



A Conceptional Framework for Integration of Architecture and Gerontology to Create Elderly-Friendly Home Environments in Egypt

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Abstract

The global aging population is rising rapidly leading to significant impacts on the built environment. Egypt is expected to witness a notable increase in its elderly population, prompting a need for proactive measures to address the challenges and opportunities arising from this demographic shift. Architecture and gerontology are critical fields when understanding the person-environment relationship in later life. However, it is notable that all studies, laws, and research related to the elderly in Egypt have been approached from demographic, social, economic, political, and health, and have predominantly overlooked the significance of the built environment, particularly the relationship between the elderly and their home environment. Therefore, this research paper seeks to bridge this knowledge gap and aims to formulate a conceptual framework that establishes a theoretical basis for creating elderly-friendly home environments in Egypt. This framework is based on the idea of integration between architecture and gerontology through a human-centered design approach that places older adults at the core of attention. The research follows a descriptive-analytical methodology and an inductive approach, by conducting a comprehensive literature review in three main axes: gerontology, architecture, and human-centered design. Through the adoption of this proposed conceptual framework, the body of knowledge on creating elderly-friendly home environments in Egypt stands to be enriched. It can also empower architects, planners, policymakers, and other stakeholders to develop an elderly-friendly home environment; this environment is inclusive, accessible, and usable, supporting the elderly and promoting their health, and well-being, and allowing them "aging in place" independently and safely.

1- Introduction

Currently, two significant demographic shifts are reshaping the globe: the aging of populations and the process of urbanization. (Das, et al., 2022). The term "population aging" refers to a growth in

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the percentage of people aged over 60 years in the population, as a result of longer life expectancy and lower fertility rates (UN., 2013; WHO. 2015a). The global population is experiencing a significant demographic shift, with an increasing number of older adults in society. The number of people aged 60 years or older will rise from 900 million to 2 billion between 2015 and 2050, moving from 12% to 22% of the total global population (WHO., 2022). By 2050, it is estimated that 16% of the world's population will be aged 65 years or older, compared to 6% in 1990 (Das, et al., 2022). The number of persons aged 80 years or older is expected to triple between 2020 and 2050 to reach 426 million (WHO., 2022).

In Egypt's context, one of the main features of the Egyptian population over the last few decades is the gradual increase in the absolute and relative numbers of older people. Although Egypt is considered a young country, it is expected to witness fast and dramatic demographic changes. Recent decades have witnessed remarkable changes in both fertility and surviving rates. In Egypt, the Fertility rate decreased from 6.14 to 3.24 children per woman from the year 1971 to 2020 respectively; also, life expectancy levels improved for males and females (WDA. 2021). These changes in life expectancy and fertility led to a change in the population's age composition by increasing the number of older adults.

The population of the elderly in Egypt is growing rapidly. Classification of old age starts at the age of retirement (age 60). Nowadays, the Egyptian government has proposed to change the retirement age from 60 to 65 years by 2027; this probably may change the definition of old age in the future (Ahmed et al., 2014; Mostafa, 2013). According to the Central Agency for Public Mobilization and Statistics (CAPMAS), the current percentage of the elderly population (60 or more) in Egypt is 6.6% in 2022 (CAPMAS., 2022), However, the percentage is projected to be 10.9% in 2026 (Gadallah, 2015), and it is expected to reach 20.8% in 2050. This means that by 2050, the largest portion of the older adults in the region is expected to be living in Egypt (about 23.7 million) (Sweed, 2016).

Aging is attributed to the cumulative effects of diverse molecular and cellular damage as time passes. This results in a gradual decline in both physical and mental abilities, increased susceptibility to illnesses, and eventual mortality. Apart from biological transformations, aging is frequently linked to other life shifts like retirement, social isolation, relocating to more suitable housing, and experiencing the loss of friends and partners (WHO., 2022). according to the previous, as people age, they experience several changes that can impact their relationship with the world around them. Physically, they may become more vulnerable to illness and injury and may have difficulty performing routine tasks. Mentally, they may experience changes in cognitive function, such as memory loss or difficulty with decision-making. Socially, they may become more isolated as their social networks shrink or as they lose touch with friends and family members. All of these changes can impact how the elderly interact with the built environment, which can either facilitate or hinder their ability to engage in physical activity, social interaction, and access to services and resources, and can make it more difficult for them to maintain their independence and quality of life (Zheng, et al., 2022).

The built environment is the man-made physical surroundings and the settings for human activity where people can live, work, learn, entertain, and recreate daily (Kaklauskas and Gudauskas, 2016). This aging population presents unique challenges and opportunities for the built environment, particularly in urban areas where two-thirds of the world's population is expected to reside by 2050 (Das, et al., 2022). ***This paper focuses on the built environment, which plays a significant role in shaping the health and well-being of older adults.*** Research has shown that certain features of the

built environment can influence physical activity levels, social engagement, and overall health among older adults (Van Hoof, et al., 2018; Jarzebski, et al., 2021), Also, the built environment can influence behavior, attitudes, and perceptions of older adults, and in turn, their behavior can shape the environment (Tuckett, et al., 2018). This person-environment relationship is a theoretical framework that emphasizes the dynamic interaction between individuals and their environment. This approach recognizes that the built environment is not a static entity, but rather a complex system that is constantly changing and evolving (Bonaccorsi, et al., 2020). Therefore, understanding the person-environmental relationship is crucial for designing and implementing effective interventions that promote healthy aging and improve the quality of life for older adults. the built environment includes housing, outdoor spaces, public buildings, and transportation, ***this paper will focus on understanding the relationship between the elderly and their home environment for the following reasons:***

- According to Al-Tarazi (2021), individuals spend the majority of their lives within buildings, approximately 70 years out of an average life expectancy of 78.7 years, 50 of those years spent in residential buildings.
- In comparison to other age groups, the elderly spend almost 80% of their day at home engaging in various activities (Horgas et al., 1998).
- Despite the challenges of aging, it is preferable for older adults to continue living in their own homes not in nursing homes. Homes provide a familiar physical environment and emotional connections for the elderly (Stones & Gullifer, 2016; Chau & Jamei, 2021)
- During the COVID-19 pandemic, seniors have spent more time at home due to structural isolation measures, leading to concerns about social isolation and loneliness (National Academies of Sciences, 2020).

All over the world, sciences like gerontology, sociology, psychology, economics, geography, and architecture are all making efforts to deal with population aging problems and their impact on the built environment. Architecture and gerontology are critical fields when understanding the person-environment relationship in later life. Gerontology provides insights into the physical, cognitive, social, and emotional changes that occur as people age. Gerontologists can provide insights into the needs and preferences of the elderly population, which can inform the design of spaces that promote their well-being. also, Architecture, on the other hand, offers the means to shape the physical environment, accounting for these individual needs and enabling supportive settings. Architects can design spaces that increase the possibilities of active aging with quality of life.

Returning to the Egyptian context and considering the significance of the built environment and its impact on the well-being and independence of older adults, it is notable that all studies and laws related to the elderly in Egypt have been approached from demographic, social, economic, political, health, and recreational perspectives. However, little attention has been given to the aspects concerning the built environment, especially the relationship between the elderly and their home environment. Even the few and rare architectural studies have mainly focused on nursing homes, which are not favored by older adults, as mentioned earlier.

1-1 Research Aim:

This research paper seeks to bridge this knowledge gap and aims to ***formulate a conceptual framework that establishes a theoretical basis for creating elderly-friendly home environments in Egypt.*** This framework is based on the idea of interdisciplinary integration between architecture and

gerontology, from the perspective of the person-environment relationship through a human-centered design approach that places older adults at the core of attention.

1-2 Research methodology:

To achieve this aim, the research follows a descriptive-analytical methodology and an inductive approach through a comprehensive review of the literature in three main themes, figure (1):

- **Theme One: Gerontology** (the Elderly): Discussing and analyzing prevailing theories and concepts in gerontology from the perspective of the relationship between the individual and the environment.
- **Theme Two: Architecture** (the built environment): Discussing and analyzing concepts, theories, and approaches in architecture that support age-related changes and how our home environment can be designed, developed, or improved to be elderly-friendly.
- **Theme Three: Human-Centered Design** (the integrative relationship): Discuss its concept, tools, processes, and how the integration of architecture and gerontology can create a home environment that considers the physical, cognitive, and emotional needs of older adults.

