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Salutogenic Landscape Design with Cognitive Restoration Stimuli for Stress Intervention

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Abstract
This study explores the potential of neighbourhood parks in reducing stress and promoting mental well-being in urban settings. Through in-depth interviews with experts in clinical psychology, neuropsychology, and landscape architecture, landscape attributes influencing psychological well-being were identified. Thematic analysis revealed the importance of human-centred design and incorporating elements that inspire enthusiasm for cognitive restoration. The study resulted in a salutogenic and cognitive landscape framework that integrating cognitive behavioural therapy (CBT) into the park design. This framework offers valuable insights and practical guidance for creating healing spaces in neighbourhood parks, catering to physical and psychological needs in urban environments.

Keywords: Salutogenic design; landscape attributes; cognitive restoration; stress intervention.

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1.0 Introduction

Urbanisation is a significant factor contributing to the prevalent health issues in our society, and this challenge will persist in the future. Therefore, it is crucial to introduce new interventions focused on mental health that can be integrated into urban environments to enhance people's well-being (Azman et al., 2023). This aligns with Target 3 of the Sustainable Development Goals (SDGs), which emphasizes improving human health and well-being for future generations. Researchers have recognized a strong connection between urban design and psychological well-being. They believe that there are significant factors linking stress issues to the quality of urban planning and design. Furthermore, there is a growing interest in studying the impact of landscape design on enhancing the well-being of urban residents (Thompson & Kent., 2013).

The built environment evokes cognitive and emotional responses in people (Pykett et al., 2020). Interdisciplinary researchers are increasingly interested in studying the complex interaction between the urban environment and human cognition. This has led to the emergence of new fields such as, neurourbanism and neuropsychological research, which aim to explore how the brain and urban landscapes influence health and well-being (Pykett et al., 2020). Experimental evidence suggests that spending time in natural

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environments has both perceived and tangible benefits, including reduced cognitive or mental fatigue, improved mood, and lower stress levels (Twedt et al., 2016). Numerous empirical studies have also shown that landscape attributes and outdoor activities reduce stress and improve mental health (Hartig, 2021; Corazon et al., 2019). The aim and objective of this study are to identify landscape design elements that contribute to cognitive restoration and to investigate the views of experts regarding the impact of landscape design on cognitive function and stress rehabilitation.

2.0 Literature Review

Previous studies have explored the potential of the physical environment as a source of healing for human illness, also known as the healing environment (Gruebner et al., 2017). Healing environments have been recognized as utilizing views of nature to alleviate stress and support the recovery process, particularly in hospital or healthcare settings (Dilani, 2008). A salutogenic environment, otherwise, is characterized by elements that support general physical health, mental well-being, and overall wellness (Antonovsky; 1979). It can encompass a variety of natural and man-made habitats, particularly in outdoor settings, to promote health by considering the creation of aesthetically pleasing settings that also enhance human well-being. Environments shape behaviour and offer behavioural possibilities. Drawing on the principles of the Attention Restoration Theory (Kaplan, 1995) and the Stress Reduction Theory (Ulrich, 1991), an environment is restorative if it has many exciting features, is easy to navigate, and aligns with the person's interests. Specific environmental attributes have the potential to impact psychological well-being positively. Kanthong & Zhang (2023) emphasized that exposure to natural environments alone can be psychologically restorative and beneficial for emotional reflection. Urban green spaces, including trees, parks, and greenery, play a crucial social role in improving psychological health (Alcock et al., 2014). These spaces are utilized for therapeutic interventions, benefiting vulnerable groups like individuals with mental illness, depression, dementia, and at-risk youth (Lederbogen et al., 2013). Alcock et al. (2014) noted that people residing in greener urban areas tend to have better mental health. Similarly, studies highlight the positive impact of water elements on mood and mental well-being, providing a meditative response and alleviating mental fatigue (Hartig, 2021).

