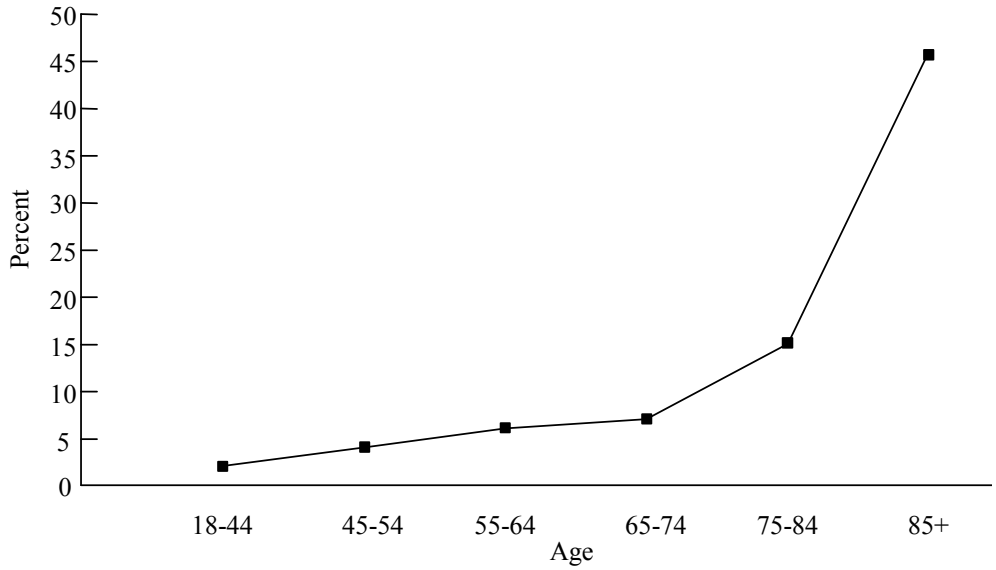



Figure 2.19 Severe limitations of activities of daily living, by age
(Reference: Cox 1993, U.S. National Center for Health statistics)

With regard to physical activities, young adults between 20 and 35 are at the top of either their physical or biological performances. During the middle ages between 35 and 45 physical activity generally decreases conversely, they get much fat 5 or 10 kg., after middle aged period between 45 and 65 women stop menstruating, men lose hormones on a large scale. Despite the fact that this age group might be at the top of their career, they could get physically weaker. During the pre-elderly period between 65 and 75 their physical activities might increase a little but it could be considered as an effort to spend their leisure time efficiently. In the mid-elderly between 75 and 85 some people may have physical troubles but people over 85 are very old and they are almost completely in need of care (Oktik 2004).

Many of the problems faced by the people are caused not by illness but the natural gradual degeneration of the body. As people age chronologically, their bodies grow frail, they begin to lose mobility and their senses become impaired. Although the problems of the elderly that becoming unhealthy (exp.; visiting the hospitals more often), reduction of productivity (exp.; not enough working capacity), and not being able to move 64 without help (exp.; immobility) are quite similar in most countries, in order to increase the alternatives for elder people in daily living activities, product design can respond to changes in sensory processes and perception, the central nervous system and cognitive functions, and also health associated with the aging process.

### 2.4.1. Declines in Sensitivity and Sensory Changes

The elderly people's ability to receive information about the physical and social environment, and also about the body itself is affected by sensory changes during the aging process. All senses that are sight, hearing, taste, touch, and smell gradually decline in sensitivity. Sight is one of the most common and demanding sensory. Nearly half of all visually impaired and blind people and many hearing-impaired people are elderly.

Sensory losses change among individuals. Vision and hearing problems may emerge early in life for some of people, while others save sensory capacity well into the sixth, seventh, and eight decades. At the same time, individual sensory abilities may also change. One can, for example, have poor eyesight and good hearing while another may have good eyesight and poor hearing. Therefore, this variation may appear at different ages for different people. On the other hand, most elderly people with vision impairments also get impaired hearing, mobility, or agility. People tend to solve for the loss of one sense by relying more on the senses that remain. For example, people hearing with loss, unconsciously begin to sight-read lips (Pirkl 1994).

Consequently, it is important considering the combined effects of multiple losses while products are designed. Sensory losses typically start around the age of 65. Changes in vision and hearing are more common than others, as they are the primary senses that most information about the environment is collected. Sensory information also acts as a conductor of the meaning of the environment.

#### 2.4.1.1. Vision

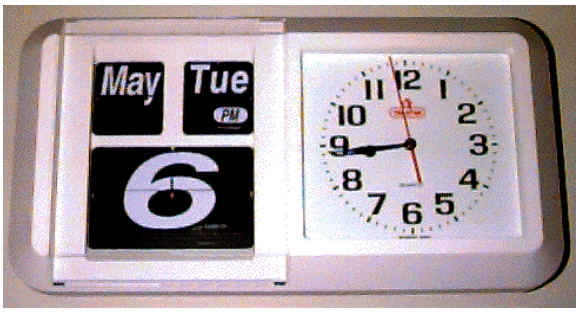
People's eyesight changes with age. The lens becomes inflexible and the eye muscles lose their ability. Apart from the natural ageing process there are diseases of the eye that influence older people, such as glaucoma and cataract, both treatable conditions in the short term but which ultimately tend to lead to loss of vision (Torrington 1996). The normal aging process may cause vision losses gradually over long periods of time and many older adults do not recognize the changes taking place. As people grow older, most of them experience one or more changes in their vision. The changes as follows:

- Increased sensitivity to glare

- Decreased ability to see objects clearly (visual acuity)
- Need for greater illumination
- Difficulty adapting to darkness and brightness
- Altered colour perception
- Narrowing field of vision

Firstly, according to Pirkl (1994) the lens and fluids in the eyes vary and begin to disrupt incoming light rays due to aging. Cataracts that are cloudy or opaque areas in the lens also increase the glare. They decrease the transition of light rays, and influence the eye's ability to focus. Torrington (1996) explains that there is a scattering of light within the eye which increases sensitivity to glare. Therefore, shiny surfaces should be avoided.

Visual acuity also maximizes in teen ages, remaining constant until the fifth decade, gradually declining until people reach their 60's, and after age 70 sharply falling  Additionally, the level of illumination required for "normal" viewing increases due to declining visual acuity. Therefore, people need more light in order for perception to occur. For example, a 60 years old man requires twice the level of illumination as a normal 20 years old man (Pirkl 1994). Temporary blindness may also be seen while the eye slowly regulates to changes in illumination (Atchely 1972). Visual changes need greater design sensitivity to scale, dimension, and distance (Figure 2.20).

a 

b 

Figure 2.20.'a' Calendar Clock (Source: WEB_4, 2005), 'b' Telephone (Source: WEB_5, 2005)

Particularly after the age of 70, aging and disease may make it difficult to discriminate fine detail or even faces. The quality and quantity of light required for focusing on an image increase with age (Atchely 1972). The quality of lighting is of equal importance; lighting levels should be high, but glare free. Light requires to be well directed (Torrington 1996). Also visual accommodation concerns to the eye's ability to focus on close or nearby objects. People can focus their eyes on objects as

close as 10 cm at age 20's, their near-point of focus reaches 100 cm at age 70's. Pirkl (1994) defines that the ability to adapt to rapid changes that appear from dark to light or light to dark in lighting decreases in the later years. Adaptation to light and dark may take longer. Moreover, elderly people need increasing contrast to maintain their perception level because the eyes lose their ability to distinguish between dark and light. Elderly gradually experience increased difficulty seeing objects in dim light and need more and more light for to see objects clearly. Therefore, as people get older, they need the greater levels of illumination and higher contrast. Consequently, night driving becomes increasingly more demanding.

Vision is the primary mechanism for receiving and interpreting information about the environment. The thickenings, becoming increasingly opaque and also yellowing of the lens of the eye can impair colour vision. The ability to distinguish between closely related colour, especially blue and green, also decreases with age. Violet, blue, and green, particularly along the dark end of the spectrum are filtered out by the yellowing of the lens. Yellow, orange, and red are seen easier than darker colours or those in the blue-green range (Carstens 1993). Researches disclose that warm colours are preferred more than cool colours in elderly residents (Pirkl 1994).

Finally, until age 35 the angle of the eye's field of vision, is the total circular area that people see when looking plain ahead at a fixed point, continues nearly constant 180° horizontal and 135° vertical. This angle begins to diminish slightly with age, becoming rapid after age 50 (Pirkl 1994). After 75, tunnel vision may occur with age, reducing ability to negotiate space and perceive motion because peripheral vision acts as a warning and guiding system Atchely (1972). Table 2.8 shows the severe visual impairments. As a result, older people see the world differently and it follows that design for them needs to take account of the perceptual world they inhabit.

| Age (years) | Total Population (in 1,000's) | Prevalence Rates (per 1,000) | Prevalence Estimates |
|---|---|---|---|
| ***All Ages*** | 248.710 | 17.3 | 4.293.360 |
| ***0-17*** | 63.604 | 1.5 | 95.410 |
| ***18-44*** | 107.493 | 3.2 | 349.350 |
| ***45-54*** | 24.838 | 13.5 | 340.510 |
| ***55-64*** | 21.533 | 28.4 | 600.600 |
| ***65-74*** | 18.107 | 59.0 | 1.068.290 |
| ***75-84*** | 10.055 | 118.4 | 1.190.520 |
| ***85 and over*** | 3.080 | 210.6 | 648.680 |

Table 2.7 Severe visual impairments
(Referencece: Pirkl 1994)

### 2.4.1.2. Hearing

As with eyesight there is a natural deterioration in hearing due to aging. Sounds connect a person to the environment, provide important warning signals, and permit conversation, and also help in monitoring the environment. According to Carstens (1993) that "flat loss" and "selective loss" are two main parts of hearing losses with age. Flat loss is loss of hearing at all frequencies. Selective loss generally influences the reception of higher pitches. Thus, many older people prefer music with lower-pitched sounds, usually of uniform intensities. Torrington (1996) states hearing loss is at low sound levels, so while soft speech may be inaudible shouting is uncomfortable to the elderly.

a  b 

Figure 2.21. 'a' Phone Amplifier, 'b' Audifono (Source:WEB_6, 2005)

It is important to recognize that there is a clear distinction between hearing impairment and deafness. Hearing impairments are caused by the following situations:

- Wax or bone growth blocking sound waves in route to the inner ear
- Damage to the inner ear mechanism (infection or the trauma of explosion or continual loud noises)
- Damage to the neural transmitters or decoding areas of the brain

As people age, their sensitivity to sounds at the higher frequencies diminishes. Therefore, many elder people seem to prefer low frequency sound rather than high frequency sound and set their radio's tone control on "bass" (Pirkl 1994). According to Atchley (1972) that the intensity or loudness which required hearing may increase with age, although in many cases sheer volume will not increase reception. Pirkl (1994) also states sound intensity (loudness) is evaluated in decibels (dB). The initial of normal hearing ranges from 0 to 3 dB hearing level (HL). The level of conversational speech, for example, is about 50 dB. Prolonged exposure to noise at 85 dB may cause hearing

loss. Above 100 dB, permanent damage may appear due to noise. Atchley (1972) defines men over 55 years of age generally have greater hearing difficulty than women over 55.

Although hearing loss can appear at any age, it is most common among elder people. Many elder people will experience one or more of the following changes in their hearing with age.

- Decreased hearing acuity (volume)
- Loss of frequency (pitch) discrimination
- Reduced speech discrimination and comprehension
- Altered directional hearing (Pirkl 1994).

Young people also lose their hearing sensitivity. Prolonged exposure to loud noise can cause gradual, but accelerating, permanent hearing loss. Such exposure leads many young people to exhibit hearing loss patterns of people two and three times their age.

### 2.4.1.3. Touch

Older people are often slower in evaluating objects through taste and less capable of reaching a decision about identifying an object.

According to Pirkl (1994) most of elderly people should use their limited sensory information in order to interact with the environment. One of the senses is touch that means of gathering environmental information (Figure 2.22). Sense of touch consists of tactile sensitivity, pressure sensitivity, and thermal sensitivity.

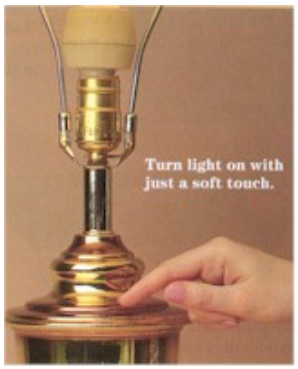



Figure 2.22 Touch sensor for lamps (Source: WEB_7, 2005)

The skin gets people with an ability to “feel” objects and surfaces, and also allows people to perceive forms, textures, and shapes with just the sense of touch. The tactile sensitivity connects the skin’s condition, its receptors, and the neurological condition of the central nervous system. Skin is made up two layers. The epidermis which is the surface layer of skin becomes thin and the number of receptors belongs to epidermis reduces with aging. Progressive decline of oil-secreting glands also influence the skin’s sensitivity.

Aging may cause to diminish the ability to “feel” actions or movements through the sense of touch. People, for example, “feel” when the seat of a chair is hard or soft the moment people sit on it. Pressure receptors deep within the underlying tissue, and decrements related to other functions of the central nervous system supply the sensitivity. Consequently, the sensitivity could be reduced with increasing age.

There are two reflex centres in the brain control the body’s temperature; one sensing an increase, the other sensing a decrease. As age increases, older people get heat less efficiently. Moreover, the ability of the body’s temperature regulating mechanism to conduct correct information also diminishes. Thus, elderly people may become less sensitive to extreme temperature. Hot bath water, radiators, hair dryers, irons, ovens, and freezers are dangerous environmental elements for elderly people. Therefore, they should be more careful while they are using these elements (Pirkl 1994).

### 2.4.2. Dysmobility and Movement Limitations

Factors related to bodily movements directly affect the ability to remain independent. All activities of daily living (ADL) such as bathing, dressing, toileting, and feeding need some form of bodily movements: walking, sitting, lifting, reaching, grasping, stooping or bending. Disease, injury, and the aging process cause limitations in the ability to perform these movements and restrain access to the ADL (Pirkl 1994).

The aging person’s boundary of activity may decrease related the loss of health, mobility, income and social roles. Older people may find it difficult to get out into the community. Daily activities take place within a progressively smaller range, closer to the home. Therefore, the lack of opportunities for establishing meaningful roles in the community may cause this restriction in range of activities (Carstens 1993).

After the age of 75, use of walking aids such as cane, walker, crutch, and wheelchair increases substantially. Elderly people need these elements that contribute comfort and conservation of energy because of their weakness and tiredness easily. It will be mentioned detailed in the following chapter.

### 2.4.2.1. Arthritis

Pirkl (1994) describes arthritis as a variety of degenerative and inflammatory changes in the joints. This disease involves over 100 different diseases, many involving heat, swelling, redness, and severe aches and pains in the joints. Although not considered part of the aging process, it restrains the daily activities of 4 % of all young adults, 50 % of those in middle age, and about 80 % of those in their seventies. According to Arthritis Foundation those over age 75, 85 % have arthritis in one or more joints. Generally, most forms of arthritis are chronic, and there is, unfortunately, no treatment. Osteoarthritis and rheumatoid arthritis are the common types of arthritis influencing elder people.

Osteoarthritis is the most common form of joint disease and performs all other causes of disability in those over 65 years and over. Deformity and limited joint movement are the main features of osteoarthritis that is determined by gradually progressing joint pain. Commonly, women have more severity of osteoarthritis in the hands, knees, ankles, and feet; whereas men have more severity in the spine and hips (Pirkl 1994).

Restricted movement in the hands causing discomfort or severe pain is relatively common in older people. Some causes are rheumatoid arthritis, Parkinson's disease, or stroke leading to partial paralysis. All parts of the building that are handled by elderly should be designed for easy manipulation (Figure 2.23) (Torrington 1996). Rheumatoid arthritis commonly appears in the middle ages and continues as an ongoing process into the later years. After osteoarthritis, it is the most frequent form of arthritis. It emerges primarily in the small joints of the hands, feet, and wrists, later containing such larger joints as the elbow, shoulder, hip, knee, and cervical spine. With this disease, people become gradually disabled, reducing their access to functional ability. Prolonged bed rest, for example, may induce temporary immobility to become permanent (Pirkl 1994).

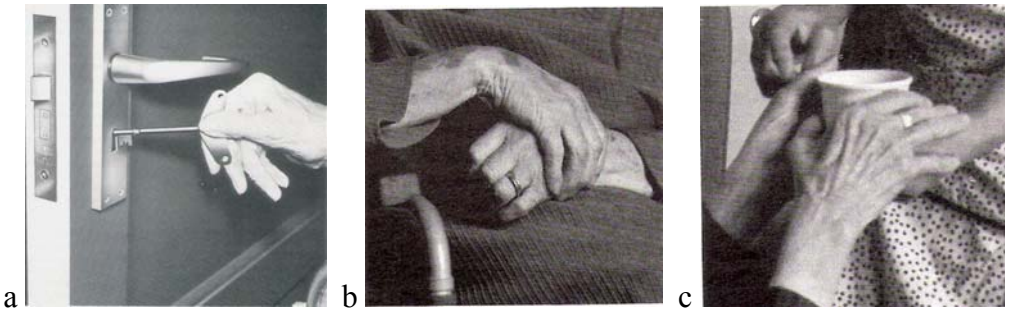


Figure 2.23. ‘a’Helping Hand Hardware, ‘b’ and ‘c’ Restricted Hand Movements (Source: Torrington 1996)

Elderly people need physical and occupational therapy, exercise, and assistive products in order to continue their independence. These assistive products such as canes, walkers, and braces may cope with many environmental barriers. Appearance of most such devices tends to attribute a sense of embarrassment and loss of dignity. Many elderly people are reluctant to use these devices. Therefore, such products can be redesigned alternatively to suggest a less repulsive appearance. Moreover, those can also suggest more supportive, and humane environments and artifacts such as bathtubs, shower stalls, and stairwells featuring soft, nonskid surfaces; hand rails and grab bars appropriately placed and attractively integrated into environmental settings; adequate, indirect glare-free lighting; easy to grasp controls and handles for ranges, ovens, washers, dryers, doors, and windows; and many other objects used in the ADL (Pirkl 1994). Figure 2.24 shows some products for people with arthritis.

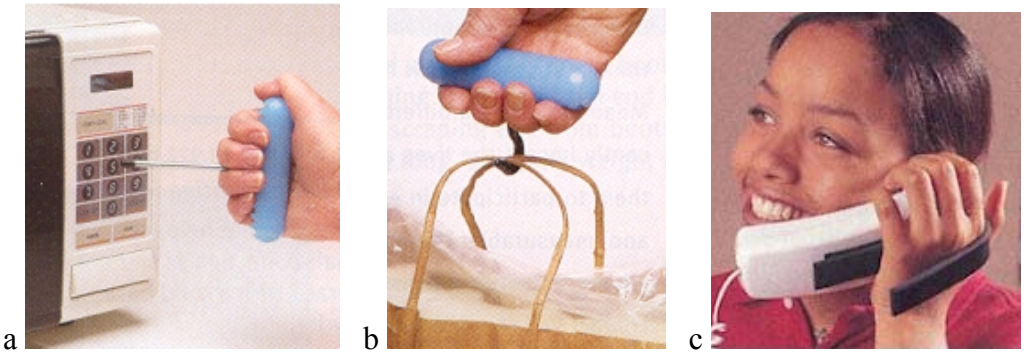


Figure 2.24 ‘a’ Button Pusher, ‘b’ Grocery Grip Bag Holder ‘c’ Phone Pal Phone Holder (Source: WEB_7, 2005)

Button pusher, for example, helps of using microwaves, telephones, keyboards, elevators that needs to push of a button to operate. Bag Holder can hold several grocery bags and helps to carry for people who cannot fully close their hands. Phone Holder also supplies people with limited grasp the ability to hold onto the phone independently.

Consequently, arthritis is a very conspicuous and disabling condition. It affects severely control and motion. Activities requiring movements of the body or fine dexterity, for example, are difficult for those with arthritis. One of the most significant results of these diseases is to make them dependant and unable in their daily activities

### 2.4.2.2. Tremor

Tremor appears when a person is tired, and it reduces the ability to discriminate small motor movements and make controlled adjustments. Parkinsonism is a kind of tremor disease.

**Parkinsonism**

Parkinson's disease is a chronic, progressive illness that affects about 1 % of those over 50. Although it is seen associated with the elderly and those with impaired motor function, it is rarely seen in those under 40. The gradual stiffening and slowing of movement, a bent-over posture, and uncontrollable muscle spasms commonly cause Parkinson and it usually results with deteriorated mental processes.

Nearly, 1 million people in the United States have Parkinson's disease that affects both sexes and emerges most frequently in those between ages 50 and 79. About 70 % of those with Parkinson's disease exhibit tremor affecting the upper extremities. It increases with age. Parkinson affects mainly the upper extremities and commonly begins in one or both hands. The fingers generally respond with a familiar "pill-rolling" motion. Tremor can also influence the leg, head, voice, lips, and tongue.

Figure 2.25 shows some products for people with arthritis.

a 

b 

c 

Figure 2.25 'a' Weighted Pen, 'b' Klick Pencil Holder, 'c' Type Aid
(Source: WEB_7, 2005)

Weighted Pen includes five weights, 8 to 10 grams each that can be added or removed as required and uses standard ballpoint pen refills. Type aid uses on adding machines, calculators, keyboards, and touch telephones.

Instinctive and spontaneous movements like swinging the arms while walking, diminish and eventually finish. Thus, some basic ADL such as walking, dressing, cooking, eating, and writing can be particularly impaired. Walking becomes increasingly difficult because of progressing disease. The posture of the body has more stooped and the gait is diminished to a shuffle. The reduced speed of muscular movements makes it impossible to right. If the body pushed from the back or front, falls can also emerge (Pirkl 1994).

### 2.4.3. Balance and Falling

Elderly people tend to lose their balance because they experience sensory losses, and changes in body and spatial orientation. Moreover, complex combinations of disabilities such as, vision, hearing, osteoporosis, osteoarthritis and the use of medications tend to increase their risk of falling.

Falls are an incompatibility between environmental demand and postural competence. Stated another way, whenever aging or disease changes the ability to stand, walk, or navigate, elderly need compensating environmental responses. To reset this lost balance with suitable environmental support is the main goal. Figure 2.26 shows the concept of postural competence. Falls emerge when environmental demand (a continuous variable) exceeds postural competence (another continuous variable).

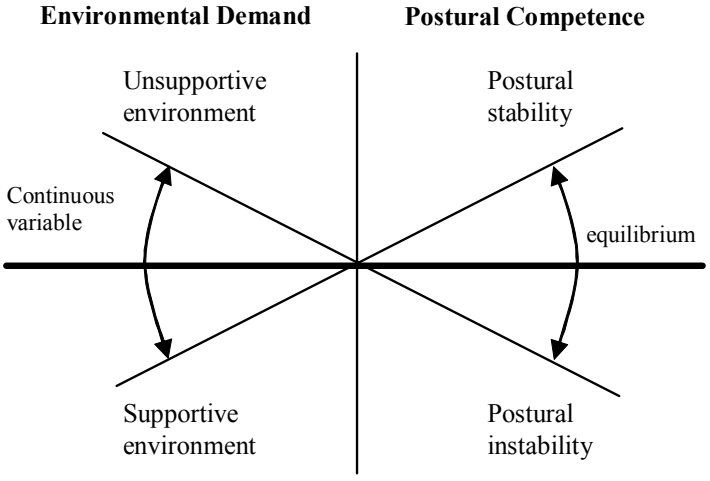



Figure 2.26 Model of postural competence (Reference: Pirkl 1994)

The interaction of three unimpaired elements; senses, motor function, and central processing are necessary in order to a safe and stable upright posture. Thus, impairments to any one of these elements diminish safety and stability, and boost the risk of falling.

### 2.4.3.1. Balance

**The Sensory Element**

Vision supplies people with the most accurate information about the spatial position of the body contributes to the postural competence. Researches indicate the rate of disease-related visual impairments to age, and define impaired vision as a major risk factor for falls.

Vestibular diseases reduce the accuracy of the sensory input. Therefore, people receive inaccurate and conflicting input signals that send unsuitable stimuli to the central processing system. Vertigo, defines as a hallucination of movement, is one of the results of this situation. Falls appear when people cannot place their limbs outside their body's balancing limits (centre of gravity). The characteristic shuffling gait of older people also grows their risk of falling. Their shorter step lengths and heights restrict recovery once their body's centre of gravity enlarges beyond this shorter step base (Pirkl 1994). These are visualized as in the following figure (Figure 2.27).

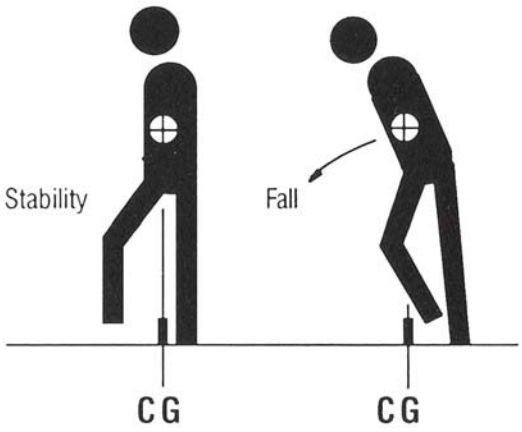



Figure 2.27 Influence of centre of gravity (CG) on falling (Source: Pirkl 1994)

**The Motor Element**

Motor changes can also blight postural competence and cause chronic instability. Elderly people trust muscular strength and tone, and joint stability, in order

to continue the stable upright posture. Studies show that the aging process diminishes both of these requirements and contributes to early tiredness. Motor function is also weakened by degenerative joint disease (arthritis), soft tissue injury (bruises and lacerations), fractures, and bodily weakness leaded by a sedentary life style.

**The Central Processing Element**

Visual, vestibular, and proprioceptive sensory areas and the various motor functions send the raw stimuli that gathered and processed from the central processing system that affects chronic diseases such as dementia, Parkinsonism, and stroke. These diseases obstruct the postural competence and increase older person's risk of falling. Particularly, there is a strong relation between dementia and the probability of falls and fall-related injury among the elderly. Stroke-induced paralysis, perceptual changes, and proprioceptive losses also influence postural competence by changing one's gait and balance. Parkinsonism is other disease that restricts one's gait and diminishes the speed of muscular movement. The disease greatly affects stability because of flexing the posture (Pirkl 1994).

The agility, strength, and muscular control tend to reduce with aging. Muscle strength peaks between 20 and 30 years of age and then declines. A person in his or her mid 70s, for example, has approximately half the strength of 30s. Circulation and strength are improved by walking and exercises involving the leg muscles (Carstens 1993).

> "Older persons may also experience changes in their walking gait and posture. Their gait becomes more reserved, with broader and shorter strides to improve stability. Some may shuffle their feet while walking and focus their vision on the ground plane directly in front of them in order to "see" it" (Cartens 1993, p.12).

The skeletal system becomes less flexible with age and more vulnerable to accident or injury. Fractures of the pelvis, femur, and spine are common. Bones do not get better as readily as they do in younger people. Many elderly people also cope with to adapt to temperature, either high or low. Therefore, metabolism, hormones, and muscular responses may change for this reason.

Older people are most often troubled with chronic conditions (long-term or permanent conditions, such as hearth trouble). The hearth of older person, for example, has a slower rate and lower output. The capacity of the lungs to oxygenate the blood is

reduced with age. Under stress there is less reserve; therefore, the older person may tire more easily. Kidney cells also are reduced in number with age. Associated with progressive age and kidney disease, incontinence may be worried. Arthritis, rheumatism, hearth disease and high blood pressure are common chronic conditions among the elderly population. The limitations that they place upon activity participation are the most obvious implications of these conditions (Cartens 1993).

### 2.4.3.2. Falls

Richard J. Ham who is Distinguished Chair in Geriatric Medicine at the State University of New York Health Science Centre states that falling is an important syndrome for the elderly people. Therefore, it may be accepted specific or nonspecific disease and accurately gives voice to a risk for elderly. Not only injury occurs, but also confidence and potential institutionalization decrease. Table 2.9 represents consequences of falls.

| |
|---|
| ***Medical*** |
| Fractures, especially hip, wrist, vertebral, and hip |
| Soft tissue injury, hematoma, laceration |
| Subdural hematoma, contra coup injury, concussion |
| Exacerbation of arthritis |
| ***Psychological*** |
| Loss of confidence, depression, fear of falling |
| ***Social*** |
| Social withdrawal, dependency |
| Institutionalization |
| ***Functional*** |
| Immobility, deconditioning, decreased joint mobility, decreased righting reflex |
| Immobility may lead to hypothermia, thrombosis, dehydration, contractures, pressure sores, urine retention/incontinence, chest infection, osteoporosis |

Table 2.8 Consequences of falls (Reference: Pirkl 1994)

Injury does not only one result of falls. Treatment may be enough for falls by elderly people living at home. Another functional result of falls is immobility that can also contribute to hypothermia, dehydration, joint contractures, and pressure sores. Hip fractures are the most common among all fractures. Nearly, 200.000 hip fractures

emerge in the United States each year, with 84 % emerging in persons 65 and over and of these, about 25 % people die within 6 months of injury.

Pirkl (1994) states falls by the elderly demonstrate a frequency rate of 14 to 19 falls per 100 people per year. Older women who are in poor health and live alone experience falls most frequently. Falling is now becoming related to diminish in general health with increased falling regarded as a motion of weakness and the greatest frequency emerging as death approaches.

It is important to recognize that there is a strong correlation between the nature of falls and the environmental conditions. These conditions can contribute to safer environments through the design of products and spaces that suggest suitable support because falls can be fatal. The relationship between accidental death and age is shown as in the following figure 2.28.

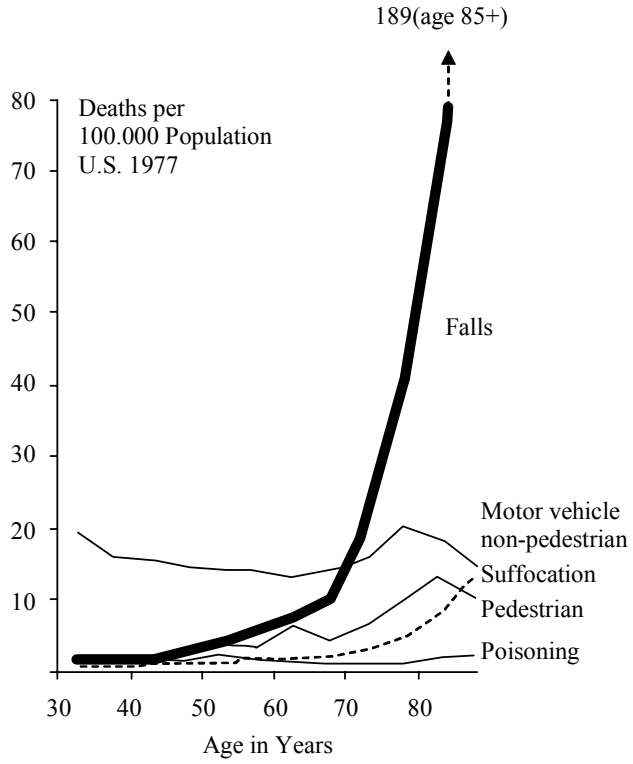



Figure 2.28 Relationship between accidental death and age (Reference: Pirkl 1994)

Activities associated with chairs, beds, and toilets cause to falls more frequently. The optimal design should permit the feet to be placed on the floor near the centre of gravity with hips flexion 90° or less and a stable support object such as bureau, and safety rail in reach. Elder people, for example, push their chairs and furniture against the

walls for stability indoors, and they choose sitting near such stable objects as trees, walls, benches, and other stable points of references outdoors.

