Analysis of Empirical Research Methods of Rehabilitation Landscape

Jia Luo, Hanxin Liu*

Gold Mantis School of Architecture, Soochow University, Suzhou, 215123, China
Email: 3221500@qq.com

Abstract. In modern times, the natural environment has attracted people's attention as a resource for maintaining people's physical and mental health. Nature and health involve many different disciplines. In the landscape disciplines, it is called "rehabilitation landscape". Rehabilitation landscape is important to the mind and physiology of individuals there are also many scientific research results for new types of gardens. On this basis, this paper analyzes the current empirical research methods of rehabilitation landscape from the perspective of subject and object by combing the development process of rehabilitation landscape, and points out its shortcomings, analyzes its future development trend, and finally proposes future empirical research. The method should have a more rigorous and systematic research structure, strengthen the grasp of the research essence, and promote the formation of an evaluation system with optimized practical significance.

Keywords: healing landscape design; empirical research; research progress; health benefit

1. Introduction

With the rapid economic development and the continuous improvement of living standards, people are paying more and more attention to health. People demand not only physical health, but physical, psychological and social health. From the perspective of the landscape, the rehabilitation landscape is a specific way to apply the concept of health to practice. At the end of the 20th century, the concept of modern rehabilitation landscape was introduced to China and gradually accepted by related scholars and practitioners [1]. The scope of application of rehabilitation landscape is wide, and it is a multidisciplinary concept. At present, there are many researches and practices on it at home and abroad, but they are scattered and not targeted; this article sorts out the development process of the rehabilitation landscape, classifies and summarizes the empirical research methods of the rehabilitation landscape, and analyzes its internal mechanism and development trend, to provide references for related researchers.

2. Rehabilitation Landscape and its Research Progress

2.1. Concept of Healing Landscape

Since "Silent Spring" was published in the United States, it has caused great repercussions all over the world. People have begun to re-examine the value of nature, and researchers around the world have also begun to actively explore the relationship between environment and health [2]. Then put forward the concept of restoring the landscape. It is also called a healing garden, a healing landscape, or a healing landscape. It is a new form of garden that appeared in the United States in the 1930s. It can be referred to in a narrow sense. The landscape environment of medical institutions with rehabilitation
purposes can also refer to all outdoor environments that have health benefits to the human body.

Different scholars have different definitions. Roger Ulrich proposed that there should be many green plants, flowers, water, etc. to restore the landscape, which have a positive effect on most users [3]. Yang Huan, Liu Binyi and others believe that the rehabilitation landscape is composed of natural landscape and humanistic landscape, which can help patients recover as soon as possible, reduce the pressure of users, improve their physical and mental conditions, and achieve the purpose of treatment [4]. On the basis of previous research, the concept of restoration of the landscape was integrated. Therefore, the rehabilitation environment is an environment that allows the user to recover or maintain health, interact with the user, and make the user's spirit and soul in a healthy state.

2.2. Research Progress of Rehabilitation Landscape at Home and Abroad

2.2.1. Domestic Research Progress. Nowadays, the rehabilitation landscape is gradually familiar to people, and there are many scientific research results. However, domestic research on it started relatively late. From the perspective of landscape (Table 1), the introduction to it in the 1990s was mostly scientific in nature. The earliest introduction was Li Shuhua's "Early Establishing a Disciplinary System of Horticultural Therapy with Chinese Characteristics" (top and bottom) [5,6], which systematically described horticultural therapy and proposed methods and methods for developing horticultural therapy in China. In 2002, Liang Yongji and others summarized its layout and other aspects in the book "Hospital Sanatorium Garden Green Design" in combination with actual cases [7]; then Niu Zehui proposed the concept of "health-care garden". Health and improve one's own awareness of health care, and made a prospect for health-care gardens [8]. Wang Zhifang and others conducted empirical research on rehabilitation landscape based on foreign ART and SRT theories, and talked about applying revelation to evidence-based design.

From a medical point of view, Xiu Meiling et al. measured the blood pressure and pulse of the elderly before and after activities, and found that the environment can improve them [9]; Chen Zheng et al. focused on restorative environments and the available measurement instruments. Quantitative research on rehabilitation landscape [10]; Li Ying studied that the aroma produced by aromatic plants can balance the body’s physical and mental health; Li Yongzhen conducted experiments on children in kindergartens and found that by guiding students to plant flowers and plants, children with rough emotions can become Careful, introverted children become cheerful.