2.1 Integrating Salutogenic Criteria into Landscapes

Antonovsky's salutogenesis theory emphasizes the importance of a sense of coherence (SOC) in dealing with life situations. The SOC theory identifies three criteria: comprehensibility, manageability, and meaningfulness, which help us understand how individuals perceive and respond to their environment. SOC components could be used to analyse and integrate landscape elements into design interventions. Fostering a sense of coherence in landscapes create a positive perception of the environment and enable people to cope better with stress, leading to better mental health outcomes. Psychosocially supportive design (Dilani, 2009) addresses psychological, social, and cultural needs. By incorporating the elements into landscape design, we can create spaces that promote social interaction, privacy, relaxation, and a sense of belonging. The neurology of salutogenic design by Golembiewski (2014) explores how design affects the brain and neurological processes. Integrating this theory into landscape design creates environments that engage the senses, evoke positive emotions and support cognitive functions. Maikov's framework of salutogenic landscape properties provides a set of characteristics that contribute to the overall well-being of individuals. These properties include access to nature, sensory, legibility, safety, and social support. Incorporating these principles into landscape design ensures that environments promote physical activity, sensory stimulation, feelings of safety, and opportunities for social interaction, thereby fostering salutogenic experiences. By exploring the potential synergies between salutogenesis, psychosocial and neurology of salutogenic design, and landscapes, it envisions a multidisciplinary perspective to improve human well-being through the built environment. Table 1 elaborates on the extension of salutogenic criteria concerning psychosocial, neurological and salutogenic landscape elements.

Table 1. Extension of Salutogenic Criteria Concerning Multidisciplinary Design Elements

Sense of Coherence (Antonovsky, 1979)	**Psychosocially Supportive Design** (Alan Dilani, 2009)	**Neurology of Salutogenic Design** (Golembiewski, 2014)	**Salutogenic Landscape Properties** (Maikov, 2016; Maikov et al., 2008)	**Salutogenic Landscape and Cognitive Elements** (Authors, 2021)
Comprehensibility Ability to understand the settings and comprehend the scenario.	Wayfinding Colours Nature Landmarks	Perceptual Cues Texture and Materiality Size of Spaces Number of inhabitants Environmental Features (light, air, plants) Functional alternatives	Rich in Species (Attention / Feelings) Wild (spaces & senses)	**SOC factor:** Adaptation **Cognitive:** Focus and alertness **Design elements:** *Adaptive* elements that promote order, predictability, and legibility to support individual adaptation and stimulate mental cognition.
Manageability Ability to tolerate the settings and mediate scenarios.	Aesthetic Elements Natural Light Green Environment Restoration Interior Design	Control of Environment Accessibility Comfort Cosiness	Serene (Peace & Silence) The Common (Relax & Calming) Space (Longing & Mystical)	**SOC factor:** Contemplation **Cognitive:** Self-sense **Design elements:** *Restorative* elements that stimulate self-reflection and mediation to promote spiritual growth, inner calm, and positive feelings.

Meaningfulness Ability to control social environment and be effective in behaviour.	Social Support Art Music Culture Gym / Fitness Recreation Pets Views	Sense of Place and Community Personal or Cultural Connection Quality Aesthetic	The Pleasure (Secure & Personal) Festive (Freedom & Joyful) Culture (Fascination)	**SOC factor:** Behaviour **Cognitive:** Sensory **Design elements:** *Assertive* elements that promote stimuli-driven attention to encourage the sensation and feelings of a person and associate them with a sense of place.

(Source: Authors, 2021)

2.2 Theoretical Development of Neuro-Salutogenic Landscape Framework

The literature review explores landscape attributes that stimulate cognitive function, salutogenesis aspects, and neuro-salutogenic stimulus for stress reduction. A theoretical framework of a neuro-salutogenic landscape is proposed for analysing the relationship between SOC theory, neurological aspects, and restorative design. The neuro-salutogenic landscape framework includes three main stimuli: *adaptive, restorative*, and *assertive*. The *adaptive* stimulus emphasizes cognitive development and comprehensibility in SOC theory. It enables individuals to adapt and cope with the world. The *restorative* stimulus aims to reduce negative affect and restore mental exhaustion, reflecting the manageability aspect. It focuses on utilizing resources for effective behaviour. The *assertive* stimulus represents balanced and self-confident responses, embodying the meaningfulness aspect of SOC theory. Elements promoting affection and a sense of place are associated with this stimulus. The theoretical framework in Figure 1 illustrates how neuro-salutogenic landscape stimuli can mitigate stress by incorporating elements of psychosocial design, neurology (cognitive) aspects and landscape design.