### 2.4.4. Memory and Confusion

Although several diseases and general senescence may affect cognitive functioning, intellectual processes remain basically unchanged. While stored information and verbal information are generally sustained, concept formation and other functions may decline (Carstens 1976). For most people intellectual function does not significantly decrease with age; small loss of brain cell efficiency is compensated for by experience. It is reasonable to assume that elderly people may have stiff joints, decreased eyesight and poor hearing but not that there will be any impairment in intellectual. There is, however, people do suffer serious mental impairment in old age as a result of disease or damage to the brain, which can be described as suffering brain failure, otherwise known as dementia. People with dementia suffer progressive loss of brain function (Torrington 1996).

The loss of cells is the main change in the central nervous system. This may explain the cause of a slowing of reacting time, but reaction time may sometimes be stabile; therefore, elderly persons may need a more constant environment. Confusion may be caused by new environments. To form a “cognitive map” of a new area, for example, for some older people may find it difficult, and they easily become confused.

The inability to notice a difference between background noises and foreground sounds cause to the confusion that related to loss of orientation. To follow a conversation for elderly may be more difficult because of background noises. However, an environment that allows the mental faculties to be exercised the most important factor in maintaining mental skills into old age (Atchley 1972).

#### 2.4.4.1. Dementia

The aging process leads the bodily organs to decrease upon reaching maturity. One of these organs is the brain that controls the intellect and all bodily functions. With the aging, millions of nerve cells gradually diminish and ten thousand processes associated with other cells become less effective. Although, many linkages in the brain

are available to take damaged neural routes, the brain's nerve cells do not rebuild them. Therefore, the brain cannot replace its cells and maintain functioning like the skin, liver, and kidney. Consequently, diseases of the brain cause to permanent damage such as physical, cognitive, and sensory changes and affect the lives and life styles of elderly people, their spouses, and their children (Pirkl 1994).

Dementia is a condition caused by changes within the brain. The causes of brain nerve destruction are not known. The older people get the higher their changes of getting the disease. It is more common among women than men. Dementia can appear firstly in the middle ages, though mostly it influences people over 65 (Torrington 1996).

The most common degenerative neurological diseases are Alzheimer, parkinsonism, and muscular dystrophy. The degenerative processes related to these diseases cause environmental toxins, immunological and viral processes, and factors premature aging. These cerebral function disorders influence the most vital of the human processes such as thinking, creating, conversing, feeling, and moving.

### 2.4.4.2. Alzheimer

According to many medical community Alzheimer's disease is the most critical and challenging disease facing the elderly. It causes 50 to 60 % of all dementia. The term is described as a diffuse progressive loss of mental function because of an organic disturbance. It also means having lost the mind and refers to gradual intellectual decline and memory loss. Therefore, Alzheimer affects the thought processes such as reasoning and identification and movement by producing falls, stiffness, rigidity, and difficulties in walking.

Alzheimer's disease is not a natural part of the normal aging process. Although, this untreatable intellectual deterioration appears at any age, it generally appears among those aged 50 to65. Within the over 65 group, 5 to 15 % may have the disease. While also appearing in the seventies and eighties, it rarely emerges in those under.

The symptoms and progressive nature of Alzheimer's disease may vary person to person, however, the disease produces similar patterns of behaviour. Initially, people with Alzheimer's disease begin to forget and lose things. Elderly people cannot recall a name or a word and cannot retrieve data from memory and the ability to get new data and store it is limited. This is a difficult time for relatives and household. They also tend

to become careless in their dress and conduct. When the disease progresses, they become confused and face increased difficulty with such daily living tasks as cooking, housekeeping, home maintenance, shopping, and transportation. As speech and written problems occur, they leave from complex social groups. With the disease, memory failures also become very noticeable. There is disengagement from events in the world, the friends and family (Torrington 1996).

An advanced stage, produces complete disorientation, is called ambulatory dementia. At this term, they become increasingly self-absorbed and fail to recognize family members and friends. They begin to wander, becoming confused, agitated, belligerent, or combative. Their impaired ability to reason, recognize others, and take safety precautions makes them increasingly dependent on care-givers. Moments of intelligible punctuate their contradictory recognition of family members, body parts, and mirror images. They lose weight, forgetting how to eat, swallow, and chew. There can be complete loss of language, inability to speak as well as understand, or endless repetition of words or sentences. Consequently, death quietly ends their vegetative life (Torrington 1996).

Consequently, in this chapter, some of the general features of the elderly and their problems have been outlined. The data show that the aged population and the percentage of them are getting higher rapidly. Especially, the increase of the 75 and over and living alone inevitably make this subject more significant and urgent. As people live on longer than their past generations, most people gain one or more functional limitations that will restrain the activities of daily living. Such limitations decrease the dignity, independence, and the self respect and make an elderly person different than ordinary person.

# CHAPTER 3

# DESIGN AIDS AND ENVIRONMENTAL SUPPORT

People's independence depends directly on freedom of choice. The quality of life that people perform activities of daily living (ADL) correlates with the number and types of choices available. According to Pirkl (1994) when the environmental context suggests the independence to choose from a variety of options, people maintain their independence and the quality of their life is positive, otherwise when faced with environmental conditions such as limit choices and frustrating encounters with hostile physical environments diminish the pleasure, independence, and the quality of life.

If people live long enough, their ability to move will be limited by one or more functional limitations, are defined the inability to carry out sensory and physical activities, interfere with the ability to carry out sensory and physical activities. Environmental conditions also change people's choices and ability to maintain their independence. Functional limitations are not only normal aspects of aging, but rather the result of one or more chronic disabling conditions. Disability as a phenomenon associated with aging is highly prevalent among older people because of the obvious and strong correlation between aging and disability. An able-bodied person accepts a living environment as it is required and built and does not try to make any changes in his or her microenvironment, otherwise, disabled person may be unable to live independently and his competence to cope is in opposite relationship to the degree of his disability, and he is easily faced with an impossible environment.

Independent living is one of the main goals for elderly people with disabling conditions. On the other hand, many institutions tend to support dependence and use personal home-care assistants rather than encouraging independence by using of supportive products and environments.

Elder people are mostly forced to cope with products and environments that limit choices, reduce options, and decrease the ability to remain independent. Additionally, they face the environment with their competence, but more environmental support is required to compensate for the associated functional loss due to decreasing health.

Commonly, elderly people do not require institutional support. Although their functional limitations decline, most live in the same kind of spaces and use the same

kinds of products, and express the same desire for independence like younger people. Remaining independent, however, is required the keeping control, means the chance to change the environment to accommodate one or more functional limitations, over the micro as well as the macroenvironment.

Macroenvironment has large scale and exists at the community or architectural level such as cinemas, concert halls, and bus terminals. On the other hand, microenvironment has small scale and exists at the personal level such as mobile telephones, tables, music sets. When the severe functional limitations gradually increase, environmental support becomes closer and tighter to remain independence. Many products and environments restrict the competence of disabled users and block efforts to continue independent because of failing to accommodate the functional limitations associated with normal human aging.

Private products and environments such as wheelchair, knife, toothbrush, refrigerator, home, and car suggest the greatest opportunity for assist that people prefer these products for the degree of assist. Contrary to this situation, public products and environments such as bus stains, trains, taxis, hospitals, shopping malls offer a little opportunity offer little opportunity to change the elements to appropriate particular needs. These needs have already been “chosen for people” by others. This thesis researches the private products in microenvironments as small scales.

Legibility, accessibility, adaptability, and compatibility are attributes for achieving environmental quality for elderly people. Transgenerational design aims to answer the question that what must products and environments contribute to enlarge human independence and improve the quality of life for all people. Thus, the answer could be found by gathering forms of human understanding, forms of beauty, and also forms of function.

## 3.1. Impairments, Disabilities, and Handicaps

World Health Organization proposes the International Classification of Impairments, Disabilities, and Handicaps, each relating to a different plane of experience consequent upon disease. However, the consequence of disease, injury, or congenital malformations enlarges on this set of impairment, disability, and handicap definitions into a linear progression of relationships (Weisgerber 1991).

- **Disease**, injury, or congenital malformation (the intrinsic pathology or disorder), leads to
- **Impairment** (loss or abnormality of psychological, physiological, or anatomical structure or function), which leads to
- **Disability** (restriction or lack [resulting from an impairment] of ability to perform an activity in the manner or within the range considered normal for a human being), which leads to
- **Handicap** (a disadvantage for a given individual, resulting from impairment or disability that limits or prevents the fulfillment of a role that is normal [depending on age, sex, and social and cultural factors] for that individual.)

These concepts are visualized in Figure 3.1.

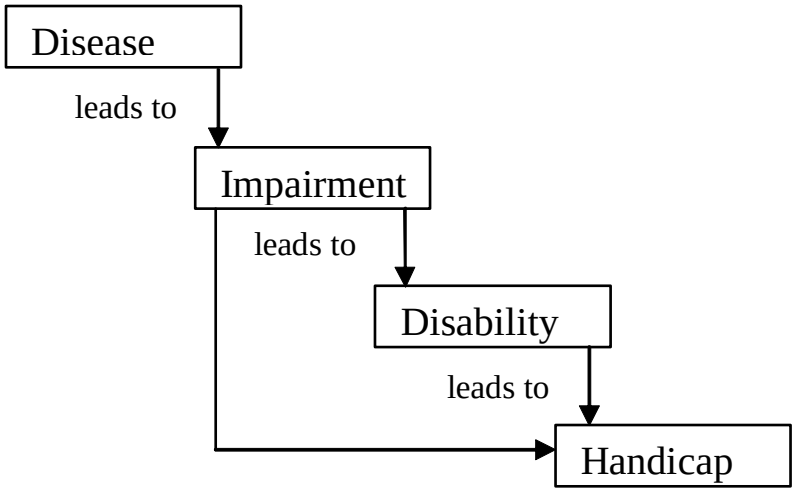



Figure 3.1. Progression of definition relationship (Reference: Pirkl 1994)

A summary of the World Health Organization's International Classification of Impairments, Disabilities, and Handicaps is explained as below:

**Disease**

Diseases and conditions occur in all ages of people. It is splited up conventional definitions and it is made a unique distinction between these terms. He says that a disease is distinguished by a physical situation in which the body's immunization system would normally be activated. A condition can be the result of a disease, but often is the result of an accident, a genetic backfire, malfunctioning body chemistry, and naturally old parts or organs.

**Impairment**

A characteristic of impairment are temporary or permanent losses or abnormalities, occurrence of an anomaly, defect, or loss in a limb, organ tissue, or other structure of the body, exteriorization of a pathological state, and in principle reflects disturbances at the level of the organ. “Impairment” is more comprehensive than “disorder” in that it includes losses, for example loss of a leg is impairment, but not a disorder.

**Disability**

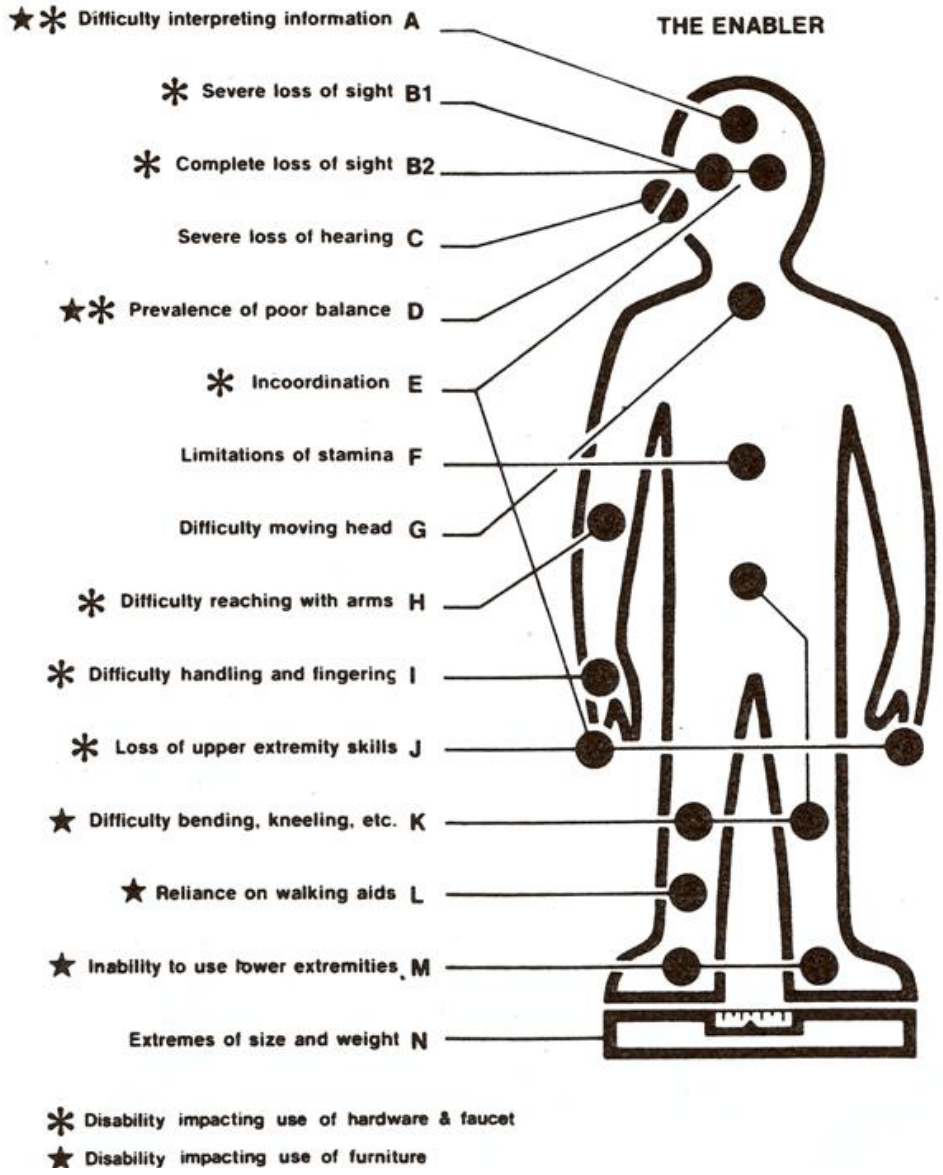



Figure 3.2. Disability areas impacting use of furniture, faucet controls & hardware (Source: Raschko 1982)

Four factors define the presence of a disability (DeLoach et. al. 1983). Each is potential barrier limiting a person's freedom and independence:

- An "objective nature" related to a medical condition
- An "ongoing condition that is the result of an injury, illness, or congenital cause"
- A disability "can usually be verified, described, or diagnosed by a physician or other appropriate professional" and
- A disability "limits or impairs physical or mental functioning"

Disabilities tend to restrict the choices to their severity directly. A broken arm, for example, restricts the choice of playing golf, a hip replacement limits the choice of bathing or showering, and if people are legally blind, they cannot choose driving. Each person develops coping strategies to maintain a "possible level of independence and quality of life" (Weisgerber 1991). Thus, factors suggesting environmental support, such as products that accommodate the disability and help people in the ADL, contribute to self reliance, and help maintain the independence.

More people are now living with disability. The disabilities considered are those that may be helped through planning and designing of a suitable environment. Those with disabilities listed include the physically deficient. For purposes clarity, the classification of the disabled is presented in Table 3.1.

| DISABILITY | CHARACTERISTICS | NEEDS |
|---|---|---|
| 1. Sensory<br>1.1 Vision<br>1.1.1. Central field loss | 1.1.1. Central field defects, which can be congenital, or developmental, e.g., macular degeneration, congenital absence of cones. Severe loss of acuity (may be 20/70 or less); colour discrimination greatly affected. | 1.1.1. Colour cuening may not help. Value cueining more helpful, i.e. use of light and dark tones; oversized lettering on signs; auditory and tactile cues valuable. |
| 1.1.2. Peripheral field loss | 1.1.2. Usually developmental; glaucoma, retinal disease, etc. Results in "tunnel vision"; causes poor orientation, confusion. Colour vision usually not affected. | 1.1.2. Colour cueing helpful; all other aids applicable. |
| 1.1.3. Cataract corneal disease | 1.1.3. Clouding, distortion or opacities of lens or cornea of the eye. Slight to severe effect on vision. If central, poor vision in bright light (pupil constricts), better vision in reduced light. Can be improved surgically with good results. | 1.1.3. Strong colour cueing; oversized letters on signs; auditory and tactile cues; diffused lighting. |
| 1.1.4. Blindness | 1.1.4. Total blindness or person may only perceive light;if perdon familiar with his environment, may be very self-sufficient. | 1.1.4. Raised letters on signs; generally, more space needed in living unit, particularly counter space in kitchen. |

| | | |
|---|---|---|
| 1.2. Hearing loss | 1.2. May be mild to severe, congenital, progressive (presbycusis); due to disease, old age, or trauma. May be neural (high tones), or flat (all tones). Tinnitus (ringing) may be present. Manier's disease, affecting hearing, may also affect balance. | 1.2. Visual and tactile cues necessary; signal lights for doorbell, telephone; special amplification and adaptation of telephone, TV, radio; signal lights for emergency, along with bed vibrator, when sleeping. |
| 1.3. Tactile loss, touch, temperature | 1.3. Sensory deprivation, often accompanied by motor loss; brought about by variety of disorders, usually accompanied by varying degrees of paralysis. | 1.3. Will need protection from injury; insulation of exposed hot water pipes; water temperature controls in Kitchen and bathroom; need to avoid sharp and abrasive surfaces. |
| 2.Motor loss | 2.1. May be due to vestibular impairment; usually accompanies other disabling conditions, such as paralysis, spasms, amputation, etc. Usually person will use walking aids, will move more slowly reaction time will be slow. | 2.1. Special care in furniture and furnishings selection for safety; need to take care of primary cause of poor balance. Poor balance, of itself, is not a deciding factor as to selfcare. |
| 2.2. Incoordination | 2.2. Caused by a wide variety of conditions; cerebral palys, multiple sclerosis, chorea, Parkinsonism, etc.; inhibits performance Of otherwise simple tasks; can affect all ages. | 2.2. May need assistive services; some conditions trainable; special aids for disability, often custom-fitted; prostheses. Ability for self-care judged on individual basis. |
| 2.3. Stamina | 2.3. Cardiopulmonary disorders; severe hypertension; advanced age; activities that are painful owing to a variety of disorders, e.g., herniated vertebral disc. | 2.3. Depending upon degree of disability, may need assistance at home; avoid stairs; break tasks down in duration, severity of effort; avoid prolonged aggravation of injury. |
| 2.4. Reaching and lifting with arms | 2.4. Persons with limited strength and range of motion of arms; many causes: bursitis arthritis, paresis, etc. | 2.4. In moderate cases, may be able to function in a self-help environment; in severe cases, may need some assistance. |
| 2.5. Handling, fingering | 2.5. Persons who are unable to perform hand movements; arthritis, congenital deformities, spasms, contractures, etc. | 2.5. Special aids, furnishings, equipment to offset disability; replace grasp, twist, pinch functions with push-pull; oversized handles, grasping surfaces; reduce two-hand operations to one-hand, and vice versa. |
| 2.6. Upper extremity skills | 2.6. Complete paralysis; absence of upper extremities; often quadriplegia. | 2.6. Will require assistance; ability for self-help dependent on retention of other skills, or ability to be trained. Puff system. |
| 2.7. Bending, kneeling | 2.7. Stiff joints; arthritis, casts, braces; often difficulty in sitting or kneeling. | 2.7. Usually able to take care of self; storage of often used items in middle and upper ranges. |
| 2.8. Reliance on walking | 2.8. Braces, prosthetics, canes, crutches, walkers; many disabilities can cause impairment; arthritis, polio, amputation trauma, etc. | 2.8. Relative independence possible; need special helps for ambulation; special design features needed some training necessary. |
| 2.9. Inability to use lower extremities | 2.9. Confined to wheelchair; paraplegia, amputation, etc. | 2.9. Independent living possible; must have supportive devices; living unit needs adaptation to needs; may need some supportive services; accessible environment. |

| | | |
|---|---|---|
| 3. Extremes in weight | 3.1. Extreme obesity | 3.1. Self-sufficient usually; need special furniture, furnishings; should be protected from excessive exertion, e.g., climbing stairs |

Table 3.1 Classification of disabilities: characteristics and needs (Reference: Raschko 1982)

There are various methods of classifying the disabled. Another is presented in Figure 3.2. It is given a breakdown by percentages of the estimated disabled people.

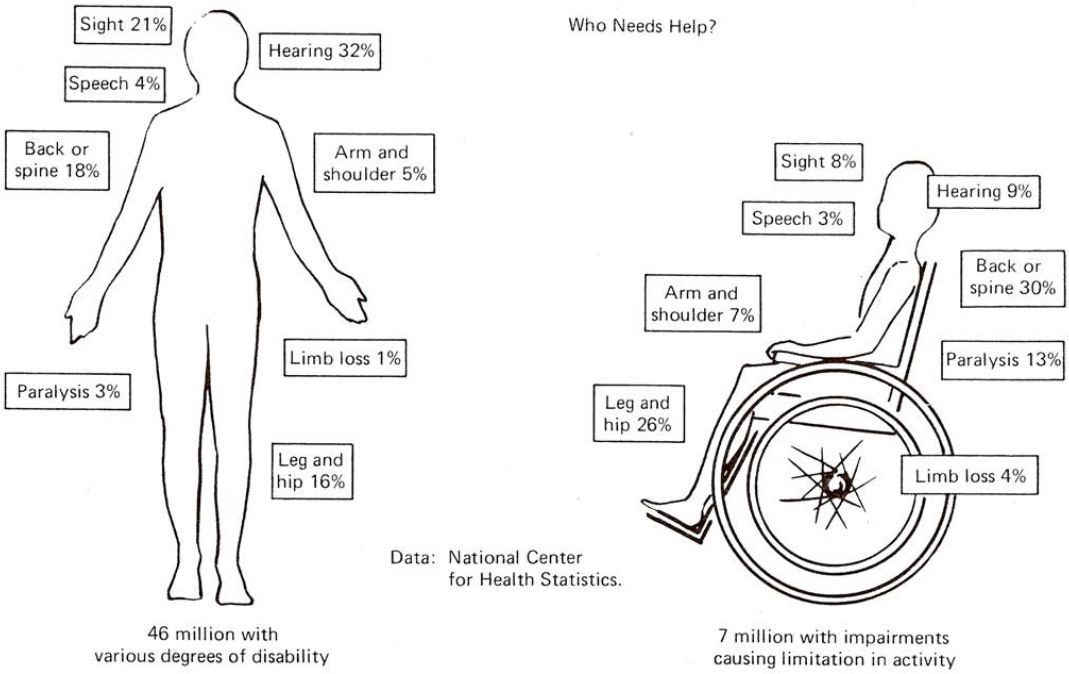



Figure 3.2. Physical Disabilities by Percentages
(Source: Raschko 1982 cited Zimmerman M., 1978. Technology for the Handicapped)

Consequently, old age is not always a condition of disability, but rather an increase in the possibility of a number of small changes in performance parameters.

**Handicap**

Handicap means the totaled result of the obstacles that disability interposes between the individual and his maximum functional capacity. DeLoach et. al. (1983) distinguishes between the two categories that are disability and handicap. He clarifies the handicap with the following words:

> "Handicap is a disadvantage, interference, or barrier to performance, opportunity, or fulfillment in any desired role in life (e.g., vocational, social, educational, familial), imposed upon the individual by limitation in function or

by other problems associated with disability and/or personal characteristics in the context of the individual's environment or role" (Pirkl 1994, p. 76).

The concept of handicap is a relative term, much broader than disability. People with handicaps may be disabled, they are not necessarily disabled. Moreover, identical impairments will influence different people in different ways. For example, some functional limitations, such as a broken leg or an arthritic hip can discourage the disabled person from freely standing and walking. Such an imposed limitation can become a handicap for someone who needs mobility. Age, education, employment, sex, race, or even the geographic location of one' residence are other factors affecting a handicap. Advanced age, for example, gets added significance when that factor is associated with a disability. Thus, elderly people become disabled with greater frequency than the general population. Therefore, as one grows older, these disabilities and their resulting handicaps become an ever growing concern (DeLoach et. al. 1983).

Another handicap is also social stigma. The same bias and stereotyping that face those who are old with or without disabilities. These negative reactions and attitudes from society can greatly interfere with the older person's effective performance in various life roles (DeLoach et. al. 1983).

The World Health Organization illustrates their recommendations with the examples demonstrated in Table 3.2. The WHO (1993) states that it should not be used the same word to identify an impairment, a disability, and a handicap.

| **Impairment** | **Disability** | **Handicap** |
|---|---|---|
| *Language* | *Speaking* | |
| *Hearing* | *Listening* | *Orientation* |
| *Vision* | *Seeing* | |
| *Skeletal* | *Dressing, feeding* | *Physical independence* |
| | *Walking* | *Mobility* |
| *Psychological* | *Behaving* | *Social integration* |

Table 3.2. World Health Organization's recommended nomenclature
(Reference: Pirkl 1994)

## 3.1.1. Some Assistive Aids

Many aged people use canes or walkers, and some need wheelchairs. There is a brief list of assistive aids used by people with a wide variety of disabilities. All of the

aids intend to assist in the categories of mobility and balance. Limitations in mobility have a wide range of causes (e.g., a sprain, which might be helped with a cane, or a cervical trauma, which would need a wheelchair). Within each of these product groups, there are variations in quality, design, and suitability.

Figure 3.3. Man with cane (Source: WEB_8, 2005)

### 3.1.1.1. Ambulatory Aids

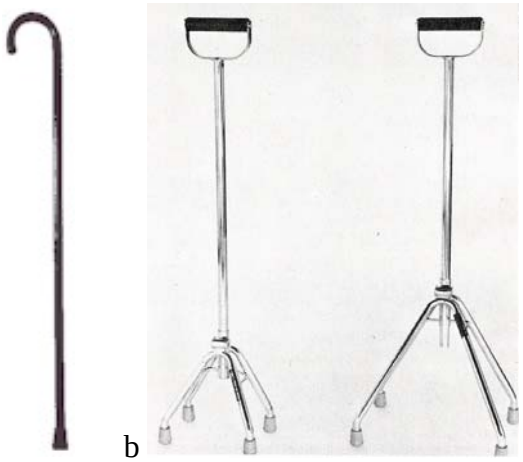
Walking aids are used for these reasons including:

- Provision of greater stability and balance by supplying a wider base of support
- Helping maintain body posture
- Increase user's confidence in their walking ability
- To redistribute some of the bodyweight through the walking aid to reduce stress on joints and limbs
- To give that all-important importance not otherwise available without the walking aid (Source: WEB_9, 2005)

Gait disorders that elderly people face are common and in most cases cannot be treated medically or surgically. Therefore, treatment often relies on ambulatory devices such as canes, crutches, and walkers. Elderly requiring only one upper extremity may use a cane, while they requiring both upper extremities are best served by forearm crutches or arms. Generally, ambulatory aids are used in their basic form, but all aids can be fitted with accessories to modify their function. An appropriate candidate for an ambulatory aid will have sufficient cognitive function, judgement, vision, vestibular function, upper body strength, and physical endurance to use the device (WEB_10, 2005).

**Canes**

The cane is used for support while walking, generally to assist balance and relieve pain in an extremity. This device, should be held in the hand opposite the influenced leg, prevents tilting of the trunk over influenced extremity because it supplies a wider base of support for body weight. A cane should also have a good suction tip, deeply grooved and with about a 4-inch even surface for balance. People use their good leg going up first on a step, but they use the bad leg first while going downstairs.



a b

Figure 3.4. ‘a’ basic cane, ‘b’ quad cane (Source: Raschko 1982)

Canes can be adjustable or nonadjustable, and have a variety of handgrips. They can also act to assist in sensory disabilities for example blindness. The ortho cane adjusts in height from 68 cm to 106 cm. The quad cane is a cane with four legs and a base for support of bodily weight when there is only fair balance. It is used for transition from parallel bars to a cane support, as demonstrated in Figure 3.4. It provides solid four-point ground contact (Raschko, 1982). Canes should be the proper for the height and weight, and should always be used on the stronger side of the body. All canes need a rubber cup at the bottom to prevent slipping.

Figure 3.5 also shows some kinds of cane designs. Folding cane, folds up easy, is particularly suitable for traveling. Walking stick cane uses for support when walking. The cane can be used as a normal walking cane to give that support needed, but it then can be folded into a seat for resting.

a  b  c 

Figure 3.5. ‘a’ folding cane, ‘b’ standard quad cane, (Source WEB_7, 2005)
‘c’ walking stick cane (Source WEB_11, 2005)

**Walkers**

Walkers are used by those who need assistance with balance while walking, particularly the elderly or paretic. They must have some arm strength. Figure 3.6 illustrates a stair walker. The person uses the extended arms when climbing stairs. The aluminium frame is adjustable in height from 81 cm to 91 cm (Raschko 1982). However, walkers should not be used on stairs in general.

Figure 3.6. Multipurpose stair walker (Source: Raschko 1982)

Walkers improve balance by increasing the elderly people’s base of support, developing lateral stability. The standard walker is the most stable, but it needs a slower, controlled gait pattern because elderly using it must be able to pick the walker completely off the ground and place it forward before stepping forward. In comparison to canes, one study note that a greater attention demand was required for use of walkers,

and the demand was the greatest when using a standard walker. Figure 3.7 illustrates some kind of walkers.

a b c

Figure 3.7. ‘a’ standard walker (Source WEB_12, 2005), ‘b’ front-wheel walker (Source WEB_13, 2005), ‘c’ four-wheeled walker (Source WEB_14, 2005)

Standard walkers may be useful for elderly with reasonable to severe impairments, but the need for attention makes them less desirable for cognitively impaired elderly.

Front-wheeled walkers are best for elderly with a gait that is too fast for a standard walker. Wheels allow the elderly to sustain a more normal gait pattern than they would with a standard walker, but they also reduce stability. A possible use for front-wheeled walkers is to help the ambulation of elderly with frontal loberelated gait disorders, reasonable to severe Parkinson’s disease.

A four wheeled walker can be used if the elderly needs a larger base of support and does not rely on the walker to bear weight. If an elderly person applies full body weight through the aid, it could roll away, resulting in a fall. Four wheeled walkers are best for higher functioning elderly people who walk long distances and need minimal weight bearing. Four wheeled walkers are proposed for moderate Parkinson’s disease, mild cautious gait. When needed, these walkers can be modified to supply sturdier construction, larger wheels, hand-braking systems, or a seat (WEB_10). Moreover, they are easier to turn, and the rolling speed is adjustable.

Although, walkers support weight bearing, they have also some disadvantages. These include difficulty maneuvering the device through doorways and congested areas, reduction in normal arm swing, and poor posture with abnormal flexion of the back while walking. Figure 3.8 illustrates the selection an ambulatory device for elderly person’s requirements.

