Biophilic design patterns and universal design principles application in the long-term residential care centers for the elderly

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Abstract:

The number of elder people living with dementia and related cognitive disorders is predicted to increase dramatically in the coming years. As a consequence, the need is increasing for appropriately designed long-term care (LTC) environments and design guidelines for these settings. This investigation presents the findings of a broad literature review on biophilic and universal design and their application on LTC. Biophilic and universal design can reduce stress, enhance creativity and clarity of thought, improve our well-being and expedite healing; as the world population continues to urbanize these qualities are ever more important. Theorists, research scientists, and design practitioners have been working for decades to define aspects of nature that most impact our satisfaction with the built environment. "14 Patterns of Biophilic Design"and 7 principles of universal design articulates the relationships between nature, human biology and the design of the built environment so that we may experience the human benefits of biophilia and universal design in our design applications. Biophilia in Context looks as the evolution of biophilic design in architecture and planning and presents a framework for relating the human biological science and nature. Design Considerations explores a sampling of factors (e.g., scale, climate, user demographics) that may influence biophilic and universal design decisions to bring greater clarity to why some interventions are replicable and why others may not be. The Patterns lays out a series of tools for understanding design opportunities, including the roots of the science behind each pattern, then metrics, strategies and considerations for how to use each pattern. This paper moves from research on biophilic responses to design application as a way to effectively enhance health and well-being for elder people and society, and the study of the different patterns of biophilic design and universal design and how to apply them within the centers of elder people, and thus its impact on the psyche, health. **Research problem**:1-The fast growth of the built environment has caused designers to focus mostly on the function of the building and more recently on the impact of the building on the natural environment. 2- Determine what are the design mechanisms and determinants that help the designer in activating the role of the environment and integration with nature in nursing homes for their important role in the recovery of the elderly and raising the efficiency of their psychological and physical health. **Objective:** How to benefit from applying the concept of biophilic and universal design trends in interior design, and benefit from them in designing long-term residence centers for the elderly to make a positive impact on their psychological and physical health. **Hypotheses: 1-**The application of the concept of biophilic and universal design in the residence centers for the elderly reflects positively on their mental and physical health. 2-The application of the concept of biophilic and universal design in the residence centers for the elderly increases their communication with the surrounding environment and harmony with it. **Methodology: 1-**The descriptive analytical approach: through a definition of biophilic design patterns and universal design and their determinants and how to apply them in residential centers for the elderly. 2- Analytic approach :through the analysis of an example of elder people center achieving biophilic and universal design.

Keywords:

Biophilic design, long-term residential care centers, universal design

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Introduction

Biophilic design reduce stress, It clarify the idea and enhances creativity, this is what theorists and research scientists have reached and practitioners of

biophilic design and with the spread of diseases and stress recently studies were directed to solve these problems by providing opportunities for people to live in healthy spaces be less stressful and enjoy greater well-being for its users, Previous studies on elder people's growth and development showed that natural elements have positive effects on elder people by bringing mental and physical changes for them in various aspects, which helps them become healthier and happier, and here comes the role of nature-loving design, as "biophilia" is the innate biological connection of man with nature, therefore, it was necessary to study the different patterns of biophilic and universal design and their role in improving public health, thinking and creativity of space users.

It stands to reason that long-term care (LTC) environments for the aged, including those designed for persons with dementia, a condition that results in significantly diminished cognitive and physical functioning, should be designed, planned and built to promote occupants' wellbeing and enjoyment of this stage of life to the fullest extent. The majority of LTC environments are not explicitly designed from the standpoint of facilitating meaningful person-nature connectivity. Biophilia is defined as people's innate affinity to other forms of life, and the natural world; **(3-p21)**

The biophilic design states 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. . **(2-p167)**

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 beenevaluated 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 design and life stages; it leads to intelligent solutions for all generations and areas. Thus, universal design evaluates society as a single society with different physical conditions, needs, and various characteristics. . **(3-p21)**

There is a need to compile design solutions that increase the life comfort of users. For this reason, examining the biophilic design and universal design principles together creates accessible, easily usable solutions for elderly nursing homes, which do not reduce the quality of life but increase them. **(5-p22)**

First: The theoretical framework

1-Patterns of Biophilic design ;