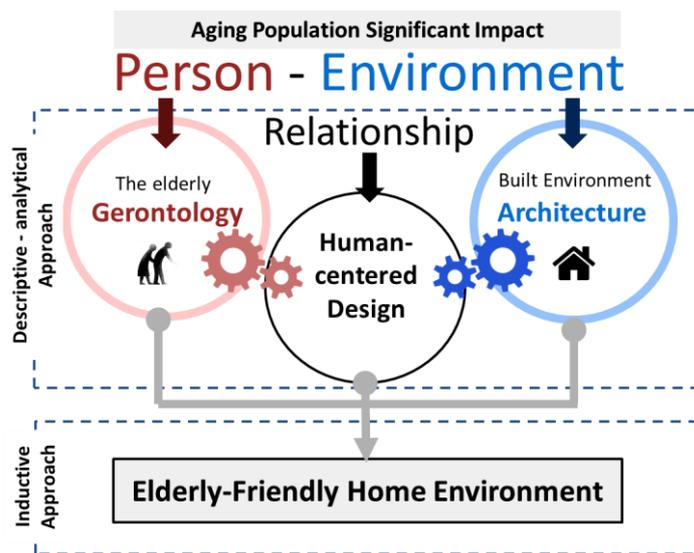


Fig. (1): The Research paper concept and methodology

2- Theme One: Gerontology (the Elderly):

Gerontology is an interdisciplinary field of study that focuses on the biological, psychological, cognitive, social, and cultural aspects of aging in older adults. Its goal is to raise awareness about aging through comprehensive and international studies in various disciplines, including biology, psychology, sociology, economics, political science, architecture, geography, public health, housing, and anthropology. Gerontology differs from geriatrics, which focuses on the treatment and medicine of diseases in older adults. Gerontology is concerned with the social, physical, and mental changes in the elderly and the impact of an aging population on society. It aims to apply its knowledge to programs and policies to improve the quality of life for older adults (Hooymann & Kiyak, 2008; Takahashi, 2019). Gerontology concerns life purposes for the elderly not only for their long lives but also for their quality of life. *Therefore, it must be emphasized that this paper deals with concepts and theories related to Gerontology, not Geriatrics.*

2-1 Gerontology different fields:

Gerontology has given rise to many subfields, including biogerontology, geographical gerontology, social gerontology, and environmental gerontology. The aging process is influenced by both internal factors such as genetics and external factors such as physical and social environments. While genetics were once thought to be the primary determinant of longevity, recent research has shown that environmental factors play a significant role in healthy and active aging (Matteson, 1997; Wahl, 2001; WHO., 2002). Different contexts in which the aging process occurs should be first understood to determine which field of gerontology is most relevant to the person-environment relationship.

2-1-1 Ageing process in various contexts:

The context of aging is a key feature in biological, social, and behavioral science models. Some biological characteristics are common among people in the last stage of the life course, although the fact that the aging process differs physically and socially according to various contexts (Golant, 1986).

- Biogerontological theories view aging as a chronological process associated with declining health and eventual death, with environmental factors such as temperature, stress, and diet playing a role in survival time (Vaupel et al., 2003).
- Social and behavioral sciences emphasize the impact of historical, cultural, and societal contexts on aging processes, with events, expectations, and norms shaping the life course (Wahl & Oswald, 2010).
- Psychological models of aging highlight the importance of the relationship between older adults and their environment, with adjustments necessary to accommodate changes in functional capacity or life events such as retirement (Baltes et al., 1998). Environmental gerontology focuses on the impact of physical surroundings on older adults, with research on housing and the ecology of aging contributing to our understanding of the role of the environment in healthy aging (Lawton and Nahemow 1973; Kahana 1982). Environmental psychology has also played a crucial role in aging research by emphasizing the importance of older adults' physical environments (Wahl and Weisman, 2003).

Drawing upon the preceding discussion, this paper focuses primarily on "Environmental gerontology," a field of gerontology that is deemed particularly suitable for examining the person-environment relationship during later life. The term "Environmental gerontology" underscores the interdisciplinary nature of the person-environment relationship in aging, drawing upon diverse fields such as psychology, sociology, architecture, social geography, occupational therapy, and urban planning (Wahl and Gitlin, 2007)

2-2 Environmental Gerontology:

Environmental gerontology, established in the 1960s, is a multidisciplinary field that studies the relationship between older adults and their social and physical environments to optimize their quality of life (Hoh et al., 2021; Rowles and Bernard, 2013a). Research has shown that older adults prefer to age in their original environments due to their attachment to place and spatial experience (Andrews and Phillips, 2005). The social-physical environment, particularly natural environments such as gardens and landscape views, has been found to contribute to longevity and quality of life for older adults (Sanchez-Gonzalez, et al., 2018). In the 1990s and the first decade of the twenty-

first century, environmental gerontology became a multidisciplinary field with researchers from various disciplines, including biomedicine, psychology, architecture, social sciences, behavioral sciences, engineering, computer science, ergonomics, design, and others collaborating on scientific research (Rowles and Bernarda, 2013b).

2-3 Theories of Environmental Gerontology:

The proliferation of societal welfare has facilitated an extensive lifespan, fostering communal support and caregiving for the elderly. Numerous theories of aging have been postulated and developed to address the healthy years associated with a prolonged lifespan. The 1970s, 1980s, 1990s, and 21st century shaped a significant development of Environmental Gerontology theories. Scientists of Environmental gerontology confirm that attachments to people's living places increase as long as they age, but at the same time their relations to the social and physical environment become more sensitive and vulnerable (Rowles, 1978; Lawton & Nahemow, 1973). ***Reviewing the Environmental Gerontology literature, there are three prevalent theories concerning the person-environment relationship: The Ecological Theory of Aging, the Environment Congruence Model, and Residential Normalcy. The following three sub-sections will illustrate them.***

2-3-1 The Ecological Theory of Aging

The Ecological Theory of Aging is created by Lawton and Nahemow (1973). This theory claims that the behavior of older adults is shaped according to the environmental circumstances and pressure that face them and their competencies; see figure (2) (Lawton and Nahemow, 1973).

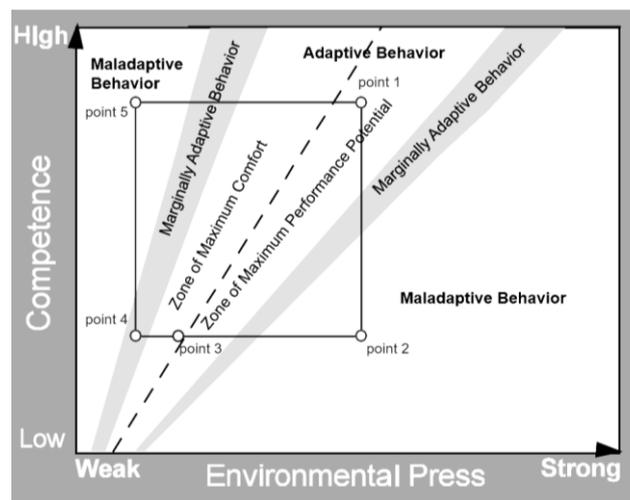


Fig. (2): Ecological model of aging (Lawton and Nahemow, 1973)

The ecological model is developed by Lawton and structured on three main pillars: persons, environments, and the relations between the both of them. This descriptive model represents the concept of the person-environment relationship and its impact on older adults' choices and compromises in their daily life to maintain their independence and autonomy. The competence (vertical axis) represents independence; it's a universal indicator of strength or weakness of personal ability that includes physical, mental, or emotional qualities. While Environmental Press (horizontal axis) represents difficulties of the built environment; it's a universal indicator of a supportive or unsupportive environment that includes friendly or hostile qualities of the environment. Adaptation level (The diagonal dashed line) represents the theoretical mean for

persons with average competence. The shaded area on the right and left sides of the adaption level line represents the positive effect; this positive effect means that the person is feeling comfortable in his/her environment. While the Negative effect is located far away from the adaption level; this negative effect means that the environment seems to be more stressful and less tolerable due to sensory deprivation of individuals. As a person's competence degrades, they are exposed to additional environmental stresses, which can lead to maladaptive behavior. On the other hand, adaptive behavior can keep a person's mood in the positive zone (Regnier and O. Byerts, 1983).

As a person's ability to act independently degrades according to his/her changes in functional abilities, he/she can have different positions in the ecological model. According to Figure (2), Point 1 represents a condition that satisfies the relation between environmental stress and personal competence. Point 2 represents a less satisfactory relation between the same environment and human competence (low independence due to illness or accidents). Point 3 represents a condition with less environmental stress (which is a different position where more assistance is provided). Point 4 represents a situation in which the environment is offering excessive care (nursery home, hospital, etc.). Returning to functional competence (recovery from an accident or illness), a person can proceed to point 5 with low environmental stress. When this low stress becomes unacceptable, they might return to point 1 (Regnier and O. Byerts, 1983).

Environmental gerontology challenges the conventional portrayal of older adults as passive and reliant on their surroundings. Instead, it acknowledges that older individuals can remain highly active and productive, adapt to their physical and social environments, and make valuable contributions to society. To explain these ideas, alternative theoretical approaches have been introduced within this field. These approaches illustrate the process of negotiation, wherein individuals modify their behavior patterns and/or environmental factors to suit their living conditions based on their personal abilities. This adaptation stems from interactions between the person and their environment, which can be categorized into four types: responsive (impact of the environment on health and user behavior), interpretive (effective processes and sense of place), evaluative (assessment of the built environment and attitudes), and operational (actions taken to modify the built environment). Additionally, the interactions between older adults and their environment should be examined at three levels: macro (national and city context), meso (neighborhood), and micro (elements within the home) (Stokols 1978; Lawton 1985).

2-3-2 The Environment Congruence Model:

The Environment Congruence Model by Kahana (1975, 1982) is a theory of person-environment relations applied to gerontology; Kahana, like Lawton, shows that the built environment and an older adult's ability impact the well-being of their surroundings. The Congruence Model establishes a best-fit interaction between older adults and their surrounding environment to analyze the influence of the environment on a person's well-being. According to Kahana, an individual's desires must be congruent with the most suitable environment, and the ideal setting must be customized to the individual. Congruence is defined as an individual's sense of well-being, and the individual's behavior changes in response to his or her surroundings. The model considers an individual's requirements and preferences, as well as the environmental relation between individuals' needs and what the environment offers; as shown in Figure (3). Individual needs and preferences are addressed, which leads to the provision of personalized solutions for the aging consumer instead of a "one size fits all" policy. Congruence between environmental conditions and human needs is vital, especially for older persons who have restricted environmental and individual

options. The level of congruence is influenced by individual and environmental variables, including forms of housing and personal attributes such as health status, age, level of functioning, ethnicity, socioeconomic position (SES), and experience (Kahana, 1975, 1982; Gupta, 2017).

