



Restorative Design Approach for Elderly People: Revisiting Biophilia Hypothesis and Universal Design Principles in Assisted Living Facilities

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Abstract

The increase in the elderly population, need for assistance, and family structure change have increased assisted living facilities' need. Although these spaces contain specific regulations, the design criteria that are suitable for everyone are not set. This study discusses the biophilia hypothesis, biophilic design, and universal design patterns; in line with the information obtained in the following part of the study, an evaluation is obtained. The seven parameters of universal design and fourteen patterns of biophilic design are evaluated together. The Rockwood Retirement South Hill, defined as an exemplary project, was examined in the light of the pattern criteria in the table and determined that it meet the preferred conditions to a great extent. This study evaluates the biophilic design criteria, which are determined to positively affect the users in terms of psychological, physiological, and sociological fields; and the universal design criteria, which are both easy access to the elderly, equal social opportunity is an infrastructure for future studies.

1. INTRODUCTION

Today, the elderly population rate is increasing due to finding solutions for diseases and the decreased birth rate. According to TÜİK data in Turkey: the elderly population ratio was 3.9 in 1935, 6.7 in 2000, and 9.1 in 2019; this ratio is projected to increase to 25.6 in 2080. [1] In addition to the increase in the elderly population, changes in the family structure led the elders to assisted living facilities. These facilities are generally considered where older adults wait for an end; however, they should be places where they can maintain their healthy physical, psychological and sociological existence, away from the stress and chaos of life. In light of the mentioned problems, the research's main question is the design approaches in the design of assisted living facilities that will meet the elders' social, physical, psychological needs and comfort, and is it possible to create a framework to evaluate their design quality. The biophilic design theory and universal design principles are examined due to their positive effect on the health and equitable approach in needs and comfort.

The biophilic design suggests that space has a healing effect on people, and it is a design principle that has a psychological, physiological and social improvement effect with studies put forward by various fields of researchers. Although several theories have been within biophilic design discourse, Browning's 14 biophilic design principle is suitable for the research because of its more precise and applicable parameters in the design process.

Universal design is a design principle that is suitable for appealing to as much wider society as possible to offer everyone equal opportunities, knowing the differences of everyone, and ensuring the use equally. Although universal design is a necessary design principle in today's world, it has created a discourse taught as a lesson in schools, and then its decision to use the principles is left to the designer's choice. It is

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impossible to ignore these principles in nursing homes and assisted living facilities where the most significant physical needs differences accommodate.

There is a need to compile design solutions that increase the life comfort of users. For this reason, examining the universal design and biophilic design principles together creates accessible, easily usable solutions for elderly nursing homes, which do not reduce the quality of life but increase them. There is no nursing home designed by evaluating these two design principles together in Turkey. Therefore, Rock Wood South Hill, an award-winning retirement community in the United States, which is understood to have met biophilic design within its architect's design principles and fulfilled the universal design criteria to a great extent, has been examined as an example project in the research. In this paper, biophilic design, then universal design criteria, is explained in the general framework, and their applicability is examined with an evaluation table on the sample project.

2. METHOD

In the study in which qualitative methods are adopted, universal design principles, *biophilia* hypothesis, and biophilic design parameters were presented in light of examples to form the study's theoretical framework. With the literature study, how these design approaches can be used in assisted living facilities and their positive effects on people's health and living in these places have been explained. The Rockwood Retirement South Hill assisted living facility, which was selected to answer the research question, was analyzed through the drawings, photographs, and narratives obtained from its website. Its relationship with the universal design principles and biophilic design principles is examined through the evaluation chart framework.

3. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

3.1. Biophilic Design

Today, with the changing parameters of the modern world as industrialization, technological developments, and fast production, there are intense migrations from rural areas to cities. Within this conjecture, people are forced to disengage from nature. Inside that concrete world, humans have psychological, emotional, and biological needs related to nature. Time in technology and human psychology and needs have different velocities. [2] Innate human expectations that cannot be met in the built environment cause mental health problems and high stress that triggers diseases. Nature's positive effects on humans are subjected to stress recovery theory (SRT), attention restoration theory (ART) and biophilic design. ART is proposed with various studies; researchers claim unnatural settings could lead to mental fatigue and nature has a restorative capacity on human attention, psychology. [3] Additionally, another theory, SRT, focuses on stress, which affects human health and psychology in the built environment and the reduction of it has a close relationship with the natural settings. [4] Psychologist Erich Fromm firstly uses the *biophilia* term as "the passionate love of life and all that is alive". [5] After the first usage, the term is popularized by Kellert, and it defines the hypothesis as the innate tendency to focus on life and natural forms. [6] The biophilic design discourse has a multidisciplinary approach after the *biophilia* definitions and positive outcomes with study and research. Different researchers interpreted it, and various theories and principles are produced on it.

The sustainable design strategies considering the environment are not human-centered approaches; they are centered on nature and do not examine humans' psychological conditions with nature. Biophilic design searches for the optimal possible human-nature relation in the built environment that contributes to human health and well-being. Browning put forward fourteen biophilic design patterns and their effects on humans. [7] Table 1 shows the biophilic design patterns, explanations, examples, and studies of their effects on human health. These principles seem helpful for humans and their health and have the potential to be applied to assisted living facilities.

Table.1 Biophilic design principles and their effects on human health [7]

	Patterns of Biophilic Design	Explanation	Examples	Effects on Health
The Nature in the Space	1. Visual Connection with Nature	A visual connection to a living system or nature	Windows with a nature view, green walls, and interior flowers	Positive impact in cognitive performance [8]
	2. Non-visual Connection with Nature	Except for the sight, haptic senses that connect human with nature	Touching an animal, smelling a flower, nature sounds	Reduce stress and maintains the blood pressure [9]
	3. Non-Rhythmic Sensory Stimuli	The nature connection that human cannot analyze while it happens	The movement of the leaves while a wind breeze, kinetic façades, movement of the water	Create solutions for the headaches [10]
	4. Thermal & Airflow Variability	Instant and delicate differences in airflow and temperature	Operable windows, balconies, inner courtyards	Constructive influence on well-being and comfort [10]
	5. Presence of water	The places that enable to connect with water element with its noise, sight, and presence	Aquarium, pool, pond, fountain	Lower the blood pressure and heart rate and stress reduction effect [11]
	6. Dynamic and Diffuse Light	Having diverse consistency of shadow and light that has alteration with the daytime	Taking daylight to the interior with possible varying methods as windows at partition walls, roof light	Constructive influence on the circadian functioning system [12]
	7. Connection with Natural Systems	The consciousness of phases of nature and ecosystem	Courtyards, gardens, indoor plants which has life cycles and leaf changes	Memory restoration and increase at the concentration level [13]
Natural Analogues	8. Biomorphic Forms and Patterns	Patterns, forms, or textures that are mimicking the natural arrangements	Nature-inspired shapes and colors in the design, organic forms in nature	Memory restoration and increase at the concentration level [14]
	9. Material Connection with Nature	The materials from nature that are raw or has the least processing	Leather, wood, stone, or clay materials	Diastolic blood pressure decreases [15]
	10. Complexity and Order	The repetitions and changes in rhythms of the elements in design mimic the natural organization	Creating a hierarchy or repetition in façades with different materials or location and sizes of the windows	Increase in mental engagement [16]
Nature of the Space	11. Prospect	A panoramic, comprehensive open view that allows humans to control the environment	Open floor plans and viewing surrounding from a high place as in high floors create a broad sight for the humans	Stress reduction, safety and comfort level increase [17]
	12. Refuge	The space for humans that feel safe and protected with a semi-closed form	Benches with closed-back, semi-closed bus stop areas, reading nooks	Better attention level, sense of security [18]
	13. Mystery	A view that it semi-open which creates curiosity for a human to discover	Paths with a flowing form, allotted paths	Produce response of pleasure [19]
	14. Risk and peril	A perceivable danger with a protection	Transparent floors, walkways upon the water feature	Powerful pleasure reactions from the users [17]








