

Inclusive Design: An Approach to Adapt Homes for the Elderly

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ABSTRACT

The aging trend of the world population has increased the number of elderly people. Older people prefer to spend most of their time at home. The problem is that today's homes are often unsuitable for the elderly and the disabled. Thus, problems of the current design approaches, which are based on percentiles as well as the tendency to involve the elderly and disabled people in society, have put the concept of inclusive design into consideration. Application of new design approaches, such as inclusive design allows designers to design products and services to meet the needs of a larger group of users regardless of their age and ability. Given the rapid aging of the world population, more research is needed to design specific products and environments for elderly people.

Keywords: Home design, Aging, Ergonomics, Adaptation.

INTRODUCTION

The aging phenomenon has been one of the greatest demographic changes of the last century [1]. The aging of worldwide population began in the mid-twentieth century among the developed countries. In recent years, this trend has also been observed in other countries. Population aging is mainly caused by the reduction in fertility and increase in life expectancy around the world [2, 3]. In less developed areas, fertility decline has started later but proceeded faster. Overall, global fertility decline is expected to continue. In the 1950s, life expectancy was 65 years in most developed areas, while it was 42 years in less developed ones. From 2010 to 2015, life expectancy reached 78 and 68 years in more developed and less developed countries, respectively. By 2050, life expectancy is predicted to reach 83 and 75 years in more and less developed areas. As a result, the rate of aging is assumed to increase in all parts of the world [2-5], so that the world's elderly population (65 years and older) is expected to triple by 2050 [6]. The elderly population has the fastest growth rate in the total population throughout the world. Consequently, the number of people over the age of 65 years is believed to surpass the number of individuals under the age of 14 years by 2050 [6, 7].

In the United States, this age group is supposed to double and reach 71 million by 2030 [8]. Statistics also show that the number of people aged 60 years and over has doubled in the last three decades so that the number of the elderly has been predicted to rise from 795 million in 2010 to 2 billion in 2050 [2, 4]. Moreover, by 2020, according to the World Health Organization (WHO), 20% of the world's population had been made up of people over the age of 60 years [9, 10].

Old people prefer to spend most of their time at home, where they have lived for many years [11, 12]. The home environment plays a key role in the autonomy, health

status, and independence of the elderly [11, 13]. In other words, the elderly prefer 'aging in place' because they feel more comfortable at their own home beside their family members [14]. By the very definition, aging in place refers to the ability to live in one's home and community safely, independently, and comfortably regardless of age, income, or ability [15]. However, since the home environment is designed based on the needs and abilities of young people, it cannot meet the needs of the elderly [11, 16].

According to the estimates provided by the United States Census Bureau in 2009, approximately 93% of Americans with more than 65 years of age lived in their homes and social environments; 2% resided in long-term nursing care centers, and 4% lived in their homes using supported living services [14].

The related literature has also shown that more than half of the elderly have difficulty performing their basic daily activities such as bathing, dressing, etc., and old people have higher rates of disability [9, 14, 17]. However, despite their physical and sensory limitations, the majority of the elderly have extensive abilities, which can be maximized if they are provided with a suitable environment [9, 18].

Old people, who live an active life are psychologically and physically healthier than the those with a sedentary lifestyle [9]. Furthermore, dimensions of life quality are lower in the elderly living in nursing homes than those residing in their homes [19].

The problem is that today's homes are often not appropriate for the elderly and the disabled [14]. In this regard, home improvement can reduce both these individuals' dependence in carrying out daily activities and the risk of accidents. Therefore, these residents will be able to spend more time in their homes safely and independently [14, 20].

Based on the literature, improvement of functionality and accessibility of home features is associated with the

elderlies' increased levels of well-being and independence in daily activities [21]. Despite the need for such improvement and its benefits, many old people refuse to modify their homes [14].

Aging and Declining Trend of Physical Activity Skills: People's abilities decrease as they become older [9, 17]. Moreover, age-related changes are not the same in all people and a great variety exists among the elderly regarding such changes [22, 23].

Based on statistics in the United States, more than 38% of people over 65 years of age report at least one type of disability, so that the highest prevalence of disability is related to this age group [24, 25]. In Europe, moreover, the prevalence of disability in people aged 65 years and older is was four and two times higher compared with individuals in the age groups of 15-44 and 45-64 years, respectively [25, 26].

In the aging process, different systems of the body degrade. Decreased abilities of the elderly increase their dependence on others and affect various aspects of their lives, including reduced vision, hearing, memory, and grip strength [27, 28].