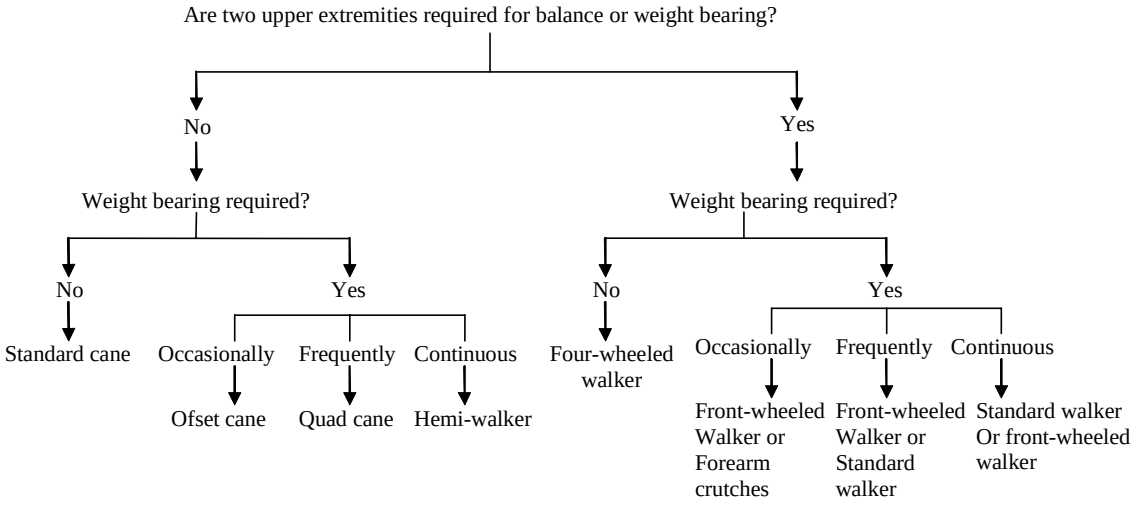



Figure 3.8. Algorithm for selection an ambulatory device (Reference: WEB_10, 2005)

## 3.1.1.2. Nonambulatory Aids

Impairments, regardless of cause or manifestation, for all practical purposes, confine individuals to wheelchairs.

A wheelchair is a chair that provides mobility easier for elderly who have difficulty walking or who are unable to walk. There are many different types of wheelchairs. The most common types are outdoor wheelchairs, indoor wheelchairs, manual wheelchairs, standard wheelchairs and electric wheelchairs. In this thesis, indoor, standard and manual wheelchairs are mentioned briefly.

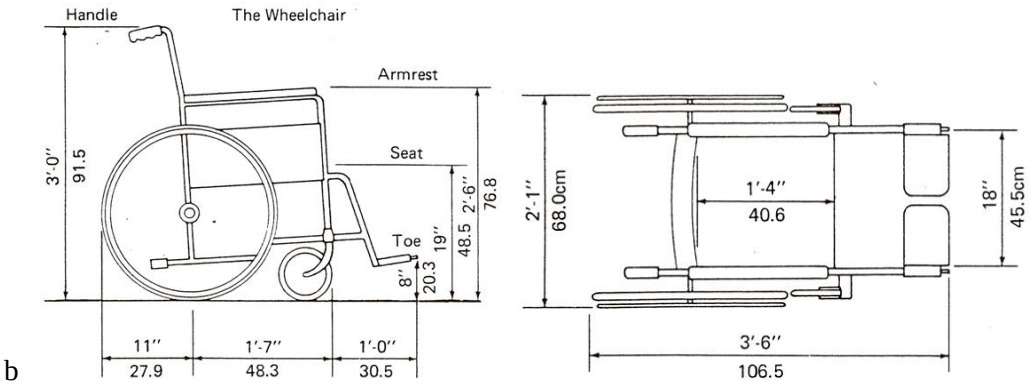
**Indoor Wheelchairs**

According to Raschko (1982) indoor wheelchairs are characterized as follows:

- Drive wheels are in front; the chairs need less space for manoeuvrings.
- They are unable to climb up or down curbs or steps.
- It is easier to traverse carpets with these chairs
- They cannot closely approach tables and desks.
- They are for people with weak arms and shoulders, and double leg amputees.

A standard wheelchair is seen in Figure 3.9.

a




b

Figure 3.9. 'a' Wheelchair with full-length removable arm,
'b' American standard wheelchair (Source: Raschko 1982)

**Manual and Standard Wheelchairs**

The most popular type of wheelchair for everyday use for an elderly person with good upper body mobility is the lightweight manual wheelchair, can be managed easier, supply maximum independence of movement with a minimum of effort. Manual wheelchairs provide mobility which the user can self-propel or can be propelled by another person. Polymer tires are best suited to indoor use (Figure 3.10).

a b c

Figure 3.10. 'a' aluminum manual wheelchair, 'b' steel manual wheelchair
(Source WEB_6, 2005), 'c' standard folding frame (Source: WEB_15, 2005)

Most people still prefer standard wheelchair that is characterized by a cross-brace frame, built-in or removable arm rests, swing-away footrests, a mid-high-level back, and push handles to allow non-occupants to propel the chair. It supports the pelvis, relieves pressure on the spine, and has a soft, comfortable fabric.

Some permanent disabilities result in constant wheelchair use, and interior design in such cases must accommodate the needs of elderly person who is always seated. Not only necessities such as light switches and medicine cabinets must be lowered, but also bending and reaching from a seated position can be particularly exhausting (Figure 3.11). Activities that are needed repeatedly in interior space, and design solutions that minimize physical effort can be reviewed by designers.

Figure 3.11. Entrance with electrical control (Source: Raschko 1982)

### 3.1.2. Functional Dependencies

The ability to live independently acts a role as the key indicator of quality of life. Weisgerber (1991) argues that for many people with disabilities prefer to live their own instead of living in the protective care of their family or in an institutional setting where their needs are taken care of. It is the main viable goal of their life. Thus, in the view of him elderly people with disabilities require personal assistance in noninstitutional living.

Such care, obviously, emphasizing personal assistance and ignoring the potential of supportive technology and other design accommodations to help those with functional impairments continue functionally independent, encourages the continuation of discriminatory artifact environments and prevents most of people with impairments and disabilities of all ages from reaching their full potential of independent living (Pirkl 1994).

There is a strong relationship between independent living and a barrier- free environment. According to DeLoach et. al. (1983) those with severe disabilities cannot be functionally independent without the absence of artifact barriers in both public and private from the macro (architectural) to the micro (product) level.

Accurately, choices reduce as people grow older. Thus, with advancing years, opportunity to make choices is made increasingly difficult by the onset of chronic illness and a variety of functional impairments, as well as financial concerns. Still, categories of impairment alone do not determine the potential for living independently. An elder person with a broken leg, for example, may have strong arms and hands, and excellent stamina. Another person with a broken leg may be young and obese, with very little stamina.

Ninety percent of those living alone want to maintain their independence with a strong desire. Too much dependence is their greatest fear. Some negative effects can also appear with living alone. Depression is the most common among them. Although, 60 % of those over 75 experience severe loneliness, their desire to live alone continues strong (Pirkl 1994).

### 3.1.3. The Requirement for Assistance

The old people will do all daily routines by themselves if they live alone. An old person should be able to do the activities such as having bath, getting dressed, walking around, eating and going to toilet without any help, otherwise they could not be regarded as capable or independent. In the case of lacking one of these activities, they need long-term care and support.

According to Pirkl (1994) most of elder people are able to live and functionally independent, only 4 to 5 % are institutionalized. While half of these may need some nursing assistance, the other half need only housekeeping assistance. Their need for such assistance is directly related to age. This is seen in Figure 3.12. Those 85 years and older people need the most assistance in activities of daily living. Thus, 95 % of the elder population is not institutionalized. They continue to live in the same spaces and use same products, and they also want to live independently as do younger population in their later years (Figure 3.12 and Figure 3.13).

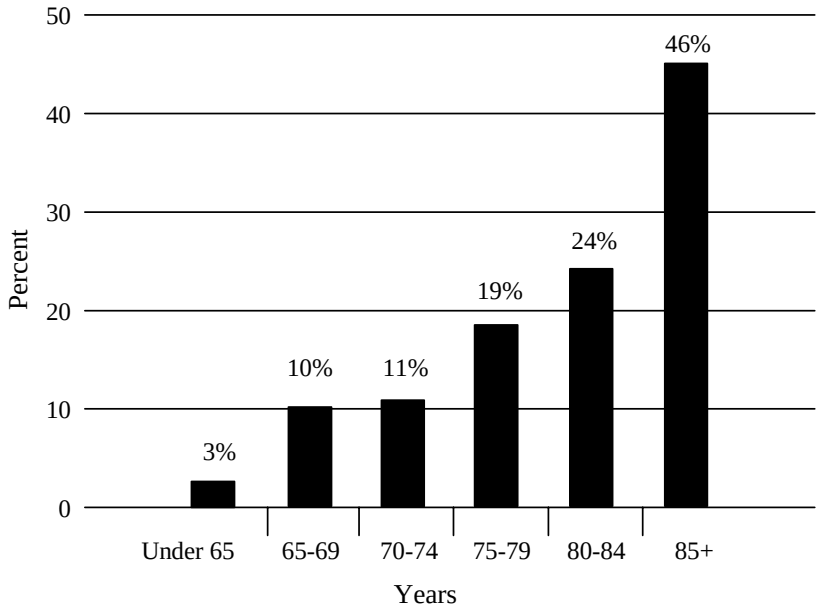



Figure 3.12. Persons needing assistance in activities of daily living (ADL).
(Reference: Pirkl 1994)

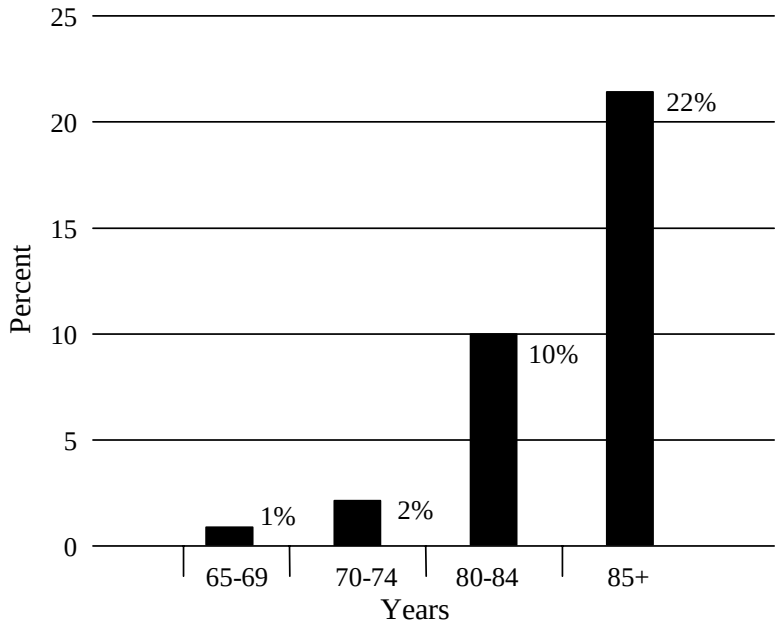



Figure 3.13. Living in homes for the aged
(Reference: Pirkl 1994)

Assistance is an issue of concern for younger as well as older people. Still, of all age groups, the elderly are most in need of help. Women outnumber men in the need for assistance, within all age categories. The data demonstrates that the percentage of those needing assistance with daily activities range from 10.8 % within the 65-74 age group to 20.5 % of those 80 years and over. On the other hand, it is important to notice that

although those between the ages of 15 and 64 account for 46.2 % of all people needing assistance, this group consists only 2 % of the total (Table 3.3).

| Age and Sex | Total (in 1000's) | One or more activities | Needing Assistance With | | | | No Assistance Needed |
|---|---|---|---|---|---|---|---|
| | | | Type of Activity | | | | |
| | | | Personal care | Getting Around Outside | Preparing Meals | Doing House-work | |
| ***Total*** | 186.022 | 8.206 | 3.211 | 5.213 | 4.830 | 5.927 | 177.816 |
| ***65 and under*** | 158.359 | 3.794 | 1.383 | 2.077 | 2.315 | 2.821 | 154.564 |
| ***65-69 years old*** | 9.615 | 890 | 285 | 546 | 484 | 635 | 8.724 |
| ***70-74 years old*** | 7.319 | 806 | 336 | 525 | 472 | 566 | 6.586 |
| ***75-79 years old*** | 5.434 | 1.026 | 408 | 678 | 554 | 710 | 4.408 |
| ***80-84 years old*** | 3.126 | 738 | 311 | 595 | 365 | 473 | 2.388 |
| ***85 and older*** | 2.097 | 952 | 487 | 791 | 639 | 722 | 1.145 |

Table 3.3. Persons needing assistance with activities, by type of activity, age and sex (Reference: Pirkl 1994)

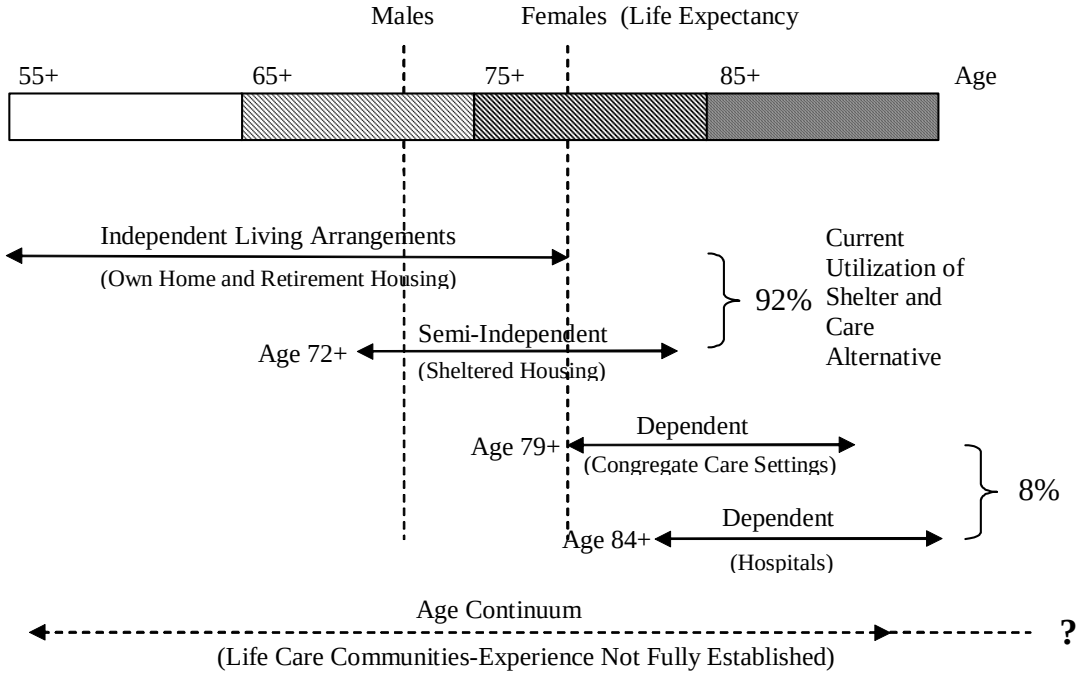



Figure 3.14. Relationship between age, shelter, and services (Reference: Pirkl 1994)

When compared with those living independently within the community, the proportion for women is higher than for men for each activity. This explains that why people give the greater need to assistance among women and the reducing rate of older men's survival. Figure 3.15 shows elderly women with assistants.

a  b 

Figure 3.15. ‘a’ Hairdressing appointment, ‘b’ Walking with assistant,
(Source: Torrington 1996)

Moreover, residents of long-term care institutions in the community need some level of support in performing ADL or other basic physical activities. With this view, industrial product design can go a long way toward preserving, both the individual’s independence and the community’s support resources that could be used more effectively by those with severe disabilities. When identifying similarities between non-elderly and elderly people with long-term service needs, the population with long-term service needs is more objectively distinguished across the life span than is generally acknowledged (Pirkl 1994). According to Regnier (1994) existing nursing homes should be more like hospitals and they should be the last alternatives when all other options have been exhausted. The requirement of institutionalization in a nursing home should be argued just like the “required hospital stay” under hospital utilization guidelines. To improve independence, new product forms should:

- Encourage self-expression
- Provide free choice
- Maximize independence
- Allow self-governance
- Stimulate creativity
- Optimize environmental control

Consequently, elderly people today are more reluctant to accept placement in a nursing home. The development of home care in the community and improved options that provide advanced communications technology will give the approaching generation of older people more options than in the past. New technologies permit them to safely live at home (Figure 3.16). Moreover, elderly people’s desire that is living in their own homes is the most significant circumstances. This explains why product design is so important for elderly people rather than all other assistance types.

Figure 3.16. Tele-Alarm (Source: Regnier 1994)

## 3.2. Environmental Support and Independence

To enlarge an environment for the user should be one of the main goals of a designer. Mayer Spivack explains own his words as following:

> "An appropriate environment, one that fits and supports the behaviours and needs of the users, is out of awareness for most of its users. Only when environments inhibit process, confuse perception, or otherwise impede our lives, do we notice our surroundings. We also may notice our environment (consciously) when it gives great delight. These are both extremes of the same continuum. A successful environment is either unnoticeable or delightful" (Raschko 1982, p.3).

The relationship between environmental support and independence due to the range of functional limitations that deny people independence is accurate and simple. According to Pirkl (1994) the degree of independence (I) is a function (f) of environmental support (ES) and functional limitation [I= f (ES, FL)]. This relationship is visualized in Figure 3.17. The vertical axis describes the spectrum of functional limitations ranging from mild (need for corrective lenses) to severe (paralysis of the lower extremities). The horizontal axis describes the degree to which a particular product (microenvironment) supports independence. The model shows that people maintain independence through a wide variety of options. The central diagonal line which is called adaptive equilibrium demonstrates these combinations. Any point on this line arranges the negative effects of the functional limitation with an appropriate environmental level of support. The more the severe functional limitation, the greater the environmental support needed to maintain a particular level of independence. The limitation, presbyopia (inability of the eye to focus on nearby objects) requires far less environmental restructuring than paraplegia (paralysis of the lower extremities).

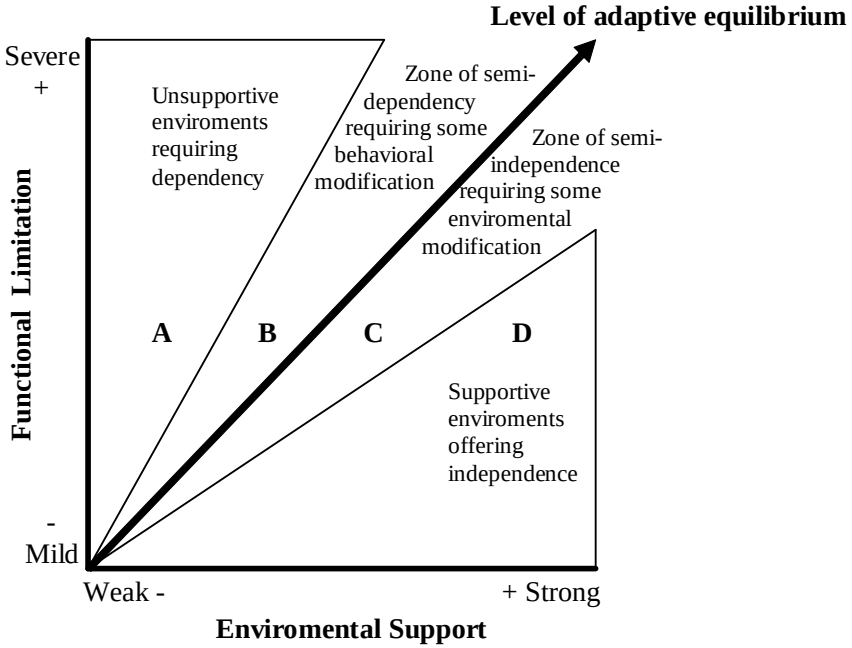



Figure 3.17. Environmental support and independence (Reference: Pirkl 1994)

The diagram consists of four areas: On the left (area A) is the zone of dependence. Products that decrease against independence and discriminate against those with functional limitations are unsupportive in this area. On the right (area D) is the zone of independence. Products support a wide range of functional limitations and supply independent living. One additional area, is placed left of the line of adaptive equilibrium, is the zone of semi-dependency (area B). Products need that people transform their behaviour to improve independence. The zone of semi-independence (area C) needs alteration of the environment to renovate their independence.

## 3.2.1. Environmental Press and Competence

It is generally accepted that as people get elderly, they can face at least one chronic disease. Elderly people challenge their environment with their own competence. The number and severity of health-related functional limitations enhances with age. When health diminishes, more environmental support is required to compensate for the functional losses.

Pirkl (1994) cited Lawton and Nahemow (1973) suggest similar ecological model of environmental press demonstrates the dynamic relationship that occurs

between the environmental support and the competence level of the person performing it. The basic idea of this model is that individual behaviour and satisfaction are related to the dynamic balance between the demand character of the environment (press) and the individual's ability to deal with that demand (competence). Any point on the schema shows the outcome of a person/environmental transaction, and adaptive behaviour or positive effect may result from a wide variety of combinations of individual competence and environmental press. Figure 3.18 represents the relationship between environmental press and individual competence.

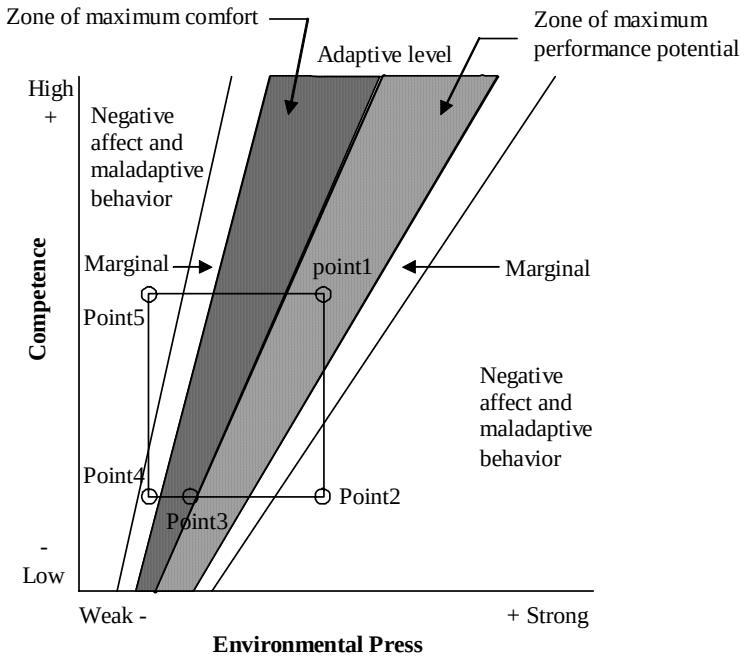



Figure 3.18. Ecological model (Reference: Pirkl 1994 cited Lawton and Nahemow 1973)

Point 1 demonstrates a situation of satisfying the match between the presses of environment and personal competency. Point 2 demonstrates a situation of a less satisfying match between the same environment and personal competency (less independence due to illness or some accidents). Point 3 demonstrates a situation with lower press from the environment (which is a different place where more assistance is provided). Point 4 demonstrates a position where the environment is providing too much care (nursery, hospital). Back to the level of functional competence (convalescence from an accident or an illness), a person can pass to point 5, providing low environmental press. When this low press becomes unsatisfactory, the person can move back to point 1.

Any point in the shaded areas shows the positive result of the level of environmental demand balances a person's ability to answer. For example, a woman is

85 years old and, although she is legally blind, some peripheral vision permits her to identify nearby objects. She also has rheumatoid arthritis in both hands which causes severe pain and limits her ability to grasp and manipulate most objects. Over the years she has changed her living spaces and gained particular products that make possible her to achieve activities of daily living (ADL) and stay independent. Then, she has changed her product environment (gained transgenerational products) to decline her level of dependency and frustration (environmental press), and increased her competence level (functional ability) through the use of supportive products, and generated independence (positive adaptive behaviour) (Pirkl 1994).

Most people particularly elderly people choose and produce their own product environments and will maintain to do so for as long as they stay independent. Accurately, people need more supportive products because their health-related competence reduces, particularly with age. Nearly, all housing for the elderly provides barrier-free designs suggesting such features as grab bars, flush thresholds, and waist-high electric outlets, their associated product environments usually fall far short of adequate accommodation. Figure 3.19 represents some industrial products that designed for these problems. Wall switch extender supplies easy access to existing wall switches. These grab bars provides security and a non-slip hand hold.

a  b  c  d 

Figure 3.19. ‘a’ Wall switch extender, ‘b’ Economy handgrip, ‘c’ Folding and locking grab bar, ‘d’ Tub grab bar (Source: WEB_7, 2005)

Many products such as beds, telephones, chairs, clothes washers and dryers, and door and bathroom hardware are miscarriage to accommodate the elderly person’s needs and level of competence. This according to Pirkl (1994) usually emerges for one of three reasons;(1) either those who design, produce, specify, or purchase such products are unaware of transgenerational design; (2) such designs do not yet exist; or (3) the decisions were made for expediency.

As people 65 and older experience one or more physical impairments, they turn to products and environment that remain their independence and support their ADL. Many products that once increased the quality of life gradually become less supportive because of declining functional capacity. Elderly people are forced to cope with products and environments that become frustrating at best (e.g., handles and knobs are difficult to use), and dangerously hostile at its worst (e.g., confusing range, oven, and faucet controls). Figure 3.20 shows some handles and knobs. Rotary doorknobs need add-on lever-action doorknob turners to increase the twisting leverage required by those with arthritic hands and wrists. These grips fit over and revolve doorknobs and faucet handles for an easier, less painful grip. Tap turner can be very handy for elderly who may have trouble gripping. Counter turner is used to turn a whole range of small difficult items like gas and radiator taps.

a  b  c 

d  e  f 

Figure 3.20. ‘a’ door lever conversion covers, ‘b’ Ribbed soft door grips (Source: WEB_7, 2005), ‘c’ Plug, ‘d’ Tap turners, ‘e’ Contour turner, ‘f’ Plug pull (Source: WEB_11, 2005)

Those 85 and over experience major limitations in their daily living activities are secondary to age-related changes. Additionally, the extra burden of illness physical, social, and psychological and their ability to cope diminishes quickly. On the other hand, Raschko (1982) states the challenges in designing a supportive environment to help independent living:

- To ensure that disabilities do not become handicaps
- To make the artificial environment more responsive to behavioural and physical needs
- To improve products that can be assistive aids
- To design products and equipment that will enhance competences and support satisfaction in the performance of independent ADL.

## 3.2.2. Personal and Environmental Characteristics

The quality of life depends on a people's physical, social, and economic well-being. It is also affected by the degree of the activity of daily living. Not only continual changes in the levels of competence and environmental press determine the quality of life and psychological well-being, but also three additional environmental functions such as maintenance, stimulation, and support determine them. People of all ages need these functions, and some environments provide some functions better than others. McRae states that there is an interaction between a person and the environment (Pirkl 1994). It may be visualized as personal characteristics and environmental characteristics coming together in Figure 3.21. If the environment becomes too demanding to the individual's competence, the outcome is negative and if the environment is not demanding enough, the encounter is negatively effect since it is unstimulating.

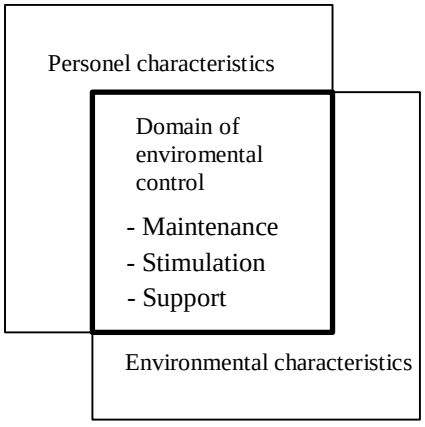



Figure 3.21. Interactions between a person and the environment (Source: Pirkl 1994)

**Maintenance**

Maintenance is generally the normal state of relationship with the environment for most people. People experience well the context of the daily living activities and

routine behaviours such as toileting, dressing, eating, and walking have become usual through daily repetition. People found to adapt to the various environmental demands that press upon the lives. An important quality of environmental maintenance is being in the background. Although the background environment fits people and people fit the background environment, people normally are not conscious of the background environment. Only when impairments suddenly attack, people recognize their need to arrange. Mostly, microenvironments (products) are sources of maintenance for most people. Both products and people, however, alter with time. Their elements run down and become dysfunctional (Pirkl 1994).

**Stimulation**

Stimulation can be described as a different approach from the maintenance function; a deviation from routine behaviours. It is distinguished as conditions where environmental demand is notably stronger than the range normally experienced by people of a given level of competence. Such conditions supply a context requiring an emotional, cognitive, or behavioural response. They supply experiences involving novelty, learning, and problem-solving, and suggest an affirmation of the competency level, for example, learning a new task or skill.

Products progress from maintenance to stimulation by upgrade through the purchase of a new model with new visual appeal and new features. Products that were used routinely can also become stimulating as people experience diminishes in physical or sensory capabilities. Such products, used effortlessly in the past, can gradually become difficult to use, so offering a new form of satisfying activity. Environmental challenges may not supply enough stimulation. Products which protect people with much behavioural insulation can blight the physical and mental stimulation necessary for a healthy mind and body. Such overprotection includes the danger of independence, motivation, and residual ability for maintaining control of life (Pirkl 1994).

**Support**

According to Pirkl (1994) personal loss and physical disability such as vision, hearing, and movement often diminish situations. Thus, environments become supportive or unsupportive to the degree they accommodate the needs of those using the environment. If competence falls outside of positive effect and adaptive behaviour, a

product might fail to meet the needs adequately. The better the environmental support, the greater maintenance achieved, and the higher adaptive level will be.

Weisgerber (1991) states that as people consider the quality life for persons with disabilities, it is important to think in terms of how the quality of people's lives is influenced by the environment around them. Elderly people's difficulties in accomplishing the activity of daily livings also affect the quality of life. There is little enjoyment to be obtained from continuous meets with physical barriers that stand in the way of the most crucial life activities. According to Pirkl (1994) transgenerational design is an important facility for removing these barriers and obtaining environmental compatibility. The challenge is to care for a person's sense of values and improve the quality of life for both the young and old.

### 3.2.3 The Classification of Environmental Regions

Pirkl (1994) states independence needs the competence of level to be balanced by a corresponding level of environmental support. Moreover, any environment should support the level of competency if people are to sustain their independence. Thus, if an impairment and disability reduces the level of the competence, people should

- Provide a new environment suggesting a higher level of support
- Raise the level of competence to meet the higher environmental demands, or
- Modify the existing environment to raise the support level and achieve balance

These offers note the importance of sustaining control (choice) over the environment. These also offer that a variety of environments face people with greater or lesser degrees of control. Environmental control, however, is not a choice. Pirkl (1994) cited Howell (1978) defines four environmental zones ranging from those suggesting the user less to more control. It can be seen in Figure 3.22. Three zones, "public", "semipublic", and "semiprivate" are based on shared use. One zone, "private", is based on individual use.