2.2.2. Research Progress Abroad. Since the 1990s, led by North America, landscape restoration design practices have been actively carried out all over the world. From a medical point of view, Jin et al. Horticultural therapy has conducted experiments on children with intellectual disabilities, showing that garden therapy can improve children's attention. Kaplan proposed the theory of attention recovery, which believes that the natural environment can restore attention, eliminate fatigue, and improve mood and perception. Stephen Kaplan and Rachel Kaplan put forward the theory of stress recovery, that stress resolution is the core mechanism of natural landscape recovery [11].

From a landscape perspective, in 1975, the British geographer Jay Appleton proposed a lookout in the book "Landscape Experience"-Asylum theory. In 1984, E.O. Wilson proposed a biological hypothesis that people tend to be close to nature. In 1997, Claire Cooper Marcus published "Rehabilitation Landscape: Evidence-Based Rehabilitation Garden and Outdoor Space Design Method" [12]. Cooper Marcos evaluated four parks in San Francisco, USA, and found that the mood of tourists has improved significantly after the tour.

Through the analysis of the research progress of the rehabilitation landscape at home and abroad, the current rehabilitation landscape has gradually expanded from the initial medical field to the rehabilitation of the environment and people. In modern times, it focuses on the mechanism, design practice and empirical research of the rehabilitation landscape. The design and practice of a large number of rehabilitation landscapes presents a logical clue of "theory-practice-empirical". However, there are still some problems with the current rehabilitation landscape. First, the rehabilitation
landscape comes from foreign countries and is not very closely integrated with the oriental culture in theory. The integration with the Chinese local culture should be strengthened to establish the theory and design of the rehabilitation landscape for the oriental culture. System; Secondly, the connection between rehabilitation landscape and landscape architecture is not strong. Most of them focus on the research of medicine, psychology and environmental behavior. There are fewer researches based on landscape architecture, and more attention should be paid to the role of landscape architecture in health. Finally, the evaluation system for the rehabilitation landscape is better applied to practice, and the current design system is improved through the concept of evidence-based design to enhance the scientficity and applicability of the design.

3. Empirical Research Methods of Rehabilitation Landscape

The development and perfection of the theory requires a lot of empirical research. At present, there are many researches in the aspects of design, practice and evaluation, but there are few literatures on the summary and analysis of its research methods. The following is mainly from the perspective of the subject and the object to sum up.

3.1. Research Methods from the Perspective of the Subject

The research methods under this research perspective are based on the user's subjective feeling evaluation and physical and mental health data measurement (figure 1) to empirically study the healing effects of the rehabilitation landscape. The former is measured by letting the subjects score the environment in which they are in "relieving fatigue and recovering cognition", scoring the environmental recovery scale [2], place preference and attachment degree, and map markers. For example, Karin analyzed the relationship between nine different characteristics of small-scale urban green space and human perception restoration [13], Moohan Kim et al. studied the relationship between human characteristics in Korean parks and environmental perception restoration [14].

Figure 1. Research methods based on users' subjective feelings.

The latter measures three types of health data: emotion, stress and attention. Emotion is the most direct response to mental health, and using the Concise Mood Scale to empirically study the relationship between environment and health, MIT-related researchers have discovered a method of using a variety of emotional-related physiological indicators to calculate emotions, provides a new research method for emotion research Physiological data collection and wearable physiological data collection devices are used to measure stress performance. Huang Shuqing and others have used VR technology to study the health healing (stress) performance of people in different window views in the
living room [15]. In terms of attention, Rodiek Susan et al. studied the attention feedback of the elderly in Nanjing on the environmental quality around the street trees [16], and analyzed that different environmental qualities have different effects on human perception recovery. Eye tracking technology has been studied in recent years. It is used to conduct environmental visual evaluation and study the relationship between the environment and human attention recovery [2].

The empirical research from the subjective perspective is mainly based on people’s scoring and evaluation of a series of scales, combined with physiological instruments to reflect people’s subjective feelings about the environment, and quantitatively determine the health effects of the environment on people, but the results are often certain. The physiological data indicators of the human body change in a moment, and the long-term effect of the environment on the human body has not been studied. Many research conclusions need to be confirmed more systematically.