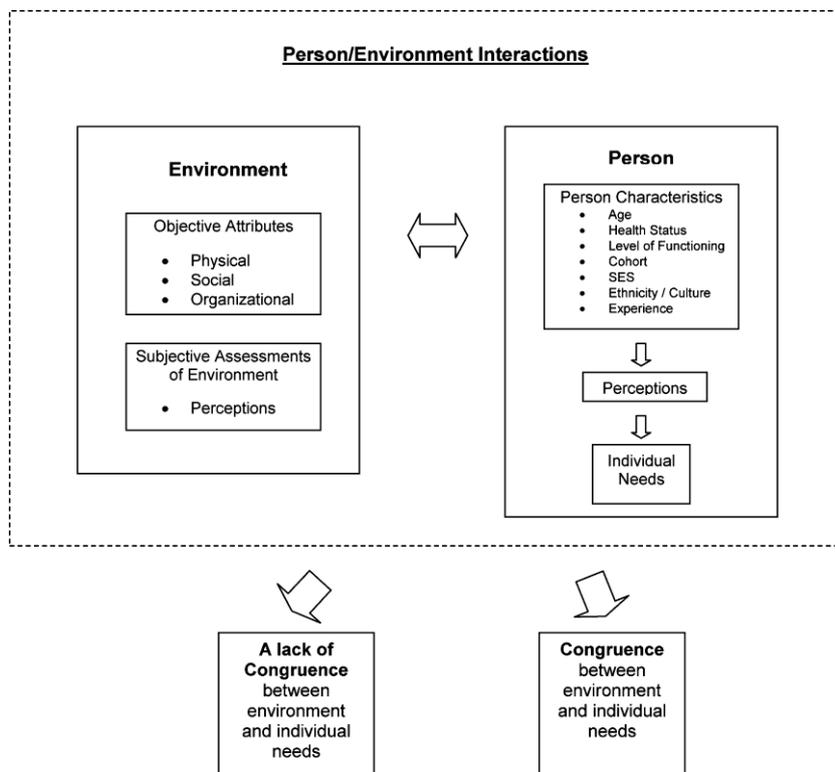


Fig. (3) The Environment Congruence Model (Adapted from Kahana, 1982)

The congruence model emphasizes the importance of a proper alignment between the objective and subjective environment, as well as the subjective and objective characteristics of the individual. It also proposes a close association between the mental health of older adults and the availability of resources in their environment. According to the model, environmental resources are expected to be more abundant to compensate for limitations in individual resources among older adults. The model views the relationship between older adults and their environment as an ongoing transaction, as older adults strive to cope with how well they fit in with their surroundings. Both the individual and environmental resources are seen as relatively flexible, adaptable, and subject to negotiation in accordance with the transactional model. This represents a notable improvement over previous adaptation and adjustment models, which viewed the environment as mostly inflexible, stable, and unchangeable. Consequently, when personal resources decline, older individuals are generally expected to adapt (Fry, 1990).

2-3-3 Residential Normalcy Theory:

In Residential Normalcy Theory, Golant (2018) claims that the elderly are “motivated to initiate coping actions when they feel out of their residential comfort and/or mastery zones” Figure (4). Golant relies on Lawton's, Nahemow's, and Kahan's person-environment interaction theories, as well as the fit-congruence environment model, to understand why certain older adults, have more evolved coping competencies and age more successfully (Golant, 2018).

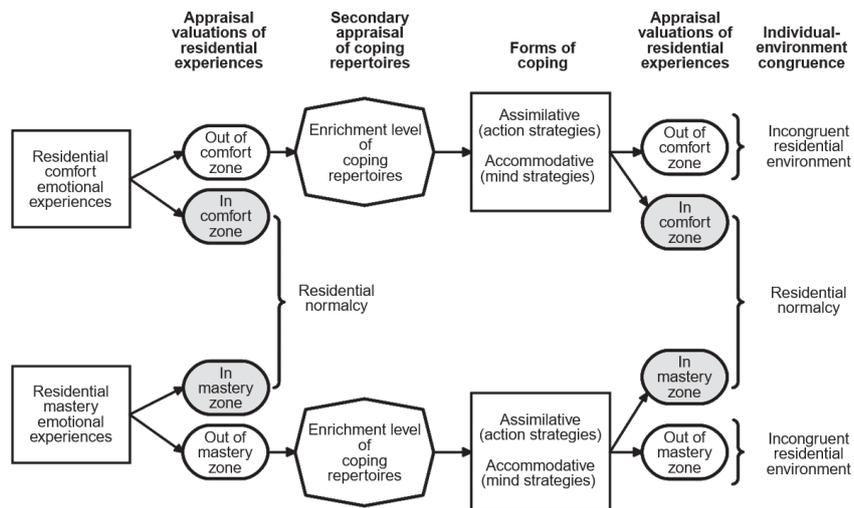


Fig. (4) Residential Normalcy Theory (Golant, 2014)

The Residential Normalcy Theory emphasizes how “older individuals differently coped with their incongruent residential environments”. According to this, two major factors impact on person's ability to learn adaptive behavior. The first factor is a person's personal assessment of unmet needs. The second factor is how they interpret information (Golant, 2014). Golant demonstrates that object indicators can help to build resilient residential environments. As Golant argues that different individuals can assess the same object in various ways, people's coping strategies may become highly individualized. Even when older people successfully cope with their appraised incongruent residential settings, their adaptive responses may unintentionally result in new negative residential experiences. (Golant, 2014).

By reviewing theories and ideas related to environmental gerontology for Lawton, Nahemow, Kahana, and Golant, it can be said that the interaction between individuals (the Elderly) and their living environment requires an understanding of a person's capabilities, competence, and environmental requirements. These requirements must be compatible with a person's capabilities and match individual needs that make them adapt to their environment and feel their Comfort Zone (the place and society they prefer and love to live and interact with) and Mastery Zone (being able to perform his daily activities safely and independently), as shown in Figure (5).

Comprehending the diverse physical and social factors that impact the daily lives of elderly individuals is of utmost importance in the context of an aging society. Successfully managing all these factors that influence aging presents significant complexity. Hence, any study in environmental gerontology that merely assesses life events without proposing solutions, overlooking social issues, neglecting the experiences of the population, or failing to involve social partners in training would have limited practical value, especially when applying models from other countries with different cultural backgrounds.

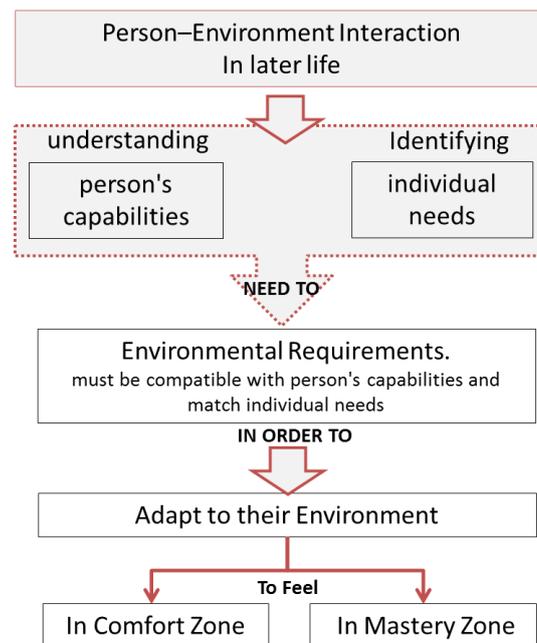


Fig. (5) The dynamic interplay between older individuals and their living environment (Compendium of environmental gerontology theories)

2-4 Prevalent Concepts in Environmental Gerontology

A study conducted a quantitative analysis of the empirical environmental gerontology literature published between 1989 and 2000 based on three main keywords (aging, environment, and behavior) and found that environmental gerontology strongly stemmed from a psychology-based perspective. The study focused on the relationship between elderly behavior and their socio-physical environments based on empirical criteria and distinguished three basic research themes: The first theme is the private (traditional) home environments, the second is the planned environments (nursing homes, assisted living facilities, etc.) and the third is residential decisions (decisions to move from one home to another, from home to institution, or from institution to home). The results indicate a gradual decline in studies towards planned environments and residence decisions, but a growing interest in research related to private home environments in the late nineties and the beginning of the new millennium figure (6). ***This reflects the researchers' interest in studying the behavior of adults aging in their own home environment, based on their desire towards a trend called "Aging in Place"*** (Wahl, 2001; Wahl & Weisman, 2003).

(Askham et al.1999) investigated the preferences and needs of older people regarding their living environment. They revealed that policies, as well as older adults' needs, have a significant impact on how long they decide to remain in their homes. It is well-known that most older adults value being in their familiar environments and prefer to continue living in their homes under the concept of "Aging in place" (Means, 2007). This is because self-reliance, self-management, and self-esteem are promoted by independent living (Milligan, 2009).