Table 1 Illustrate the patterns of biophilic design

	Description , effect on health and examples	-How to apply it within long-term residential care centers for elder people
1-1 Nature in the Space Patterns	**1-1-1-visual contact with nature** A visual connection to nature or a living system , Ensure visual access to real presentations of nature throughout the station complexes in preference to simulated nature and non-nature representations , A view to elements of living systems, natural processes, and nature. (9-p369-374) Stress Reduction: Lowered heart rate and blood pressure Cognitive Performance: Improved mental engagement/ attentiveness Emotion, mood & Preference: Positively impacted attitude and happiness  Image no 1 Explains visual contact with nature in LTC for elder people http://innovation.seniorhousingnews.com  Image no 2 Explains visual contact with nature in LTC for elder people https://www.bdcnetwork.com	**Exterior design:** - Provide vegetation as much as possible, especially trees. - Design with flexible lines for letters, shapes and formations instead of sharp lines. - Using natural materials such as stones, wood, bamboo and others. **Interior design:** - Place the plant component as possible within the center. - Vertical green walls , natural fish ponds. - Establishment of water fountains. - Interest in raising some pets. **The relationship between interior and exterior design:** Enlarge window spaces as much as possible. -Extension of window sills to the floor. -Extending windows to the ceiling. -Providing the centers with openings for the ceilings. (1-p85)
	1-1-2-Non-Visual Connection with Nature Priority is given to the sounds of nature over the sounds of civilization through digital simulation of the sounds of nature, the release of natural plant oils using mechanical means, and the use of tissue contacts that simulate the contacts of natural raw materials this pattern is defined as "auditory, olfactory, haptic , or gustatory stimuli that engender a deliberate and positive reference to nature, living systems or natural processes." (8-p10) Stress Reduction: Reduced stress hormones and systolic blood pressure Cognitive Performance: Positively impacted on cognitive performance Emotion, mood & Preference: Perceived improvements in tranquility and mental health (13)	**External design:** -Hear the sounds of water fountains and waterfalls , wind and rain. -The sounds of tweeting and chirping of birds and birds. -Smell the scents of flowers and plants. -Touch different cultivated plants. -Taste the fruits from the trees grown. **Interior design:** -Touching potted plants. -Touching natural materials.

Image no 3
Explains Non-Visual Connection with Nature in LTC for elder people
https://www.kaufmanlynn.com

Image no 4
Explains Non-Visual Connection with Nature in LTC for elder people
https://www.mooringspark.org

-Hearing the sound of raindrops falling on the windows and inner waters.
-Enjoy touching pets.

The relationship between interior and exterior design:

Equipping and preparing windows to hear external sounds. (6-p57)

1-1-3. Non-Rhythmic Sensory Stimuli

Non-Rhythmic Sensory Stimuli differs from Non-Visual Connection with Nature in that it is most commonly experienced at a subconscious level through momentary exposure that is not typically sought out or anticipated and is inclusive of all sensory systems; whereas Non-Visual Connection may be planned ,deliberate , and over longer more predictable durations of time. (14)

Stress Reduction	Cognitive Performance
Positively impacted on heart rate, sympathetic nervous system activity and systolic blood pressure	Observed and quantified behavioral measures of exploration and attention (4-p12)

Image no 5
Explains Non-Rhythmic Sensory Stimuli in LTC for elder people
https://www.55communityguide.com

Image no 6
Explains Non-Rhythmic Sensory Stimuli in LTC for elder people
https://dirtworks.us

Exterior design

-Merging the sounds of air breezes with moving clouds, singing birds, and rustling trees.
-Flying birds and animals.
-Smells and fragrances of plants.
-The sound of a water drop falling into still water.

Interior Design

-Materials that move with the breeze and shimmer with the light.
-Movement of fish in fish tanks.
-Clouds cover the sun's rays suddenly and expose the internal environment to unexpected darkness for a moment.
-Mechanically released vegetable oils.
-Natural sounds recorded and broadcast at different times. (14)

The relationship between interior and exterior design:

-wind enforcing its way into the inside from the window and doors.
-Birds standing on windowsills and then flying away.
-Entry of various flying insects into the inner space.
-Choose window box plants that attract bees and butterflies. (6-p59)

1-1-4. Thermal & Airflow Variability

Subtle changes in air temperature airflow, across the skin, relative humidity, and surface temperatures that mimic natural environments. A space with good Thermal & Airflow Variability feels refreshing, active, alive comfortable, and invigorating. The space provides a feeling of both flexibility and a sense of control. (12)

Stress Reduction	Cognitive Performance	Emotion, mood & Pref
POSITIVELY IMPACTED COMFORT, PRODUCTIVITY AND WELL-BEING	Positively impacted concentration	Improved perception of temporal and pleasure (alliesthesia) (4-p12)

Image no 7
Explains Thermal & Airflow Variability LTC for elder people
https://www.seniorlivingguide.com

Image no 8
Explains Thermal & Airflow Variability LTC for elder people
https://perkinseastman.com

Exterior design

-The open air is the original source of temperature fluctuation and air flow.
-Correct study of building orientation.
-Cultivation of seasonal plants.