3.2. Research Method from the Perspective of Object

From the perspective of environmental stimulus presentation (objective perspective), there are three main types of empirical research methods (Figure 2).

(1) It is photos and photography. In the early days, due to experimental efficiency and evaluation tools, the evaluation research was carried out by using photos to simulate the real environment. Adeleh Nejati uses visual simulation technology to evaluate the difference in the quality of restoration of hospital staff in different environments [17]. Rodiek Susan uses PS technology to combine real-life photos to allow the elderly to score the environmental quality around the street trees to study the elderly People’s preference.

(2) It is a computer model and virtual reality. In some more complex researches, computer modeling (3D Max, Sketchup) is used to create a real environment to analyze the correlation between target characteristics and restorative feelings. Ye Yu et al. used VR technology to study the social utility of public spaces in low-rise buildings in different regions, and through the use of wearable watches to check [18], the quantitative research results provide suggestions for similar designs in the future.

(3) It is a real environment. Due to many uncontrollable factors, many researches based on visual perception are not carried out in the real environment. They emphasize the overall perception of the environment. Among them, indoor plants, gardening therapy and forest therapy are the main ones. Ruth K. Raanaas measured the results of the scale for students in the environment of indoor plants and studied the effects of indoor plants on human physical and mental health [19].

![Figure 2. Research methods from the perspective of object.](image)

With the application of wearable and portable technical devices, more possibilities for research methods and scientific research results are provided. The research method under this perspective has gradually developed from early qualitative research to a composite empirical research combining qualitative and quantitative.
3.3. Problems in the Research

3.3.1. Research Methods Fail to Eliminate Interference Items. Most of the empirical studies are quantitative studies, analyzing the recuperation and perception restoration of people under different environmental conditions, thereby verifying the health effects of the rehabilitation landscape on people. The environmental recovery scale, functional MRI, and emotional recovery scale are used to quantitatively evaluate people's mental and physical health, and through correlation analysis, the relationship between the environment and human health is obtained, but there is a problem of insufficient reliability in the empirical process.

First of all, due to other external factors that interfere with the subject during the research process, the instrument itself has an impact on the subject, which will produce different physiological and psychological states, and the virtual nature of computer technology (VR) leads to the final study The result is untrue. Secondly, investigations and studies are mostly about the changes in various indicators of the human body at a certain moment. The measurement results have short-term shortcomings and lack the support of long-term reliable research results. Therefore, it is necessary to ensure the scientific nature of the research methods and the reliability of the research results during research. Finally, in visual evaluation with vision as the core, the aesthetic preference rule is too broad and lacks pertinence, and it is difficult to apply to specific projects with large individual differences, and other non-visual landscape perception approaches need to be considered.

3.3.2. The Number of Samples Drawn in the Study is too Small. Judging from the sampling data selected from the literature, many quantitative research survey data have a small sample size and insufficient scientificity. The results obtained by analysis cannot achieve universal effects, and more stringent experimental samples and experimental control are required, and the research conducted takes the researcher’s city as the research object. Due to the limitation of seasons, time, region and other factors, the research objects selected in different cities have obvious differences in regional characteristics. The research sample selected based on a certain city is not representative, and the results obtained cannot be universally applicable to all cities.

3.3.3. The Selection of Research Sites is not Integrated. Empirical studies mostly choose small green spaces, campus landscapes, parks and other places as research plots, and there are few literatures on selecting medical institutions, residential quarters, public spaces and leisure and holiday service facilities. And in the selection of people participating in the experiment, as many age levels as possible are covered, and the research is turned to the health of all residents, rather than specific selected experimental subjects, and in the selection of places and audiences, both local and overall research should be emphasized, and the selection should pay attention to its comprehensiveness to make the research more scientific.

4. Conclusion and Discussion

The research of rehabilitation landscape design has gradually moved from theory to practice and empirical research, expanding to a deeper and broader level [2]. The validity of empirical research depends on the development of research tools, and technologies such as virtual reality, wearable portable physiological collection devices, and spatial positioning are becoming more mature, and promote related research to better assist design practice, and empirical research methods have gradually developed from the previous subjective and qualitative judgments to quantitative measurement and research, becoming more rigorous and scientific. But what needs reflection is that the advancement of technology does not mean the high quality of research. For the problems in empirical research, the following suggestions are made:

1) Ensure the rationality of the research structure

The number of samples should be reasonable. The number of samples should be changed from small samples to high-precision and big data collection. The number of valid questionnaires should be
at least about 300 in order to achieve the reliability of the data analysis results. Conduct many field investigations, research the long-term effects of the environment on people, not just the value of the instrument before and after a certain moment, and expand the applicability of the research results. Under the influence of uncontrollable factors (wear of the instrument itself), experiments can be carried out in the control group, and more advanced data analysis techniques can be used for noise reduction and better experimental design processes to optimize, and ensure the systematic and rigorous nature of evidence collection and analysis of empirical research.