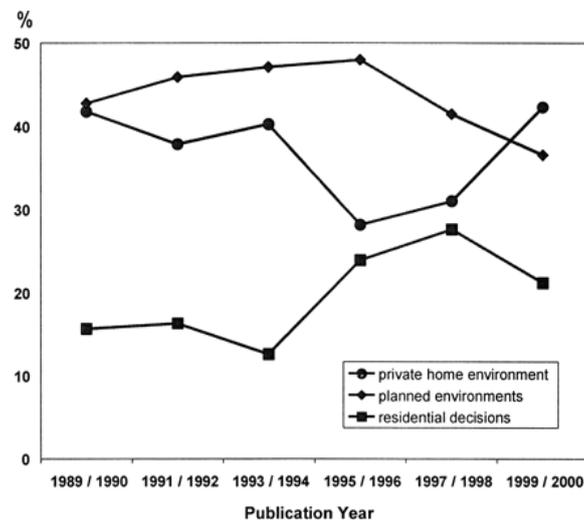


Fig. (6) A quantitative examination of empirical research from 1989 and 2000, focusing on aging, environment, and behavior (Wahl & Weisman, 2003).

2-5 Aging in place:

Environmental gerontology helps us understand how people interact with their environments as they age (Chaudhury and Oswald 2019). With the rising population aging in many countries, “Aging in place” -a common trend in environmental gerontology- has become a cost-saving strategy for stakeholders and a sign of independence for the elderly (Lewis and Buffel 2020). The World Health Organization’s work on healthy aging and age-friendly cities has also focused on the socio-physical environments of aging (WHO., 2007; 2015a).

“Aging in place” refers to older adults who prefer to age (most frequently through the end of their lives) in their homes, in spaces that represent their lives, and ideally close to family and friends (WHO., 2015a). The goal is to maintain and extend the circumstances that enable older adults to live their daily lives in their homes with a minimum amount of independence, as an alternative to institutionalization (Wiles et al. 2012; Mauk, 2014; Grimmer et al., 2015). This may require home modifications, assistive devices, and in-home services to meet the challenges of aging (Mauk, 2014; Grimmer et al., 2015; WHO., 2015b). The notion of “aging in place” has gained significant popularity in environmental gerontology literature, to the extent of being almost obsessively emphasized (Rowles and Bernard, 2013b). Despite the focus on older people remaining in their homes, there have been few attempts to provide a comprehensive view of the issue, with definitions often being overly simplistic and only partially representing the experiences of the elderly (Bigonnesse and Chaudhury 2019).

Previous studies have shown a preference for aging-in-place, and home-based care over institutional care (Grabowski, 2006; Judd et al., 2010; Lewis & Buffel 2020). This is due to the pleasure it brings to older people, its cost-effectiveness compared to options like nursing homes and care centers, and the positive health outcomes it offers for older adults, including potentially extending life expectancy. As a result, the term “Aging in Place” has become a cornerstone of research on later-age residential dynamics, support, and well-being over the past three decades (Vasunilashorn et al., 2012).

2-5-1 Overarching principles of aging in place:

The concept of "Aging in place" can be interpreted in terms of five guiding principles. They comprise theoretical assumptions and underlying structures that must be explicitly expressed to better understand how aging-in-place operates and how it can be supported.

- **1st Principle: "Aging in Place" a Complex Interactive Phenomenon:** Aging in place is a multifaceted and dynamic process that entails intricate interactions between older individuals and their social and physical surroundings. It is not a result nor a conclusion but rather an ongoing equilibrium between individual needs and capabilities and the resources and demands offered by the environment. This concept finds support in The Environment Congruence Model (Wahl et al. 2012).
- **2nd Principle: Empowering Active Protagonists:** The elderly individuals who age in place are active agents in shaping their lives within the context of person-environment relations. They should not be seen as passive victims of their surroundings. However, it is essential to recognize that some elderly may face challenges in taking on active responsibilities due to social exclusion, inequity, or marginalization. Future research on "Aging in place" should incorporate empowerment strategies and explore the role of responsibility (Dannefer and Huang, 2017).
- **3rd Principle: "Aging in place" Focus on Well-Being:** The primary goal of "aging in place" should be to improve the quality of life for the elderly. If "aging in place" negatively affects well-being, alternatives must be considered to avoid disempowerment and marginalization. The assumption that "aging in place" is universally the best option is problematic, as certain contexts, such as insecure or gentrifying districts, may cause them to be "stuck in place" and, as a result, can adversely affect the physical and mental health of the elderly (Golant, 2015; Smith et al., 2018). Researchers, policymakers, and stakeholders must be aware of potential negative consequences.
- **4th Principle: Customized Approach to "Aging in place":** "Aging in place" is not a one-size-fits-all concept and varies across individuals, cultures, regions, and socioeconomic settings. The definition of AIP, the concept of "home," and the strategies enabling AIP to differ for each case. Initiatives promoting AIP should be flexible and adaptable, accommodating the unique needs and realities of different communities (Wiles et al., 2012; Vasara, 2015).
- **5th Principle: Multidimensional Approach and Collaboration:** Understanding "aging in place" requires an ecological perspective, considering various environmental scales and interdisciplinary collaboration. "Aging in place" is influenced by individual, societal, and physical factors, which interact at different geographic levels, from home to neighborhood and city. Policymakers and researchers must employ an ecological framework and use multiple methods to develop effective "aging in place" initiatives and policies (Wahl et al. 2012; Greenfield 2012).

In summary, aging in place represents not just a philosophy but a concept that fosters independence and the capacity to reside in various living settings. Irrespective of age or abilities, effectively implementing the principles of aging in place enables individuals to thrive in an environment of their choosing. When comparing available alternatives like residing in nursing homes or assisted living facilities, staying at home, especially with an optimized living environment, emerges as the most preferable and cost-effective option. The idea of aging in place signifies an enduring cultural advancement that will reshape our perspectives on our living environment.

3- Theme Two: Architecture (the built environment):

Architecture is a multifaceted concept that lacks a universally agreed-upon definition. Scholars and architects have offered their own interpretations of architecture. According to the Oxford Dictionary, architecture is the art or practice of designing and constructing buildings. Lefebvre (1991) defined architectural space as a social product and argued that architecture is a social construct based on values and social meanings. Rybczynski (1986) argues that architecture is about producing space on various levels, from furniture to landscape. Andersson (2011) suggests that architecture involves formulating spaces for particular purposes, influenced by cultural and social values, and involves a collective effort and democratic decision-making process. Heidegger (1971) links notions of architecture with notions of residence, habitation, and belonging, suggesting that housing is the primary purpose of construction and dwelling implies a sense of attachment and belonging to the place. Thus, architecture is not just about constructing buildings but also about creating spaces that evoke emotions and psychological comfort. *In this study, architectural design, interior design, landscape architecture, physical planning, and urban planning are combined under the roof of a comprehensive definition of the word architecture: architecture is the physical, social, and cultural product that results from the process of planning, designing, and setting the environment for human usage.*

3-1 Aging Process in the Architecture Field:

Within the context of architectural discourse, aging assumes a crucial role in the essence of existence, being regarded as an indispensable facet of life. This perception stems from the recognition that aging necessitates the ongoing cultivation of skills and an assimilation of novel knowledge to enhance one's own competencies. Architecture, in this regard, serves as a compelling testament to the intrinsic nature of aging. Indeed, certain architectural endeavors deliberately consider age as a pivotal factor in their design, catering to specific groups such as children in educational facilities like kindergartens, schools, colleges, student dormitories, and universities. Additionally, spaces tailored for older individuals also bear the imprint of age-related considerations, although there exists a debate regarding whether the emphasis lies on age itself or the potential vulnerabilities that accompany the aging process.

The understanding of age, space, and spatial behaviors within the domain of architecture is not explicit but rather assimilated as tacit knowledge. This implicit understanding is seamlessly incorporated into the "reflection in action" methodology, a defining characteristic of professions that apply theoretical knowledge to pragmatically address pertinent issues (Andersson, 2011).

Aging exerts a transformative influence not solely on an individual's physical characteristics and interactions with the environment but also impinges upon their cognitive perception and utilization of spatial surroundings. Consequently, the study of aging assumes paramount importance within the realm of architecture and necessitates thoughtful considerations in the design of spaces tailored to accommodate the needs of an aging populace.

The built environment is primarily intended to accommodate the requirements of an adult with full cognitive and functional abilities. The ecological model of aging, developed in environmental gerontology, provides a framework for understanding how architecture can support older adults (Lawton and Nahemow, 1973). This theory proposes that human behavior is influenced by both environmental pressure and personal competencies, the greater an individual's cognitive and functional competence, the less they are influenced by environmental pressure. Consistent with this,

the less competent a person is, the more they are affected by their environment (Svensson, 1996). Therefore, The theory highlights the challenge in architecture of creating solutions that are applicable to a broad population and implies that architects should design spaces that accommodate users' competencies and are inclusive of all ages and abilities.

