

Landscape Design of Therapeutic Garden for Dementia Patients Based on Trilism of Landscape Planning

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Abstract:

In the context of China's deep aging society, the construction of a dementia-friendly habitat has become an inescapable key issue nowadays. This study focuses on the design of rehabilitation gardens for dementia patients based on the trilism of landscape planning, which has been proven to significantly reduce the pathological symptoms of dementia patients, improve their quality of life, protect their dignity, and have significant socio-economic benefits. Starting from the theoretical framework of landscape triad, combined with the in-depth analysis of the characteristics and environmental needs of dementia patients, this study constructs a landscape design strategy in three dimensions: morphological element, contextual element and activity element. The implementation of this strategy will optimize the living environment of elderly dementia patients and aims to provide innovative ideas and reference basis for theoretical research and practical operation in related fields.

Keywords:

Trilism of Landscape Planning, Dementia, Therapeutic Garden, Landscape Design

1. Introduction

As the world ages, the number of elderly people with dementia is increasing, posing a challenge to the health of society. Dementia is a neurodegenerative disease that affects memory, thinking, language and behavior, impacting the lives and socialization of those living with it. Data show that nearly 50 million elderly people worldwide will have dementia in 2020 and it is expected to double in 30 years. China, the most populous country, also has a large number of elderly people with dementia. Studies show that nearly 10 million of China's population over the age of 65 will have dementia in 2020, and this number is growing. Against this backdrop, it has become especially important to improve the quality of life and satisfaction of the elderly with dementia. Dementia rehabilitation gardens, which are designed for the environment of elderly people with dementia, optimize the layout of space and facilities to improve their quality of life and social skills. However, the understanding of dementia therapeutic gardens in China is still shallow and there is a lack of design methods. In

this paper, we apply the trilism of landscape planning to design therapeutic gardens in order to provide new perspectives and strategies for improving the quality of life of the elderly with dementia.

2. Foundational Theoretical Analysis

2.1. Trilism of Landscape Planning

Trilism of Landscape Planning, a significant concept advanced by Professor Liu Binyi of Tongji University, encapsulates three core elements: background elements consisting of the material environment formed by natural and human factors, also known as environmental greening; activity elements encompassing the outdoor sensations and behaviors of humans and other life forms, otherwise referred to as public behavioral psychology; and form elements, denoting the space on which human environment and behavior are predicated, that is, the visual landscape image. These elements mutually supplement and are inseparable in shaping human environmental perception. An excellent landscape environment invariably embodies the combined effect of these three elements, a reflection of the profound principle of environmental design, mirroring the integrated function of physical environment, emotional environment, and artistic conception in Chinese classical gardens.

2.2. Therapeutic Gardens

Therapeutic Gardens Or wellness gardens, healing gardens or medical gardens, as the name suggests, are gardens that have the ability to help the elderly recover and maintain their health in a medical or wellness environment. The main idea of a therapeutic garden is to combine natural and human elements in a passive or active way to promote the full recovery of the user's physical, psychological, spiritual and social functions[1]. In a convalescent or rehabilitation setting, therapeutic gardens are believed to significantly improve the physical and mental health of elderly people with dementia. Studies have found that green spaces and natural environments can significantly reduce stress levels and enhance physical and psychological comfort, thereby improving quality of life. A study in Holt, Michigan, USA, showed that seniors with dementia who spent just 10-15 minutes a day in a therapeutic garden experienced significant improvements in their physiological indicators[2]. In a Canadian care facility, research found that exposure to a garden stabilized the mood and improved behavioral problems of elderly people with dementia[2]. Therapeutic gardens provide effective support for the physical and psychological rehabilitation of elderly people with dementia by providing a natural, comfortable, and safe environment and beneficial activities.