Interior design

-Design a natural ventilation system inside the building.
-Developing a system for sensing temperature changes and air flow in different seasons.
-Benefit from sunlight to heat the interior spaces during the day.
-Take advantage of the shadows.
-Controlling the treatment of glass used in windows.
-Setting an operating system for windows and variable ventilation. (1-p92)

1-1-5.PRESENCE OF WATER

A space with a good Presence of Water condition feels captivating and compelling. Fluidity, lighting,sound, proximity and accessibility each contribute to whether a space is stimulating, calming, or both. (4-p32)

External design:

-water fountains.
-Falls.
-Artificial pools.

Stress Reduction	Cognitive Performance	Emotion, mood & Preference
Reduced stress, increased feelings of tranquility, lower blood pressure and heart rate	Improved memory and restoration concentration	Observed preferences and positive emo responses (4-p12)

-Swimming pool.

Interior design:

-Indoor water fountains.
-Indoor artificial waterfalls.
-Fish tanks.
-Floors with fish tanks.
-Water reflections (real or simulated) on another surface. (6-p62)

	Image no 9 Explains PRESENCE OF WATER in LTC for elder people https://www.naplesnews.com Image no 10 Explains PRESENCE OF WATER in LTC for elder people https://dirtworks.us	
	1-1-6.DYNAMIC & DIFFUSE LIGHT Dynamic & Diffuse Light leverages varying intensities of shadow and light that change over time to create conditions that occur in nature. A space with a good Dynamic & Diffuse Light condition conveys expressions of movement and time to evoke feelings of drama and intrigue, buffered with a sense of calm. (7-p20) Stress Reduction: Positively impacted circadian system functioning Increased visual comfort . (4-p12) Cognitive Performance Emotion, mood & Preference	**Exterior design:** -Control of light and shadow unevenly. -Tree shadows. -Moonlight and stars. -The diversity of the glare of the sun's rays in the seasonal changes. **Interior design:** -Use matte or transparent glass for windows to control the light entering from the outside. -Adjust the size of the windows. -Place windows on each side of the building. -Deepen window frames to control unwanted sunlight.
	 Image no 11 Explains DYNAMIC & DIFFUSE LIGHT in LTC for elder people https://issuu.com  Image no 12 Explains DYNAMIC & DIFFUSE LIGHT in LTC for elder people https://www.yelp.com	-Adjust the lighting colors that produce white light during the day, and reduce blue light that increases stress during the night. (1-p96)
	1-1-7.CONNECTION WITH NATURAL SYSTEMS Awareness of natural processes, especially temporal and seasonal changes characteristic of healthy ecosystems. A space with a good Connection with Natural Systems evokes a relationship to a greater whole, making one aware of seasonality and the cycles of life. (10) Emotion, mood & Preference Enhanced positive health responses; Shifted perception of environment . (4-p12)   Image no 13 Explains CONNECTION WITH NATURAL SYSTEMS in LTC for elder people https://www.perkinseastman.com Image no 14 Explains CONNECTION WITH NATURAL SYSTEMS in LTC for elder people https://www.perkinseastman.com	**Exterior design:** -Different weather conditions such as rain, snow, storm, fog, thunder and lightning. -Hydrology (precipitation, water flows, floods and droughts). -The night sky and (phases of the moon, eclipses, planetary alignments, and astronomical events). -Monitor seasonal changes, seasonal patterns (freezing, light intensity and color, plant cycles, animal migration, ambient odors). **Interior design:** -Simulating daylighting systems. -Indoor wildlife simulation (bird cages, honey bee apiary, flowering plants). -Giving the used materials such as (leather, stone, copper, bronze, wood) the appearance of the "old" time shift. -Monitor the color change of indoor plants and leaf density during different seasons. (1-p98-99)
I-2 Natural Analogues Patterns	**1-2-1 . Biomorphic Forms & Patterns** Biomorphic Forms & Patterns are symbolic references to contoured, textured, patternedor numerical arrangements that persist in nature. (2-p21) Emotion, mood & Preference Memory restoration and increase at the concentration level. (2-p16,21)   Image no 15 Explains Biomorphic Forms & Patterns in LTC for elder people https://www.perkinseastman.com Image no 16 Explains Biomorphic Forms & Patterns in LTC for elder people https://www.rockwoodretirement.org	**Exterior design** -Landscape design with biological lines and shapes. -Design functional elements such as fences and gates in a biological form. **Interior design** -Fabric, carpet and wallpaper designs based on the Fibonacci series or the golden ratio. -The design of interior walls, floors and ceilings simulate natural systems. -Preference for furniture with a dynamic shape. -Using vibrant artwork as decorative elements and motifs. -Designing windows and balconies with biological shapes and models. -Simulating the structural system in nature, such as columns in the form of trees. (1-p101)
	1-2-2 .MATERIAL CONNECTION WITH NATURE A Material Connection with Nature is material and elements from nature that, through minimal processing, reflect the local geology or ecology to create a distinct sense of place. Cognitive Performance: Improved creative performance Decreased diastolic blood pressure Emotion, mood & Preference: Improved comfort (4-p40)	**Exterior design:** -Fences and outdoor furniture are made of natural materials such as wood, bamboo sticks and stones. -Natural materials for cladding walkways and bridges, such as stone or tree trunks. -Cladding the facade with natural materials such as wood, bamboo, and others. **Interior design:** -Cladding floors and walls with natural materials. -The use of natural materials in furniture. -The use of cotton, wool and leather in furniture upholstery. -Use natural colors, especially green.