3.2. Universal Design

Universal design (UD) is introduced as a reaction to shaping design principles according to society's majority perception. While the majority is perceived as society's usual standards, the group that does not comply with this standard is excluded from the potential user category. However, even if only the life stages of humanity are considered, humans will not remain in a fixed physical condition; it has not been evaluated in a single standard in childhood, youth and old age. The universal design is understood as a specific design solution for a specific group with a disability issue; however, it includes every phase of life and design stages; it leads to intelligent solutions for all generations and areas. [20] The solutions and developments in crucial issues such as accessibility and usability and the fundamental necessities of a broader range of humans began to take attention. Thus, universal design evaluates society as a single society with different physical conditions, needs, and various characteristics. A leadership group consists of environmental designers, architects, product designers and engineers in the Center of Universal Design

in North Carolina; there designed seven principles for universal design to integrate into the processes of design of environments and products [21]

Table 2. shows the seven principles of universal design patterns with the necessary keywords for the patterns and exemplary conditions and figures. The patterns are capable of adapting to different fields such as architecture, industrial design, interior architecture, urban design, and landscape architecture.

Table.2 Explanation of universal design principles [22]

UD Principles	Equitable Use	Flexibility in Use	Simple and Intuitive Use	Perceptible Information	Tolerance for Error	Low Physical Effort	Size and Space for Approach and Use
Important keywords	The design should be useful for every user	Supplying alternative ways of usage and preferences for the user	Comfortable and uncomplicated design, easy to understand the design unconditional with the previous experiences of the user	Operating the design such as with sensory methods for user	Decreasing the occurrence of risk and supply cautions for user	Providing minimum wasted effort and free from constraints	Provide comfortable reach conditions, designing for various posture and body size alternatives
Exemplary figures							
Exemplary conditions	The facility entrances with ramps or without a level difference	The bars at the bathroom provides alternative usages for the users	The user must understand the usage without intense explanations. The signs with images instead of words	Using the contrast of colors	Non-slip and soft floor covering materials to protect users from possible damage	Using automatic doors leads to minimize physical effort for the users	Kitchen countertop or information desk countertop multilevel design

4. DESIGNING OF ASSISTED LIVING FACILITY THROUGH BIOPHILIC AND UNIVERSAL DESIGN PRINCIPLES: ROCKWOOD RETIREMENT SOUTH HILL

Rockwood Retirement is located in Spokane, Washington, and was established in the 1960s. After the need for restoration is required to understand the new residents' needs and more ecologically sustainable. The design is created considering the biophilic principles. NAC and Perkins Eastman architecture firm restore the place and design the eleven-story building in March 2016. The renovation includes 62 living units, an auditorium that allows concerts, a heated pool, fitness center, bistro and library. It won the 2017 Merit Award in AIA-Design and Aging Review Category. [23]

The community has a Live-well program that includes seven patterns: a healthy mind and body, social connections, lifelong learning, financial well-being, mindfulness, fun and entertainment, and spirituality. There designed four different dining alternatives within these principles: an outdoor dining area, a ballroom, an indoor swimming pool, a business and arts center, a wellness center, and a library. Moreover, the residents have an opportunity at the garden to plant and gardening [24]

The building has a view of mountains, forests, and the Spokane River. The renovated design is also inspired by the river, the curvilinear corridor that connects the amenity areas designed like the flowing river. [24]



Figure 1. Rockwood South Hill Plan [25]

There designed several alternative room layouts for residents to choose from according to their needs. All alternatives have balconies, a private kitchenette, and bathrooms. The rooms for the aging residents with memory care designed with a visual line for the site and broad perspective points to understand where they locate and sign and wayfinding systems are provided.



Figure 2. Room plan alternatives to provide a choice option for residents' needs [25]

Table 3 shows that the Rockwood Retirement Community has fourteen patterns of biophilic design examples in the facility. There is a vast green courtyard near the forest, and it allows the residents even to see the deers near the facility; also, the facility is pet friendly, which allows creating a non-visual connection for the residents with the haptic experiences as touching, petting and sharing a feeling with the animals. The materials' usage is mimicking nature with their forms and colors. For instance, the interior corridors have a flowing form mimicking the Spokane River near the facility; the design helps to provide

the mystery pattern in the environment; the user is curious about the areas that do not remain in their perspective. The façade of the facility is not carrying a biophilic character, with it appears like the interior. The weakness of the building is the character of the interior and the environment has harmony. However, building envelope acts as a separator rather than bring together and support the flow. The facility has wide windows that open and close by user choice, unlike another usage as the shopping malls' fixed windows. These broad and operable windows provide dynamic and diffused lights to the interior and create airflow and thermal control and provide a wide perspective for the viewers that maintains the prospect pattern. The height differences in the common areas and the dividers define and complement different areas; low ceilings and semi-closed parts support the refuge pattern.