3. Characteristics of Elderly Dementia Patients and Their Corresponding Environmental Needs

The factors and processes of dementia disease result in the elderly with dementia presenting different symptoms, including core symptoms dominated by memory, orientation, comprehension, and executive dysfunction, as well as behavioral and psychological symptoms (BPSD) marked by behaviors such as agitation, hyperactivity, depression, delusions, roaming, and violent speech [3]. The author initially summarized the corresponding needs of the elderly with dementia for the rehabilitation garden environment by taking the physical and mental characteristics of

the elderly with dementia as the basis and combining them with existing studies (i.e., Table 1) .

Table 1. *Characteristics and environmental needs of the elderly with dementia.*

Characteristics of people with dementia	Capability Description	Environmental design requirements
Physical and mental characteristics	Hallucinations, agitation, restlessness, fear	Avoiding ambiguity
	Loss of immediate memory, retention of distant memory	Memory tips, nostalgia therapy design
	Degraded sensory ability and untimely perception of high temperatures in bright light	Avoid extreme light and temperature stimuli
	Limited motor skills, frailty, safety concerns	Avoiding fatigue and falls, staying within sight and ensuring absolute safety
	Disruption of circadian rhythm, disrupted sleep, depressed and irritable mood	Exposure to sunlight promotes vitamin D absorption
	No sense of time, forget to use it if you don't see it	Natural scenery visible from the window establishes a sense of time and the garden is easily visible
	Apathy, lack of interest, lack of motivation	Create spaces and experiences that are exciting and engaging
	Depression, sadness, guilt, reduced sense of well-being	Contact with nature, emotional soothing
	Degradation of sensory abilities (sight, smell, touch, taste, hearing)	Multiple beneficial sensory stimulation
Cognitive behavioural characteristics	Loitering behaviour	Freedom of behaviour and security
	Delusions of grandeur and 'escape' behaviour	Behaviour avoidance, soft containment
	Reduced visual-spatial orientation, weak location recognition, and tendency to get lost	Location cues, weak entrances, clear, simple and easy to understand spatial layouts and spatial paths
	Weak cognitive understanding	Reduces the difficulty of understanding
	Walking aimlessly, pacing, wandering	Provides safe, easy-to-navigate circular paths

4. Landscape Design Strategies for Dementia Therapeutic Gardens

Informed by empirical research and trilmism of landscape planning, the design of a therapeutic garden for dementia incorporates three pivotal dimensions: background elements, activity elements, and form elements. As the foremost layer of landscape design, visual landscape imagery concentrates on the visual cognitive needs of the patients, creating an aesthetically pleasing and easily identifiable environment[4]. The aspect of environmental ecological greening necessitates consideration of the physiological needs of dementia patients, crafting a harmonious space for patients and nature through ecological principles and strategies that support physical and mental health. The behavioral-psychological dimension respects patients' behavioral patterns and social needs, designing to establish an ideally comfortable space for rehabilitation interactions. These three dimensions provide a comprehensive framework for

understanding the design of therapeutic gardens, aiding in devising effective and inclusive design strategies to meet the diversified needs of dementia patients.

4.1. Form Elements: Creating Comfortable and Aesthetically Pleasing Visual Landscape Imagery Design

(1) Simple and clear spatial organization layout

In order to optimize the spatial orientation of the elderly with impaired cognitive function, the spatial layout of the therapeutic garden needs to be clear and simple so that the elderly can enjoy the space of the therapeutic garden independently and comfortably. To ensure that the elderly with dementia can have a clear overview of the garden from any corner, avoid dense planting of shrubs at eye level, and replace them with tall trees or low shrubs. The transition of space should be natural and smooth, avoiding a maze-like environment, and roads should avoid being too busy with too many branches. They should be designed as curved loops, "8"-shaped, without end roads and forks to unknown directions, in order to prevent anxiety and confusion of the elderly with dementia (i.e., Figure 1). In addition, by using different ground materials to distinguish trails and main paths, it helps the elderly to better identify different paths.