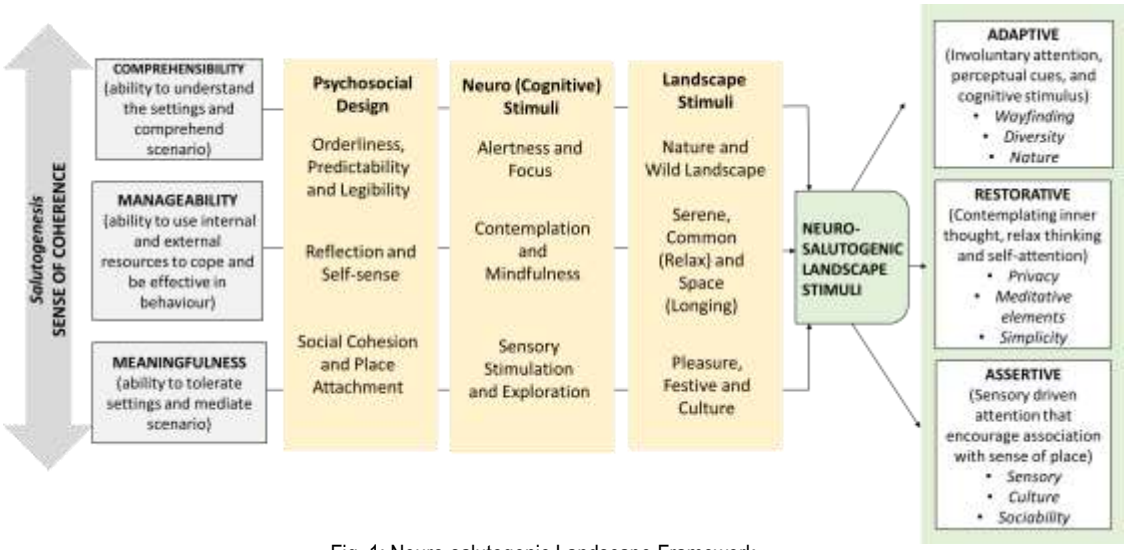

Fig. 1: Neuro-salutogenic Landscape Framework
(Source: Authors, 2021)

3.0 Methodology

This study employed a qualitative approach through in-depth expert interviews with experts from clinical psychology, neuropsychology, and landscape architectural fields.

3.1 In-depth Expert Interviews

In-depth interviews were used to study a specific phenomenon and gather detailed and comprehensive data (Creswell & Creswell, 2018). The purposive sampling method ensured a diverse range of participants, and the interviews aimed to gather insights from psychological experts and landscape professionals. Semi-structured in-depth interviews were used to collect detailed data on stress factors in urban communities, cognitive function in stress rehabilitation, and design recommendations for restorative environments. Experts were selected from different backgrounds, including clinical psychologists, neuropsychologists, counsellors, therapists, landscape professionals, and academia. A total of 12 experts participated in the interviews, with six being psychological experts, four landscape professionals, and two from landscape academia. Ethical approval was obtained from the Universiti Malaya Research Ethics Committee (UMREC) to ensure confidentiality of the respondents. Pseudonyms were used during the transcription and manuscript authoring processes to maintain anonymity.