2) Form an evaluation system with optimized practical significance

Break through the constraints of landscape architecture and environmental behavior psychology, integrate urban planning, medical health, sociology and other disciplines to break the bottleneck in research. Combined with the conclusions of empirical research, a set of evaluation system with practical significance is formed. In the context of rehabilitation landscape, design will no longer be the end point, but will serve as a cyclical process of "research-design-feedback-perfection-research" An important link. On the basis of a large amount of empirical research data, we draw lessons from foreign POE evaluation systems to form a subjective and objective evaluation mechanism, translate the research conclusions obtained into the design language, and promote rehabilitation landscape design.

References
[1] Shi Sh L 2018 Summary of research and Practice on rehabilitation landscape design in China [J] South Architecture (03): 11-17.
[2] Li Sh H Liu Ch, Yao Y N, et al. 2018 Research frontier of rehabilitation landscape: hot topics and research methods [J] Southern Architecture (03): 4-10.
[3] Stephen L 2009 Introducing healing gardens into a compact university campus: Design Natural Space to Create Healthy and Sustainable Campuses [J] Landscape Research 34(1): 55-81.
[4] Yang H, Liu B Y, Patrick A M 2009 Application of traditional Chinese medicine theory in healthy garden design [J] Chinese Landscape Architecture 25(7): 13-18.
[5] Li Sh H 2000 Establishing a system of horticultural therapeutics with Chinese characteristics as early as possible (1) [J] Chinese Landscape Architecture (03):15-17.
[6] Li Sh H 2000 Establishing the system of horticultural therapy with Chinese characteristics as early as possible (2)[J] Chinese Landscape Architecture (04):32.
[7] Liang Y J 2002 Landscape Design of Hospital Sanatorium [M] Beijing: China Forestry Press: 1-120.
[8] Niu Zh 2006 Theory and Practice of Health Landscape Planning and Design [D] China Agricultural University.
[9] Xiu M L, Li Sh H, 2006 A preliminary study on the influence of horticultural activities on the physical and mental health of the elderly [J] Chinese Landscape Architecture (06):46-49.
[10] Chen Zh, Zhai X Q, et al. 2016 Meta analysis of the impact of restorative natural environment on the mental health of urban residents and its planning implications [J] International Urban Planning 31(4):16-26.
[11] Kaplan S 1995 The restorative benefits of nature: Toward an integrative framework [J] Journal Of Environmental Psychology 15(3): 169-182.
[12] Zhao Y J, Zhao X Z 2019 Analysis of American rehabilitation landscape design methods [J] Architecture and Culture (10): 125-126.
[13] Karin P, Ulrika K S 2013 Association between park characteristics and perceived restorativeness of small public urban green spaces [J] Landscape and Urban Planning 112.
[14] Kim M, 2018 Influence of perceptual range on human perceived restoration [J] Sustainability 10(9): 31-39.
[15] Huang Sh Q, Xu L Q, et al. 2019 The healing landscape of living room - VR research on the health benefits of indoor and window view [J] New Building (05): 23-27.
[16] Wang X X, Rodiek S 2019 Older adults’ preference for landscape features along urban park walkways in Nanjing, China International Journal of Environmental Research and Public Health 16(20).

[17] Adeleh N, Susan R, Mardelle S. 2016 Using visual simulation to evaluate restorative qualities of access to nature in hospital staff break areas [J] Landscape and Urban Planning 148.

[18] Ye Y, Zhou X H, et al. 2019 Quantitative measurement and control of social utility of public space in low area of high-rise building based on virtual reality and physiological sensing technology [J] Time Architecture (06):152-159.

[19] Raanaas R K, Evensen K H, et al. 2011 Benefits of indoor plants on attention capacity in an office setting [J] Journal of Environmental Psychology 31(1): 99-105.