Image no 17
Explains MATERIAL CONNECTION WITH NATURE in LTC for elder people
https://globalageing.org

Image no 18
Explains MATERIAL CONNECTION WITH NATURE in LTC for elder people
https://www.google.com

-Distinctive crafted details (natural wood grain, leather, stone, fossil materials, bamboo, straw, dried grass, cork). (6-p68)

1-2-3 COMPLEXITY & ORDER

The concept of complexity and order arises from the rich sensory information found in nature in geometrical patterns and complex fractal of natural forms. A space with good Complexity & Order feels engaging and information-rich, as an intriguing balance between boring and overwhelming. (7-p21)

Stress Reduction	Emotion, mood & Preference
Positively impacted perceptual and physiological stress responses	Observed view preference (4-p12)

Image no 19
Explains COMPLEXITY & ORDER in LTC for elder people
https://hmcarchitects.com/news/a-

Image no 20
Explains COMPLEXITY & ORDER in LTC for elder people
https://www.spvv.com

Exterior design:
-In interface design, preference should be given to fractal and hierarchical structures.
-Multilevel waterfall design following fractal formations.
-Taking into account the fractal formations in the design of fences and paths.
Interior design:
-The use of fractal formations in the design of windows, interior partitions, furniture and other functional decorative elements , interior stairs.
-The use of fractal formations in the design of wallpaper and carpets.
The relationship between interior and exterior design:
-Designing fences and safety bars on windows, balconies and doors are the best places to play with fractal formations. (1-p105-106)

1-3 Nature of the Space Patterns

1-3-1 PROSPECT

A space with a good Prospect condition feels freeing and open, yet imparts a sense of control and safety, particularly when alone or in unfamiliar environments.

Stress Reduction	Cognitive Performance	Emotion, mood & Preferen
Reduced stress	Reduced boredom, irritation, fatigue	Improved comfort and perceived safety (4-p44)

Image no 21
Explains PROSPECT in LTC for elder people
https://www.google.com

Image no 22
Explains PROSPECT in LTC for elder people
https://www.architectmagazine.com

Exterior design:
- The orientation of the building, and the design of the perimeter fence, will help improve visual access to the internal and external scenes, activity centers, and facades.
Interior design:
- Use of transparent materials.
- Open Horizontal Projection.
The relationship between interior and exterior design:
- Designing balconies, platforms, and stairs in a way that provides an open view of the space. (1-p107)

1-3-2 .Refuge

Refuge is a place for withdrawal, from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.

Image no 23
Explains Refuge in LTC for elder people
https://www.archdaily.com/941691/

Image no 24
Explains Refuge in LTC for elder people
https://www.pinterest.com/pin/6262

Exterior design:
- Design of covered pergolas and walkways.
- Leaning on tree trunks or hiding behind them when playing.
- Tree house design.
Interior design:
- Design work to take advantage of the corners of the rooms.
- Height control through the internal cladding of the ceilings.
- Designing walls with cavities resembling small caves.
- Exploiting the spaces under the stairs.