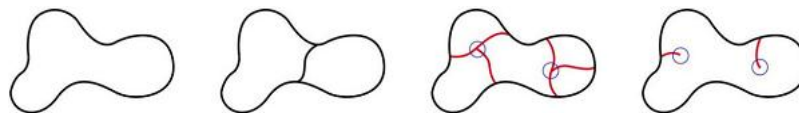


Figure 1. Road forms.

(2) Rational grasp of the scale of landscape space

When considering the spatial design of a dementia therapeutic garden, the rational grasp of scale is an extremely critical factor. Based on the needs of visual perception, three scales are to be considered: natural scale, superhuman scale and intimate scale. The natural scale focuses on the presence of dementia patients, and meets their visual and physical needs by adjusting the width of the passage, the design of stairs and ramps; the height of stair steps should not be higher than 10 cm, the width should be greater than 30 cm, and the slope of ramps should be controlled between 0.3%-2% to reduce the slope length as much as possible. The superhuman scale is used to show spectacular views, but excessive space should be avoided in the design; instead, the memorability of the environment should be enhanced through symbolic elements. The goal of the intimate scale is to create intimate landscape spaces. Considering the characteristics of the elderly with dementia in terms of recent memory loss and long-term memory retention, the design should create spaces that evoke their sense of familiarity as much as possible, imitating their familiar living environment or landscape elements from the past.

(3) Systematic configuration of visual perceptual elements

The selection of visual perceptual elements should focus on readability, recognizability and visual safety. In terms of color, as the seniors with dementia have a weaker perception of color and contrast sensitivity, different spaces need to have clear color distinctions to provide clear visual instructions for the seniors with dementia. In addition color selection should be based on a soft, non-impactful color palette, as overly bright or high-contrast colors may over-stimulate their visual system, triggering distress or even panic. Spatial elements should be designed to be highly recognizable to support the elderly's ability to navigate. Landmarks or markers with

distinctive features can be used to help them identify and remember routes and spatial areas in their environment. For example, in the outdoor landscape design of the Hof van Nassau Cognitive Care Center in the Netherlands, each of its activity areas was made highly recognizable and easy for the elderly to identify and use through the use of unique sculptures and decorations such as fountains and iron flowers (i.e., Figure 2).



Figure 2. Courtyard vignette at Hof van Nassau Cognitive Care Center, Netherlands.

4.2. Background Elements: Ecological Greening Design Adapting to the Needs of Elderly Dementia Patients

(1) Plant configuration driven by dementia characteristics

The selection of plant species and configurations for the characteristics of elderly people with dementia is a human-centered and plant-assisted design thinking process. Rappe, a researcher, found that plant elements in gardens can effectively enhance the sense of well-being of the elderly through questionnaire surveys and behavioral observation [2]. Due to the memory loss of elderly people with dementia, the design should introduce familiar and tactile plant species, such as plants with distinct seasons, to help restore their perception of time and seasons. At the same time, choose plants with fragrance, such as lavender and jasmine, to evoke memory and enhance cognitive functions through olfactory stimulation. At the same time, it is important to consider the cultural background of the elderly and choose plants that can evoke their past memories to increase the sense of intimacy. It is also necessary to retain native tree species and original soil to provide good growing environment and shade. Safety is also key, avoiding plants that are toxic, allergenic or thorny.

(2) Environmental Optimization of Water Elements, Light, and Air Quality

Environmental optimization is a key component of healing garden design, including the proper use of water elements and light. Water elements provide a vivid visual effect, while the sound of rushing water has a soothing effect. Proper reflection of the water surface enhances light and adjusts the environmental climate. For example, the Willis Woods Hospital Therapeutic Garden in the United States uses 1.2-meter-tall containers and shrubs to form water elements that enhance the diversity and interest of the garden. It also helps to relieve psychological stress (i.e., Figure 3). In addition, considering that the elderly may have varying degrees of visual impairment, light regulation is also particularly important. The design selects plants with moderate height and canopy width for shade, while some translucent shading facilities are installed to regulate light, for example, the Abundant Life Center Garden in Kings Mountain, USA, has translucent glass installed at its entrance porch, which provides shade from the rain and also provides a transition of sight lines. (i.e., Figure 4).