The facility meets the universal design criteria to a great extent. The facility's entrance is designed without a level difference and steps, and usage of automatic doors satisfies the equitable use and low physical effect patterns in UD. Generally, soft materials like carpet covering are used on the floors that prevent slipping and minimize the damage in case of any falling cases, which meets the tolerance for error principle. Generally, the facility uses natural colors, but the colors used red and green at the corridors cause awareness of the residents' location and ease the wayfinding. The design provides the perceptible information pattern.

Table.3 The evaluation of universal design and biophilic design criteria in Rockwood Retirement South Hill

IMAGES	EQUITABLE USE	FLEXIBILITY IN USE	SIMPLE AND INTUITIVE USE	PERCEPTIBLE INFORMATION	TOLERANCE FOR ERROR	LOW PHYSICAL EFFORT	SIZE AND SPACE FOR APPROACH AND USE
 VISUAL CONNECTION WITH NATURE	+	+	+	+	+	+	+
 NON-VISUAL CONNECTION WITH NATURE	+	+	+	+	+	+	+
 NON-RHYTHMIC SENSORY STIMULI	+	+	+	+	+	+	+
 THERMAL & AIRFLOW VARIABILITY	+	+	+	+	+	+	+
 PRESENCE OF WATER	+	+	+	+	+	+	+
 DYNAMIC AND DIFFUSE LIGHT	+	+	+	+	+	+	+
 CONNECTION WITH NATURAL SYSTEMS	+	⊕	⊕	⊕	⊕	⊕	⊕
 BIOMORPHIC FORMS AND PATTERNS	+	+	+	+	+	+	+
 MATERIAL CONNECTION WITH NATURE	+	+	+	+	+	+	+
 COMPLEXITY AND ORDER	+	+	+	+	+	+	+
 PROSPECT	+	+	+	+	+	+	+
 REFUGE	+	+	+	+	+	+	+
 MYSTERY	+	+	+	+	+	+	+
 RISK AND PERIL	+	+	+	+	●	+	+



SATISFYING THE PATTERN



NOT SATISFYING THE PATTERN



NOT POSSIBLE TO EVALUATE

5. CONCLUSION

When people imagine that they will work throughout their lives and be comfortable during retirement, the physical problems and ailments brought by the increasing age put them at a disadvantage with underestimated designs. A design that will prevent this and give them equal opportunities with everyone should be such that they will not feel incomplete or behind in their most comfortable life; they adapt and feel good.

The study investigates suitable design strategies for assisted living facilities and creates a framework for the design quality assessment for occupants' benefits in design processes or existing buildings. The study concludes that resulted from the previous studies on their effects, biophilic design and universal design principles are beneficial theories and design strategies for assisted living facilities; by considering the universal design criteria, designs put the elderly in a suitable and physically and psychologically friendly environment. Additionally, biophilic design criteria made the designed spaces suitable for the elderly and employees in physiological, psychological, and sociological ways and made them feel at home and safe.

The Rockwood Retirement South Hill is a convenient resource for examining the principles of universal and biophilic design. Table 3 shows that the design mostly meets the requirements of the patterns. The framework table presents for the assisted living facilities to be designed in the future or renovated and served as a guidebook to evaluate the design quality for their residents and how much the design meets the needs.

Humans have a life cycle; no human being is the same as yesterday; the body is in a constant state of transformation and needs to take shape with this transformation. Physical differences, which are congenital or potentially a candidate for the encounter, should be taken into account at every design stage as much as possible. The article aims to outline the design criteria that will positively affect their health by feeling better in spaces designed for the elderly. The determined table should aim to eliminate the deficiencies by determining how the assisted living facilities comply with the biophilic and universal design criteria. In future studies, a design guidebook and assessment criteria will be constituted with more detailed research for only the elders and the places for their physical, social, and mental health.

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