Cognitive Performance
Improved attention, concentrationand perception of safety (4-p46)

- The use of curtains and barriers that can be controlled.
The relationship between interior and exterior design:
- Designing another main gate, especially for the entry of children.
- Designing some windows with low heights for the elder vision level and securing them with barriers.
- Covering balconies and roofs with umbrellas. (6-p74)

1-3-3- Mystery and exploration

Enticement creates mystery with the assurance of information beyond what is currently accessible, it evolves from the human nature to explore and understand . Fear inducing spaces would have a shallow depth of field, or feel as though anything encountered would be a surprise. Mystery and exploration must be deliberate, because going too far may cause them injury or a type of phobia. (12)

Emotion, mood & Preference

Induced strong pleasure response

Image no 25
Explains Mystery and exploration in LTC for elder people
https://walkerconstructioninc.com

Image no 26
Explains Mystery and exploration in LTC for elder people
https://www.spokanejournal.com

Exterior design:
-Winding paths within lanes in gardens.
-Overgrowth of plantings to obscure the depth of the garden.
Interior design:
-Curved edges are more effective than sharp corners in drawing people through a space.
-Dramatic shade can enhance the experience of mystery.
-Audio effects from an unknown source.
-Designing curtains and barriers that block vision from some areas.
-Exploiting the space under the stairs.
The relationship between interior and exterior design:
-Half exposed gate design.
-Transparent windows partially reveal the exterior.
-Covering part of the balconies. (1-p111)

1-3-4.Risk/Peril

A space with a good Risk/Peril condition feels exhilarating, and with an implied threat, maybe even a little perverse or.mischievous .One feels that it might be dangerous, but intriguing, worth exploring and possibly even irresistible. (4-p50)

Stress Reduction | Cognitive Performance | Emotion, mood & Preference

Resulted in strong dopamine or pleasure responses

Image no 27
Explains Risk/Peril in LTC for elder people
https://www.mansionglobal.com

Image no 28
Explains Risk/Peril in LTC for elder people
https://continuingeducation.bnpmedia.com

Exterior design:
-Rocks interspersed with some water to give the feeling of fear of getting wet and avoid it.
-High walls or fences.
-Semi-dark corridors with soft lighting.
Interior design:
-Transparent floors.
-Handrails of colored transparent materials for stairs.
-A depiction of some large, life-size animals in some areas.
The relationship between interior and exterior design:
-Transparent gates.
-Transparent facades from floor to ceiling.
-Glass railings on the balconies. (4-p50)

2.The main principles of universal design: (5-p41-45)

Table :2 Illustrates patterns of universal design

Description and examples	-How to apply it within long-term residential care centers for elder people
2-1 Equitable use: A design should be usable by many groups of society.  Image no 29 Explains The facility entrances with ramps or without a level difference in LTC for elder people ttps://www.kkstokyo.co.jp	The design must be facilitating the same means used for all groups. The designs requires security , privacy and safety for all users. The designs should be attractive for all visitors.
2-2Flexibility in use: A design must be usable by users with many individual capabilities.  Image no 30 Explains The bars at the bathroom provides ailernative usages for the users in LTC for elder people https://www.archdaily.com	The design must be user-friendly usable in more than one condition. The design must have flexibility for users with some unconventional ways.

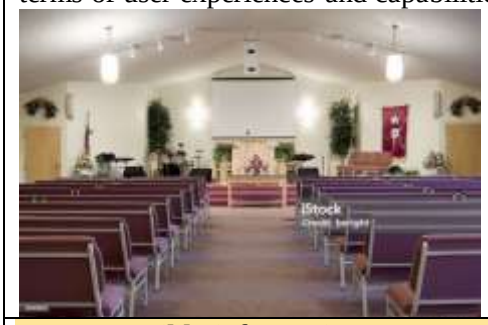
2-3 Simple and intuitive use: This means that the design is ,understandable, easy and reviewed in terms of user experiences and capabilities.  Image no 31 Explains The user must understand the usage without intense explanations. The signs with images instead of words. in LTC for elder people	The designs is easily understood. The designs must adapt to all users capabilities. The designs provide various language skills and unique fonts. Important information is placed in strategic places.
2-4 Perceptible information: Which means that a product and place must be equipped with supporting information vital for all users by adjusting users capabilities .  Image no 32 Explains Using the contrast of colors. in LTC for elder people https://www.archdaily.com	Important information is easy to understand read , and provides clear instructions quickly according to users various abilities. The use of different types of markings (text,textures images ,) must contain clear information. Contrasting colors are used to distinguish important information from its surroundings.
2-5 Tolerance for error : Means minimizing dangers and errors that can be detrimened.  Image no 33 Explains Non –slip and soft floor covering materials to protect users from possible damage.. in LTC for elder people	Providing safe alert information when a feature fails. Arranging the elements to reduce hazards and errors. Facilitating safe and precise hazard warning information. Anticipating the loss of awareness in every situation .
2-6 Low physical effort : A design must be able to be used efficiently and comfortably and can reduce the occurrence of accidents.  Image no 34 Explains Using automatic doors leads to minimize physical effort for the users.. in LTC for elder people	The design can be used in a normal body position. The design can be used in one movement without repetition and is not difficult to use. The design must accommodate unusual ways.
2-7 Size and space for approach and ues: The spaces size should consider approaches to the users size ,movement., and posture .	Providing precise forms and boundaries of each design. Creating comfortable shapes for the users standing and sitting. Paying attention to