- **Public environments:** shopping malls, theatres, transportation terminals, restrooms, drinking fountains, etc.
- **Semipublic environments:** nursing homes, hospitals, supermarkets, restaurants, airline seating, waiting rooms, etc.

- **Semiprivate environments:** congregate housing, offices, elevators, telephones, etc.
- **Private environments:** private residents, bedrooms, automobiles, refrigerators, razors, etc.

Public environments supply people little design control. They also suggest people little or no opportunity to support the particular level of impairment or disability by transforming the surroundings. People cannot, for example, control light levels, select floor surfaces, or choose how the environment is furnished. People must adjust to existing conditions or avoid from using such environments.

There is no easy way for people as individuals to guarantee that any public environment will fit their functional limitations and support their independence. People must rely on those who plan, finance, design, specify, produce, and promote the environmental spaces and artifacts with which people interact daily. Actually, the quality of any public environment depends on the collective decisions by those with little or no understanding about the pressing needs of those who depend on the outcome. Not all products keep independence. Many which are ill-designed cause an immediate decrease in competence and an increased level of environmental press. Such products prevent those with functional limitations from participating fully in the public environment (Pirkl 1994).

Semiprivate, semipublic, and public environments supply decreasing opportunity for freedom of choice and suggest people the least control. Such shared environments alter the responsibility for providing transgenerational design support to others, whose decisions may or may not adequately accommodate the particular needs.

On the other hand, people normally control, to a relative degree, the design pf private (individual) environments such as living spaces, car, furnishing of houses or apartments. Thereby, within financial and other constrains, private environments permit people to customize the surroundings according to the dictates of the individual aesthetic and social values, impairment or disability. As the level of competence declines or improves, people are free to adapt these environments as people wish, replacing hostile elements with industrial design alternatives. Individual, private control allows people to change the environment: adjust lighting, replace floor coverings, or install products more useful to competence to achieve ADL. Private environments also supply people the greatest freedom of choice and suggest people the most control because people provide the degree of industrial design support which they need.

Consequently, people maintain maximum control over their environment and their freedom. Recognizing the need for designing, specifying, and selecting industrial product design products may help this purpose (Pirkl 1994).

The products and environments people meet should balance the need for support in order to get or keep the competence, otherwise, the environment must adjust to people or people must adapt to the environment. In the case of private environments, people organize the level of support that they receive. People do this through choice and selection of such elements as their auto, residence, furniture, artifacts, appliances, and utensils. Sensitive choices can make private environments safe, comfortable, convenient, and supporting; insensitive choices can make private environments dangerous, frustrating, hostile, and demeaning.

### 3.2.3.1 The Distinction of Environmental Settings

The term “environment” includes certain elements within and about which people interact. For example, the environment of a shopping mall consists of shops, signs, walkways, elevators, escalators, directories, and telephone booths. The environment of the telephone booth consists of a telephone, a seat, the sound barrier, a shelf, a phone book, and possibly a door. The environment of the telephone consists of a receiver, a cord, a case, a dial or push-buttons, and alphanumeric information. Accurately, there are various environmental settings in the context of the term environment. Thus, each setting may be classified as follows:

- **Macroenvironments:** shopping malls, arenas, urban landscapes, commercial spaces, residential spaces, etc.
- **Minienvironments:** telephone booths, kitchens, bathrooms, offices, transportation spaces, etc.
- **Microenvironments:** telephones, sinks, fire alarms, toilets, chairs, television sets, etc (Pirkl 1994).

Most designers and researchers would agree that the macro-environment is really an architectural and community level of design and structuring of the physical environment. In contrast, microenvironment is distinguished by personal scale. The immediate surroundings of an individual are that part of the physical environment that is

within reach of a person. The more enlighten that a person is, the tighter his or her personal microenvironment becomes.

Pirkl (1994) explains that Figure 3.21 which is a model of the environmental landscape shows the relationship between the scope of environmental settings (ranging from macroenvironments to microenvironments), control over them (private products to public products), and their use: individual use (products used by individuals), shared use (those shared by several individuals), and public use (those shared by many individuals).

There are located a number of similar products and environments within the diagram. Three examples, illustrate this relationship, are: an air terminal (a macroenvironment and a public product for public use), an office (a minienvironment and a semiprivate product for individual or shared use), and a razor (a microenvironment and a private product for individual use).

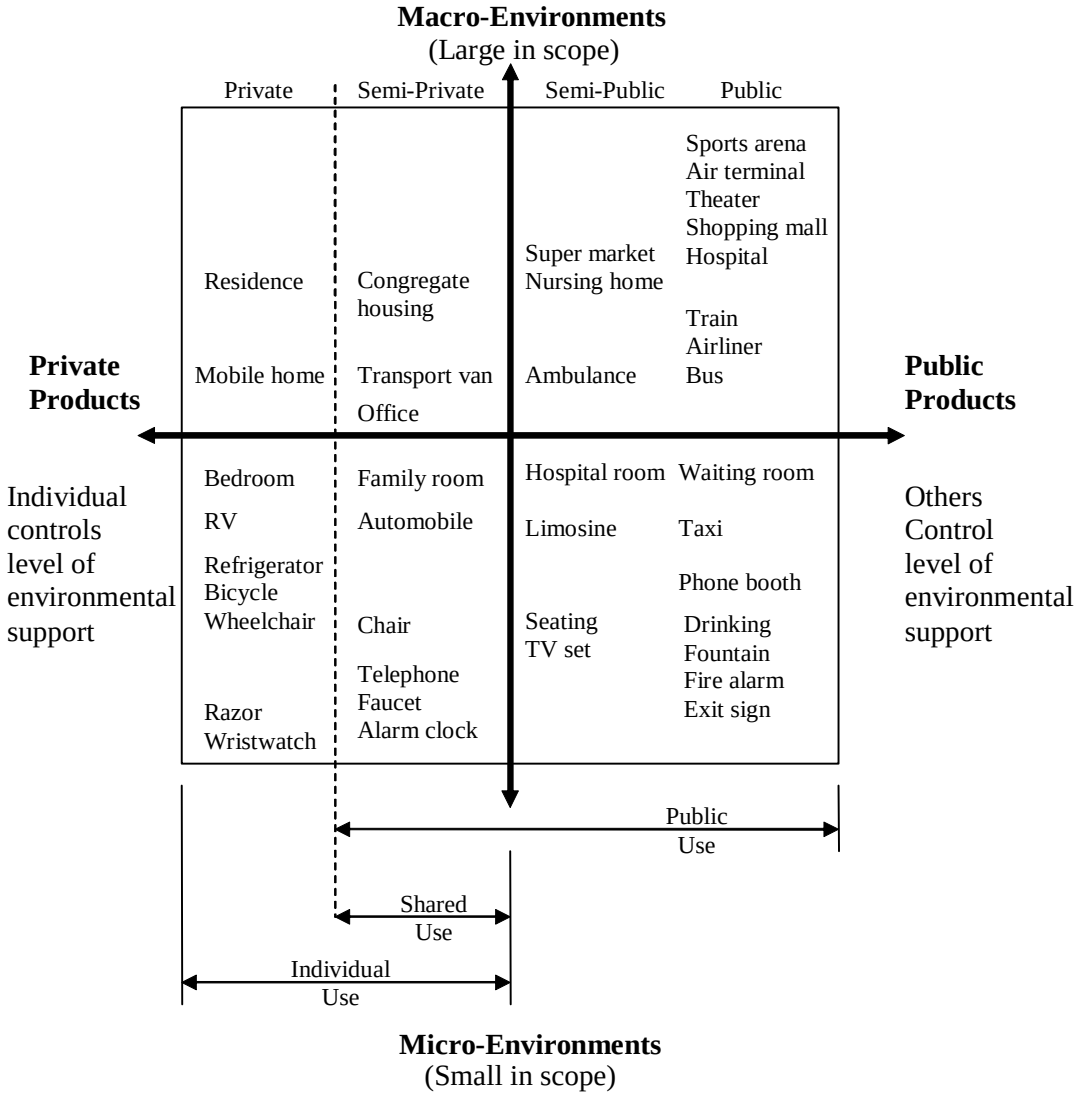



Figure 3.22. The environmental landscape (Source: Pirkl 1994)

All the physical, sensory and psychological effects of aging influence the relations between person and environment. For the visible handicaps, it is easier to create solutions, but people with invisible handicaps are often restricted by an environment that surpasses their competences.

## 3.3. Structure of Accommodation

According to Pirkl (1994) aging is becoming a forceful societal issue among professional groups. Pirkl cited Byerts (1978) suggested three attributes for accomplishing environmental quality that should be thought when developing settings for use by elderly people.

- Legibility supplies those environmental cues that permit people to recognize a sense of place, and which provide messages of orientation, direction, and differences.
- Accessibility allows people to move freely and normally throughout an environmental setting.
- Adaptability determines the range of adjustability offered by an environment.

Pirkl (1994) adds compatibility as a fourth attribute. According to him environments should also show compatibility that is artifacts and spaces should be soft, tolerant, unassertive, agreeable to the functional limitations of people, offering such additional support as safety, comfort, convenience, ease of use, and ergonomic fit. Environmental qualities humanize technology and form the centre ingredients of transgenerational design.

### 3.3.1. Legibility

Legibility supplies cues that allow people to perceive a sense of place, and provides messages of orientation, direction, and differences. Product interaction needs people to “communicate” with product and, products also have “communicate” with people. Human factors specialists define term this interaction as a person/machine system that may be explained an arrangement of people and machines interacting within an environment in order to achieve a set of system goals. In order to use a washing machine, for example, people must first communicate their instructions. They start by determining the set of washing conditions appropriate for the task (e.g., load size, water

temperature, type of fabric, etc.). Next, people "tell" the washer their intentions by "instructing" the controls to perform the desired tasks (e.g., soak, wash, rinse, spin, etc.). Then, as the operation proceeds, the washer processes their instructions and "informs" people of its progress by "displaying" the status and progress information. Finally, when the cycle is complete, the washer turns off and the instructions have been carried out (Pirkl 1994). This interactive communication between a product and its user includes the person/machine interface and depends on three factors:

- **Perception:** perceiving information communicated by a product's form, components, controls, displays, instructions (visual, auditory, tactile).
- **Interpretation:** understanding the information communicated, displayed, transmitted, or symbolized (clarity, readability, comprehension).
- **Response:** reacting to the information received (human motor response, machine reaction).

**Perception**

People, generally, rely on sensory, clues to perceive the various forms of information demonstrated by products. Vision, for example, permits people to perceive forms, shapes, and surfaces; positions and relationships; words and numbers; and graphic symbols and color codes (Figure 3.23). Hearing also warns people to changes in a sound's pitch and intensity, and receives verbal and symbolic information from recordings and synthetic speech. Sense of touch reacts to texture and surface modulations, as well as pressure and vibration cues related to activating switches or push buttons. In Figure 3.23, controls are large elastomeric keys that offer redundant tactile cues. A speaker phone and radio, integrated into the system's water column, also serves as an emergency call-for-help station.

Each sensory cue can communicate a wide range of information. Sense of hearing, for example, supplies an important element in personal safety; those who are deaf are unable to receive important audio signals and must rely on other signals, (e.g., facial expressions, body language, environmental conditions, etc.), to stay alive and prevent injury to themselves and others.

a 

b 

Figure 3.23. Water column (Source: Pirkl 1994)

**Interpretation**

Failure to understand environmental messages causes to diminish the competence and safety, and prevents people from responding appropriately. People with one or more sensory impairments or disabilities must rely on their remaining senses to complete the person/machine communication cycle. Thus, product information that fails to deliver its message, regardless of impairment or disability, discriminates against people and becomes a hostile element, militating against independence (Pirkl 1994).

Redundant cuing is a strategy that increases the independence of people with impairments and disabilities while, at the same time, benefiting users who are unaffected. Supplying redundant cues that link the senses helps guarantee that important product information is perceived and understood by all.

Such redundant cuing extended to a variety of product applications will be seen in the future. Its use needs that a product's control and information exhibits include more than one sense. The identifying word "fire" on a fire alarm in Figure 3.24, for example, should consist of large high contrasting letters (visual cue) raised from the background (tactile cue). It assists elderly people with low vision. It can be also operated in the dark. In another example that can be seen in Figure 3.25, the numbers and letters on a telephone's dial or push-buttons should feature large, high-contrast numbers and letters (tactile cue), and induce a unique audio tone when pressed (audio cue). Such cross-sensory redundant cuing enables those with sensory impairments to choose their mode of communication and interact with products no less effectively than those who are unimpaired.


Figure 3.24. Lodex (Source: Pirkl 1994)

a  b 

Figure 3.25. 'a' AT&T Big button phone (Source: Pirkl 1994)
'b' Big button phone (Source: WEB_5)

Big Button Phone is an ergonomically sensitive product that can accommodate a large population of users, including elderly people. The large, bold graphic numerals enable those with reduced vision to place calls easily. An added benefit comes from the numerical layout, which is identical in each set and easily memorized by blind callers who can also access the phone without the need for a braille template.

The Americans with Disabilities Act (ADA) that is the most important civil rights legislation prohibits discrimination on the basis of disability in places of public accommodation and needs that all new places of public accommodation and commercial facilities be designed and constructed so as to be readily accessible to and usable by persons with disabilities. For greater environmental support, the ADA has perceived the importance of redundant cuing as a means for promoting greater independence. It needs redundant tactile, braille, and visual indicators on such environmental elements as elevator controls, fire alarms, room designations, and directional and warning signs. The use of such redundant indicators should become a common practice throughout the artifact environment.

**Response**

Most products that people use in ADL need some form of response from people. Many people with physical and sensory limitations are prevented from responding to the dictates of a product's functional demands. A person with impaired gripping and grasping capability, for example, has difficulty operating round doorknobs. A lever needs a more sympathetic action to operate. A person with limited eyesight has difficulty responding to set of instructions or a warning label printed in very small type against a low-contrast background. Large, well-contrasted typography is easier to read. Design influences one's response either positively or negatively. Products that are presented in Figure 3.26 are appropriate examples some form of response.

a  b 


Figure 3.26. 'a' Timex easy reader, 'b' Clear solutions calculator (Source: Pirkl 1994)

Watches are designed for easy reading while maintaining their function as fashion accessories attractive to people of all ages. Elderly people can read the time without their glasses. Large, black, clearly defined numerals and hands contrast with the clean white dials, enhancing legibility, particularly in low-light environments. Calculator features, a light touch keyboard and large "no mistake" numbers, make it easy to use by impairments. The calculator is powered by daylight or artifical light, and there are no batteries to replace. The large, clean numbers are isolated from the background, reducing clutter and helping those with poor vision. The transparent plastic case allows the user to increase or reduce the contrast between the numbers and the background by placing the unit on an appropriately dark or light surface. The flat surface with large numbers has also reduced the usual small, hard-to-push buttons. Heat from the fingers activates this calculator, making it ideal for people with arthritis or other hand dysfunctions.

### 3.3.2. Accessibility

Still, most consumer products and living accommodations found in today's private and public environments ignore accessibility and equality of use and support to millions of elder people, most of whom do not have severe disabilities. Indeed, each environment public or private should be accessible by all who would use it. To know the environment is to reach it, manipulate it, and understand it.

While many guidelines and standards for ensuring accessibility, the result of the barrier-free design, are becoming effective in the architectural barriers that bar those with disabilities from accessing public spaces and buildings, these standards do not apply to the majority of consumer products. Such standards should be developed by industrial product design and organizations. Pirkl (1994) states transgenerational design can fill the current gap by responding the growing demands of elderly people. Today, under the context of "universal design", barrier-free architectural and interior design accommodation supplies accessibility that is preserved by civil rights legislation to architectural and interior spaces for people who are blind and deaf, or use wheelchairs. But in today's world and certainly tomorrow's this is not enough. Elderly people, who experience some form of functional limitation, are still denied a product environment that improves their quality of life, continued independence, and ability to achieve the ADL. The availability of transgenerational design products would develop eliminating this problem. Consequently, accessibility allows people to move independently and normally throughout an environmental setting.

### 3.3.3. Adaptability

The transgenerational design idea is a concept that supports sympathetic products that adapt to the widest range of individual needs. For example, it should make no difference whether a fire extinguisher, a detergent package, a can opener, or a telephone is used by a teenager or an adult person. Each needs equal access. However, elderly people, is one of the very group, need the most environmental support is offered the least. From a transgenerational design perspective, adaptive design does not mean adapting or modifying existing products or environments to accommodate a range of disabilities. Thus, it means that all products should be designed at the beginning to

accommodate the widest range of abilities of those who would use them (Pirkl 1994). Adaptability resolves the range of adjustability offered by a product or environment.

Many products such as television, washing machine, refrigerator, microwave and electric oven, are generally acquired when people are middle-aged and without impairments and disabilities. These same products are likely to be used by same people in their later decades, when they obtain one, or more functional limitations. Tasks, such as manipulating knobs and dials, grasping handles, opening doors, lifting heavy awkward pots of food or bundles of clothes become difficult, if not impossible, for those with debilitating physical or sensory conditions (Figure 3.27).

a  b 


Figure 3.27. ‘a’ Thin dials on a recessed surface- not easy to grip, ‘b’ Protruding dials are easy to grip and labeling easy to see (Source: WEB_5, 2005)

Transgenerational products, designed to accommodate those with the least competency, may succeed in increasing their competency level and enlarge their period of valued independence. These products are also better for the young and able-bodied, particularly when normal ability is limited by an impermanent illness or accident.

## 3.3.4. Compatibility

Transgenerational products help support and keep independent functioning for all who would use them, not only the young, the able, or those who can afford customization. Pirkl (1994) offers these products suggest increased safety, better comfort, added conveniences, simplified use, ease of handling, and bodily fit elements that bridge between us and the environment.

**Safety:** Products should be designed to hope a wide variety of physical and sensory impairments, supplying safe, supporting features before they may be needed.

Such products should be free from danger, injury, or damage under reasonable conditions by all who may be expected to handle, use, or operate them.

**Comfort:** Products should be free from disturbing, painful, or distressing forms or features. Products that offer comfort to those with impairments will also bring better comfort for those who are able-bodied. In many cases, comfort for all can be achieved with simple adjustments of type size, contrast, color, proportion, or dimension.

**Convenience:** Products should be designed to provide convenient, handy, and appropriate use for all who would operate them. This means such things as convenient storing, repair, cleaning, packaging, and carrying. Planning, foresight, and sensitivity go a long way toward providing convenient use by all.

**Ease of Use:** Products should be designed for simple, easy, and uncomplicated use, regardless of age or limitation. People should demand understandable instructions, simple operations, and logical controls that do not confuse their intelligence, tire their muscles, or defy their dexterity.

**Bodily Fit:** Products should be designed to accommodate and fit the widest possible range of appropriate human dimensions. People should recognize that while bodily dimensions reach their full limits during their late teens and early twenties, the also decrease as they reach the older years. Eye glasses, hearing aids, crutches, canes, walkers, and seeing-eye dogs become extensions of one's body and should be considered along with the person who must use them.

## 3.4. Transgenerational Design Requirements

Pirkl and Babic developed the following requirements for designing transgenerational design products in 1987 by Syracuse University. These are:

- Provide cross-sensory redundant cuing for all alarms, signals and controls (combine an audio signal with a visual indicator)
- Offer redundant modes of operation utilizing the next larger set of motor movements (finger to hand; hand to arm; arm to foot)
- Establish consistent display/motion relationships left to right and forward/up to increase, backward/down to decrease)
- Provide definitive feedback cues (control positions (detends) should "snap" into position)

- Reduce the complexity of all operations (minimize the number of tasks)
- Place critical, and frequently used controls within easiest reach (cluster controls on basis of priority)
- Prevent accidental actuation of critical controls (relocate, recess, or provide a guard)
- Provide adjustable product/user interfaces (horizontal/incline, vertical/incline, raise/lower, push/pull)
- Design for use by a variety of populations (male, female, young/old, weak/strong, large/small)
- Design to facilitate physical and cognitive function (encourage user to practice and improve by making operations easy and enjoyable)
- Design beyond the basic physical/functional need (enhance the user's independence, self-respect, and quality of life)
- Compensate for a range of accommodation levels (provide for some exercise through user interaction/participation)
- Strive to make task movements simple and understandable (clockwise for "on" or "increase," counterclockwise for "of" or "decrease")

Pirkl (1994) states these relate equally to all users, and their adoption by the design community can lead to better products for all users, regardless of age. Transgenerational design includes designing all products, and critical thinking about human accommodation. It is about making suitable choices between competing alternatives.

As a result, transgenerational design leads to universal design, designing for grandfather as well as for grandchildren. As people make life transitions from child to teen to adult to parent to grandparent, they also get and lose physical and mental acuity. This transition is determined as aging. Universal design's aim is to make the transitions of life and the transitions in design as well-designed as possible. Therefore, it creates scenarios of people with gender, faces, and personality and design for all people.

# CHAPTER 4

# UNIVERSAL DESIGN FOR ELDERLY PRODUCTS IN INTERIOR SPACES

The key in designing for the elderly is to survey good design principles, while acknowledging the personal needs and preferences. Design for the elderly is accurately based on the principles of Universal Design. To incorporate the basic construction and products in a space that would allow elderly people to live comfortably in their later years.

The percentage of elderly is getting higher rapidly and more people are now living with disability. There is a direct relationship between disability and aging, and accessibility relates to a wide variety of disabilities. Hence, elderly people could not function normally without the aid or other products used to increase of their performances. With the aging process, firstly mobility is influenced and the bathroom or kitchen may be inaccessible. In the kitchen, for example, the stepstool may not be usable for reaching to higher places. Accessibility may bring the user through the entry door to his or her private spaces, but safety, comfort, stimulation, and independence are based on the ability of the user. Accessibility and usability provide elderly people the ability to circulate without barrier within microenvironment, the independence to perform daily living activities; the right and the means to continue privacy; and also “in control” requiring minimum outside assistance. Many design characteristics will help people, but they do not always satisfy in all conditions. In the kitchen, for example, a counter height is appropriate to use for a tall ambulatory person, however, it is a frightening barrier to a person in a wheelchair. Therefore, Universal Design suggests one solution that can accommodate people with disabilities as well as the all other population and provides maximum inclusion that products and environments are accessible and usable by all, including people with disabilities.

For the elderly people, it may be the only place where they may role with any degree of independence in their later years. Capacity of the various tasks that maintain for daily living such as housekeeping, food preparation needs a supportive environment and products that will help the elderly, as much as possible, to follow the independence.

The specific interior spaces to be included are:

- Entry, is initial communication area, supplies transition from exterior space to interior space
- Living spaces are the socialization areas of people
- Bedroom is a rest and privacy area
- Kitchen is the area that people cook and eat meal
- Bathroom is a personal care and hygiene area

Elderly people spend their most of time in their private microenvironment. Thus, product design has an ongoing effect on the quality of the elderly people's lives in order to provide independence. Moreover, there are many elderly people that confront with their environments, so product design can provide environmental accommodations that can be used with dignity.

## 4.1. Designing for All: 'Universal Design Principles'

Universal design can be defined as the design of products and environments to be usable by all people to the greatest extend possible regardless of age, ability, or situation (North Carolina State University 1997). This approach is an inclusive process that enables all people to experience the full benefits of the products and environments without the need for adaptation or specialized design. Design for All, Inclusive Design, and Human Centered Design are the other terms of Universal Design around the World. Sometimes referred to as Lifespan Design or Transgenerational Design, it includes and beyond the accessible, adaptable, and barrier free design concepts of the past. It eliminates the need for stigmatizing, embarrassing different looking, and usually more expensive, special features and spaces for special people. Universal design is a design concept that products and spaces are more universally usable and marketable to nearly everyone whose human ability is ordinary, not special.

This concept includes the elderly as well as children, woman as well as men, left handed people as well as right handed people and the disabled and frail people that have an occasional weakness or imbalance due to sprained ankle, a broken bone, a dizzy spell, or being pregnant. Universal design is intended to be inclusive not exclusive. It is the idea that everyone should have access to everything all of the time. One of the aims of Universal Design supports the activities of daily living and tries to meet the needs of

all people. Designing with all the senses that are sight, sound, touch, smell, and taste help all people to meet their needs easily. Another is to create a product or place that can be used by the widest possible range of individuals. The efficient design of space relates to an understanding of the products to be used in that space. Universal Design allows people to lead full productive and independent lives. Designing for a broad range of users from the beginning of the process can enhance usability of a product or environment.

All people will not be able to use the end products. Some severely disabled individuals will require specific adaptations for use. By the help of Universal design, however, fewer and less-costly adaptations will be required. On the other hand, Accessible Design includes principles that widen the standard design process to those people with some type of performance limitation, whereas Universal Design covers the design of products for all people and includes all design principles. The Principles of Universal Design, published by the Center for Universal Design at North Carolina State University in 1997 (WEB_16, 2005), were organized by a group of architects, product designers, engineers, and environmental design researchers to lead a wide range of design disciplines including environments, products, and communications. These seven principles may help to improve existing designs, lead the design process, and also depict features that allow products and environments universally usable are as follows:

**Principle One: Equitable Use**

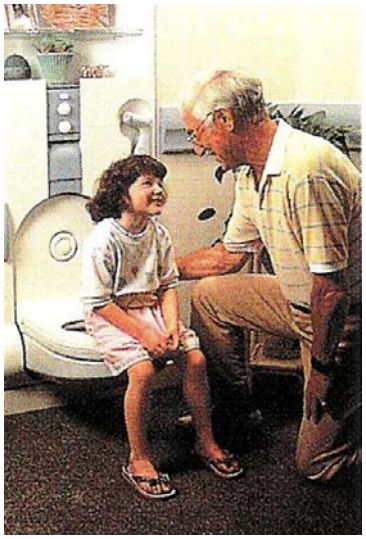


Figure 4.1. Toile personal hygiene system (Source: Viemeister 1993)

The design is useful and marketable to people with diverse abilities.

Guidelines

- Provide the same means of use for all users: identical whenever possible; equivalent when not.
- Avoid segregating or stigmatizing any users.
- Provisions for privacy, security, and safety should be equally available to all users.
- Make the design appealing to all users.

**Principle Two: Flexibility in Use**

Figure 4.2. Freehand tray (Source: WEB_17, 2005)

The design accommodates a wide range of individual preferences and abilities.

Guidelines

- Provide choice in methods of use.
- Accommodate right- or left-handed access and use.
- Facilitate the user's accuracy and precision.
- Provide adaptability to the user's pace.

**Principle Three: Simple and Intuitive**

Figure 4.3. Modular bath steps (Source: WEB_18, 2005)

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Guidelines

- Eliminate unnecessary complexity.
- Be consistent with user expectations and intuition.
- Accommodate a wide range of literacy and language skills.
- Arrange information consistent with its importance.
- Provide effective prompting and feedback during and after task completion.

**Principle Four: Perceptible Information**

Figure 4.4. Microwave (Source: WEB_19, 2005)

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Guidelines

- Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
- Provide adequate contrast between essential information and its surroundings.
- Maximize "legibility" of essential information.
- Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
- Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

**Principle Five: Tolerance for Error**

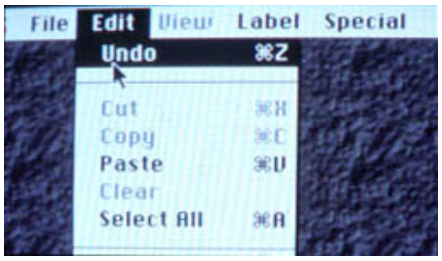



Figure 4.5. Computer undo function (Source: WEB_16, 2005)

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Guidelines

- Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
- Provide warnings of hazards and errors.
- Provide fail safe features.
- Discourage unconscious action in tasks that require vigilance.

**Principle Six: Low Physical Effort**

a  b 


Figure 4.6. 'a' Key turner , 'b' Rocking T knife (Source: WEB_7, 2005)

The design can be used efficiently and comfortably and with a minimum of fatigue.

Guidelines

- Allow user to maintain a neutral body position.
- Use reasonable operating forces.
- Minimize repetitive actions.
- Minimize sustained physical effort.

**Principle Seven: Size and Space for Approach and Use**

a  b 

Figure 4.7. Reacher (Source: WEB_20, 2005)

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

Guidelines

- Provide a clear line of sight to important elements for any seated or standing user.
- Make reach to all components comfortable for any seated or standing user.
- Accommodate variations in hand and grip size.
- Provide adequate space for the use of assistive devices or personal assistance.

## 4.1.2. Anthropometric Data on the Elderly

People differ in every conceivable way. Particularly, anthropometric dimensions vary such in height, sitting height, arm reach, and in the hundreds of different ways in which bodies can be measured as well as sensory abilities, motor abilities, mental abilities, personalities, and attitudes. The challenge for industrial designers is to design for elderly no one of which is exactly like any other.

Accessibility should be the fundamental consideration in any discussion of product and interior design for elderly people. Young people can use a step ladder, move heavy furniture and products to get at hard to reach areas, or sprawl flat on the floor to reach under a low piece of furniture. On the other hand, with the aging, strength and dexterity decrease, the competence to reach products and areas diminishes, and as a

result accessibility also shrinks. As a result of the aging, there will be loss of physical and mental activities and also adaptation ability. Besides decreasing height and diminish of the reaching distances are the other important effects of the aging. Figure 4.8 demonstrates some anthropometric data related to reaching for elderly person.

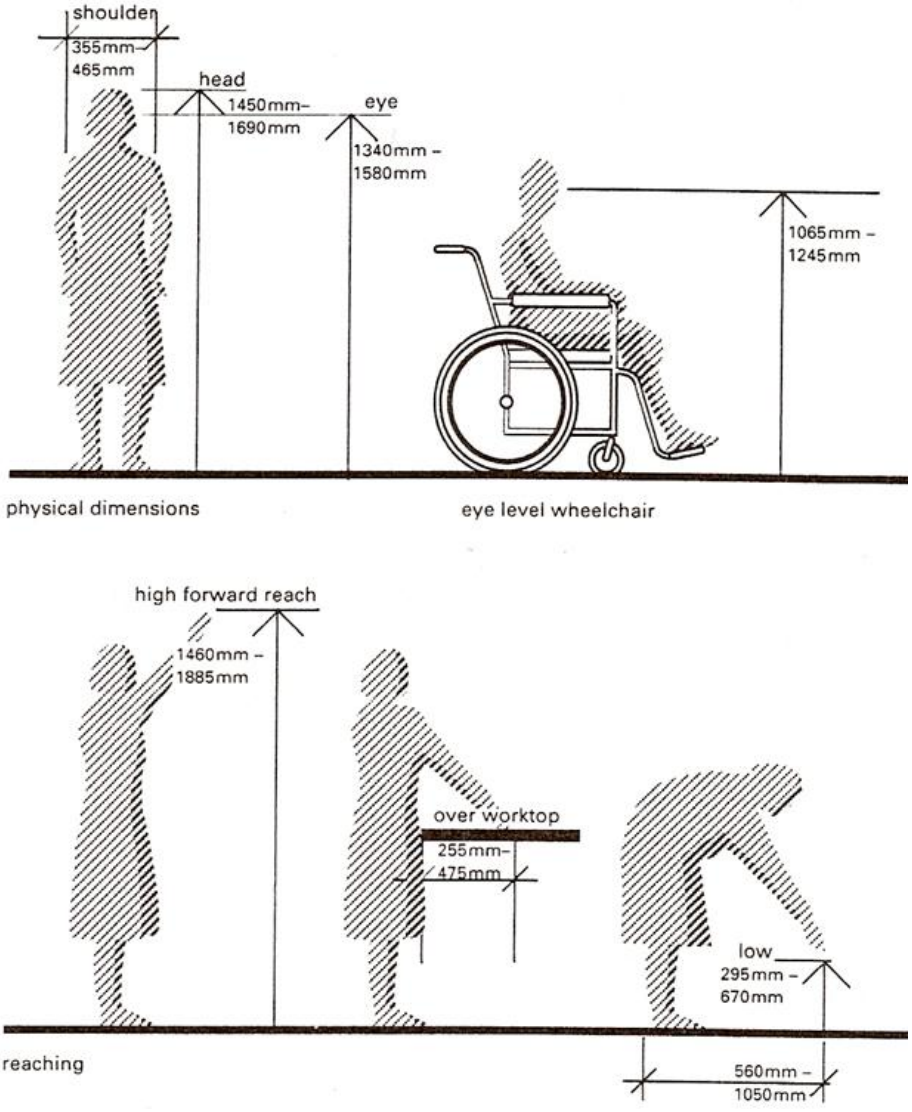



Figure 4.8. Anthropometric data for older people (Source: Torington 1996)

Anthropometric data differentiate between female and male, young and elderly, and able and disabled. Products should be usable within the comfortable reach of the elderly users, including those who are sitting and those who are standing and products should be designed to reduce bending and stretching. Circulation areas should be large enough to accommodate wheelchair users. Figure 4.9 shows the reach specifications for wheelchair users.