3.2 The Interview Protocol

The interviews were conducted online between April and August 2021 due to the COVID-19 pandemic. Adhabi and Anozie (2017) state that semi-structured interviews can be conducted using different techniques, each with advantages and disadvantages. Nine interviewees were interviewed using Google Meet, while three responded via email due to scheduling constraints. The interviews were conducted in English or Malay and lasted between 30 and 60 minutes. Prior to the interviews, participants received an interview protocol

containing questions developed based on relevant literature. Participants had the opportunity to seek clarification on the questions in email interviews. This approach ensured comprehensive responses and high-quality data acquisition. Participants were asked to return the completed interview questions at an agreed-upon time. The interview protocol was tailored according to the expertise of the participants. Psychological experts were asked about their professional background, mental health concerns, stress in urban environments, and stress rehabilitation. Landscape professionals were asked about their professional background, common practices in designing neighbourhood parks and restorative environments, and recommendations for restorative landscape design for mental health.

3.3 Data Analysis

Thematic analysis was carried out using Atlas.Ti 9 software. In this process, recurring patterns of meaning were identified and classified into higher-order categories and themes. Open coding was used to code important data, followed by the grouping of similar codes and categorisation of related ideas. The final phase involved selective coding and constant comparison in identifying thematic patterns and relationships. The Code-Document Table and Co-Occurrence Table functions in Atlas.Ti 9 was used to visualise major themes and patterns through cross-tabulation, highlighting dominant factors and common attributes. This software facilitated the analysis and interpretation of the data set for a comprehensive understanding of the themes that emerged from the interviews.

3.4 Limitations of the Study

The COVID-19 pandemic and the subsequent Movement Control Orders (MCO) imposed during the data collection phase posed significant challenges to the study. Due to restrictions on physical meetings and face-to-face interactions, online interviews had to be conducted between April and August 2021. Although online interviews were a viable alternative, they could have limited the depth and richness of the interactions compared to face-to-face interviews. Non-verbal cues and body language, which can convey valuable information during interviews, might need to be noticed, affecting the depth of data collected.

4.0 Findings

4.1 Stress and Psychological Intervention

The findings of this study shed light on essential aspects related to stress and the design of restorative landscapes. According to the psychological experts during the interviews, stress is a common psychological problem experienced by people. It is important to note that stress is not classified as a mental illness and is usually intermittent and occurs over a shorter period. However, it can become more severe when stress persists over a more extended period, intensifies, and begins to interfere with daily functioning due to negative emotions. The expert interviewees acknowledged that some aspects of our living environment have the potential to trigger stress.

"Stress can arise from circumstances like your job, living in a busy city, or being in crowded and noisy places" (Interviewee 1).

"Unconducive living environment with pollution, loud noises, chaos, boring surroundings, untidiness, and small spaces can make people feel bad and harm human cognition and emotion" (Interviewee 4).

"The city's hectic life leads to a stronger brain response and cognitive difficulties when confronted with stress. The amygdala, a brain region that controls emotions such as anxiety and fear, is more active in stressful situations" (Interviewee 6).

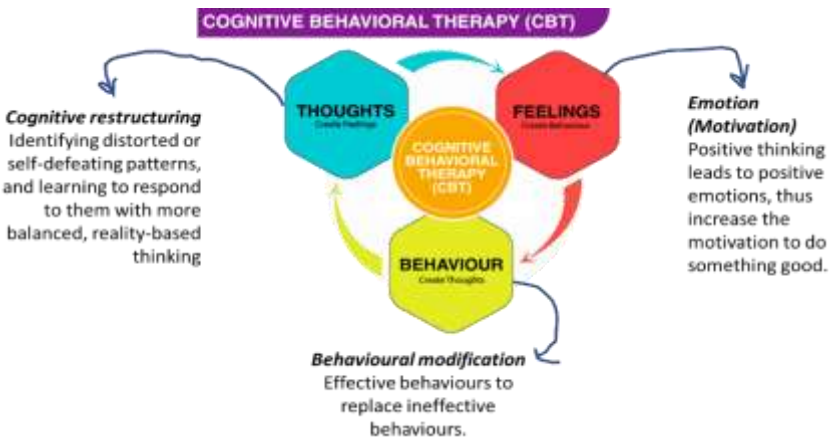

Fig. 2: Mechanism of psychotherapy using CBT approach.
(Source: Authors, 2021)

"The key intervention in CBT is to recognise distorted or self-defeating patterns and learn to respond to them with more balanced, reality-based

thinking. This then leads to fewer emotional problems and successful patterns of behaviour. This process is called cognitive restructuring. For the behavioural part, the problems are analysed, and problematic behaviours are identified. The main mechanism of change in behavioural therapy is to facilitate the implementation of effective behaviours to replace ineffective behaviours."