3-2 The interplay between Architecture and Aging at different spatial levels

The built environment encompasses human-made surroundings that facilitate daily human activities, such as daily human habitation, working, education, recreation, and relaxation (Kaklauskas & Gudauskas, 2016). Architecture and Aging are related to all aspects of a built environment. The ecological theory of aging discusses various scales (depicting diverse physical and behavioral settings) that affect individuals differently, while the zooming capacity of architecture describes degrees of spatial cognition from comprehensive to individual usage (see Figure (7)). Thus, architecture's inclusive definition can be connected to gerontology through spatial scales ranging from macro (city/urban setting), Meso-scale (neighborhoods and districts) to micro (site/building design)



Fig. (7): Architecture and Aging through spatial scales (Lulle, 2019; Sharifi & Yamagata, 2018)

3-2-1 The macro level:

- Architecture is a vital aspect of natural and physical planning, as it helps to organize space for different purposes. This includes balancing agriculture with built environments, arable land with industrial plants, and natural resources with infrastructure and other spatial settings that benefit society's welfare and modernity. The space is structured in a way that accommodates specific functions and prioritizes the creation of a sustainable environment. These requirements are determined through public political discourse to achieve the desired societal model.
- At the macro level, various environmental factors influence the perception of community care support among elderly individuals. This level primarily involves the support provided by institutions and policies, such as community support services. Previous research has demonstrated that community-based services and healthcare facilities play a crucial role in enabling older adults to age in place successfully. By offering appropriate community support services, older adults can maintain an active lifestyle within their homes and communities while receiving the necessary daily assistance (ARCC, 2011; Davey, 2006). These services can also contribute to slowing down physical decline and postponing institutionalization. Tang and Pickard (2008) classify personal care and health/prevention care services as part of community care support.

3-2-2 The meso level:

- This level of architecture involves a more nuanced approach to urban settings with human interactions with space. Collective use of space can be observed, and the process of human appropriation, involving either a group or individual user, becomes apparent.
- This level serves as an intermediary between the micro-scale of individual homes and their immediate surroundings, encompassing neighborhoods and communities. Rioux and Werner (2011) emphasized the significance of integrating a dwelling with its physical and social community rather than isolating it. While the design of a home is essential for older adults, the community and neighborhood can also have a profound impact on their health (Glass & Balfour, 2003). Older individuals who have lived in a neighborhood for an extended period tend to become closely connected to its physical and social contexts. While the physical community environment and individual functional abilities are crucial, subjective feelings about the neighborhood and social interactions with friends and relatives are also vital factors for elderly satisfaction (Gory et al., 1985). To ensure successful Aging-in-Place, it is imperative to consider elderly individuals' perceptions of their neighborhood environment (Oswald et al., 2011).

3-2-3 The micro level:

- At this level, architecture encompasses a group of buildings or individual structures. Similar to the meso level, human interactions with space involve both collective and individual use. The appropriation of space occurs both within and between architectural structures.
- The ecological model defines the micro-level as the smallest environmental level that directly affects an individual's life. This level is crucial for older adults, especially those with mobility issues, as their homes are more than just a physical entity. Social and symbolic aspects are closely linked to their homes, making housing design critical for aging in place. Studies have found that the physical home environment directly impacts the quality of life and daily activities of older adults, affecting their psychological well-being and competencies. Enhancing the built environment can increase older persons' functional competence, as they often face challenges in their physical homes. Therefore, improving the home environment is crucial for older adults' well-being and ability to age in place (ARCC, 2011; Gitlin et al., 2008; Hwang et al., 2011).

This paper argues that architecture operates primarily at the macro, meso, and micro levels of space, corresponding to physical planning, detailed planning, landscape architecture, and architectural design. However, a common characteristic across these levels is the lack of a clearly defined user. In this context, a collective group is assumed to exhibit standardized patterns of spatial behavior and usage. Age and aging are considered less relevant, except for the general division of space intended for children versus adults. Instead, the aging process is incorporated into the concepts of accessibility and usability. The keywords of accessibility and usability enable architecture to expand into related fields of research, shifting focus from faceless users to the individual. In this context, aging and age-related issues become fundamental parameters for changes in the built environment, ensuring an accessible and usable environment for all.

3-3 Architecture Concepts and Approaches Supporting Aging-in-Place

As per Alexander et al. (2012), the increase in life expectancy, along with the subsequent growth of the older population and their preference to age in familiar environments, requires architects to

consider the requirements of an aging populace when designing. Hence, the primary goal of architecture is to enable and encourage a comfortable and profoundly satisfying life.

Kahana (1987) argues that in order to support the concept of Aging-in-Place and to meet the evolving needs of individuals throughout their lives, it is essential to maintain autonomy, overall health, and safety. *The relationship between an individual and their environment within an architectural space is underpinned by two key concepts: Accessibility and Usability.* Both concepts encompass a degree of flexibility and have become increasingly relevant in ensuring congruence between older adults and their access to societal information, services, and the built environment. Iwarsson and Wilson (2006) contend that accessibility and usability are particularly important aspects of safety and health in housing. They argue that an individual's ability to maintain independence in daily activities is a crucial indicator of health, which can be supported by an environment that is accessible, usable, and supportive.

Sinclair et al. (2020) suggest that Usability serves as a complement to Accessibility in the person-environment interactive relationship, enabling residents with a wide range of abilities to live independently, safely, and comfortably while minimizing the need for subsequent alterations and retrofitting. While both Accessibility and Usability influence an individual's ability to navigate their environment functionally, *Accessibility is more concerned with adherence to official regulatory guidelines and norms. In contrast, Usability focuses on the user's perception of their individual functionality within the environment across physical, social, and psychological dimensions* (Fänge & Iwarsson, 2005; Golant, 2003). Although both Accessibility and Usability are important considerations in the interaction between individuals and their environments, it is important to note that an environment that is accessible may not always be usable (and vice versa). Kose (2021) argues that achieving a fully accessible and usable built environment remains a significant challenge due to the diverse needs and abilities of individuals and the difficulties associated with designing for an entire population using a single approach.

Research centered on older adults and the built environment demonstrate a considerable preference for "aging in place" within this population. An examination of existing literature reveals the development of various design theories, concepts, and approaches aimed at enhancing accessibility and usability by Integrating principles that consider to the aging process when designing the built environment. These approaches encompass barrier-free design, accessible design, adaptable design, transgenerational design, and universal design, which can be summarized as follows:

3-3-1 Barrier-Free Design:

Barrier-Free Design is an approach that aims to improve accessibility for specific groups of individuals with impairments, such as wheelchair users, by removing physical barriers from the built environment (Herssens, 2013; Froyen, 2002). It focuses on creating environments that are accessible to people with mobility impairments to promote equitable access to buildings and public spaces.

3-3-2 Accessible design

The term Accessible Design was used to describe initiatives aimed at improving accessibility and was generally viewed more favorably than Barrier-Free Design. However, Accessible Design is a broader concept that encompasses barrier-free design and goes beyond physical accessibility and was more closely associated with legislative requirements (Herssens, 2013). Accessible Design aims to create products, spaces, and environments that meet established code requirements, and are

useable and Accessible by people with a wide range of abilities and disabilities (Story, 1998; Persson et al., 2015).

3-3-3 Adaptable design

Adaptable design involves modification of standard design to make it usable for an individual as needed. It offers design features that can be utilized by individuals with disabilities, but these features are concealed or left out until necessary. Such features can be adjusted or easily added or removed to "adapt" the environment for specific individuals. Adaptable design is especially beneficial in spaces where the users' needs may evolve over time, such as homes (Carr et al., 2013; Powell et al., 2017; Peters & Masoudinejad, 2022).

3-3-4 Transgenerational design

Transgenerational design, also known as lifespan design, takes into account the changes that occur in individuals as they age (Pirkel, 1994). The primary goal of this design approach is to foster compatibility between generations by developing products and environments that cater to the physical and sensory limitations commonly associated with aging. These adaptations address challenges that might hinder older adults' daily activities. The transgenerational design promotes accessibility and inclusivity for all ages by taking into account the requirements of individuals throughout their lifespan (Pirkel, 2008).

3-3-5 Universal design

Universal design embodies a comprehensive and holistic approach that seeks to create products and built environments that are accessible, usable, and understandable for everyone (Preiser, 2001). This approach encompasses not only wheelchair users, but also those with mobility, hearing, speaking, cognitive, and other disabilities that can arise throughout a person's life (Hardie, 2015). Universal design is founded on the idea that there is only one population, comprised of people with various qualities and abilities (Iwarsson & Sthl, 2003). The Center for Universal Design led by R. Mace defines universal design as: "The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Mace, 1997), also it developed a set of seven Principles of Universal Design can be used to guide the process of design, assessment of existing or new designs, and educate both designers and users about the features of more usable products and settings, The seven principles are (Story,1998):

(1) Equitable Use, (2) Flexibility in Use, (3) Simple and Intuitive, (4) Perceptible Information, (5) Tolerance for Error, (6) Low Physical Effort, and (7) Size and Space for Approach and Use.

These universal design principles not only meet building code standards for design but also go beyond these basic needs to promote equality in terms of use and accessibility for a wide range of individuals. This strategy promotes a shift in mentality towards equality and democratic governance for all individuals, particularly the growing elderly population. Universal design has the potential to enhance successful aging by assisting continued participation in life activities (Ahmer, 2021).

By reviewing different design concepts and approaches that seek to achieve accessibility and usability for the elderly in the built environment, we find that:

In examining design features catering to the needs of older adults, issues related to barrier-free, accessible, and adaptable design emerge. Although these features offer beneficial accommodations, their conspicuous and functional appearance has been associated with visual symbols of disability, potentially leading to a sense of segregation and stigmatization among users (Story, 1998;

Deardorff & Birdsong, 2003; Audirac, 2008). Moreover, specialized adaptations and equipment required for these features can incur substantial financial costs, especially when implemented as retrofits in existing spaces (Story, 1998).