Aging is further associated with a decline in motor, cognitive, and physical skills [22, 29, 30] such as fetching, bending, agility, vision [22, 29, 31], perception, and memory [22, 29, 32].

During the process of aging, adults become old and weak, their physiological capacities mostly decrease, and they become more susceptible to diseases [9, 33]. Aging is also connected with decrease in the biological actions so that the muscles become thinner and weaker and muscles responsible for rapid movements attenuate significantly. These changes can limit a person's performance; however, such restrictions vary from person to person [9, 34].

A recent survey in the UK found that the average life quality decreases in people over 64 years due to the disabilities related to mobility, vision, hearing, and memory [25, 35]. Furthermore, when individuals grow older, many of them experience physical and functional limitations, which challenge their daily activities at home and in the community [14].

Traditional Ergonomic Approach: Ergonomics is the science of matching the task with the individual and matching the product and environment with the user [36, 37]. Adapting the environment to humans is one of the main goals of this science [6, 38]. Ergonomics and human factor engineering explain human abilities and limitations by examining human features, structures, and processes

involved in designing products and environment [6]. Therefore, adapting the environment to humans is possible through appropriate design of the environment and attention to human capabilities.

Human adaptation to the environment can remarkable impact a person's life quality, spatial attachment, sense of well-being, and belonging [39]. In the traditional design process, anthropometric data are usually expressed as percentiles. Although this type of anthropometric data presentation seems simple, some issues arise when such data are used as a design criterion [40]; for example, departure of the elderly and people with disabilities form the designed structure.

Generally, environments are designed according to the youth capabilities; as a result, older users have more difficulty applying them [25, 41].

Currently, concerns exist about the application of public designs by the elderly and people with disabilities. In traditional product design approaches, these individuals are considered as sub-groups of the society and specific designs are considered for them [42-45].

New Approaches to Design: Given that there are problems in the traditional design process, new concepts have been developed in this field during recent decades, such as design for all, universal design, and inclusive design. The philosophy of all these concepts is to increase the accessibility of the designed environments to the majority of the population [40, 46].

The motivation behind developing such approaches is to consider the elderly and people with disabilities in project designs at the community level. All these philosophies try to meet the needs of more community members in their designs [42].

Inclusive Design Approach: Design is defined as the process of transforming an idea or market need into details that can lead to the production of a product or system [46]. The inclusive design approach entails an understanding the user diversity and taking this diversity into account while making decisions related to the product development to meet the needs of a larger group of users [42, 47] (Figure 1). This approach also reassure designers that products and services will meet the needs of a larger group of users regardless of their age and ability [42, 48].

In other words, inclusive design refers to designing products, services, and environments that can be used by the public regardless of their age or disability [16, 49].

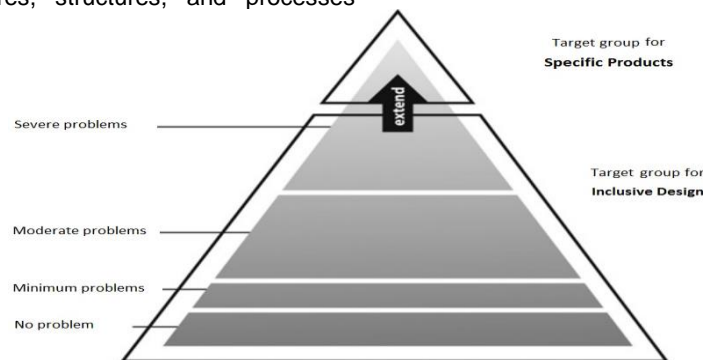


Figure 1: Inclusive Design using Population Pyramid Shows the Appropriate Response of Design to Population Diversity.

The 'What', 'Why', and 'How' of Inclusive Design

Approach: The 'what' of the inclusive design approach deals with understanding population diversity and responding to it by making the right design decisions. The dominant trend in designing is to design products based on abilities of the capable individuals, while people of different ages, abilities, as well as social and cultural backgrounds have different needs, wants, and preferences. The inclusive design approach is based on designing products and environments so that they can provide the best coverage for population diversity^[47].

On the one hand, population aging has opened up new opportunities for inclusive product design while reducing the financial risk of manufacturing products due to its suitability for a wider range of users. This lowers the cost of redesigning and adapting homes for the elderly and disabled people. It has also given a competitive advantage to the products designed by an inclusive design approach. In short, products and environments with better inclusive designs are more commercially successful and more satisfying for users, especially the elderly^[47].