Image no 35
Explains Kitchen countertop or information desk countertop multilevel design.. in LTC for elder people
https://www.ispaceoffice.com

minimum needs by adjusting room standards.

Second: Analytical framework

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. The renovation includes 62 living units, an auditorium that allows concerts, a heated pool, fitness center, bistro and library. The design is created considering the biophilic principles and universal design.. The community has a Live-well program that includes seven patterns: a healthy mind and body, social connections, lifelong learning, financial well-being, mindfulness, entertainment and fun, and spirituality. There designed four different dining alternatives within these principles: an outdoor dining area, an indoor swimming pool ,a ballroom, , a business and arts center, a wellness center, and a library. Moreover, the residents have an opportunity at the garden to plant and gardening. The building has a view of forests, mountains, 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.

The Table below shows that the Rockwood Retirement 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 view 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 petting, touching, and sharing a feeling with the animals. The materials' usage is mimicking nature with their colors and forms. For instance, the interior corridors have a flowing form mimicking the Spokane River near the facility; the design helps to provide the mystery in the environment; the user is curious about the areas that do not remain in their perspective. The facility has wide windows that open and close by user choice, These broad and operable windows provide diffused and dynamic lights to the interior and create airflow and thermal control and provide a wide perspective for the viewers that maintains the prospect pattern. The facility meets the universal design criteria to a great extent.

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

Biophilic pattern	Image	Equitable use	Flexibility in use	Simple and intuitive use	Perceptible information	Tolerance for error	Low physical effort	Size and space for approach and ues
visual connection with nature		●	●	●	●	●	●	●
non -visual connectioun wiith nature		●	●	●	●	●	●	●

non rythmic sensory stimuli		●	●	●	●	●	●	●
thermal and 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 peril		●	●	●	●	O	●	●

● satisfying the pattern

○not satisfying the pattern

O not possible to evaluate

Analytic framework results:

1. 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 .
2. 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.
3. 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.

Results:

1. Nature in the Space Patterns refers to adding natural elements into the built environment. This is perhaps the easiest and cheapest way to introduce Biophilia to the elderly living space and gives people instant access to all the feel good associations of biophilia. Views to nature from the inside of the building, natural light, and direct access to nature like courtyards, gardens and roof terraces planted with greenery, also fall into this category. These direct connections to nature have the strongest impact on us as humans.
2. Natural Analogues Patterns refers to man-made elements that mimic nature. Artificial plants, preserved moss walls, representational artwork, patterns and architecture that evoke nature are all examples of natural analogues. Furniture with organic rather than geometric shapes.

Woodgrain and building materials mimicking shells and leaves used in interior of exterior decoration are all excellent illustrations of the use of natural analogues.

3. Nature of the Space Patterns refers to the physiological way in which space planning and architectural design affect our human responses and feelings.
4. The necessity of the interaction of the elderly with nature made it necessary to search for methods of designing the natural relations of the elderly in the inner space.
5. 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.
6. Biophilic and universal design criteria made the designed spaces suitable for the elderly in physiological, psychological, and sociological ways and made them feel at home and safe.

Recommendations:

We recommend designers through associations and research centers to:

1. Finding a way to maximize the external natural ecosystem in the internal environment when designing residence centers for the elderly for long periods.
2. Linking the interior design of the residence centers for the elderly with the elements of the natural environment by applying some of the biophilic design and universal design patterns to improve the psychological and physical health of the elderly and their connection to the void.

We recommend agencies interested in the elderly to:

Applying the concept of biophilic design and universal design in architecture and interior design in spaces for the elderly because it helps in attachment to the internal environment and enhances their mental and physical health.

References ;

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