An alternative approach, transgenerational design, seeks to anticipate physical and sensory impairments linked to aging during the initial planning stages (Pirkl, 1995). While this design strategy considers the changes individuals undergo over their lifetimes, it may not comprehensively address the diverse spectrum of disabilities or usability concerns related to gender differences, cultural backgrounds, or literacy levels (Helvacioğlu & Karamanoglu, 2012). Consequently, Accommodations for different populations might be unintentionally disregarded., and the emphasis on "age" in transgenerational design could still contribute to potential stigmatization (Story, 1998; Keates et al., 2000).

in contrast, universal design aims to create accessible and usable environments without promoting stigmatization or ageism. These design principles are not specialized but integrated into the environment from the outset of planning. The universal design represents a design philosophy that not only embraces the concepts of accessibility and barrier-free design but also advocates for a broader paradigm that celebrates diversity and includes all users, regardless of age or ability.

Figure (8) provides a proposal for the relationship between universal design and other design approaches, The proposed model illustrates the interplay and overlapping nature of these concepts, contingent on specific contextual factors, thereby facilitating the creation of accessible and user-friendly environments to optimize the aging process. Nevertheless, exceptions do exist, wherein a design solution may embody one aspect but not the other, delineating the absence of complete overlap between the terms. While all these terms fall under the umbrella of universal design, certain situations may render a design solution accessible to one population but not to another, thereby placing it outside the realm of universal design.

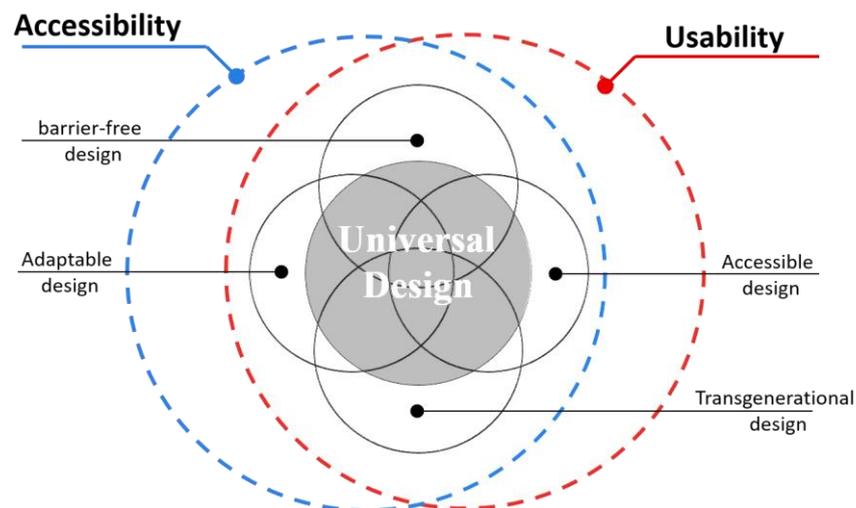


Fig. (8) Proposed Model of the Relationships among Barrier-free, Accessible, Adaptable, transgenerational, and Universal Design

Among the various design approaches aimed at accommodating the aging process, the philosophy of universal design emerges as an exceptionally desirable option due to its ability to furnish built environments that benefit all individuals, while concurrently mitigating stigmatization and enhancing engagement in daily activities. An additional appealing facet of universal design is its

conceptual nature, unburdened by strict enforceable codes, affording designers greater flexibility in catering to user needs. At present, the universal design stands as a promising and voluntary philosophy. Collectively, it becomes evident that implementing universal design in the built environment represents a crucial stride toward enabling successful aging for the elderly population.

3-4 Universal Design: An approach to successfully Aging-in-Place:

As we mentioned before, Research specific to older adults and the built environment highlights the preference of older individuals to age in familiar environments and emphasizes the need for constructed settings that are friendly, accessible, and usable for older persons. Universal design is identified as a strategy to address this demand, creating inclusive environments beneficial for individuals of all ages and abilities.

The capabilities and needs of older adults concerning their living environment vary significantly due to the aging process, which manifests differently in each individual (Shabalin, 2018). There are numerous techniques for defining older individuals' needs and capacities. One method is to assess a person's ability or inability to accomplish a standardized set of activities known as Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) (Crews & Zavotka, 2006)., Both of them are crucial for successful aging (Edemekong et al., 2017; Pashmdarfard & Azad, 2020).

The built environment significantly impacts older adults' ability to age in place, making it essential to consider universal design principles for positive changes in the person-environment relationship to support aging in place (Liu & Lapane, 2009). Recommendations based on crucial Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) that are recognized in the literature and directly linked to the built environment are provided in Table 1 (Fricke, 2010; Carr et al., 2013). Implementing the universal design options in Table 1 would enhance older adults' ability to perform ADLs and IADLs, fostering independence in social and productive activities and promoting active engagement in life.

Researchers have highlighted the benefits of universal design in creating age-friendly environments, as it supports people of all ages and abilities, accommodates changes that come with aging, and aids in reintegrating older individuals into society by eliminating barriers and stigma (Crews & Zavotka, 2006; de Souza & de Oliveira, 2016; Iwarsson & Stahl, 2003). Applying universal design principles has the potential to improve the lives of older individuals by promoting independence, safety, and social inclusion.

Now, we can answer the research question of, how can the home environment accommodate and adapt to those restrictions and changes (physical, sensory, and cognitive) associated with advancing age. The analysis reveals only two options:

- ***Maintaining the status quo and ignoring the problem:*** Opting to ignore the challenges faced by older adults in their home environments can result in continued difficulties in performing daily activities independently, ultimately diminishing their quality of life. Moreover, this approach may lead to increased risks, such as falls, which could have severe consequences, including fatalities.
- ***Embracing a universal design approach for successful Aging-in-Place:*** Universal design, a design philosophy aiming to create inclusive and accessible products and spaces for people of all ages and abilities, offers a promising solution. Implementing universal design principles in house planning and construction enables older individuals to maintain their

independence and dignity. By incorporating universal design from the outset or modifying existing homes, older adults can better meet their present and future requirements with fewer necessary changes as their needs and abilities evolve. This approach allows older individuals to continue living safely and independently, supporting the concept of aging in place. Additionally, universal design enhances and facilitates in-home care for both family members and professional caregivers. As such, universal design emerges as a comprehensive strategy to address the evolving needs of older adults and promote their well-being within their home environments.

Table (1) Some examples of universal design techniques that promote Aging in place through (ADLs) and (IADLs) (Adapted from: Carr, et al.,2013; Grazuleviciute-Vileniske, et al., 2020)

ADLs	
Bathing	<ul style="list-style-type: none"> ▪ During construction, making sure to strengthen the walls in the shower area so that grab bars can be easily installed in the future. ▪ The controls for the bathtub or shower placed such that they can be operated from outside the fixture ▪ Lever handle faucets ▪ No threshold walk-in shower
Physical ambulation	<ul style="list-style-type: none"> ▪ No threshold, zero step entrances ▪ Wider doorways and corridors ▪ Open floor plan ▪ Straight staircases with consistent risers and treads and a stopping place (landing) midway between levels.
Toileting	<ul style="list-style-type: none"> ▪ During construction, making sure to strengthen the walls in the shower area so that grab bars can be easily installed in the future. ▪ Installation of a bathroom on the ground floor of a building. ▪ Providing simple access by installing adjustable toilet and sink and ensure that the paper dispenser and grab bars are within easy reach.
IADLs	
Food preparation	<ul style="list-style-type: none"> ▪ Kitchen counters of various heights to suit both standing and seated users, as well as persons of various heights ▪ Kitchen storage units with narrow ranges and multiple approaches and manipulation options ▪ Contrasting colors, readouts in bigger font size, controls that provide sound and touch feedback ▪ Prevent entry to kitchen stoves located adjacent to countertop areas
Shopping	<ul style="list-style-type: none"> ▪ Electronic devices commonly used for regular transactions, such as credit card readers or swipes, that can be adjusted to a lower position or made height-adjustable. ▪ Bigger font on signs specifying aisle numbers and locations of merchandise, as well as on product packaging. ▪ Larger aisle ways ▪ Using automated doors at entrances and exits.
Transportation	<ul style="list-style-type: none"> ▪ To complement higher-order roads such as interstates, it is important to have lower-speed, two-lane through-routes. ▪ Reducing walking distances by connecting local street networks in neighborhoods

Current design thinking embraces the notion that designing is a collaborative process involving people – it is for them, with them, about them, and by them. To maintain a design focus, designers

adopt methodologies, which may comprise one or several working methods. *In the context of universal design for Aging-in-Place, the "Human-Centered Design" can be regarded as the applied methodology.* This approach extends beyond mere visual information, creation, and representation, as it prioritizes all human experiences throughout the design process.

4- Theme Three: Human-Centered Design (the integrative relationship):

Human-centered design (HCD) has long been a priority for designers. Human-centered design has hundreds of years of history and is based on notions from ethnography, sociology, and cognitive psychology (Nemeth, A. 2019). Human-centered design is often misunderstood and mistakenly considered a design style. However, HCD is actually "*a process for designing and developing everything for humans who will use them, including buildings, communities, services, and products, regardless of age or ability*" (Harper et al., 2008). In other words, Human-centered design is rooted in understanding the physical and psychological requirements of human users. It considers all elements of the physical environment to cater to users' needs and capabilities, empowering them to perform effectively (Maguire, 2001).