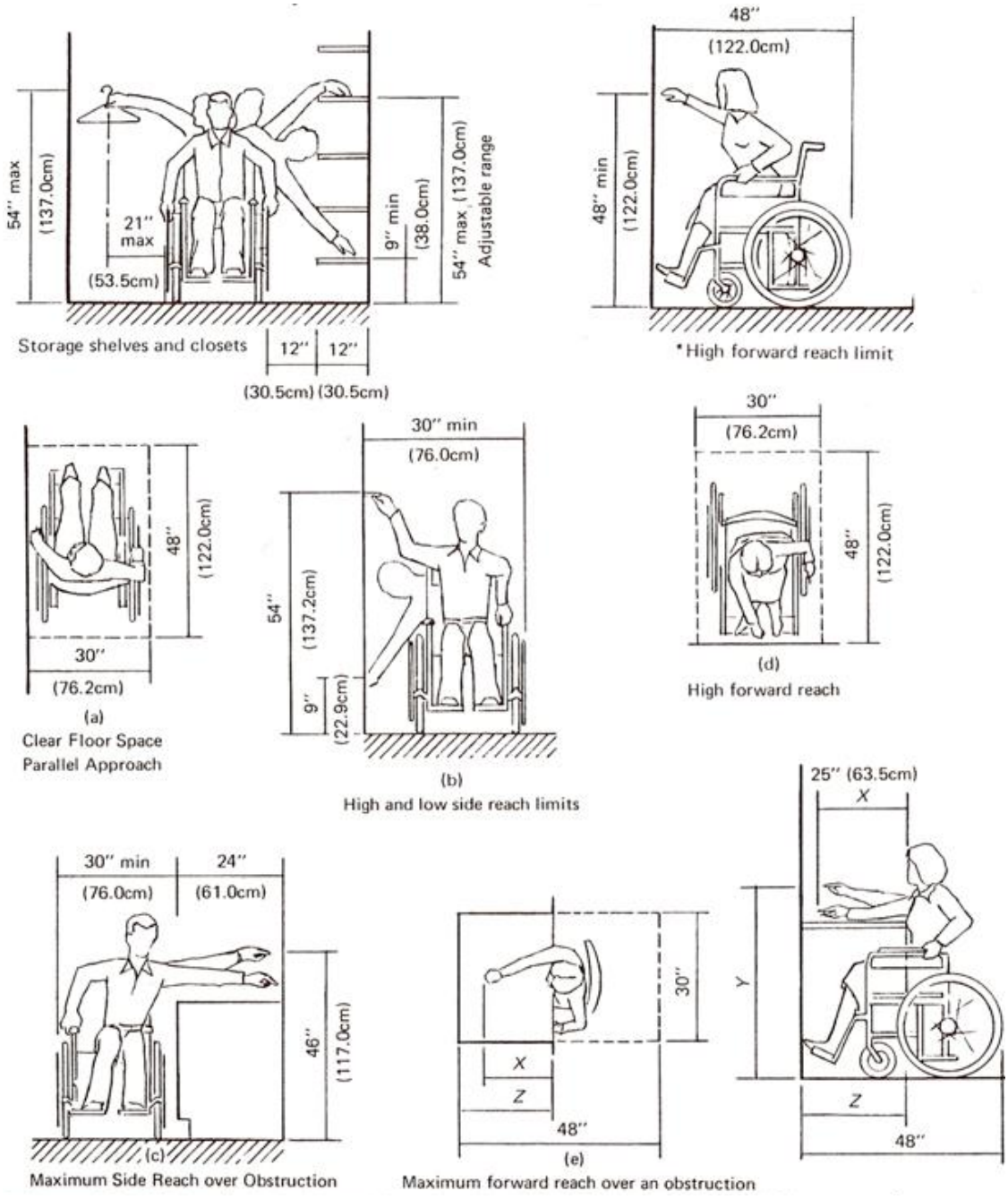



Figure 4.9. Reach specifications for average wheelchair users
(Source: Raschko 1982)

Anthropometric data describing the abilities of the small elderly female and the small female in wheelchair, the large elderly male and the large male in a wheelchair will define the appropriate areas of accessibility, as demonstrated in Table 4.1. The table supplies some very meaningful measurements. Data for the upper and lower reaches for elderly and disabled that upper limit (for small female, wheelchair) forward reach is 45.5 inches (115.6 cm), while (for the tall, elderly male standing) the lower

limit is 27.3 inches (69 cm). This range is called the “comfort area” by Raschko. This vertical area is accessible to 95 % of the elderly and wheelchair users and it should be the determining factor in the placement of all fixtures, such as light switches, door knobs, and light plugs, included in daily living activities are placed in the comfort area that is shown in Figure 4.10.

| DISTANCES TO FLOOR | ELDERLY (STANDING) | | WHEELCHAIR (SITTING) | |
|---|---|---|---|---|
| | Small Female | Tall Male | Small Female | Tall Male |
| 1. High reach, without obstruction | 63.0″ (160.0 cm) | 77.9″ (197.9cm) | Forward 45.5″ (115.6 cm)<br>Sideways 53.0″ (134.6 cm) | 59.2″ (150.4 cm)<br>71.2″ (180.8 cm) |
| 2. Low reach,without obstruction | 21.7″ (55.1 cm) | 27.3″ (69.3 cm) | Sideways 18.7″ (47.5 cm) only | 10.0″ (25.4 cm) |
| 3. High reach, with obstruction | *58.5″ (148.6 cm) | *72.0″ (182.9 cm) | Sideways 48.5″ (123.2 cm) | 67.7″ (172 cm) |
| 4. Eye Level: | | | | |
| Standing | 53.4″ (135.6 cm) | 66.9″ (169.6 cm) | | |
| Sitting | 37.4″ (95.0 cm) | 48.6″ (123.4 cm) | 42.8″ (108.7 cm) | 51.1″ (129.8 cm) |
| 5. Shoulder height | 46.4″ (117.9 cm) | 58.7″ (149.1 cm) | 35.8″ (90.9 cm) | 42.8″ (108.7 cm) |
| 6.Elbow height | 34.5″ (87.6 cm) | 43.4″ (110.2 cm) | 24.5″ (62.2 cm) | 30.0″ (76.2 cm) |
| 7. Easy forward reach without bending | 17.0″ (43.2 cm) | 21.2″ (53.8 cm) | 18.5″ (47 cm) | 22.3″ (56.6 cm) |
| 8. Easy sideways reach without bending | | | 16.2″ (41.1 cm) | 22.5″ (57.2 cm) |
| 9. *Height | 57.4″ (145.8 cm) | 71.5″ (181.6 cm) | 46.8″ (118.9 cm) | 55.8″ (141.7 cm) |

Table 4.1. Limits of reaching ability for population extremes (Source: Raschko 1982)

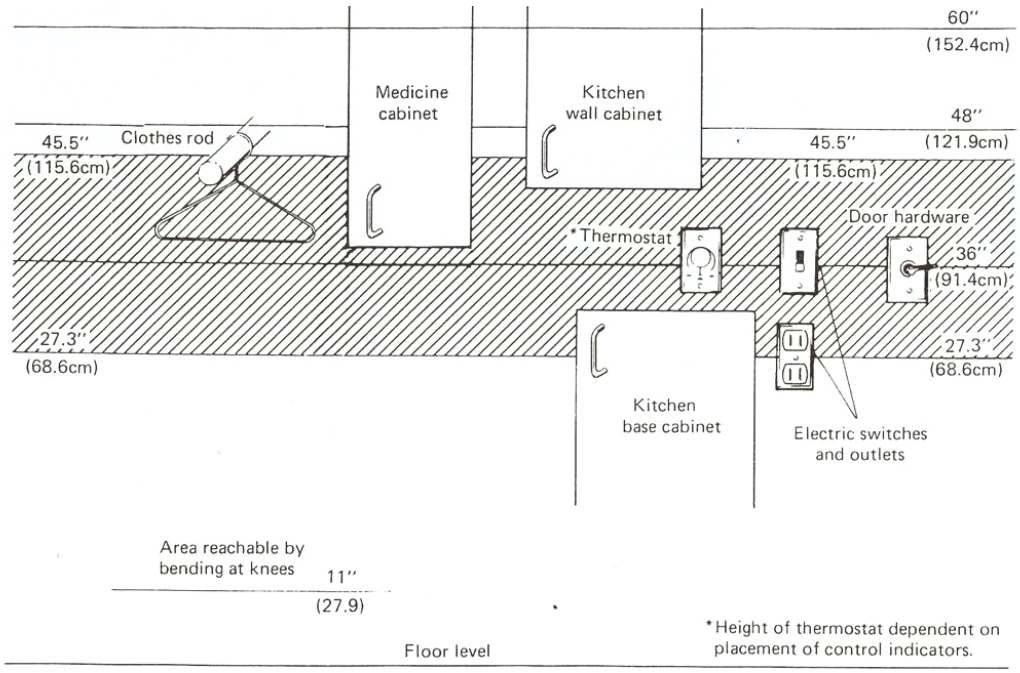



Figure 4.10. The “comfort area” Recommendations denoting minimum and maximum height of various components. (Source: Raschko 1982)

A second range should be determined the “area of accessibility” that includes the comfort area and extend beyond. It is seen in Table 4.1 that this range would extend

from 18 inches (46 cm) to 63 inches (160 cm), but that would be deficient. For the small woman in a wheelchair anything higher than 45 inches (114 cm) forward reach from the floor might be inaccessible.

Raschko (1982) argues that it would be more correct that the area of accessibility varies with each individual. A large, elderly man, for example, can reach anything that lies between 27 inches (69 cm) and 78 inches (198 cm); a small female in a wheelchair, from 19 inches (48 cm) to 53 inches (135 cm), supplied she can make a side approach. Thus, vertical and horizontal adjustability is the logical answer.

There are too many activities related to eye level. For example, trying to look into a large kettle on a stone burner, looking through a peephole to see who is at the front door, sitting by a window and looking out, using a mirror over the bathroom sink. Obstructions such as a window ledge, a mirror set too high, a shelf, or a high kitchen counter prevent the ability to see the object of interest. It is considered that the eye level of the small female in a wheelchair (42.8 inches, or 109 cm) will influence heights of many features in the home (e.g., the bathroom mirror), but the height of some features (e.g., window sills) may be lowered in consideration of the small elderly female in a sitting position (Figure 4.11). Her eye level is significantly lower (37.4 inches, or 95 cm) than that of other members of the user population (Raschko 1982).

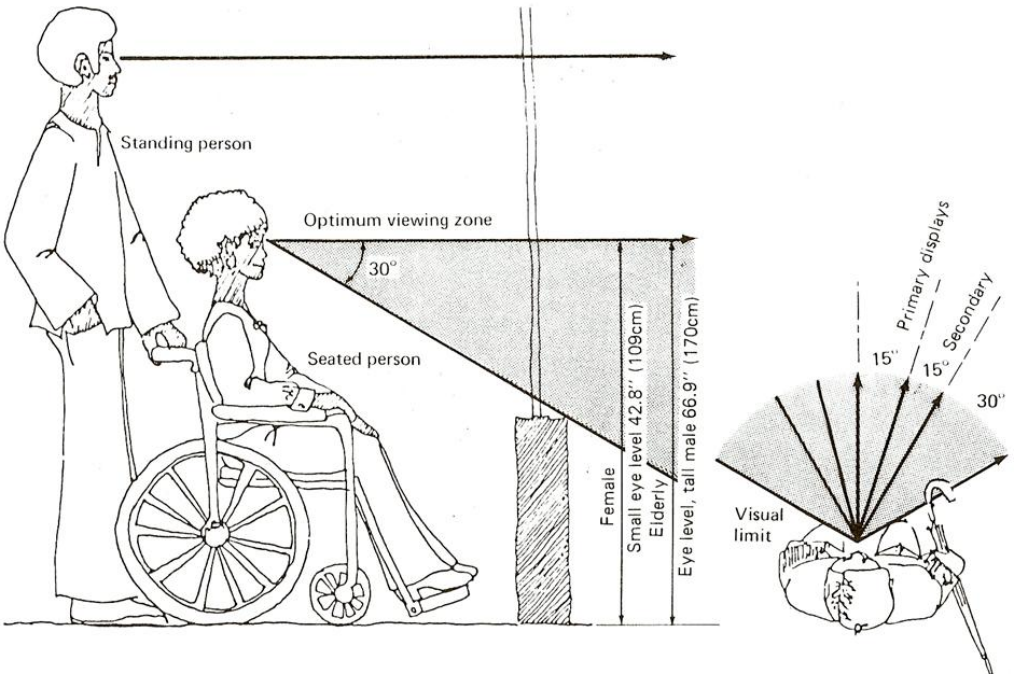



Figure 4.11. Sight lines-ranges for wheelchair users, small female and large male, and ambulant small female and large male elderly (Source: Raschko 1982)

According to Raschko (1982) shoulder height acts a very important role as maximum forward reach and sideways reach. This is particularly critical in areas like the kitchen and bathroom for the small female, because the base cabinets enforce a barrier when she is trying to reach the wall area. Since are traditionally 24 inches (61 cm) deep, special requirements must be made immediately. Hence, shoulder height and maximum reach must be taken into thought.

Elbow height is also important in considering use of the hands. Although hands can be used at almost any level, the optimum height is between elbow and shoulder height. For example, discrete manipulations, such as writing, a surface near or equal to elbow height is best. This measurement is also important in the contemplation of table and counter heights, in shelf heights, and in heights of other related products.

Kroemer et. al. (1994) states measurement of body dimension is done generally in a cross-sectional approach. One measures all suitable people and then gathers their measurements together within certain age brackets. Thus, measurements do not make a big problem in the "young adult" population because dimensions do not alter very much in the 20 to 40 year age span. On the other hand, elderly people's body dimensions vary in terms of age span and this creates a major problem in the depiction of the aging as well as of children for several reasons. Kroemer et. al. (1994) explains these reasons as follows:

- Among the aging, some people alter dimensions rapidly within a few years, for example, in stature because of posture and shrinking thickness of spinal discs, or in weight because of changes in nutrition, metabolism, and health; and in musculature and strength because of varies in activity levels, habits, and health. Other people, in contrast, demonstrate little change over long periods.
- The age brackets used for surveys are rather wide, usually including decades or even longer time spans, as opposed to the common five years in younger groups. Hence, people with very different dimensions are enclosed in each observation sample.

Thus, thinking of changes in body dimensions and capacities are observed within one individual over many years is better description than classification related to chronological age for the aging. Anthropometric information reported in the literature is made by the result of cross-sectional surveys. It is listed in Appendix B. It contains some current problems with anthropometric information, for example, most of the

samples are extremely small; surveys are done for a few age ranges only; there are no discriminations between ethnic origin, region, socioeconomics status, health or other attributes of anthropometry. The paucity of these data from the United States, one expects even poorer and less complete data from other regions of the earth. The obvious height loss with age, nearly 1 cm per decade, emerges in the thirties. According to Kroemer et. al. it results from:

> "(a) flattening of the cartilaginous disks between the vertebrae; (b) a flattening or thinning of the bodies of the vertebrae; (c) a general thinning of all weight-carrying cartilages; (d) a change in the S-shape of the spinal column in the side view, particularly an increased kyphosis in the thoracic area (hump back); (e) in some cases, scoliosis, a lateral deviation from the straight line displayed by the spinal column in the frontal view; and (f) possibly bowing of the legs and flattening of the feet" (Kroemer et. al., 1994, p.617).

The user must be considered in any design of products. The designer should propose products of interior spaces within the limits of accessibility, using the best data available. Flexibility, adaptability, safety and convenience must be also incorporated whenever possible.

## 4.2. The Application of Universal Design Principles for Interior Spaces

It is important to see that how universal design concepts can influence the products and how can be applied into interior spaces. Lever-style door handles fit more comfortably in the hand than knobs. Moreover, they can easily be turned and operated with an elbow if hands are unable. The office also need orthopedically correct furniture. Kitchen is to be usable by the elderly people, particularly those in wheelchairs. Routine kitchen tasks may strain people to bend, stoop, reach, lift, push, and pull repeatedly. Therefore, it is necessary to consider the "comfort zone" that is the area within easy reach for each person. All appliances should be placed suitable height. Refrigerator shelves and pull-out cabinet shelves render food and dishes are placed at a reachable level. Cooking and eating utensils can be grasped easily in the kitchen. Jars and bottles designed with tight lids need opening devices to help people with a weak grip remove them, and eating utensils designed with thin, flat handles need large diameter slip-on handles to help people with reduced grip and muscle control hold and manipulate them. The bathroom could accommodate people with a wide range of physical limitations. In

bathroom area; safety, usability and privacy are not just a concern for the very old or disabled, these should be for everyone. Accidents and injuries can happen at anyone at any age. Both the bathroom and kitchen showcase systems should be conceived as a tool to help the elderly live more independently. For example, the MetaForm Personal Hygiene System, designed by a team led by Gianfranco Zaccai, consists of modules that are both sink node-complete with lighted mirror, medicine cabinet, outlets and drawers, and the toilet node that includes a built-in bidet and folds into the wall for automatic sanitization. This system enables everyone from wheelchair users to small children to elderly.

### 4.2.1. The Entry, Interior Doors and Windows

> "Getting to the door is one thing, opening it is quite another. The doorway that is open somehow symbolizes Universal Design, the entrance is permitting entry. Locked doors are barriers to many things but permitting entry maybe only an unkept promise if the door's handle prevents entry" (Covington&Hannah 1997, p.37).

The entry space, relates to both sides of the entry door, as the exit. For the entry door, only one type of mechanical lock system is offered. This type supplies the key disengage both the deadbolt and the door latch, so the door is free with one action. Figure 4.12 demonstrates two locks and handles of this type. It cancels the use of two hands, does not need a great deal of strength, and is reasonably resistant to forced entry. Metal doors and frames are suitable for great security. Lever handles are also convenient for all doors, because they are the most easily operated by all groups who are unable to grasp and twist (Raschko 1982).

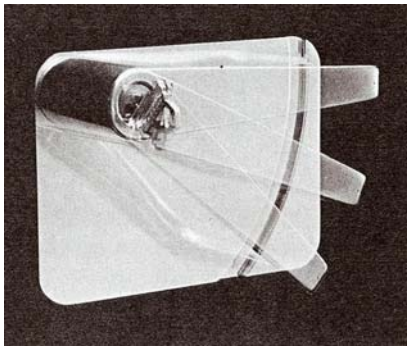
a  b 


Figure 4.12.'a' Deadbolt lever handle with closed end, 'b' the lever push handle (Source: Raschko 1982)

Levers on both interior and exterior are convenient for elderly people, in wheelchairs, children, and others with strength limits. They are much easier to use from a seated position than doorknobs. Horizontal levers need less operating force than vertical levers. Levers should turn toward door hinges for easier access. They should have a slight return to keep them from catching on clothing (Figure 4.13).

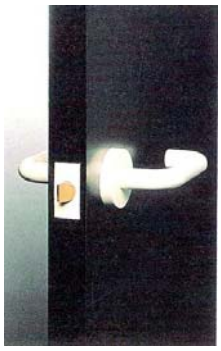
a  b 

Figure 4.13. 'a' and 'b' Horizontal door levers (Source: Leibrock 1993)

Handles are inspired by habits and humor that is blind to age, culture, and gender. The coat hanger lever handle holds a coat securely, the hook handle holds a trash bag (Figure 4.14), the bottle opener handle is useful for torquing a top off a bottle, and the "Pull the tea Towel" handle makes the towel accessible.

Figure 4.14. "A Small Collection of Handles." Designed by Six L.T. Wu at the Royal College of Art in London (Source: Covington&Hannah 1997)

In Figure 4.15a circular backplate boldly admits the placement of the door handle and the echoing form of the handle indicates the direction the handle should be moved to open the door-downward. Classic door handle in Figure 4.15b supports the ball of the hand and the hand itself finds the correct handling volume.

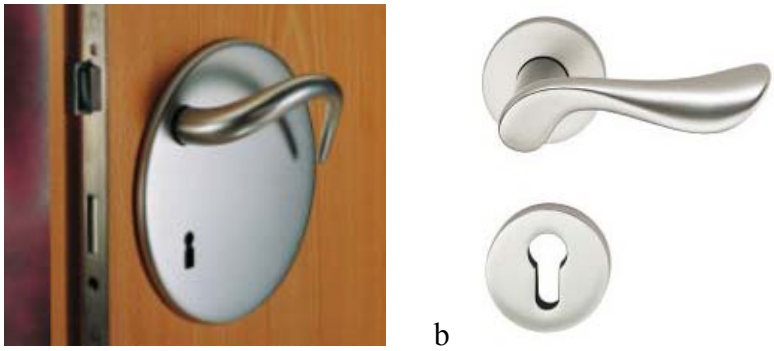


Figure 4.15. ‘a’ Handles. Franz Schneider Brakel (FSB) Designed by Philippe Stark
‘b’ Handles.Franz Schneider Brakel (FSB) Designed by Johannes Potente
(Source: Covington&Hannah 1997)

Entry can be controlled with a key or a push-button combination lock. In both cases, the locking mechanism is released, and the door can be opened. With an electric locking system, elderly people can remote-control from inside the living unit such as the living room, kitchen, or bedroom. It can also be integrated with an emergency call system, which automatically unlocks the front door. In Figure 4.16 unit has much larger viewing area than normal style viewers and makes it helpful for people in wheelchairs.

Figure 4.16. Door viewer. (Source: WEB_7, 2005)

More than any other products, doors and windows are treated in the life of elderly. This is because the elderly may spend more time in interior rather than outdoor. Therefore, the window may act as an important role in their lives. A window that may be the only communication gives elderly people to know the outdoor world.

Figure 4.17. Viewing of outside activities (Source: Torrington 1996)

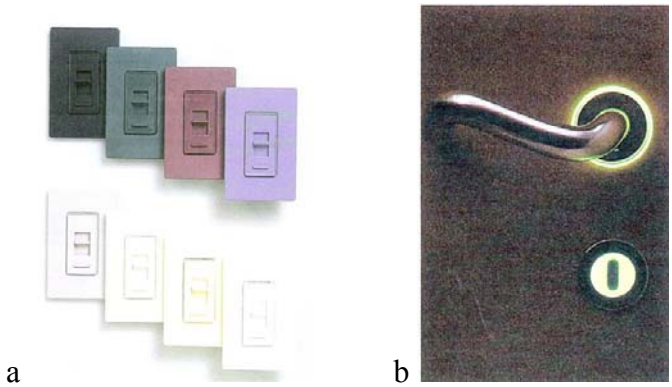
Both the design of the window and the location of the controls can progress access. Elderly people, children, and people in wheelchairs use easier windows with controls on the bottom, although a slider with ball bearings may also be easy to operate (Figure 4.18a). A longer crank or lever arm multiplies the applied force. Place levers so that they can be operated with the stronger hand for greater power. Although casement windows with levers or push rods may need more force to open, they do not require as large a range of motion as do horizontal pivoting sashes. They are also easier to clean. A crank-type control can also be added to double-hung windows. A power window suggests the easiest access, but it must have a break-out feature in case of power failure (Figure 4.18b, c). The window lock should be installed within easy reach of people.

a  b  c 

Figure 4.18. ‘a’ crank-type casement window, ‘b’ double-hung windows, ‘c’ a power window (Source: Leibrock&Terry 1999)

Technology can allow everyone to live independently. Lowered electrical switches are helpful for elderly people. They should be placed for convenience as well as for ease of access. At a minimum, plan switches at each entrance to a room. Plan light switches that can be controlled by the lecturer from the front of the room. Plan a master switch at both the back door and at bedside control all lights in a residence. These switches connect with a clap of the hands and can be a great help for people who have trouble seeing the switch or those who just want to save steps (Figure 4.19a). Lighted switches can act as a signal in the dark. Visual acuity can often be enhanced by

installing dimming rheostats on each switch to control the quantity of light in the room. A rheostat is also helpful for task lighting. It may be necessary to raise lighting over the kitchen sink or in other areas where detailed work takes place. Projecting switch plates are easier to place in areas with diminished lighting. Self- illuminated trim for switches and levers is also helpful and could be installed at bedroom, bathroom, and entry doors (Figure 4.19b).



a b

Figure 4.19. 'a' Lighted switch, 'b' Projecting switch plates
(Source: Leibrock&Terry 1999)

## 4.2.2. Living Environments

Elderly people want to relax and function with minimum effort in living environments. Therefore, the products used in these areas should be designed. According to Raschko (1982) the products for the elderly people should be selected to support with certain psycho-physiological functions; that is,

- To provide independence and stimulation
- To promote and maintain motivation and physical body functions
- To provide safety and conservation of human energy needs

The last one often related to specification of materials, the technical aspects, and constructions of the product. These aims are accurately important because elderly people whose mobility decrease and sedentary activities increase spend most of their time in their immediate living environment, particularly the living room or social area.

The living area and its products should enable the elderly to have personal freedom of choice. Their activities will give cues to his or her needs, for example, if a person reads a lot for relaxation, the bookcase should be near his or her main "relaxing chair" or swivel chair may be to assistance to increase the user's reach zone. Moreover,

the television and stereo controls and a table for refreshments or medication are to be placed in this zone. This provides a supportive environment because the elderly may strain moving around. They can continue seated in one place and have reach products which needed. This type of arrangement permits the elderly to control over his microenvironment in which elderly people require a place to relax and the personal products are generally the most important feature.

**Seating Units**

The basic seating unit is the chair, because people come in a large variety of sizes and shapes. There are many factors including the shaping of a satisfactory chair, and some of these factors contradict some common concepts. According to Raschko (1982) a chair for the elderly people should include the following functions:

- It should be supportive insofar as it increases comfort and continues to be comfortable over lengthy periods of time
- It should be usable and, thus, accessible
- It should be of a pleasing design (e.g., to the touch-pleasing in texture; and to the vision-pleasant to see)

It is necessary for elderly people, when sitting for long periods of time, for example, 6 to 8 hours to change position slightly to reduce pressure on different areas.

A properly selected chair will permit the feet to be placed flat on the floor. The front of the seat should be gently curved so that there is no pressure at the back of the knees, and the front of the seat should be low enough that there will be a small space between the thighs and the seat. Figure 4.20 demonstrates the correct seating posture.

Figure 4.20. Plywood molded chair designed for correct sitting posture
(Source: Raschko 1982)

There are two basic anthropometric measurements that lead chair seat design, length of lower leg (popliteal area to floor) which leads the "chair height" at the front edge, generally from 14 to 18 inches (35.6 to 45.7 cm); and length of the upper leg (often measured from the plane of the back to the popliteal area or back of the knee), that leads the "depth of the seat," from 15 to 18 inches (38.1 to 45.7 cm). It is visualized in Figure 4.21.

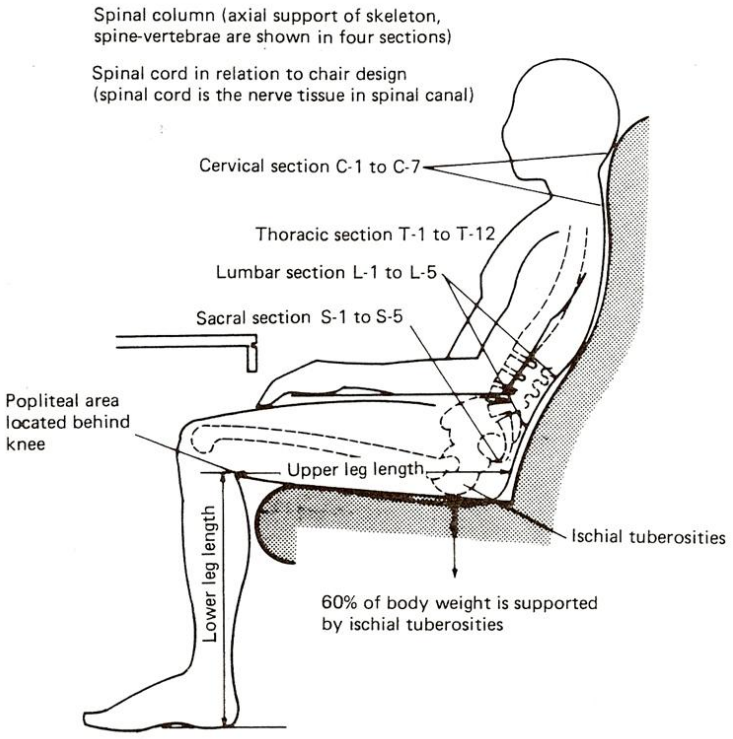



Figure 4.21. Diagram of a lounge chair showing relation of human anatomy to seat and brackets (Source: Raschko 1982)

There are many variables in chair design that are leaded by the activities such as chair for reading, knitting, and watching television related to that particular chair. However, chair height and seat depth, are starting points in selecting enough seating that will support in promoting good posture.

Everyone, particularly elderly people merit and need good "rest chair" that helps them to sit in an upright manner. Generally, they tend to droop forward and compress their internal organs. An important need for a comfortable chair is that one can try to change various resting positions in order to avoid the inevitable muscle strain that will accompany long periods of sitting. Vertical back does not permit the person to relax and it does not take up the weight of the person's upper body (Raschko 1982). To recline the

chair back provides people relaxation and better proportion for the body weight. Angles of inclination of chair backs can change related varying uses such as work, relaxation, conversation, or viewing television. The sitting height should also be considered, and the neck support and armrests should be evaluated for comfort. A recliner is sometimes too hard for elderly people to operate because they might not have the physical strength. Thus, they can choose lightweight, less imposing armchairs that occupy less floor space and are easily moved. Often a high-back winged chair that can be seen in Figure 4.22 provides protection from air drafts about the head and shoulder area.