Figure 3. *Water feature at Willis Wootts Hospital Therapeutic Garden.*



Figure 4. *Kings Mountain Abundant Life Center Garden Entrance Porch.*

(3) Acoustic control and microclimate shaping

Based on the characteristics of the elderly with dementia, the acoustics and microclimate management of the environment are critical. The design should reduce noise, especially artificial and mechanical, and prioritize natural sounds, such as birdsong, water flow, and wind, to promote psychological stability and create a harmonious atmosphere. At the same time, attempts should be made to reduce the disturbance of mechanical and artificial noises to protect the auditory comfort of the elderly. Microclimate shaping, on the other hand, should focus on physical comfort. Since the elderly with dementia are more sensitive to temperature and humidity, we need to scientifically plan the greenery of the courtyard to create proper shading and wind permeability.

4.3. Activity Elements: Space Form Design Focusing on Behavioral Psychology of Elderly Dementia Patients

(1) Building multi-level indoor-outdoor transition spaces

Considering the sensitivity of the elderly with dementia to environmental stimuli, setting up transition spaces can help them adapt to changes in light and temperature, while providing them with more diverse options to extend their outdoor activity space and time under different weather conditions. Setting up sunrooms and greenhouses, as well as spaces such as shade trees, porches, and balconies, as a buffer for the transition between inside and outside, these spaces can provide a comfortable environment to support the elderly in their outside activities, especially when the sun is strong, and this multi-level design of indoor-outdoor transition spaces ensures that the elderly with dementia can enjoy their outdoor activities in a comfortable and safe environment, thus improving their quality of life.

(2) Create a multi-private rest and social space

As cognitive and language skills decline, older adults with dementia show a tendency to become less adaptable to the external environment. In light of this, it is particularly important to design and implement a variety of recreational spaces of privacy and social intensity that can be adapted to the different needs of the elderly and provide comfortable personal or social spaces. Private and tranquil environments that enhance interaction between seniors and family and friends, and group settings that provide necessary quiet time, such as gardens, are ideal. The design should include resting places away from the common areas, such as resting corners around gazebos or trees, as well as amenities at building entrances and exits to facilitate

social activities, and caregivers can organize a variety of activities to enhance social interactions for the elderly [5].

(3) Creating a healing gardening space

The horticultural activity area will provide a place for horticultural therapy, allowing the elderly with dementia to get whole body exercise while participating in various horticultural activities, and by working with others in order to promote social interaction. Through plants, health care providers can plan activities such as planting and harvesting that correspond to the needs and abilities of the elderly. Seniors can get a sense of satisfaction and accomplishment by participating in the whole process of plant growth. Choosing plants with short growth cycles, such as vegetables and flowers, allows the elderly to see the fruits of their labor in a short period of time. Finally, health care workers can also use the plants grown by the elderly to hold activities such as flower arranging and jam making, making it possible for the elderly to have fun and a sense of accomplishment in participating in these activities .

5. Conclusions

Elderly dementia is a key issue in our aging society and in senior living environment research. Therapeutic gardens play a significant role in dementia patients' recovery and life quality, and have socioeconomic importance. This study aims to improve dementia patients' life quality using a landscape planning triad for therapeutic gardens, examining background, activity, and form elements. While offering valuable design tactics, more research is needed, possibly using field observations to validate these strategies. Therapeutic gardens can become ideal recovery environments, balancing physical, mental, and ecological needs. This research offers new theoretical insights and practical strategies for improving dementia patients' life quality, and hopes therapeutic gardens will have a deeper impact on social health and welfare.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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