4-1 Why Human-centered design

Human-centered design is a design process that involves cooperation between interdisciplinary teams and potential users to provide solutions that fulfill users' needs, requirements, and practices. The approach enables designers to engage directly with users from the beginning of the design process, using tools such as interviews, focus groups, and direct observation. In the case of older users, it is critical to take an approach that incorporates their input at every stage of the design process (Imbesi et al., 2020). HCD is a method of communicating, interacting, empathizing, and stimulating the people engaged in the design process to obtain a comprehensive insight into users' requirements, desires, and experiences. HCD sets itself apart from conventional design practices by prioritizing the needs of the end-users over the designer's creative process or the technical aspects of the artifact. Its application is expanding significantly, with companies like IDEO, P&G, and Apple embracing HCD approaches in their design procedures (Giacomin, 2014; Zhang and Dong, 2009).

4-2 Process and Cycle of Human-centered Design:

The field of design has been constantly evolving, leading to the emergence of several challenges. To address these issues, designers have developed a specific process to devise effective solutions. By gaining a deep understanding of the needs and demands of communities and users, designers are able to create and test new ideas before releasing them. According to IDEO's Field Guide to Human-Centered Design (2015), there are three main stages that should be incorporated into the design process: Inspiration, Ideation, and Implementation; as shown in Figure (9). During the Inspiration stage, designers must strive to understand people by observing their lives and listening to their hopes and desires. In the Ideation stage, designers must use the information gathered from people to generate many ideas and explore potential solutions. Finally, during the Implementation stage, designers must apply their ideas in a manner that maximizes their benefit to the world.

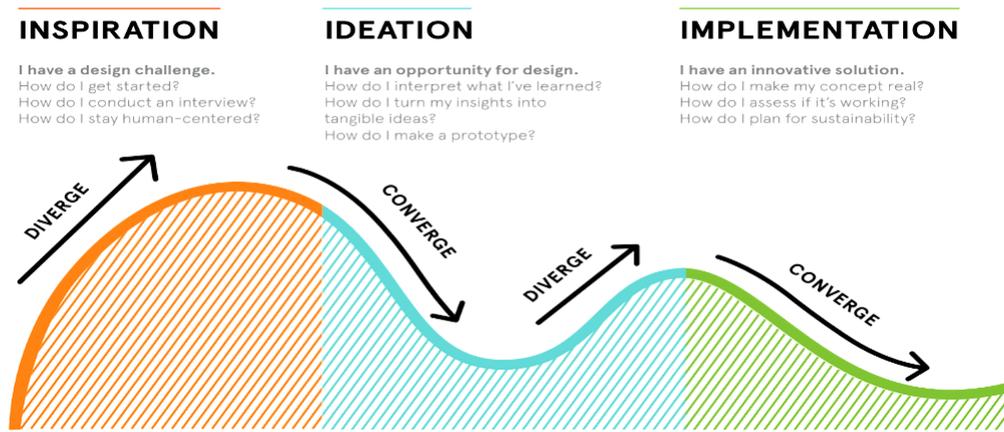


Fig. (9) Human-centered Design Process (IDEO., 2015)

Human-Centered Design is a methodology that prioritizes the needs, contexts, behaviors, and emotions of the people using the solutions being developed. By conducting research and immersing themselves in the situations where their creations will be used, designers are able to observe the thoughts, actions, and experiences of people and develop empathy for them. This understanding allows designers to generate potential solutions and select those that are most valuable and best suited to people's lives. Through prototyping, evaluation, and iteration, these solutions are refined and produced. The ISO standard (ISO., 2019) specifies five key activity phases for the human-centered design cycle to meet usability requirements: (1) Plan the human-centered design process; (2) Understand and specify the context of use; (3) Specify the user requirements; (4) Produce design solutions; and (5) Evaluate design solutions against requirements. These processes are carried out iteratively until the desired usability objectives are achieved; as shown in Figure (10).

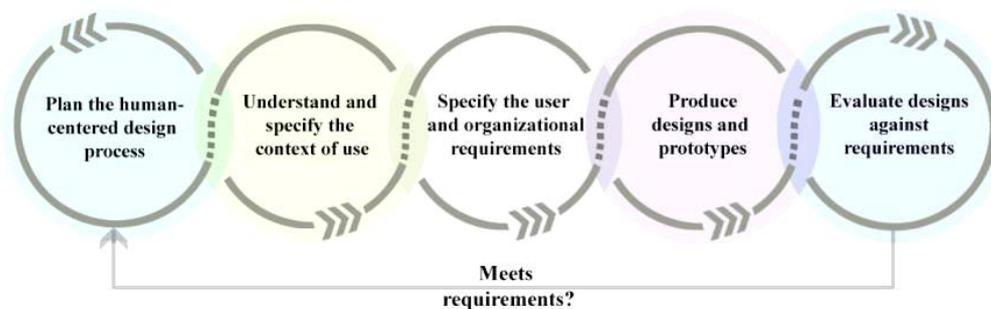


Fig. (10): human-centered design cycle (El Sayad, 2017)

4-3 Architecture and Gerontology Through a Human-Centered Design:

Nowadays, in the context of universal design for aging in place, it is not enough if an environment's accessibility and usability are well thought-out. but It should also meet higher levels of human needs. Human-Centered Design emerges as a versatile and cross-disciplinary approach with applications spanning diverse fields, encompassing sociology, and technology. Its noteworthy attribute lies in its capacity to formulate solutions that intricately consider human dignity, accessibility, and varying ability levels (Buchanan, 2001). Consequently, HCD proves instrumental in devising culturally appropriate, human-informed, and well-suited resolutions to challenges across an extensive array of domains, extending beyond the realms exclusively dedicated to products and technology. *By accentuating the significance of human experiences, this paper argues that the*

integration of gerontology and architecture through HCD can facilitate a profound comprehension of the interplay between the elderly and their environment, thereby fostering the development of an elderly-friendly home environment that maintains or improves their well-being and quality of life thereby, the promotion of aging in place.

The literature underscores a prevailing dearth of the application of Human Factors and Human-Centered Design foundations within the building industry (Dovjak et al., 2018; Agee et al., 2020). Consequently, the creation of an environment conducive to aging in place necessitates augmenting value by involving stakeholders in the design process, an advantage inherent in employing human-centered design principles. Presently, limited research exists on the application of human-centered design in the built environment, with the majority of theoretical foundations primarily employed in the context of Healing Environments (Kylén et al., 2019) or house adaptations for rehabilitation (ISO, 2019).

In light of this, a thorough examination of literature pertaining to the application of the human-centered design approach within the built environment, specifically concerning the elderly population, identified a critical focus on data collection and analysis pertaining to four fundamental elements, as shown in Figure (11): 1) human, 2) home environment, 3) Activities of Daily Living (ADLs), and 4) Surrounding community with which the individual interacts.

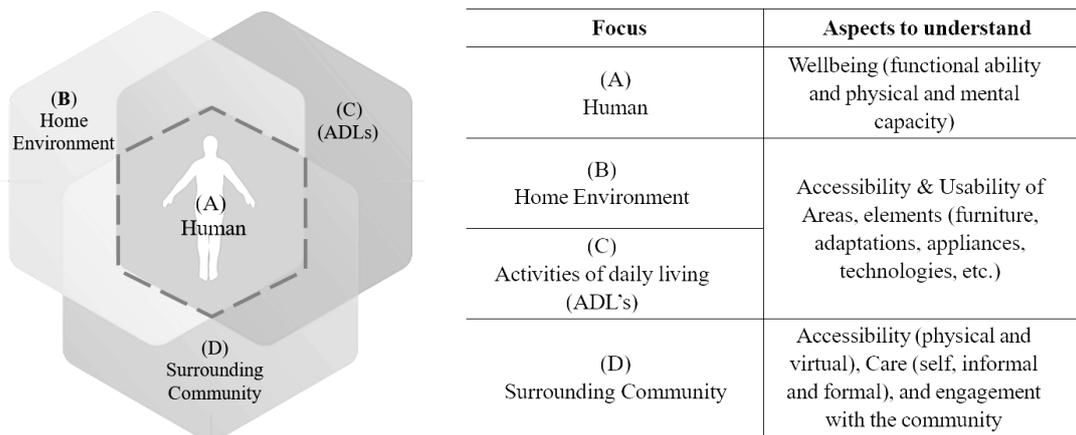


Fig. (11): HCD model for aging in place

5- Elderly-Friendly Home Environment: Conceptual Framework

According to all of the above, one of the most significant implications of unusual phenomena of demographic changes all over the world is an aging population. This demographic change has considerable consequences on the built environment, social welfare, and community services; and in light of the expected and potential aging of the population in Egypt in the coming decades, there is an urgent need to create elderly-friendly environments. These environments enable all people to have equivalent opportunities to continue their lifestyles and participate in their society to improve their quality of life and well-being, regardless of their age or ability. Creating elderly-friendly environments requires an interdisciplinary research area; This paper proposes a conceptual framework theoretical-based that can contribute to creating an elderly-friendly home environment in Egypt. This conceptual framework integrates gerontology and architecture from the perspective

of person-environment relationship in later life, through a human-centered design approach. Figure (12) illustrates this conceptual framework.

Environmental gerontology one area of gerontology that has gained attention in recent years examines how the physical, social, and cultural environment affects the well-being of older adults. Environmental gerontology has also shown that the person-environment relationship is not static. As individuals age, their capabilities, competence, needs, and preferences change, and the environment must adapt to meet those changes.

elderly typically spend significantly more time at home in comparison to younger age groups. Homes offer a sense of familiarity and emotional connection through personal experiences and memories. Despite potential declines in mobility, vision, hearing, cognition, and mental abilities associated with aging, the concept of "aging in place" remains appealing to older adults, as they desire to continue living in their own homes for as long as possible.