Figure 4.22. Wing-back chair with headrest and slanted foot-rest
(Source: Raschko 1982)

Seating devices can have many shapes and sizes to suit the individual user. Assistive seating provides for those with various disabilities, or to adapt to a wide choice of sitting heights and positions. A very common difficulty is the incapability to raise from a chair, because of weakness, arthritis, or hip, or lower extremity difficulties. Chairs have been developed that help elderly people in rising and sitting through various mechanisms that raise the back of the seat of the chair. Figure 4.23a shows the chair that has a mounted catapult seat with two to seven springs. A pneumatic/spring mechanism can be used on the chair. This seat is available separately. Another common difficulty is a hip or knee joint that has become stiff from illness or injury and cannot be easily flexed. The arthrodesis chair, by incorporating a seat permits “dropping” of either side of the front half, gives the elderly comfortable sitting without too much bending of the affected leg or stiff hip (Figure 4.23b).

Figure 4.23. ‘a’ Catapult chair, ‘b’ High-back chair with movable thigh rest (Source: Raschko 1982)

In order to shift or change position, bucket seats and some contour seats may not be appropriate. Chairs with a soft cushion will make wheelchair transfer difficult. In order to maximize the strength, products should be selected on the basis of operation. Maximum effort can then be arranged when the greatest number of muscles are used, and when muscles are resting at their length. For example, elderly people may bend the knees to extend the large leg muscles to their before lifting rather than using the weaker back muscles and avoid furniture which includes unusual angles of effort like sleeper sofas. If the elderly person does not have the arm strength to operate the controls of a recliner, he can consider a recliner with foot controls (Figure 4.24a, b). Recliner on casters permits the elderly to be pushed from one space to another on hard floors.

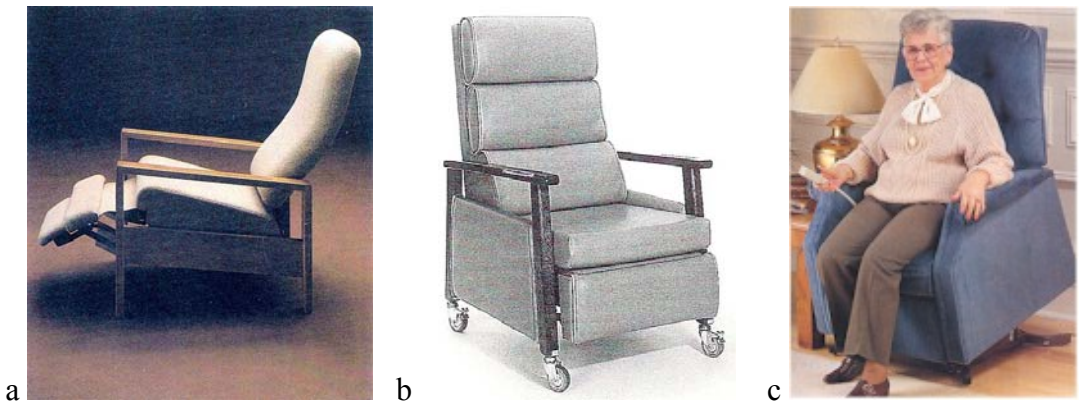


Figure 4.24. ‘a’ Recliner with foot controls, ‘b’ A recliner on casters (Source: Leibrock 1993), ‘c’ Power recliner (Source: WEB_7, 2005)

The power recliner chair also allows elderly people to get in and out of recliner. Hand-held control lets the user gradually move the chair from full recline to almost

standing. The solid, extra-wide base keeps the chair stable and secure. The durable hardwood frame is covered with soft, comfortable padding in beige (Figure 4.24 c).

**Home Office**

As the home becomes more like the office and the office more like home universality provides people continue their daily lives. For example, a home workstation in Figure 4.26 features a reclining chair, a vertically adjustable table, and accessible compartment work storage area. Designed for function, comfort, and convenience, it supports a person's activities such as work and leisure. It also uses individually or in combination, these accessory pieces allow the user to create a personalized activities center in which elderly people read, write, converse, watch television, eat and nap. The bookcase provides the limited range older people can reach as they sit in a chair. It enables people to storage for objects used in and around the chair: books, newspapers, knitting, bookkeeping materials, pens and pencils, magazines, clocks, radios. The adaptable table gives a stable surface for reading, writing, or working while seated. It purposes as a side table or a work surface pivoting across a person's lap. This position lets storage compartments on the top of the pedestal. It is easily movable, because both the table and bookcase are lightweight without compromising stability.

Figure 4.25. Sarah accessory furniture (Source: Covington&Hannah 1997)

The circular top desk permits the user to move a computer or papers closer. The top is mounted on a sliding track, allowing the top to be changing in or out. The footrest also provides storage space. It also easily adapts wheelchairs (Figure 4.26a). The desk gives a convenient, large work surface to adjust on a person's lap, no matter where the person wishes to work. It accommodates books, paperwork or a laptop computer (Figure 4.26b).

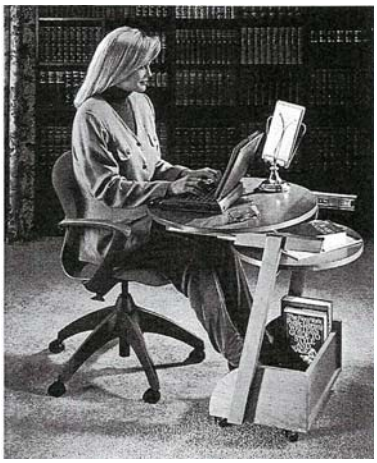
a  b 

Figure 4.26. ‘a’ Eclipse desk levenger, ‘b’ Lap desk levenger
(Source: Covington&Hannah 1997)

The height and angle both adapt to allow the person to read in the most comfortable position. Its mobility allows the user to use the desk while in bed or a chair (Figure 4.27a). Tilted work surfaces enable user less fatiguing to work at since they put work at the proper angle and do not need the user to lean down and hunch over. Upper shelves holds papers and (open) books at a comfortable angle and reach (Figure 4.27b).

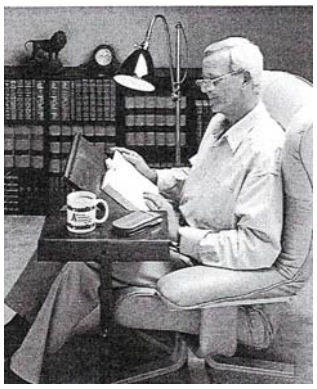
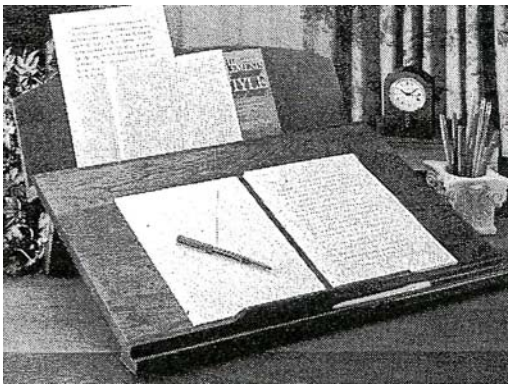
a  b 

Figure 4.27. ‘a’ Reader’s table levenger, ‘b’ Editor’s desk levenger
(Source: Covington&Hannah 1997)

## 4.2.3. The Bedroom Environment

Nearly 33 % of a human life is spent in bed. Although, the “ideal bed” has still not been determined, several researches and recommendations have been made. The elderly people’s preferences are as broad as those of another age group because they are not a homogeneous group. Their greater tendency to aches and pains, which have been individually collected over a lifetime, is the main difference. Therefore, mattress

selection will be a highly individual issue. The choice is a soft, medium, or firm mattress; however, the underspringing should be firm and not allow drooping. For the elderly people, bed heights should be the same as their sitting heights, about 16 or 17 inches (40.6 or 43.2 cm), since they sometimes sit on the side of the bed. Too low bed is not recommended in order to make possible bedmaking and an overly high bed makes getting into it too difficult and increases anxiety about falls and possible injury. On the other hand, elderly people generally prefer separate sleeping arrangements because one person has requirements that would interrupt the other's rest. Incontinence, insomnia, aches and pains need special positions in bed.

The bedroom is the most private space among the other spaces. Privacy is a very basic need to control access to one's self that is related to social and cultural norms. Elderly people need to control several systems such as lights, temperature, audiovisual systems (e.g., television), and ventilation within the bedroom. Elderly person control the setting a thermostat on either a heater control or an air conditioner, and opening or closing a window before he goes to bed. Other controls are a TV remote control and light switches on lamps that can be located by the bed (Figure 4.28).

a  b 

Figure 4.28. 'a' Big button remote control By Tandy (Source: WEB_5),
'b' Remote home system (Source: WEB_21, 2005)

For the elderly people a clothes closet arrangement is illustrated in Figure 4.29. This arrangement gives maximum storage in a relatively small space. A moveable wardrobe enables elderly to dress near the bed at night.

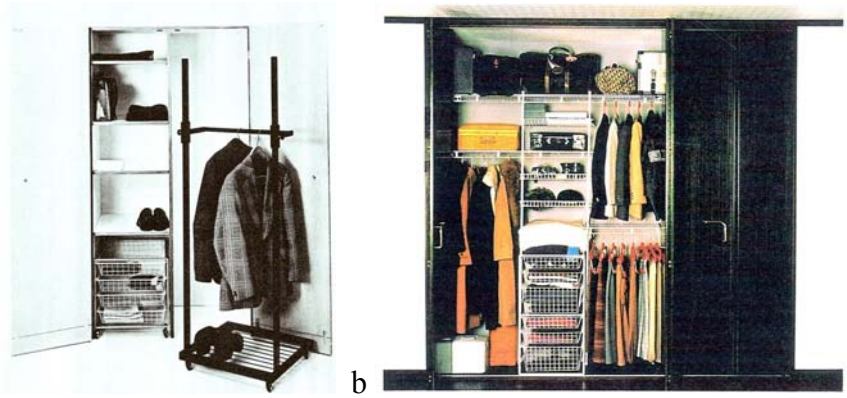


Figure 4.29. ‘a’ Wardrobe (Source: Raschko 1982), ‘b’ Wardrobe (Source: Leibrock 1993)

A bed table is located on the bed allows elderly to reach differences work in bed. It is also adjustable for reading and writing (Figure 4.30). Another bed table fits over the bed (Figure 4.31).

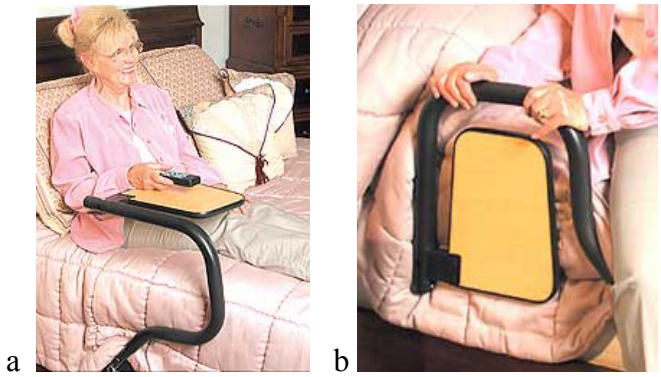


Figure 4.30. ‘a’, ‘b’ Bed rail tray (Source: WEB_22, 2005)

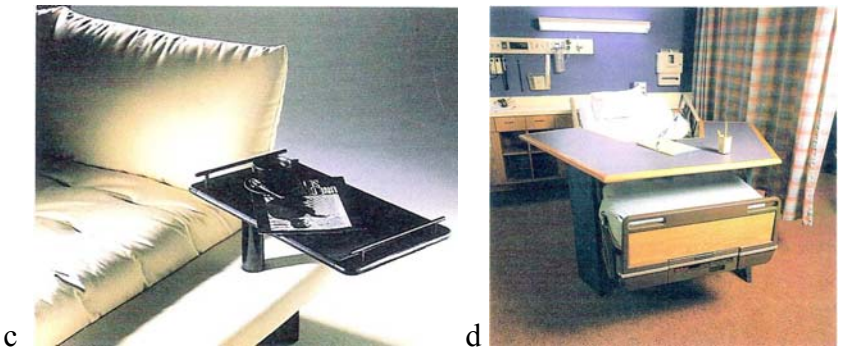


Figure 4.31. ‘a’, ‘b’ Bed tables (Source: Leibrock 1993)

In Figure 4.32, bedrail organizer, is made lightweight plexiglass, gives more independence to elderly person. It hangs over the bedrail and makes it easy to reach the items close at hand. Back rest also has a simple ratchet mechanism.

a  b 

Figure 4.32. ‘a’ Back Rest (Source: WEB_17, 2005),
‘b’ Bedrail Organizer (Source: WEB_23, 2005)

**Dressing Aids**

Dressing stick, has an easy gripping, eliminates the requirement of bend over. Shoe remover also helps people who have difficulty bending over.

a  b 

Figure 4.33. ‘a’ Dressing stick (Source: WEB_24, 2005),
‘b’ Shoe remover (Source: WEB_25, 2005)

## 4.2.3. The Kitchen Environment

Flexibility and usability are the most important keys to successful kitchen design. Products used in kitchen environment can be designed more suitable for elderly people who use kitchen for many activities such as cooking, eating, drinking coffee, watching TV, and also conversing. These basic activities must be used efficiently by the elderly people. Actually, all activities must be accessible. They have the tasks of storing the various items of cookware, utensils, small appliances, condiments, staples, flatware, glassware, tableware, linen and efficient locations possible. Most available elements in the kitchen are base cabinets, wall cabinets, tall cabinets, countertops, drawers, and the refrigerator.

Figure 4.34. Adjustable-height sinks (Source: Leibrock & Terry 1999)

According to the individual differences of the elderly people, the standard kitchen obstacles can be changeable. For example, the small woman in a wheelchair who cannot reach the wall cabinets and the tall man on crutches who finds base cabinets beyond his reach. The comfort zone is between 27 and 45 inches (68.6 and 114.3 cm) accessible to everyone. Another difficulty in the kitchen is that the counter is usually placed at a height of 36 inches (91.4 cm). It is too high for a tall man in a wheelchair whose elbow height is 30 inches (76.2 cm), and a small woman in a wheelchair. Wall cabinets start around 51 to 54 inches (129.5 to 137.2 cm). A small woman in a wheelchair does not reach at this height. Less than 50 % of the shelf space is accessible to a tall man in a wheelchair, and 33 % to an ambulant small elderly woman. Figure 4.35 shows a motor-driven countertop that can be changed in height for a variety of tasks and abilities.

Figure 4.35. Countertop with motor-driven (Source: Leibrock&Terry 1999)

Many activities such as mixing, slicing, kneading, and washing are done at a level below the elbow height of the individual. Drawers are generally usable by everyone and full with utilizes. Although stacked drawers are generally accessible, the bottom drawers may need the use of grabbers for those who cannot bend over. In

addition, hood controls are difficult to reach, rear cook top controls can be dangerous as well as inaccessible, and faucet handles may be too difficult to operate.

In every kitchen, a base cabinet next to the sink should be provided with a wastebasket (Figure 4.36). Base cabinets are inaccessible to use for people in a wheelchair. Moreover, they do not approach easily. Consequently, the problems for the elderly and others with functional limitations directly relate usability to adequate storage space, ability to operate all necessary controls, and placement of working heights and the activities of food preparation, cooking, serving, and cleaning.

Figure 4.36. Base cabinet with wastebasket (Source: Leibrock 1993)

Besides researching the usual factors of safety and ease of use, it is important to design of faucet and drawer handles. A task is performed that needed mental and physical coordination skills, and these skills included ability or limited ability in four physical areas that are reach, grasp, twist and force exertion. Additionally, sight and touch, and durability of the product are also considered. A faucet with a single lever can be easily operated with one hand. Other types of faucets are Paddles, blades, or push-type mechanisms that are also easier to use than knobs and are good choices for people who may be confused by single-lever controls.

**Faucets and Handles**

Figure 4.37 shows a paddle handles faucet control, which can be used by those with limited coordination in the upper arm/shoulder area. This handle needs little grasping and hand muscular coordination. A small amount of movement or force is needed to activate it. Cold is coded with blue and hot is coded with red. Hot water taps are normally on the left, cold on the right. These are helpful reminders to the elderly people. A gooseneck faucet can be used to fill a pan on the counter without lifting the pan into the sink (Figure 4.38).

a  b 

Figure 4.37. Faucet paddle handle (Source: Raschko 1982)

a  b 

Figure 4.38. 'a' Faucet handle, 'b' Gooseneck faucet (Source: Leibrock 1993)

An extended lever handle is illustrated in Figure 4.39a. It provides leverage with a vertical force. This lever control can be operated with an arm or elbow. The variation of functional limitations needs a variety of products to meet user's needs. Faucet design is combined a gooseneck with a pull-out spray on a retractable hose in Figure 4.39b. Both the faucet and spray can be installed in an existing sink with a single hole, and the unit is designed around the natural motion of the hand and wrist.

a  b 

Figure 4.39. 'a' Extended lever handle (Source: WEB_26, 2005),
'b' Faucet with high country spout
(Source: Covington & Hannah 1987)

A push-pull drawer handle lessens the need for fine muscular coordination is seen in Figure 4.40a. The Braille and the international design symbol support the blind and help those with memory failure. A large size handle with smooth round corners is shown in Figure 4.40b. A pull handle is for easy grasp, by a handle gripper or even a cane. Additionally, this handle prevents clothing from being snagged.

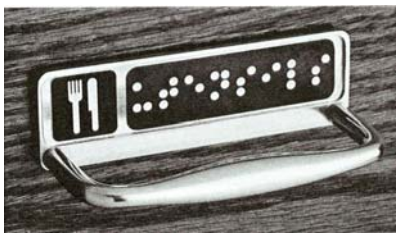
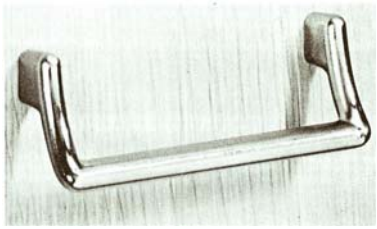
a  b 

Figure 4.40. 'a' A Push-pull drawer handle, 'b' large size handle
(Source: Raschko 1982)

**Utensils**

Figure 4.41 demonstrates slide-out rotary shelves for cookware storage, allowing for easy access, and utilizing a "hard-to-reach area" in standard base cabinetry. Dispenser can help bring cans and bottles within reach. Half-circled pull-out shelves are particularly useful in corners.

a  b 

Figure 4.41. 'a' Pull-out rotary shelve (Source: Leibrock 1993)
'b' awkward recessed strip handle (Source: Barker 1997)

Movable chopping boards over the sink are seen in Figure 4.42, can enhance usable counter space. They enable elderly to peel vegetables with one hand and ideal for those who have difficulty in gripping or only have the use of one hand. A raised edge can be added to one corner to help hold bread in place when cutting. Another cutting board is seen in Figure 4.43. It gives extra power to people with tremor or impaired sight can cut straight and safely.

a  b 

Figure 4.42. ‘a’ Chopping board (Source: Leibrock 1993), ‘b’ Food preparation system (Source: WEB_21, 2005)

a  b 

Figure 4.43. ‘a’ Cut cutting board (Source: WEB_27, 2005)

The larger handles make gripping easier, and the blade is contoured to the bowl’s diameter. The product is used easily and the user requires less pressure (Figure 4.44a). Good grips kitchen utensils are designed by Smart Design for the conditions of arthritis in the hands and loss of visual acuity. They enhance usability because they have better gripping surface (Figure 4.44b). Products are not only used for the aging communication, but also for almost everyone else. In Figure 4.45, silverwares are ideal for arthritis or decreased hand strength. The cutlery in Figure 4.45b helps to people with poor grip or restricted hand movement. The oversized handle is filled with a smart material that moulds itself to the individual user’s while the head bends sideways to optimize hand-to-mouth coordination.

a  b 

Figure 4.44. ‘a’ The chopper and bowl (Source: WEB_27, 2005), ‘b’ OXO utensils (Source: WEB_28, 2005)

a  b  c 

Figure 4.45. ‘a’ Sure Grip Silverware (Source: WEB_7, 2005), ‘b’ Cutlery with strap (Source:WEB_29, 2005), ‘c’ Spoon and fork holders (Source: WEB_30, 2005)

### 4.2.3. The Bathroom Environment

The bathroom can be a very critical space for the elderly people because it includes crucial problems that need to be resolved, affect the comfortableness and safety of elderly people who should be supported by all towel bars, grab bars, sink edges, and other items. Using the bathroom may cause slips and falls. The toilet seat and the lavatory are installed at proper height because many elderly people find it difficult to get up from the toilet. Without grab bars, washbasin area causes problems to people with declining balance. Sharp corners can also cause serious injury in falls. Faucet controls are often confusing to use particularly for those with arthritic hands. Shower and tubs should be accessible. As shown in Figure 4.46, the toilet can be located in the shower and used as a shower seat in some installations in order to use easily. Lavatory and mirror are placed far from this area in order to keep the mirror from foggy.

Figure 4.46. Bathroom with Grab Bars (Source: Leibrock&Terry 1999)

According to Pirkl (1994) in order to provide maximum safety, privacy, greater comfort and efficiency in the use of bathroom, particularly for the independently living, the following requirements are incorporated into the design:

- Access to the functional units at all times
- Skidproof flooring material
- Shallow, splash-free washbasin with distinct, positive controls
- Spacious shower booth (with room for an assisting person)
- Provisions for relaxed seating in the shower/bath

Safety, accessibility and privacy are the most important design specifics of the aged. A bathroom must provide products that respond the requirements of the people with impairments due to age and temporary or permanent disabilities. The following set of primary guidelines is that:

- Edges clearly visible
- Falling hazards minimized
- Provision for emergency access and escape
- Sharp edges and corners minimized
- Use of bedroom with minimum acute bending
- Controls easy and provide to use
- Surface glare minimized
- Color and lighting contrast for safety
- Circulation pathways unimpeded
- Maximum audible privacy
- Visual and tactile distractions minimized
- Body supports and guides properly secured
- Provisions for seating

In summary, the bathroom has to be a comfortable area that can maintain body functions. The bathroom design needs an innovative approach that utilizes technological resources in order to respond to these various needs and offers flexibility and usability for both present and future needs of the elderly population. Toilet, wash basin, and shower can be integrated in the new sanitation facility.

**The Toilet**

The three factors that are height, placement, and position of grab bars are critical in considering about the toilet design. Moreover, the toilet can be reached in several different ways. Additionally, safe transfer from a standing position onto and off the seat also is another important subject. In seat height requirement between men and women is

the most significant difference. Besides, older people are shorter than younger people and the recommended seat height for elderly is 15 inches (38 cm) to 16 inches (40.6 cm). Elderly people cope with low seating. A very low seat cannot be suggested because they have difficulties bending their knees. An ideal seat height is 15 3/4 inches or 40 cm. As a result of aging, as disability emerges, in the form of stiffening joints and decreased strength, and a seat is positioned higher is desirable (Figure 4.47). Elongated toilet gives elderly people to transfer or align easily with the shower wheelchair. The lower height range may also be necessary when using a shower wheelchair.

Figure 4.47. Elongated toilet (Source: Leibrock 1993)

The seat height can always be raised by attaching an elevated seat if necessary. Therefore, special grab bars, shown in Figure 4.48, attached to the toilet seat to assist the person in sitting and rising can be an alternative rather than installation of a new toilet that could be costly. Grab bars for the elderly and the ambulant can be attached exactly to the toilet seat but wheelchair users cannot be used because the bars could impede the transfer maneuvering. Mobile aid reduces a washbasin's barrier's in a jiffy.

a  b 

Figure 4.48. 'a' Seats with arms (Source: WEB_31, 2005), 'b' Mobile aid (Source: md)

There are many raised toilet seats on the market. These seats provide the desired height with an inexpensive method. The main requirements for these devices are giving secure support, and cleaning easily. In Figure 4.49, Hi-Loo with brackets can easily be adapted to most type of toilets. It is suitable for people who need a raised seat and it has three heights 6, 10 and 14 cm. They should not be offensive in appearance because most of people refuse them for aesthetic reasons. Another example is seen in Figure 4.50.

Figure 4.49. Hi-Loo toilet seat (Source: WEB_27, 2005)

Figure 4.50. Raised toilet seat with armrests (Source: WEB_7),

One toilet model is seen in Figure 4.51, the Toto Zoë which is designed by Ayşe Birsel, combines a bidet, toilet, and air freshener. It uses warm water for washing and warm air for drying rather than toilet tissue. This model provides people who cannot manipulate tissue to use easily. It is important to make all toiletry functions in one place. This product can be used by everyone because of adding the remote controls and portable bidet.

Figure 4.51. Toto Zoë combination toilet and bidet designed by Ayşe Birsel
(Source: Leibrock&Terry 1999)

Another toilet model is ‘Access’ won the Coram Design Award in 2000 (Figure 4.52). Design has column equipment with adjustable vertical seat height for the elderly and disabled people as well as for correct body posture. The column equipment consists of a water tank with an integrated control panel and ergonomic removable rotating arms needed for people with motor disability. Arm level may change in a permanent way at three different positions, by 30 to 60 mm. These arms help people while sitting down and provide wheelchair users different approaches to the toilet. The product provides the flexibility, adaptability, availability, safety, and also adjustability.

Figure 4.52. ‘Access’ adjustable toilet and bidet for elderly and handicapped Designed by Alberto Novara and Manuele Mariani, Coram Design Award 2000
(Source: WEB_32)

‘Metaform’ as another design, is a personal care and hygiene system. Toilet is a one node of the Metaform Hygiene System that adjusts to accommodate the height of standing or sitting user. It can be used by a small child, a tall adult or a wheelchair user. Arms are operated by hand. The rail system and its accessories give people to adjust individual needs and preferences. Controls for flushing the toilet are activated by elbow. Accessories are placed the higher level so floor can be cleaned easily. It is seen in Figure 4.53.

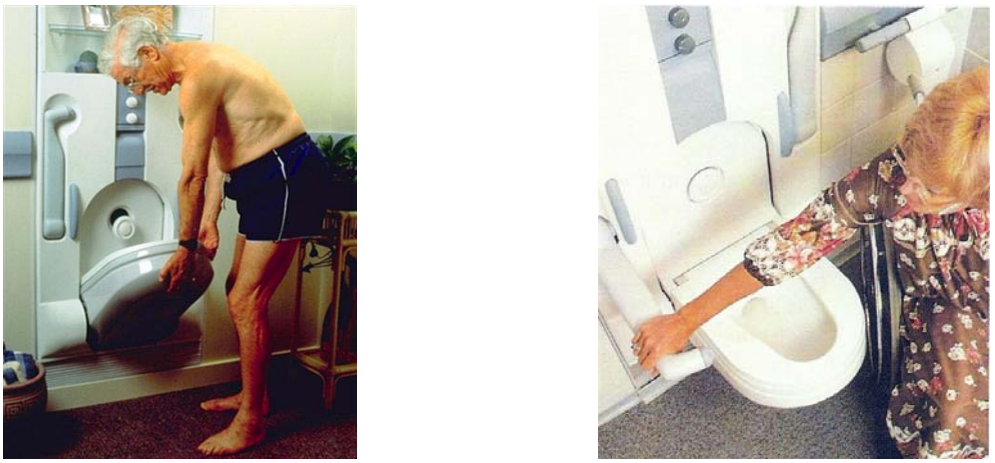


Figure 4.53. Toilet, Metaform personal hygiene system Designed by Gianfranco Zaccai (Source: Pirkl 1994)

For elderly people, it is also important to use the toilet accessories easily. In Figure 4.54 shows the lever that is easy to grip can be operated with clenched fist or elbow. It can be modified to fit most cisterns. A tissue dispenser which is shown in Figure 4.55 must be low enough so grab bars do not obstruct its use. It must be located 7-9 inch in front of the toilet. Additionally, it can be usable with one hand.

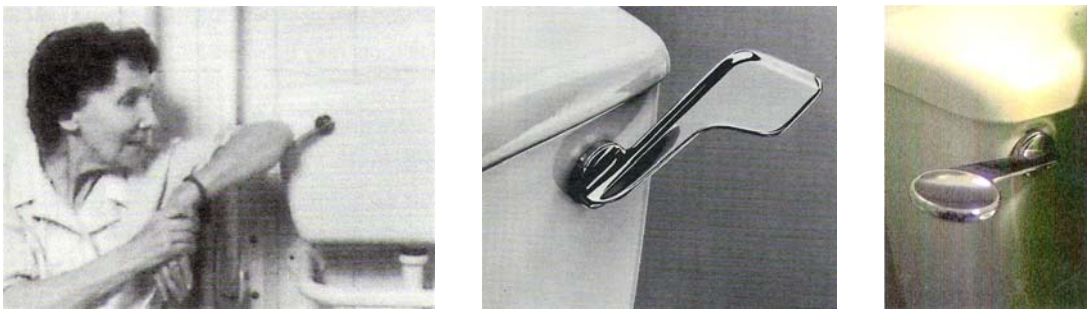


Figure 4.54. ‘a’ Paddle handles (Source: Torrington 1996), ‘b’ Paddle handle (Source: Barker 1997)

Figure 4.55. A tissue dispenser (Source: Leibrock & Terry 1999)

**Grab Bars**

Grab bars for the elderly people are often located on the both sides of the toilet and the shower seat and people in wheelchairs require only one side of the toilet because of approaching clearly. A swing-up assistance bar can respond both of these requirements (Figure 4.56). WC support handle fits with brackets and paper roll holder. The wide top profiles have anti-skid support surfaces.

Figure 4.56. 'a' Toilet with a swing-up assistance bar (Source: Leibrock 1993)
'b' WC support handles (Source: International Design Magazine)

Bars help everyone when they get into and out of the tub or shower. The best height for grab bars depends on the user's anthropometric measurements, and generally ranges from 32 to 37 inches (81.3 to 94 cm). According to Raschko (1982) the bars themselves should be made of a material that will not break or chip and will have no sharp edges. There are many grab bars on the market that are made of various materials such as polished stainless, white nylon-coated and plastic-coated, or covered with other slip-resistant materials, as shown in Figure 4.57.