Any design decision can potentially affect the involvement or non-involvement of users in design. The inclusive design emphasizes that understanding the diversity of users can be effective in making the right design decisions. The inclusive design should be considered in all decisions made throughout the whole process of product development. Specifically, a successful inclusive design requires decision making at the conceptual design stage because changes may be costly at later stages^[47].

DISCUSSION

The aging trend of the world population^[6, 25, 50-52] has increased the number of elderly people^[2, 3] due to the decline in fertility rate^[53, 54] and increase in life expectancy, as mentioned earlier^[54, 55]. In turn, this issue has exacerbated the living problems of the elderly^[54, 56]. In this regard, designing special products for the elderly can assist them with enhancing their daily life ability and improving their life quality, which are crucial in promoting social development^[54].

Considering that most seniors are retired, they have more leisure time and prefer to live in their own home and community environment due to familiarity and comfort^[14, 56-58]. However, studies have indicated that the elderly's homes often lack the required supportive features^[14]. Incompatibility between the elderly's home environment and their needs as well as the gradual reduction of their physical performance can enhance the risk factors of accidents and home injuries among this age group^[11]. As stated before, despite physical and sensory limitations, most elderly have extensive abilities, which can be maximized through providing them with the right environment^[9, 18]. Appropriate design of such individuals' living environment can also help them to live their daily lives independently and to have effective social interactions^[11]. Adaptation of the elderly's physical-sensory abilities requires investment and improvement of the existing environments and products^[29, 59].

So, to preserve the elderly population in the community, we need to design and build homes to meet their limitations. The growth of the elderly population has further increased the demand for long-term care services. The cost of long-term services provided at the nursing homes is much higher than the residence at home. Therefore, home features tailored to the needs of seniors can help them as well as the caregivers to perform daily activities more efficiently. Moreover, this adaptation can remove the costs of long-term care in nursing homes and nursing services at homes because the elderly's spouse or children can provide these services at home^[60].

In traditional approaches to ergonomics, including design based on percentiles (the 5th and 96th percentiles) potentially 10% of the population is excluded from the design. Although most problems are multivariate, percentiles are univariate. This is especially of great importance when designers and ergonomists intend to include the elderly and disabled people in the design because their inclusion requires them to make more extensive changes in design data compared to the time when the design is exclusively based on healthy and younger people^[40]. The anthropometric data obtained from the middle-aged population may not be appropriate for the elderly because the aging process significantly changes the variables related to the elderly's physical condition^[36, 61]. As a result, the elderly population is less considered in traditional design approaches. This is especially important in designing a home because a residential house may be used for several decades. However, the limitations of the elderly are not usually considered at the time of designing a house, which is mainly due to the low number of elderly in the community. Nevertheless, in the next decades, when the elderly population increases, making modifications in these houses is very expensive and usually impossible.

Application of new design approaches, such as inclusive design allows designers to design products and services to meet the needs of a larger group of users regardless of their age and ability^[42, 48]. The inclusive design refers to providing an independent life and increasing the quality of life of the elderly population^[2]. In this approach, integration of the disabled and elderly into the mainstream population is highly significant^[36, 48]. Besides, the inclusion of the elderly or those with physical disabilities in the inclusive design approach increases the market for designed products or systems^[36, 62]. Thus, problems of the current design approaches, which are based on percentiles as well as the tendency to involve the elderly and disabled people in society have put the concept of inclusive design into consideration^[16].

However, the inclusive design approach has faced with challenges. For example, design of products, processes, or environments should be appropriate at all times and for everyone, which is a difficult task to do^[46]. Moreover, designs should address the needs of a wide range of populations and a problem has confronted designers in this regard because inclusive designs lack the relevant data and tools required for designing products, processes, and environments^[40, 63].

CONCLUSION

Given the facts that upgrading inclusive design practices has been always a challenge for potential users due to the difficulty of providing accurate and relevant information [40], and understanding factors influencing design decisions and determining the number of people excluded from the design have been always a challenging part of inclusive designs, the data that directly or indirectly affect design decisions should be well determined and these changes should be well understood before making design decisions [40]. Proper inclusive design should also consider a wider range of population as real users instead of potential users [22].

Moreover, considering the rapid aging of the population, more research is needed to design specific products and environments for the elderly [36]. According to the green building principles, the health and safety of the residents are of priority, and adaptation of the physical environment to the residents is one of the important issues in this regard [64].

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