Aging in place is not only a philosophy but also a concept that promotes independence and the ability to live in different living environments. Regardless of age or ability, the proper application of the five guiding principles of aging in place, mentioned in section (2-5-1) allows individuals to survive in an environment of their choice, This enables older adults to preserve a sense of identity and independence.

In order to achieve the concept of aging in place, the home environment must be designed in a way that takes into account changes and meets needs throughout life. ***Architecture provides The rationale for this; by supporting accessibility and usability for a wide range of different abilities of residents,*** enabling them to live safely, independently, and comfortably, and reducing the need for subsequent home modification or retrofitting. ***In this context, universal design is the most preferred and desirable option among all design approaches and philosophies that seek to create accessible and usable environments for all, regardless of age or ability, and without stigma or discrimination.*** Thus, the home environment designed according to the seven principles of universal design, mentioned in section (3-3-5) will accommodate the various changes associated with aging (physical, sensory, and cognitive) and will enable the elderly to carry out their daily life activities easily and independently; which enhances the concept of aging in place.

Homes are often designed quantitatively, modularly, and instinctively for healthy adults; however, all voices are not heard and the changing needs throughout life are not considered; especially in old age. Therefore, creating an elderly-friendly home environment requires a comprehensive approach based on human-centered design. This approach focuses on people (the elderly) at the heart of the design process and on their different capabilities, their home environment, their daily life activities, and their interaction with society, through three stages in an integrative process between gerontology and architecture.

The initial stage, known as the inspiration stage, involves engaging in discussions with the elderly, and attentively listening to their experiences, hopes, and desires. This enables a profound understanding of the challenges they encounter in their current homes and identifies their specific needs and preferences for the home environment.

Subsequently, during the ideation stage, the gathered information is meticulously analyzed and transformed into design challenges. Experts in housing, urban planning, architectural design, and interior design collaborate to generate a diverse array of ideas, standers, and guiding principles. Furthermore, support from literature encompassing universal design principles to establish a home environment that caters to all individuals, regardless of age or ability.

The culmination of these efforts is the implementation stage, wherein the concept of an elderly-friendly home materializes. This concept embodies features accommodating the diverse capabilities of elderly residents, addressing their needs and desires to reside comfortably within their preferred homes and communities. The elderly-friendly home environment is universal, inclusive, and designed for all. It is accessible, and usable, enables independent living and social integration, and promotes the concept of "aging in place".

This conceptual framework indicates to the integration between gerontology and architecture at the micro-scale (elderly-friendly home environment). However, the integration can be effective and active at the meso and macro scale if we take into consideration theories, concepts, and reciprocal effects for person-environment relationships. Thus, at the meso-scale an Elderly-friendly community, neighborhood, or even residential compound can be established. Whilst, at the macro-scale, an Elderly-friendly city can be established.

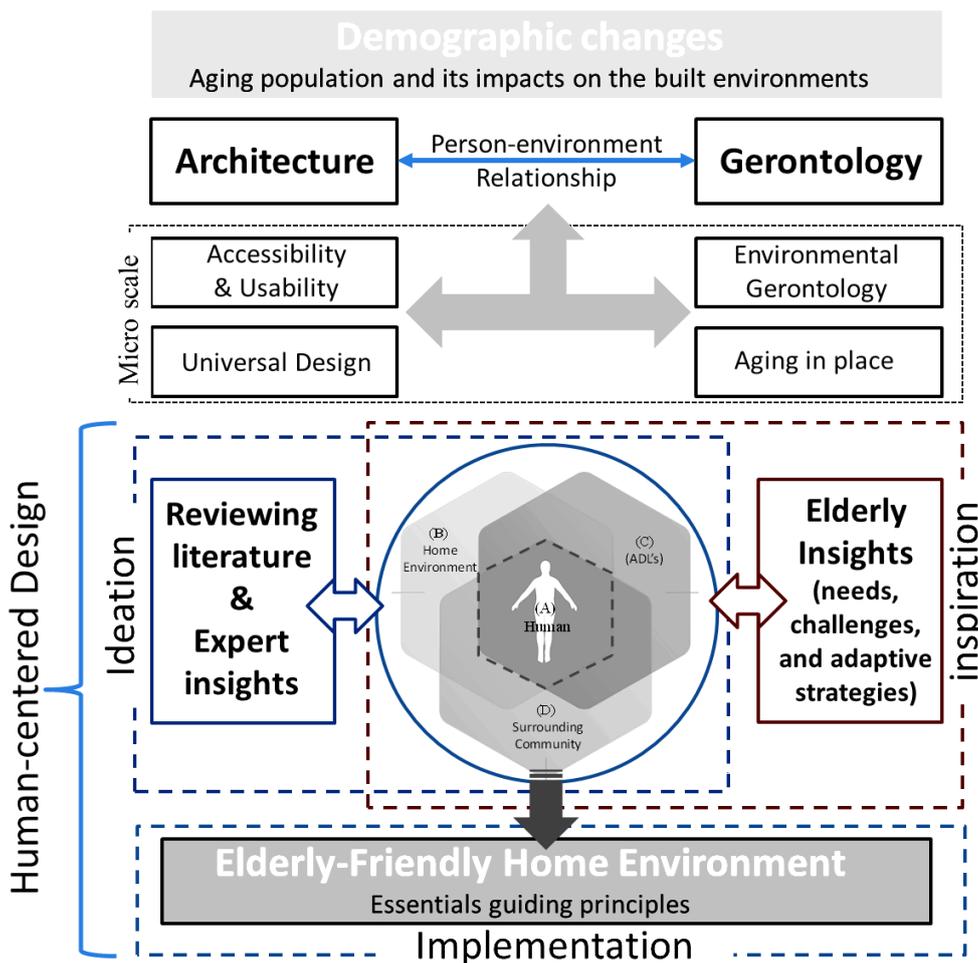


Fig. (12) Conceptual Framework for Elderly-Friendly Home Environment

6- Conclusion:

Over the years, the field of gerontology has made significant strides in deepening our comprehension of the physical, cognitive, and socio-emotional changes experienced by older adults. Concurrently, architecture has evolved to encompass design and planning concepts and approaches

that support the impact of these changes in the built environment. This paper presented a conceptual framework that can contribute to creating an elderly-friendly home environment in Egypt. Through a human-centered design approach, This conceptual framework integrates gerontology and architecture from the perspective of the person-environment relationship in later life, With the adoption of this proposed conceptual framework, the body of knowledge on the design of elderly-friendly home environments in Egypt stands to be enriched, and also will be the nucleus of the guiding principles that can empower architects, planners, designers, policymakers, and other stakeholders to develop and create an elderly-friendly home environment; this environment is inclusive, accessible, and usable, supporting the elderly and promoting their health, well-being, and allowing them "aging in place" independently and safely.

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إطار مفاهيمي للتكامل بين العمارة وعلم الشيخوخة لخلق بيئات منزلية صديقة لكبار السن في مصر

الملخص العربي:

يتزايد عدد كبار السن في العالم بسرعة مما يؤدي إلى تأثيرات كبيرة على البيئة المبنية. من المتوقع أن تشهد مصر زيادة ملحوظة في عدد كبار السن، مما يستدعي الحاجة إلى اتخاذ تدابير استباقية لمواجهة التحديات والفرص الناشئة عن هذا التحول الديموغرافي. تعتبر الهندسة المعمارية وعلم الشيخوخة من المجالات الحاسمة عند فهم العلاقة بين الشخص والبيئة في الحياة اللاحقة. ومع ذلك، فمن الملاحظ أن جميع الدراسات والقوانين والأبحاث المتعلقة بكبار السن في مصر يتم تناولها من منظور ديموغرافي واجتماعي واقتصادي وسياسي وصحي، دون النظر في الجوانب المتعلقة بالبيئة المبنية وأهميتها، ولا سيما العلاقة بين كبار السن وبيئتهم المنزلية. لذلك، تسعى هذه الورقة البحثية إلى سد هذه الفجوة المعرفية وتهدف إلى صياغة إطار مفاهيمي يؤسس أساساً نظرياً لخلق بيئات منزلية صديقة لكبار السن في مصر. يعتمد هذا الإطار على فكرة التكامل بين الهندسة المعمارية وعلم الشيخوخة من خلال نهج تصميم محوره الإنسان يضع كبار السن في بؤرة الاهتمام. يتبع البحث منهجاً وصفيًا تحليليًا ومنهجًا استقرائيًا، من خلال إجراء مراجعة شاملة للأدبيات في ثلاثة محاور رئيسية: علم الشيخوخة، الهندسة المعمارية، والتصميم المتمركز حول الإنسان. من المتوقع أن يثري ويضيف هذا الإطار المفاهيمي المقترح، إلى مجموعة المعارف الخاصة بإنشاء بيئات منزلية صديقة للمسنين في مصر. وسيكون أيضاً بمثابة نواة للمبادئ التوجيهية التي تمكن المهندسين المعماريين والمخططين وواضعي السياسات وأصحاب المصلحة الآخرين من إنشاء وتطوير بيئة منزلية صديقة لكبار السن؛ هذه البيئة شاملة ويمكن الوصول إليها وقابلة للاستخدام، تدعم كبار السن، تعزز صحتهم ورفاههم، وتسمح لهم "بالشيخوخة في المكان" بشكل مستقل وآمن.