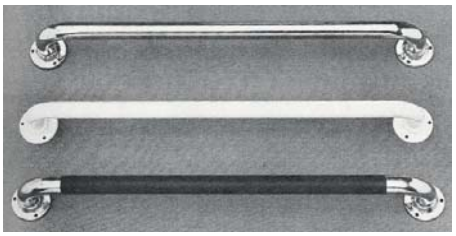
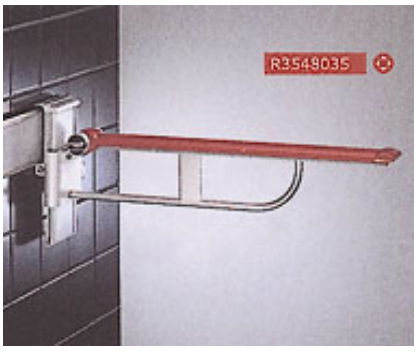


Figure 4.57. Grab bars with various materials (Source: Raschko 1982)

Some colored bars such as bright red should be in contrast to that used on the wall to guarantee quick and accurate hand and eye coordination in an emergency (Figure 4.58).

a 

b 

Figure 4.58. ‘a’ and ‘b’ Multisupportarm (Source: WEB_33, 2005)

**The Lavatory**

The washbasin should be accessible and more comfortable for frequent use. If lavatories are too low, the body can be forced to bend over lightly. Researches indicate that, the body should stand upright in a relaxed position with the upper arms vertical and with the forearms extended horizontally. The lavatory should be at a convenient height for the elderly and ambulant disabled. It should be mounted in the 32 inch (81.3 cm) range. This height helps to prevent dizzy spells when bending over and responds the needs of the elderly person. However, for taller people, this height cannot be appropriate. In these cases, 36 inch (91.4 cm) is suggested. The lavatory can be mounted at various heights, providing easy usability. An adjustable lavatory may be a solution. The height of the wash basin should be regulated to the user. It can be adjusted to a height from 32 inches (81.3 cm) to 34 inches (86.4 cm) to 36 inches (91.4 cm). Figure 4.59a demonstrates an adjustable lavatory. Another type of adjustable sink by an electrical motor is shown in Figure 4.59b can be used by children as well as elderly. Wash basin brackets are convenient for most bolt mounted wash basins in Figure 4.60.

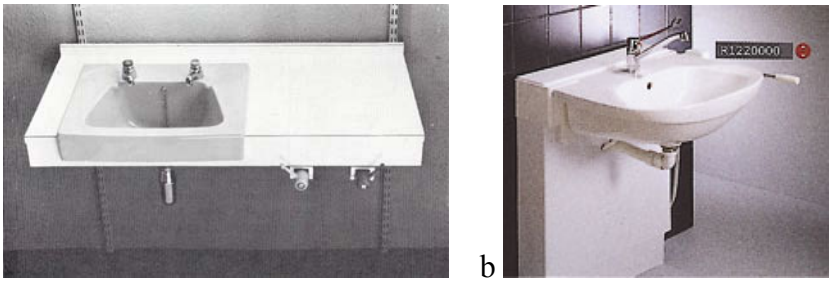



Figure 4.59. 'a' Adjustable lavatory, Source: Raschko 1982)
'b' Height adjustable sink (Source:WEB_33, 2005)


Figure 4.60. Washbasin bracket (Source: WEB_34, 2005)

Although there are numerous bathroom lavatories in the market, particularly for elderly and disabled people, they are not usable and acceptable because the controls are located too far for easy use. Therefore, lever controls should be operated by one hand only, easier to grasp and more comfortable to operate with soapy hands than wheel-type faucets. Some further complications can be included permanent water controls, particularly for the arthritic hand. Figure 4.61a illustrates faucet controls operated by knee movement, which can also be hand-operated. Thus, it prevents raising and lowering entire lavatory. Another type of faucet control is shown in Figure 4.61b needs only wrist control. Wrist control faucet handles give elderly people to control water easier and safer.

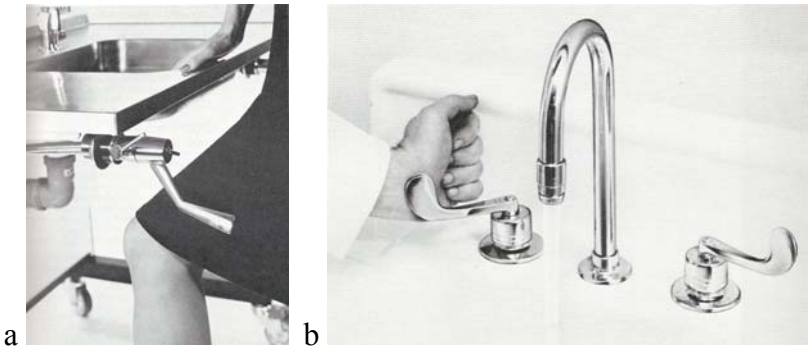


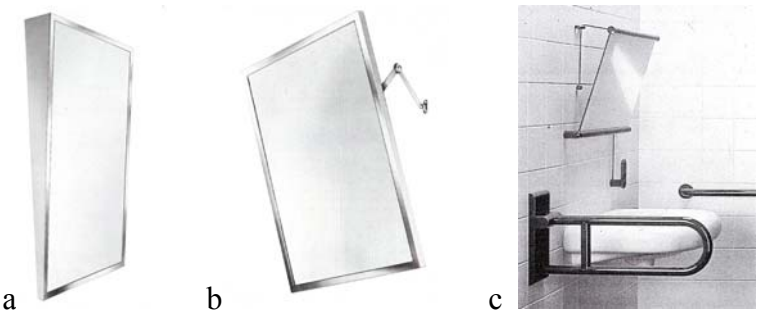

Figure 4.61. 'a' Knee single-control faucet with lever action
'b' Wrist control faucet handles (Source: Raschko 1982)

The water column in Figure 4.62 is a sink node of Personal Hygiene System. It is a dynamic node to respond rapidly to the needs of individual users of all ages and abilities. The sink node provides halo lighting from above and below the mirror. Lighting is integrated into the toilet node, too. The sink node also adjusts to accommodate the height of user.

Figure 4.62. 'a' Lavatory (Source: WEB_28, 2005), 'b', 'c' Lavatory, Metaform personal hygiene system Designed by Gianfranco Zaccai (Source: Pirkl 1994)

**Items Located the Lavatory**

Mirrors are often placed to about 40 inches (101.6 cm) from the floor, but this height will not respond the needs of the small woman in a wheelchair whose eye level is about 43 inches (109.2 cm) from the floor. For this person, the mirror should be set as low as possible. In Figure 4.63a a tilted mirror can be permanently installed, or another alternative in figure 4.63b, it can be tilted outwards at the top about 6° to 8°.



a b c

Figure 4.63. 'a' Tilted mirror, 'b' Swing-out tilting mirror (Source: Raschko 1982), 'c' Washbasin bracket (Source: WEB_34, 2005)

**The Bathtub**

According to Raschko (1982) elderly people sometimes find sitting in the bathtub difficult because they often do not have the strength or the agility to lower them

to the bottom of the tub and they may not get out without assistance. Therefore, elderly people need an elevated seat. Not only a built-in seat at the head of the tub, but also a seat set into the tub is acceptable (Figure 4.64). Another bath seat is shown in Figure 4.65. It permits users to sit comfortably in the bath.

a  b 

Figure 4.64. 'a' Bathtub transfer seat (Source: Raschko 1982), 'b' Comfy transfer bath bench (Source: WEB_21, 2005)

Figure 4.65. 'Fresh' Bath seat (Source: WEB_27, 2005)

Myco swivel bather with a rotating seat provides easy transfer over the bath, and back and arm support. It consists of two parts: A base frame which rests of the sides of the bath and a seating unit which rotates on the base. The two parts separate easily for handling or storage. The seating unit has a plastic seat and is easy to clean. The base frame has four arms that rest on the bath. The Myco Arm Extender provides the arm length of the Myco Swivel Bather seat for people with limited mobility to transfer on the seat. It also allows people to stand up easily from the seat after use (Figure 4.66).

Figure 4.66. ‘a’ Myco swivel bather, ‘b’ Myco arm extender (Source: WEB_35, 2005)

In Figure 4.67 the Cushioned Insert for Bathtubs gives elderly people to maintain a stable seated position during bathing. The insert provides safe and comfortable transfer from the wheelchair for elderly people. The unit is also removable to let conventional use of the bathtub.

Figure 4.67. Cushioned insert bathroom (Source: Pirkl 1994)

Shower and tub controls of the Personal Hygiene System are solid state temperature control devices with large light emitting diode (LED) and color-coded directional arrows. The skin experiences a reduced sense of pain and pressure with age. Sensitivity to temperature changes may be diminished and cause a person to burn or scald himself or herself. Controls are large elastomeric keys. The tub has soft resilient surface for comfort and safety. A support bar system offers a secure grip. The bathtub is seen in Figure 4.68.

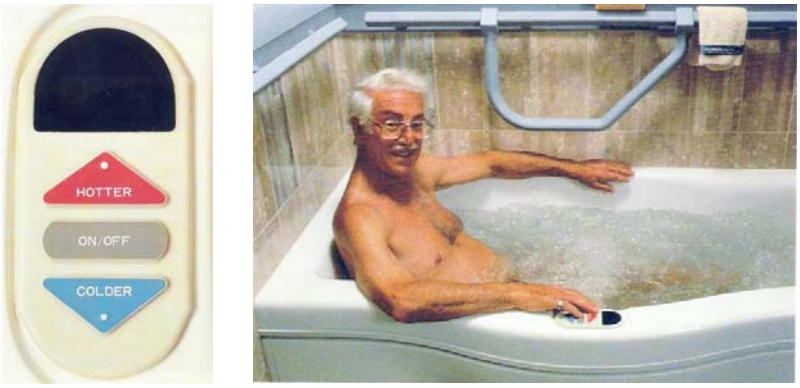



Figure 4.68. 'Bathtub' Metaform personal hygiene system (Source: Pirkl 1994)

**The Shower**

The shower is preferred to the bathtub where mobility is impaired. The high rim of the bathtub is as an obstacle to entry. On the other hand, transfer from a wheelchair may not be necessary and the person can wash in the wheelchair into the shower or a special shower chair can be an alternative for transferring. Figure 4.69 shows the shower chairs which are used easily rather than wheelchair. The armrests can be taken off in Figure 4.69a and the armrests can be folded up in Figure 4.69b. The rounded ends also provide a good grip when getting in and out of the product.

a b

Figure 4.69. 'a' 'Clean', 'b' 'Mobil' shower and toilet chairs (Source: WEB_27, 2005)

A variety of body positions must be supported and secured in the shower enclosure. The showering process should be the safest form of body cleansing for elderly people. A main problem that elderly people encounter with the shower is a lack of comfort due to prolonged standing, inadequate clearance for the various washing operations, and absence of the support. Therefore, shower seats can be one of the solutions for elderly people when having a shower safely.

Figure 4.70 shows a wall mounted shower seat that is reinforced wall for safe usage. It provides easy access for ambulatory people as well as people in wheelchairs. The unit installs at wheelchair height on either right or left handed shower stalls. It has a nonslippery soft surface.

Figure 4.70. Wall mounted seat for showers (Source: Pirkl 1994)

Some types of shower seats in Figure 4.71 consist of seat and backrest. They provide support and comfort, and they can fold up against the wall, if they do not be used. Foldable support arms can be integrated with the backrest.

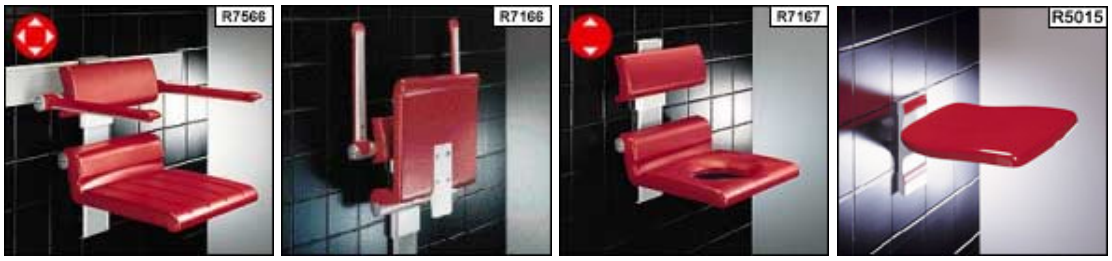



Figure 4.71. Shower seat models (Source: WEB_34, 2005)

Lack of sufficient storage areas for soaps and shampoos, is another problem for the elderly. A product should be integrated features that provide more comfort and safety for the elderly. A patent-pending drain system in Figure 4.72 that is flush with the floor makes the shower completely accessible. The rail system accepts a fold-down shower chair or a hydraulic transfer chair to make easy safe transfer and more comfortable bathing. When a shower seat is also wall mounted, no grab bar should be placed along that wall and also vertical grab bars must not restrict the required horizontal grab bars (Figure 4.73). The hook-in seat for the railing system also features a hinge mechanism (Figure 4.73c).

Figure 4.72. ‘Shower’ Personal hygiene system (Source: Pirkl 1994)

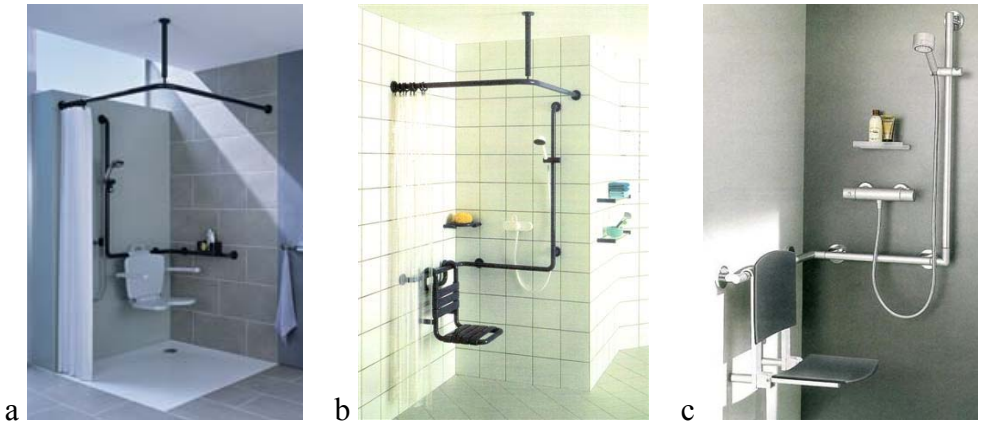



Figure 4.73. ‘a’ Accessible shower area (Source: WEB_36, 2005), ‘b’ Shower seat with grab bars (Source: Leibrock 1993), ‘c’ Railing system (md)

Shower in Figure 4.74a can be clipped to a bracket for use as a conventional shower includes a hand-held system. It is ideal for seated use. Another example is shown in Figure 4.74b wall mount a handheld unit gives elderly people to adjust height. A multidirectional shower head that rotates 360° is ideal for people who do not need a handheld system.

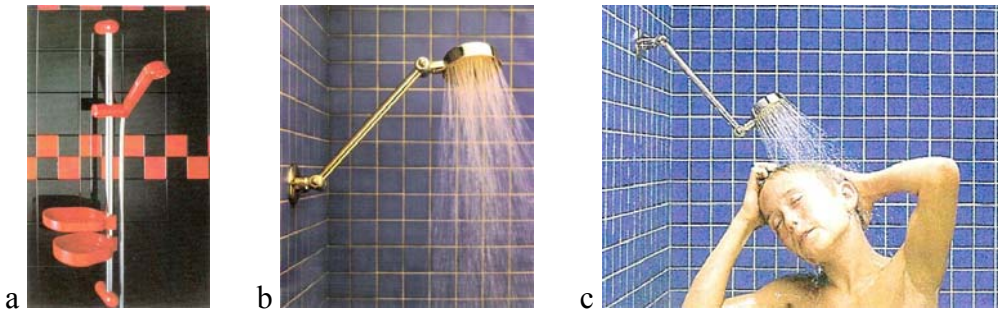



Figure 4.74. ‘a’ Handheld system (Source: Leibrock 1993), ‘b’, ‘c’ Multidirectional shower head (Source: Leibrock&Terry 1993

Hang and Glide is a flexible interior concept which includes the major bathroom elements on a joint horizontal holding profile that won the iF design awards in 2005. It suggests a life in old age and bathroom interiors of the future. The design enables doing away with or modifying certain functions.

Figure 4.75. Hang & Glide (Source: International Magazine of Design) iF Design Award 2005, Designed by Marco Steiner and Markus Schäling

The concept of the 'Hang and Glide' is centered on a horizontal wall-mounted carrying and holding profile which, on the one hand, functions like a handrail and, on the other hand, fixes (in a mobile fashion) the modules needed for individual furnishing of the bathroom. The universal seat is central importance of this project that is suitable as a WC or shower seat and is moved to the required function position. It can be moved along the wall carrying and handrail. Moreover, the shower, for example, is conceived as an around the corner shutter curtain. The wash-stand can be lowered and for a pneumatic construction for the shower basin.

There are special needs of elderly people in different environments. These simple or complex products can allow people to continue independently in interior spaces. By means of Universal Design principles, it can be formed an environment more accessible, usable and friendly to all users and products bring independence and the confidence to users.

## 4.3. A Door Handle Design Proposal for Interior Doors

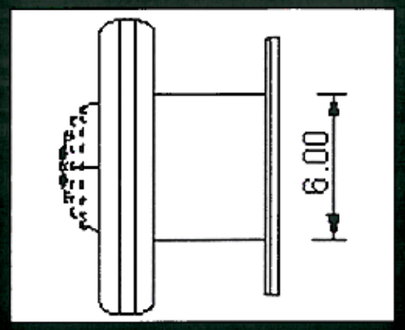
Elderly people with poor grip or restricted hand movement challenge with operating doors in interior spaces. In some cases, people are unable to apply force with their hands. For example, elderly people have some problems operating the door because their hands may be full. By the help of Universal Design principles, a lever door handle can be redesigned. A door handle should be ideal for arthritis or decreased hand strength so that it should have some features as below:

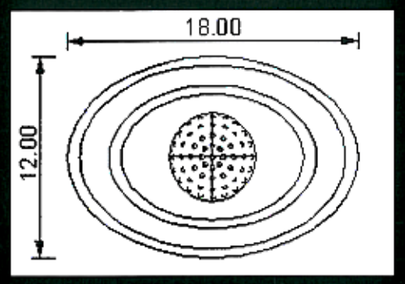
Lever door handle:

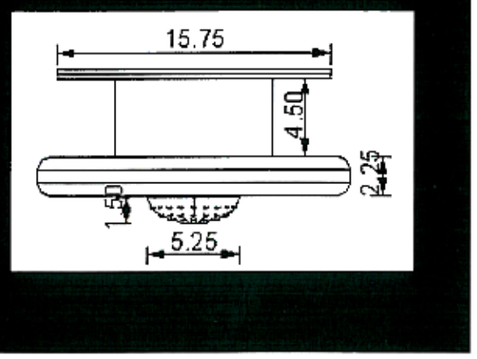
- It is not only used for aging population, but also it can be used by everyone (Equitable in use).
- It should be designed for ease of use by a variety of different grip (Flexibility in use).
- The level of technology should be kept as simple as possible (Simple and Intuitive).
- The product can include the use of color and texture contrasts to identify different controls and get better the perception of product (Perceptible information). It can be visible at night.
- People can open the door with an elbow or knee if people's arms are full (Low physical effort).
- The oversized handle is filled with a smart. It can be reached for seated or standing user. It can have some variations in hand and grip size (Size and space for approach and use).
- Additionally, it has an elegant touch at little or no additional cost (Friendly and Economic).

This design proposal tries to suggest that the ideas of elderly users related to how domestic doors should be designed according to Universal Design principles.

# H a n d e r l y




## Design Inputs of Handerly

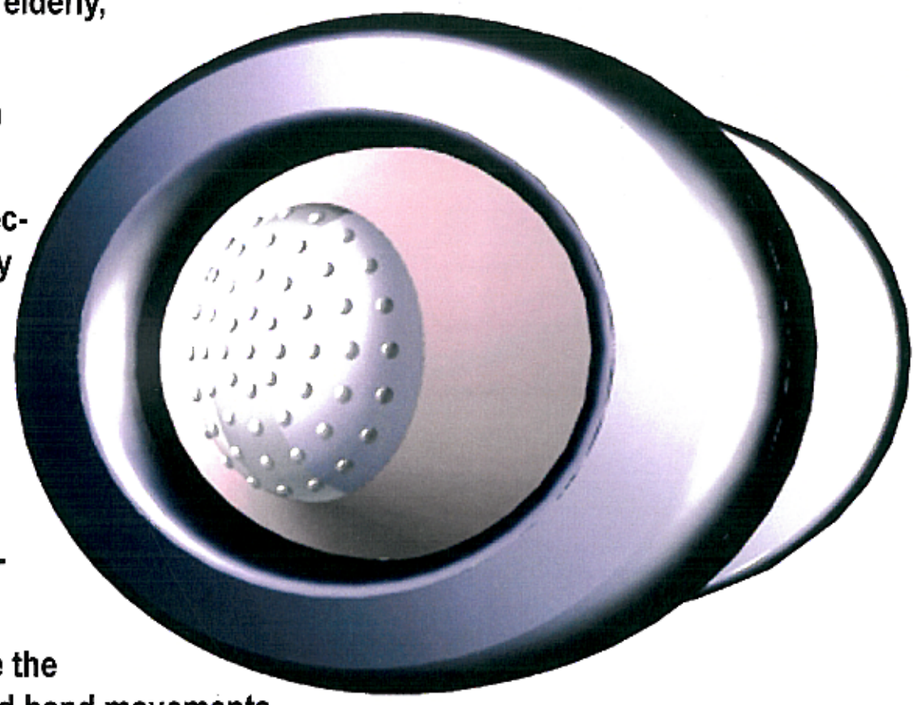
**Equitable in use:** Not only it is used by elderly, but also it can be used by everyone.

**Flexibility in use:** It provides choices in methods of use with hand or elbow.

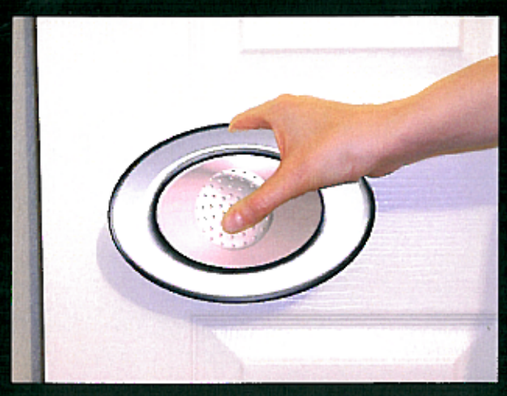
**Simple and Intuitive:** It eliminates unnecessary complexity. It can be used easily by pressing the button.
Its level of technology is simple.

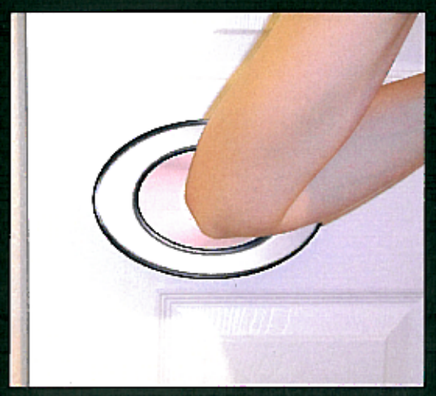
**Perceptible Information:** Product includes the use of color and texture contrasts to identify different controls. It can be visible at night with its lightining button.

**Low physical effort:** It aims to minimize the physical effort for people with restricted hand movements by pushing the button.



**Size and Space for Approach and Use:** It can be reached for seated or standing user. It can have some variations in hand and grip size.





# CHAPTER 5

# CONCLUSION

The main purpose of this study is to examine the domestic products which are being used by elderly people in interior spaces to make daily living activities more efficient and satisfying for them. Therefore, it is important to comprehend the definition, characteristics and aspects of aging population in order to design, develop and provide products for elderly people.

**1.** Aging is an ongoing process that begins with birth and ends with death as a natural consequence of life and includes some functional and cognitive impairment and also varies person to another. It does not start suddenly at age 65. Chronological age only is not accurate enough for defining aging and functional impairments associated with becoming old. Thus, not chronological age but biological age defines who is old.

**2.** Elderly people are not a homogenous and stereotypical potential user group of market so they exhibit great amount of diversity. Therefore, it is clear that the idea of Universal Design Principles is significant to reach a solution, which can be adapted by the majority of people.

**3.** Developments in medical area, industrial revolution and world wars, and industrialization and urbanization cause the occurance of aging population and increasing life expectancy gradually. At the beginning of the twenty-first century, the world exactly differs from one hundred ago. Demographic changes demonstrate that the elderly population is the fastest growing part of the world's population. Therefore, populations are getting older and more disabled, and these trends also continue in the future because of living longer and surviving better, declining the birth rate, and decreasing the mortality rates at higher ages. So, people with functionally limited due to age or disability are increasing dramatically. In later life, not only populations grow, but also they become predominantly more female.

**4.** As a result of demographic changes, aging and its consequences are not the phenomena merely related to industrial nations; it has been a topic of 'universal' interest that affects both developed and developing nations, including Türkiye. Changing social statues and transition in family structure may cause them to the dissatisfaction,

loneliness, disengagement and alienation. They may lose their participatory feelings in social and financial areas. It is quite possible for the elderly that they may feel severe isolation due to loss of physical, social, economical and psychological areas.

**5.** Elderly people are frailer than the general population because the aging process brings more physical, sensory and cognitive limitations and more motor disabilities that affect their activities of daily living and their interaction with their environment. One of the most significant results of these limitations is to make them dependant.

**6.** Most of people with disabilities are elderly. If the proportion of elderly people grows, the number of people with disabilities will increase. In other words, elderly population leads to increasing prevalence of disability. These populations are no longer an unimportant minority. Therefore, they constitute a noticeable rate in the market, and it exists new market opportunities for manufacturers.

**7.** The aging population living alone is on the increase year by year. Most of elderly people generally maintain their lives in present private households and they also remain economically independent will spend money on products that meet their needs. They constitute a significant market for domestic products made to Universal Design principles.

**8.** Independent living is one of the main goals for elderly people with disabling conditions. They are mostly forced to cope with products and environments that limit choices, reduce options, and decrease the ability to continue independent. They face the environment with their competence, but more environmental support is required to compensate for the associated functional loss due to decreasing health. Besides, maintenance, stimulation, and support determine the quality of life.

**9.** Legibility, accessibility, adaptability and compatibility are four attributes that accomplish environmental quality and improve competence to achieve activities of daily living for elderly people. These allow people to move independently and normally throughout an environmental setting. It is important to realize that ‘how elderly people’s needs meet with the products according to the Universal Design principles and concepts’. Design for elderly people move from the margins towards the mainstream of product development.

**Research Conclusion**

This study not only focuses on the elderly people and intents to meet their needs, but also it includes all people regardless age, gender, or competence in the context of the **'Universal Design Principles'** that is a way in order to reach one societal area affected by design discrimination. These principles can be adapted global needs and realities.

**1.** The concept of Universal Design that is suitable for the majority of the population groups is becoming of great importance within the society. Designers generally tend to design for ordinary people, who are between the ages 18 and 55, have similar anthropometrics, physiology, attitudes, behaviours and lifestyles. However, there are other large sections of the population that need special care in the society.

**2.** Considering the needs of elderly and disabled people in product design will make them usable by more people. Besides, there is an increasing market and demand for products that are designed for all profits all consumers. This explains why Design for All is so important.

**3.** Universal Design is as designing of products that are first of all flexible enough to be used, without assistive devices or modifications and people with the widest range of abilities should use products that have current materials, technologies and knowledge. Secondly, products can accord with the assistive technology products that might be used by those who cannot efficiently access and use directly products. Features or flexibility benefits to users with temporarily or permanently reduced abilities in general. In many situations, more people will find features useful than the number of people with disability. Thus, if products are designed to consider the all people, adaptations for people with disability because of age, physical, sensory, or cognitive ability will be reduced.

**4.** Universal design considers differences such as strength, intellectual abilities, perceptions and values. It is a user-friendly approach to design in the living environments that supports user's health and safety. For example, a door handle should be operated by people who have different strength levels. On the other hand; Accessible Design is often centered on the needs of the people who use wheelchairs or have walking aids and it often has a medical or institutional approach.

**5.** Universal design aims to have a high standard of aesthetics and usefulness. Products should be beautiful as well as useful in the context of this approach. In

contrast, ‘Assistive Devices’ can be generally lacked of good aesthetics, sensory and physical accommodation so that, technology can be leaded to design of products. They tend to address affected problems by inserting additional layers of technology between the user and the needed accommodation. Researches about the assistive technology indicate that people do not like the medical and technical appearance of these products. It is important to note that ‘specialized’ products increase a negative self concept as stigmatizing and rejected. Anybody, including the elderly, wants to be branded ‘old’. Universal Design is more commonly available related to lower costs than accessible technology or special products. However, assistive technology is much more costly. For these reasons universal design can be a strong alternative to accessible design.

**6.** Greater use of mainstream products also reduces the requirement of technical aids to live independently. However, every product does not have to be usable by every user at any time. There will always be a marginal disabled people with cruel impairments who require specialized products, but, with the Universal Design principles, the number of these people will be fewer. To address the needs of more cruel disabled people increase the usefulness of products for people with minor impairments, but, products for both elderly and disabled people are easier to use for everyone.

**7.** Older people with poor grips and restricted hand movements, and poor sight find that many products have some characteristics that make them difficult to use. Accordingly, their choices are restricted. However, features that make a product accessible to older and disabled people generally allow everyone to use products easily. With the aging process, vision, hearing, mobility and strength that are the most common impairments appear so products for all designed remain to be usable and safe in later years. Additionally, well designed products should be used easily in difficult circumstances such as dealing with a product one handed when the other hand is busy or walking with a broken leg.

**8.** Increased numbers of older consumers form a significant buying force in changing market place. Products for elderly people should be performed well, convenient to use and attractive because older people have become perceptive consumers. Products in the market should respond the requirements such as accessibility, adaptability, adjustability, and availability. They should also give optimal support to people without attributing stigma. The limitations that are elderly people face can be responded by products in both micro and macroenvironment with considering the needs of elderly people. Increasing usability and convenience for the

widest range of people spread out the customer base and so expands marketability and reduce costs for assistive technology.

**9.** The application of design method with considering usability improves the product quality and market expectations. It also contributes to increase social integration, the quality of life, and independent living. Designing for the elderly means designing for everyone.

**Suggestions**

The aging population is a universal issue and needs a universal perspective. In order to provide more adequate products and living environments for the elderly people, products should be designed flexible enough to extend independence by supporting the changing needs of people as they age. By the help of Universal Design features, products such as larger buttons with color contrast telephones will bring more old people to maintain their independence and avoid institutionalization.

It is a way that good enough products can be accomplished by concerning the attention of the designers and manufacturers onto the elderly issue as a resource of knowledge. Therefore, designers should respond that products and environments should accommodate and overcome physical and sensory impairments of elderly people will become more acceptable. Consequently, people do not want to accept easily old age or disabilities. However, people who are young and without disabilities should not forget that they can be susceptible to the disabling conditions of chronic health disorders or accidents.

It is a clear that designers, manufacturers and elderly consumers need to consider about the elderly in new ways. Conceptual restrictions which are reinforced by myths and stereotyped images lead people to think about the differences that separate the young and old rather than similarities that provide people together.

There is also a need the knowledge of many disciplines working together to accomplish an optimal solution, including product designers, architects, gerontologists, sociologists, psychologists, human factors engineers, and also medical practitioners.

Finally, ‘design for elderly in interior spaces’ is a wide area. Therefore, one of the different parts of interior spaces, such as living spaces, kitchen, or bathroom can be considered profoundly. This research is as a step for next researches in this area. The objective of this study is an overview of ‘design for elderly’ centered on Universal Design approach.

# REFERENCES


Aiken L.R., 1995. *Aging: An Introduction to Gerontology*, (Sage Publications, California)

Arber S. and Evandrou M., 1993. *Ageing, Independence and the Life Course*, (Jessica Kingsley, United Kingdom), 1st Edition

Atchley R.C., 2000. *Social Forces And Aging: An Introduction To Social Gerontology*, (Wadsworth, Canada)

Bakker R., 1997. *Elder Design, Designing And Furnishing A Home For_Your Later Years*, (Penguin Group, New York)

Barker N., Nicholson M.A., Robson D., 1997. *Homes for the Third Age: A Design Guide For Extra Care Sheltered Housing*, (Chapman & Hall Publications, London)

Barret J., 2002. "Support and information needs of older and disabled older people in the UK", The Research Group for Inclusive Environments, *Design Studies,* Vol., Issue., p..

"Barrier-Free Bathroom", *md International Magazine of Design*, 7, Summer 2005, p.66

Barrier Free Environments Incorporated, 1991. *The Accessible Housing Design File*, (Van Nostrand Reinhold Publications, New York)

Bartlett H.P. and Phillips D.R., 1960. "The United Kingdom: Demographic Trends, Recent Policy Developments, and Care Provision" in *Aging in Western Society*, edited by E.W. Burgess (Chicago Press, Chicago)

Beecher V. and Paquet V., 2003. "Survey instrument for the universal design of consumer products", *Applied Ergonomics,* Vol.36, Issue.3, p.363.

Bury M., Holme A., 1991. *Life After Ninety*, (Chapman and Hall Inc., New York)

Callahan D., 1987. *Setting Limits: Medical Goals In An Aging Society*, (Simon & Schuster Inc., New York)

Carstens D., 1993. *Site Planning and Design For the Elderly: Issues, Guidelines, and Alternatives*, (Van Nostrand Reinhold, New York)

Coleman D., Greene V., Monahan D., 1991. "Demographs". in *Primary Care Geriatrics: A Case-Based Approach*, edited by R. Ham & P. Sloane (St. Louis: Mosby Year Book)

Cowgill D.O., 1970. "The Demography of Aging" in *The Daily Needs and Interests of Older People*, edited by A. Hoffman & A. Mildred (Thomas, Springfield, Ill.)

Covington G.A., Hannah B., 1997. *Access By Design*, (Van Nostrand Reinhold, New York)

Cox H.G., 1993. *Later Life: The Realities Of Aging*, (Englewood Cliffs, N. J.: Prentice Hall)

DeLoach C., Ronnie D. W., Guy W., 1983. *Independent Living: Philosophy, Process, and Service* (University Park Press, Baltimore)

Demirbilek Oya, 2001. *Designing Armchairs With The Elderly A Participatory Design Model*, (Sanatta Yeterlilik, Marmara University, Fine Arts Ins.)

Demirbilek Oya, 1999. *Involving the Elderly in the Design Process: A Participatory Design Model for Usability, Safety and Attractiveness*, (PhD thesis, Bilkent University, The Institute of Fine Arts)

DİE, 2000. *2000 Genel Nüfus Sayımı*, TC Başbakanlık Devlet İstatistik Enstitüsü, İzmir

DİE, 2002. *İstatistik Göstergeler,1923-2002*, TC Başbakanlık Devlet İstatistik Enstitüsü

DİE, 2004. *Türkiye İstatistik Yıllığı 2004*, TC Başbakanlık Devlet İstatistik Enstitüsü

Dishman E., 2003. "Designing For The New Old: Asking, Observing And Performing Future Elders" in *Design Research Methods And Perspectives*, edited by B. Laurel (The Mit Press, Massachusetts)

Dobkin I. & Peterson M. J., 1999. *Gracious Spaces: Universal Interiors By Design*, (McGraw Hill)

Dorcey Mary, "The Art Of Aging", *An International, Interdisciplinary Conference On Textualising The Phases Of Life*, University Of Lleida, Catalunya, Spain, 6-8 November 2003

Dorfman R.A., 1994. *Aging Into The 21st Century: The Exploration Of Aspirations And Values*, (Brunner & Mazel Publications, New York)

Dychtwald K., 1999. *Age Power: How The 21st Century Will Be Ruled By The New Old*, (Jeremy P. Tarcher & Putnam, New York)

Ergene B.C., 1996. *Nüfus ve Nüfus Artışı*, (T.C. Başbakanlık Devlet İstatistik Enstitüsü, Ankara)

Field M., 1972. *The Aged, The Family And The Community*, (Columbia University Publications, New York)

Finer C.J., 2000. "Aging in Industrial Societies, East and West: A Western Comparative Perspective" in *Aging in East and West: families, states, and the elderly*, edited by V. Bengtson…(et al.) (Springer Pub., New York)

G. M. Mary, "Positive Aging New Images For A New Age", *Aging International*, Vol:27, No:1, pg.3-23, Winter 2001-2002

Gerber J., 1989. *Lifetrends: The* Future Of Baby Boomers And Other Aging *Americans*, (Macmillan Publications)

Gilbert T.A., Goltsman S.M., Wohlford S.D., 1992. *The Accessibility Checklist: An Evaluation System For Buildings And Outdor Settings*, (MIG Communications, Berkeley, California)

Goldsmith S., 1976. *Designing For The Disabled*, (Riba Publications, London)

Hamilton-Stuart Ian, 1994. *The Psychology Of Aging An Introduction 2nd Edition*, (Jessica Kingsley Publications, London, Bristol, Pennsylvania)

Hendricks J., Hendricks D.C., 1986. *Aging In Mass Society: Myths And Realities*, (Little & Brown Publications, Boston)

Hoglund D.J., 1985. *Housing For The* Elderly : Privacy And Independence In *Environments For The Aging*, (Van Nostrand Reinhold Inc., New York)

Holmes-Siedle J., 1996. *Barrier-Free Design: A Manual For Building Designers And Managers*, (Butterworth & Heinemann Publications, Oxford)

Howell S.C., 1987. *Designing For Aging: Patterns Of Use*, (MIT Press, Cambridge, Massachusetts and London), 2nd Edition

Johnson J., Slater R., 1993. *Ageing and Later Life*, (Sage Publications, London; Thousand Oaks, Calif.)

Johnson P.M., 1993. *Creation of the Barrier-Free Interior*, (A Positive Approach, Inc., Millville, NJ.)

Kaya İlkim S., 1994. *Effects of Socio-Cultural User Requirements on the Organization of Spaces for Elderly Residences*, PhD thesis, Dokuz Eylül University

Kimmel D., 1990. *Adulthood and Aging*, (John Wiley & Sons Publications)

Krishnan P., Mahadevan K., 1992. *The Elderly Population In Developed And Developing World: Policies, Problems And Perspectives*, (B.R. Publishing Cor., New Delhi)

Koşar N., 1996. *Sosyal Hizmetlerde Yaşlı Refah Alanı*, (Şafak Matbaacılık, Ankara)

Kroemer K., Kroemer H. and Kroemer E., 1994. *Ergonomics* (Prenctice Hall Englewood Cliffs, New Jersey)

Lebovich L.W., 1993. *Design For Dignity: Accessible Environments For People With Disabled*, (John Wiley & Sons Publications, New York)

Leibrock C.A., 1993. *Beautiful Barrier-Free: A Visual Guide To Accessibility*, (Van Nostrand Reinhold, New York)

Leibrock C.A. and Terry J.E., 1999. *Beautiful Universal Design, A Visual Guide*, (John Wiley & Sons Publications, Canada)

Maas I., 1960. "Germany: Demography and Aging After Reunification" in *Aging in Western Society*, edited by E.W. Burgess (Chicago Press, Chicago)

Merril T., 1973. *Social Clubs for the Aging: Including Twenty-Four Programs For Nine Clubs,* (Thomas, Springfield, Ill.)

Moggridge B., "Design By Story Telling", *Design Studies,* Vol.24, Issue.1, p.15-18.

Mollenkopf Heidrun (ed.)., 1996. *Elderly People In Industrialized Societies : Social Integration In Old Age By Or Despite Technology*, (Berlin)

Mynatt D. Elizabeth, "Developing Technology To Support The Functional Independence Of Older Adults", *Aging International*, Vol:27, No:1, pg.24-41, Winter 2001-2002

Oktik N., 2004. *Huzurevinde Yaşam ve Yaşam Kalitesi*, (Muğla Üniversitesi Matbaası, Muğla)

Pakdil O., 1992. *Yaşlılık Sorunları Ve Yaşlılara Sağlanan Servisler (İngiltere Örneği)*, (Y.Ü.Mimarlık Fakültesi Baskı İşliği, İstanbul)

Peloquin A., 1994. *Barrier-Free Residental Design*, (McGraw-Hill, Inc., New York)

Pirkl J.J., 1994. *Transgenerational Design: Products For An Aging Population*, (Van Nostrand Reinhold Inc., New York)

Raschko B.B., 1982. *Housing Interiors for the Disabled and Elderly*, (Van Nostrand Reinhold Company Inc., New York)

Regnier V.A., 1994. *Assisted Living Housing For The Elderly: Design Innovations From The United States And Europe*, (Van Nostrand Reinhold Publications, New York)

Sağdıç Yaprak, 1997. *A Framework for A Design Decision Support System Model For The Wet Space Renovation Of The Residences Used By Elder People*, (Bilkent University, The Institute Fine Arts)

Torrington J., 1996. *Care Homes for Older People*, (Chapman & Hall, London), 1st Edition

Tufan İ., 2002. *Antik Çağdan Günümüze Yaşlılık: Sosyolojik Yaşlanma*, (Kitap Matbaacılık, İstanbul)

Weal F., 1988. *Housing For The Elderly: Options And Design*, (Nichols Publications, New York)

WEB_1, 2005. U.S. Census Bureau International Data Base, April 2005 version, 08.04.2005. http://www.census.gov/ipc/www/img/worldgr.gif

WEB_2, 2005. Population Resource Center, 08.04.2005. http://www.prcdc.org/summaries/worldpop.html

WEB_3, 2005. World Population: Major Trends, April 2005 version, 08.04.2005. http://www.iiasa.ac.at/Research/LUC/Papers/gkh1/chap1.htm#high_10

WEB_4, 2005. Assistive Devices, Inc. 06.05.2005, http://www.geocel.com/ADI/prods.htm

WEB_5, 2005. Inclusive Design, 08,06,2005, http://www.ricability.org.uk

WEB_6, 2005. Alibaba, 25.05.2005, http://www.alibaba.com/manufacturers/1607/Disabilities.html

WEB_7, 2005. Life Home, 2005, 04.05.2005, http://www.lifehome.com

WEB_8, 2005. Hancock Geraldina, Cane-Camberwell Assessment of Need in the Elderly.July, 12.05.2005, http://www.ucl.ac.uk/~rejugah/

WEB_9, 2005. Equal Future, 17.05.2005, http://www.equalfuture.co.uk/ecommerce/EqualFuture/Shop/Mobility

WEB_10, 2005. Demonbreun, D., Weiss B., and Van Hook F., American Family Physician: A Peer reviwed Journal of the American Academy of Family Physicians Ambulatory Devices for Chronic Gait Disorders in the Elderly, 14.05.2005, http://www.aafp.org/afp/20030415/1717.html,

WEB_11, 2005. Comfort PLUS Products, 17.05.2005, http://www.comfortplusproducts.co.uk/accessories/Gifts

WEB_12, 2005. Spinlife, 17.05.2005, http://www.spinlife.com/critpath/match.cfm?categoryID=75

WEB_13, 2005. Elitemedical, 18.05.2005, http://www.elitemedical.com/ehms1/guarwal.html

WEB_14, 2005. America Discount Home Medical Equipment, 21.05.2005, http://www.home-med-equip.com/walker-rollators/cruiser4200.html

WEB_15, 2005. Enable Ireland, 23.05.2005, http://www.enableireland.ie/posturalmanagement/manualwheelchairs.html

WEB_16, 2005. The Center for Universal Design Principles, 16.04.2004, http://www.design.ncsu.edu

WEB_17, 2005. Equipment for Benefit and Benefit Advice, 25.06.2005, http://www.benefitsnowshop.co.uk/shop

WEB_18, 2005. Bath Rails and Steps, 25.07.2005, http://www.oakvillecarecentre.co.uk/en-us/dept_49.html

WEB_19, 2005. Toshiba Design: Universal Design: Design Examples, 27.03.2005, http://www.toshiba.co.jp/design/pr/ud/cases.htm

WEB_20, 2005. Arcoa, 07.07.2005, http://arcoa.com/products-ezar.htm

WEB_21, 2005. Active Mobility Centre Ltd, 16.07.2005, http://www.activemobility.co.uk/shop/default.php

WEB_22, 2005. Dynimic Living, 25.07.2005, http://www.dynamic-living.com/bedrail-tray.htm

WEB_23, 2005. Grover Gear, 08.07.2005, http://www.grovergear.com/bedroom-equipment.html

WEB_24, 2005. Dressing Stick - dressing aids from ActiveForever.com, 21.06.2005, http://www.activeforever.com/product_Dressing-Stick_744

WEB_25, 2005. Wisent Health Care Products, 15.06.2005, http://www.wisent.com/Dressing.htm

WEB_26, 2005. Barrier Free Living, 28.07.2005, http://www.barrierfree.org/faucets_kitchen_01.php

WEB_27, 2005. Etac Creating Possibilities, 14.09.2005, http://www.etac.com

WEB_28, 2005. Universal Design Exhibition, 16.04.2004, http://www.ap.buffalo.edu/idea/ubdweb

WEB_29, 2005. Conference Proceedings - Designing for the 21st Century III http://www.designfor21st.org/proceedings/proceedings/project_hhrc_gheerawo.html

WEB_30, 2005. Health & Personal Care: Enablers Spoon and Fork Holders, 14.09.2005,http://www.marktse.com/amazon/amazon_products_feed.cgi?Operation=ItemLookup&ItemId=B00061OHZM

WEB_31, 2005. Westons Home Health and Medical Equipment, 12.08.2005, http://www.westons.com/acatalog/Online_Catalogue_Seats_with_Arms_16798.html

WEB_32, 2005. Coram Design Award 2000: Honourable Mentions, 20.09.2005, http://www.coram.nl/designaward/inzending/hon2000.html

WEB_33, 2005. Max-Ability, 15.09.2005, http://www.max-ability.com/productlist.asp?Action=ShowProduct&Recno=19

WEB_34, 2005. Pressalit Care: Bathroom Products, 22.07.2005, http://www.enware.com.au/bathroomcare/bc_multi.htm

WEB_35, 2005. Myco, 18.08.2005, http://www.myco-uk.co.uk/

WEB_36, 2005. Hewi Life System, 21.09.2005, http: //www.hewi.pl/produkte/ produktuebersicht/barrierefrei/lifesystem/index.php

Weisgerber R.A., 1991. Quality of Life for Persons with Disabilities: Skill Development and Transitions Across Life Stages (MD: Aspen Publishers, Gaithersburg)

Viemeister T., 1993. *Product Design 6*, (PBC International, Inc., New York)

Vivrett W.K., 1970. "Housing The Needs" in *The Daily Needs and Interests of Older People*, edited by A. Hoffman (Thomas, Springfield, Ill.)

# APPENDIX A

# DEFINITIONS OF TERMS

(modified from Pirkl 1994 and Raschko 1982)

## AGING

**aged** The state of being old. A person may be defined as aged on the basis of having reached a specific age. For example, 65 is often used for social or legislative policies while 75 is used for physiological evaluations.

**ageism** Prejudice against people because they are old. Ageism implies a broader meaning than gerontophobia, the unreasonable fear and hatred of older persons. The term was coined by Robert N. Butler, M.D., first director of the National Institute on Aging.

**aging** The changes that occur normally in plants and animals as they grow older. Some age changes begin at birth and continue until death; other changes begin at maturity and end at death.

**chronological age** An individual's numerical age dating from the time of his or her birth.

**competence** An individual's ability, skill, and fitness to deal with the demand character of the environment.

**elderly or elder** Generally referring to individuals over age 60. Other terms used to describe certain groups of older people are frail elderly. Elderly people whose physical and emotional abilities or social support system is so reduced that maintaining a household or social contacts is difficult and sometimes impossible, without regular assistance from others. Healthy people are usually not in this group until after age 75, and even then

many are not frail until they reach very late years, such as beyond age 90. Individuals whose illnesses, disabilities, or social problems have reduced their ability to perform self-care and household tasks in an independent manner.

**functional age** An assessment of age based on physical or mental performance rather than on the number of years since birth.

**geriatric medicine** Also called geriatrics. The medical knowledge of physical disability in older people, including the diagnosis, treatment, and prevention of disorders.

**gerontology** The study of aging from the broadest perspective. Gerontologists examine not only the clinical and biological aspects of aging but also psychological, economic, and historical conditions. This term is used by Elie Metchnikoff, of the Pasteur Institute in Paris to describe the biological study of senescence in 1903.

**senescence** Aging. The normal process of growing old, a process that occurs continually at every biological level (chemical, cellular, tissue, organ systems, and organism).

## RESERCH ON AGING

**activities of daily living (ADL)** Normally refers to the six basic activities of daily living on the Index of Independence in Activities of Daily Living developed by Katz (1970). They include bathing, dressing, toileting, transferring, continence, and feeding. Additional ADLs include communication, grooming, visual capability, walking, and use of the upper extremities.

**independent living** It is an environment that assists a disabled and elderly person to live independently outside an institutional setting, through the utilization of architectural features and interior furnishings that will support the performance of the activities of daily living.

**aging research** The study of the interrelating factors that affect aging such as clinical medicine, social and psychological relations, and environmental conditions. Aging research attempts to distinguish the changes occurring normally during aging from changes caused by illness, heredity, or the environment.

**ambulant** Being able to walk without aid.

**anthropometrics** (1) A science dealing with the study of measurements of the human body to determine the differences in individuals and groups. (2) Human body measurements including measurements in various postures associated with different activities.

**cohort** A group of people who are born at the same period of time or who enter a system, such as a nursing home, at the same time. One type of research design compares cohorts to see if there are differences in the way they grow old.

**demography** The study of a population and those variables bring about change in that population. Variables studied by demographers are age, sex, race, education, income, geographic trends, birth, and death.

**life cycle** The entire course of a person's life from infancy to old age. Health, social roles and expectations, and socioeconomic status tend to change as an individual moves from one phase of life to the next.

**life expectancy** A statistical projection of the number of years an individual is expected to live. Life expectancy can be calculated from birth (e.g., a person born in 1984 could be expected to live to age 74), or it can be calculated from some other point (such as the number of years a person could expect to live after reaching a given age). People of the same age can have different life expectancies depending on their race, sex, or socioeconomic circumstance.

**life span** The years a human being could live if negative variables, such as disease or accidents, did not shorten the number. An ideal number, probably approaches 110 years.

**longevity** The condition or quality of being long-lived.

**minority group** A small number of people within a society. Members of racial minority groups who are elderly bear a double burden of discrimination based on both race and age.

**nonambulatory** Having impairments that, regardless of cause or manifestation, for all practical purposes, confine individuals to wheelchairs.

**Semi-ambulatory** Having impairments that cause individuals to walk with difficulty or insecurity. Individuals using braces or crutches, amputees, arthritics, spastics, and those with pulmonary and cardiac ills may be semiambulatory.

## THE BODY

**arthritis** A general term referring to disease of the joints. It often involves aches and pains in the joints and connective tissues throughout the body.

**Alzheimer's disease** A form of dementia. It produces severe intellectual deterioration in older people and is currently considered an irreversible disease.

**cataract** A cloudiness or opacity that develops in the lens of the eye and results in poorer vision.

**cognitive** Refers to the mental processes of comprehension, memory, judgment, and reasoning as opposed to emotional processes.

**dementia** The severe impairment of cognitive functions (thinking, memory, and personality). Of our elderly population, 5 to 6 percent have dementia. Alzheimer's disease causes approximately one half of these cases, vascular disorders (multiple strokes) cause one fourth, and the other dementias are reactions to medicines, and other rarer conditions. While impairment from Alzheimer's disease and vascular disorders is permanent, dementia caused by other conditions can usually be corrected.

**glaucoma** A disease in which pressure builds up within the eye and causes internal damage, gradually destroying vision. Symptoms may be blurred vision, difficulty in focusing, loss of peripheral vision, or slow adaptation to dark.

**orthopedics** The medical knowledge, diagnosis, and treatment of the skeletal system (the bones, joints, muscles, ligaments, and tendons).

**presbycusis** The mos common type of hearing loss in people over 65. It results in a gradual decline in the ability to hear high-pitched sounds.

**presbyopia** Reduction in the ability to see at close range. This is due to the gradual loss of elasticity in the lens of the eye which occurs throughout life.

**Parkinson's disease** A neurological disorder characterized by involuntary muscle tremor and rigid movements.

**RELATED TERMS**

**conditions of aging** Changes in the physical characteristics of the body associated with chronological age, including reduced mobility, flexibility, coordination, and changes in perception skills.

**disability** A restriction or lack of ability to perform an activity in the manner or within the range considered normal for a human being. A disability is a condition of a physical or mental defect or impairment that a person is born with, or that he acquires by accident, injury, or disease. To have a disability is not necessarily to have a handicap. The disability becomes a handicap only when the effects of it hamper the filling of a specific task or role at a specific time and place. Disability refers to restrictions on or prevention of carrying out an activity because of impairment, in the manner or within the range considered normal for a human (e.g., difficulty in walking, seeing, speaking, hearing, counting, lifting, reading, writing, etc.; a disability may last for a long or short time, be permanent or reversible, progressive or regressive, and may vary in its impact from one situation to another).

**dsymobility** Limitations in one's ability to perform bodily movements (e.g., walking, sitting, lifting, reaching, grasping, stooping, bending, etc.), whether produced by disease or injury. Dysmobility is a critical factor affecting one's ability to remain independent.

**falling** A common problem experienced among older people, due to any number of underlying causes. Evaluating people who have falls involves assessing the injuries sustained in the fall and the cause for the fall. In older people, falling frequently results in broken bones and other serious injuries that may lead to disability and sometimes death.

**handicap** A disadvantage for a given individual resulting from an impairment or a disability, that limits or prevents the fulfilment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual. In manmade environments, the universe of handicapped and disabled encompasses those individuals who have a mobility or dexterity impairment of a temporary or permanent nature. The disabled are those people with physical limitations caused by heredity, disease, traumatic injury, or the process of aging. The handicapped are those people limited by social and physical barriers within society. For

example, a boy of eight years who is not in school because of his impairment is a limitation in hearing capacity, his disability is that he is not able to learn without help to communicate by voice and sound; and his handicap is that he is denied the education and socialization opportunities available in the school for children of his age.

**impairment** Permanent or transitory loss or abnormality of psychological, physiological, or anatomical structure or function (e.g., amputated limb; paralysis after polio; diabetes; mental retardation; impaired hearing; near sighted-ness).

**infection** An illness caused by an organism such as a virus, bacterium, or fungus.

**sympthom** The subjective evidence of a patient's condition (pain, shortness of breath, and fainting spells) as opposed to a sign, which is the objective evidence of disease (high blood pressure, a heart murmur, and swollen joints).

**syndrome** A group of symptoms that, together, characterize a particular disease.

## DESIGN

**accessible design** Products and environments designed and constructed so as to be readily accessible to and usable by people with disabilities (e.g., providing such access to places of public accommodation, commercial facilities, and transportation systems through the installation of ramps, curb cuts, grab bars, braille signs, etc.). Also referred to as barrier-free design normally associated with architecture, landscape architecture, and interior design.

**adaptive design** Products and environments originally designed and for use by the general public that have been modified or 'adapted' to the special needs of those with disabilities (e.g., slip-on grips for eating utensils

and writing instruments, jar and bottle openers, raised toilet seats, add-on handles and grab bars, etc.).

**ergonomics** (1) An applied science concerned with the characteristics of people that need to be considered in designing and arranging things that they use in order that people and things will interact most efficiently and safely that called also human engineering. (2) The study of the relation between man and his occupation, equipment, environment, and particularly the application of anatomical, physiological, and psychological knowledge to problems arising therefrom.

**functional design** Products and environments designed primarily for their functional utility. Such designs normally offer the user little, if any, physical accommodation or aesthetic appeal. Instead, such factors as cost reduction and ease of manufacture and assembly determine the resulting appearance and usability.

**humanistic design** Products and environments designed to serve the needs of people, focusing on such factors as safety, comfort, convenience, ease of use, and bodily fit.

**industrial design** Industrial Design, as defined by the Industrial Designers Society of America (IDSA), is the professional service of creating and developing concepts and specifications that optimize the function, value, and appearance of products and systems for the mutual benefit of both user and manufacturer.

**universal design** A generic ‘umbrella’ term that embraces accessible design, adaptive design, and transgenerational design. This design ideal seeks ‘universal’ environmental access and support for people of all ages, physical and sensory capabilities, and cognitive skills. Its goal is to close the environmental gap that separates those who are functionally impaired or disabled from those who are well and able-bodied.

# APPENDIX B

# ANTHROPOMETRIC DATA ON THE ELDERLY MEANS AND STANDART DEVIATIONS

| Age range: | 50-100[a] | 60-69[b] | 60-69[c] | 65-69[d] | 65-74[e] | 65-90[f] | 66-70[g] | 70+[b] | 70+[d] | 70+[c] | 72-91[e] | 75-94[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample size: | 822 | 43 | 72 | 24 | 72 | 184 | 169 | 12 | 20 | 28 | 130 | 40 |
| Stature,against wall | | 172.8 (6.6) | | 171.9 (6.6) | | | | 171.5 (9.0) | 170.4 (7.5) | | | |
| Stature,free standing | 175.1 (8.9) | | 172.6 (6.4) | 171.2 (6.6) | | 169.0 | | | 169.6 (7.6) | 171.9 (8.4) | 168.4 (5.3) | |
| Sitting height | 79.9 (5.3) | 90.8 (3.0) | 90.8 (2.9) | 90.0 (2.9) | | | | 89.5 (3.5) | 89.0 (3.4) | 89.8 (3.9) | 88.3 (3.1) | |
| Knee height | | 53.9 (2.5) | 53.6 (2.5) | | | | | 53.5 (3.4) | 53.2 (2.9) | 53.7 (3.2) | 53.8 (2.19 | |
| Popliteal height | 42.1 (3.5) | | 42.1 (2.3) | | | | | | | 42.1 (3.0) | 44.0 (2.1) | |
| Thigh clearance height | | | 19.7 (1.4) | | | | | | | 14.8 (1.2) | | |
| Hip breadth | 37.4 (3.9) | | | 36.0 (2.3) | | | | | 35.8 (1.7) | 37.8 (2.4) | | |
| Bideltoid breadth | | | 45.3 (2.3) | 45.1 (2.1) | | | | | 44.7 (1.6) | 45.0 (1.7) | 43.4 (2.3) | |
| Biacromial breadth | | | 38.9 (1.7) | | | | | | | 39.2 (1.8) | 37.8 (1.6) | |
| Hand breadth | 7.7 (0.6) | | 8.5 (0.4) | 8.5 (0.4) | | | | | 8.5 (0.4) | 8.6 ( 0.4) | 8.4 (0.4) | |
| Head breadth | | | 15.5 (0.5) | 15.5 (0.5) | | | | | 15.5 (0.5) | 15.5 (0.4) | 15.4 (0.5) | |
| Foot breadth | | | 9.8 (0.6) | | | | | | | 9.9 (0.5) | 10.0 (0.5) | |
| Head circumference | | | 57.1 (1.4) | 57.1 (1.3) | | | | | 58.0 (1.4) | 57.4 (1.6) | 56.9 (1.8) | |
| Calf circumference | | | 35.9 (2.5) | 36.0 (2.9) | | | | | 34.7 (2.1) | 35.3 (2.2) | 34.3 (2.7) | |
| Chest circ.,resting | | | 99.6 (7.1) | 99.9 (6.3) | | | | | 99.6 (5.5) | 99.7 (5.9) | 96.2 (7.6) | |
| Chest circ.,maximum | | | 101.8 (6.9) | 101.7 (6.1) | | | | | 101.5 (5.4) | 101.7 (5.7) | 98.7 (7.4) | |
| Chest circ.,minimum | | | 97.6 (7.2) | 97.5 (6.5) | | | | | 97.8 (5.6) | 97.9 (6.0) | 94.5 (7.6) | |
| Upper arm circumference | | | 30.9 (2.7) | 30.5 (2.6) | | | | | 30.0 (2.4) | 28.7 (2.8) | | |
| Waist circumference | | | 95.5 (9.3) | 97.4 (8.9) | | | | | 97.1 (8.0) | 97.0 ( 7.6) | | |
| Head length | | | 19.6 (0.6) | 19.6 (0.6) | | | | | 19.5 (0.6) | 19.7 (0.7) | 19.7 (0.6) | |
| Hand length | 17.5 (1.2) | | 18.9 (0.9) | 18.9 (0.9) | | | | | 18.8 (0.9) | 19.0 (1.0) | 18.8 (0.8) | |
| Buttock-knee length | | | 58.6 (3.0) | | | | | | | 58.4 (3.2) | 59.1 (2.4) | |
| Buttock-popliteal length | 46.3 (3.6) | | 48.2 (2.8) | | | | | | | 48.1 (3.1) | 47.2 (2.5) | |
| Elbow to middle finger length | 44.2 (2.8) | | 46.8 (2.0) | 46.8 (1.9) | | | | | 46.6 (2.5) | 46.9 (2.8) | 46.4 (1.8) | |
| Shoulder to elbow length | | | 37.3 (1.8) | 37.4 (1.7) | | | | | 37.0 ( 2.1) | 37.4 (2.2) | 36.9 (1.7) | |
| Forward reach | | | 84.2 (3.7) | | | | | | | 85.9 (5.4) | 86.9 (3.8) | |
| Span | | | 178.7 (7.5) | 178.8 (7.5) | | | | | 177.6 (9.0) | 179.2 (9.9) | 174.0 (7.0) | |
| Skinfold(triceps) (right) | | | | 1.1 (0.4) | | 1.2 (0.3) | | | | 0.9 (0.4) | 1.1 (0.4) | |
| Skinfold(subscap) (right) | | | | 1.7 (0.8) | | | | | | 1.5 (0.7) | 1.6 (0.7) | |
| Foot height | | | | 26.3 (1.2) | 26.4 (1.2) | | | | 26.5 (1.3) | 26.8 (1.4) | 26.0 (1.0) | |
| Weight (kg) | 63.7 | | 76.6 (1.1) | 76.4 (1.0) | 65.6 (11.6) | 63.7 | | | 74.3 (0.9) | 75.3 (9.0) | 69.0 (10.5) | 63.7 (11.7) |
| Grip strength (left) (N) | | | 432 (88) | | | | 323 (58) | | | 352 (88) | 262 (80) | |
| Grip strength (right) (N) | | | 461 (88) | | | | 370 (68) | | | 412 (88) | 283 (78) | |

All measures in centimeters unless otherwise noted.

References:

[a] Molenbroek (1987; Netherlands;average of males and females).

[b] Borkan, Hults, and Glynn (1983; United States; males only).

[c] Damon et al. (1972; United States; males only).

[d] Friedlander et al. (1977; United States; males only).

[e] Dwyer et al. (1987; United States; average of males and females).

[f] Pearson, Bassey, and Bendall (1985; United States; average of males and females).

[g] Clement (1974; United States; males only).