(Interviewee 6).

"…increasing physical activities such as yoga, meditation, breathing exercises, and praying is the behavioural component of coping with stress. Additionally, challenging negative thoughts and restructuring unhelpful thinking are important for cognitive coping".

(Interviewee 5).

The interviewees also believed that stress can be alleviated using effective coping strategies. Techniques such as deep breathing, mindfulness, cognitive behavioural therapy (CBT) and psychodynamics were highlighted as forms of psychotherapy. CBT was found to be the most used approach to treat depression, anxiety, severe stress, or emotional exhaustion. CBT involves training the mind to transform negative thoughts into positive behaviours. It involves three main mechanisms: cognitive restructuring, positive emotion, and behavioural modification (refer to Fig. 2).

The use of CBT in landscape architecture and its potential application in neighbourhood parks for stress reduction was explored. Interviewees indicated that people are more likely to adopt positive behaviours when they have hope for improvement and believe they can overcome challenging situations. Interviewees agreed that neighbourhood park design must consider physiological and psychological comfort, scenic views, a sense of safety, opportunities for fun activities, and social support to prevent cognitive decline. Fig.3 shows the essential components related to the mechanism of stress coping through psychological and cognitive intervention and how the discipline of landscape architecture could be used to support the restoration of mental health.

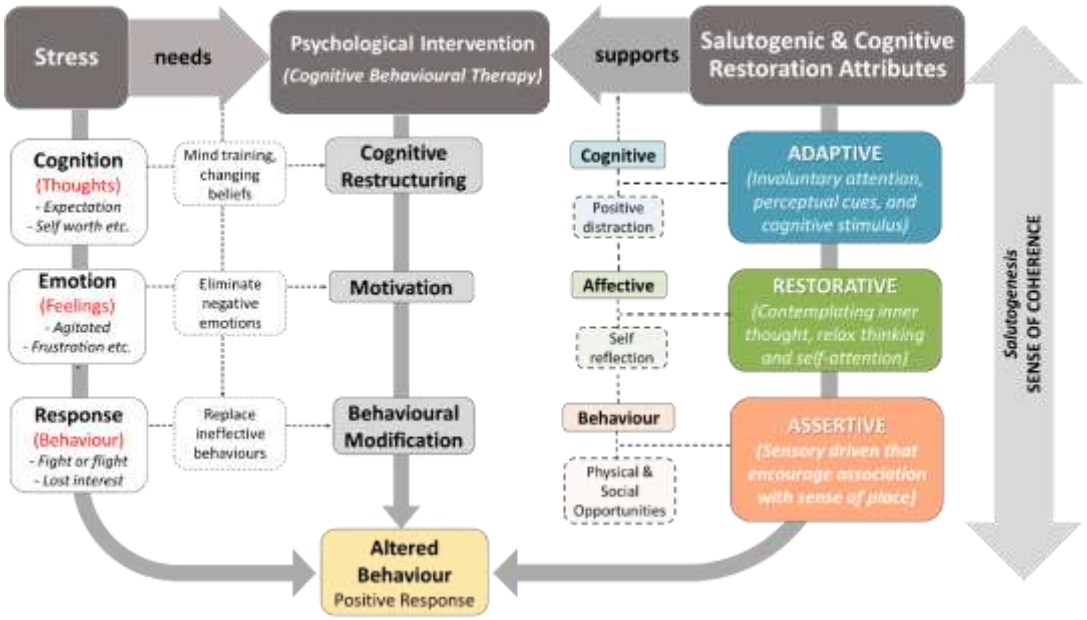

Fig. 3: Salutogenic and cognitive restoration design framework for psychological stress intervention.
(Source: Authors, 2022)

4.2 Salutogenic and Cognitive Landscape Attributes

The findings led to the formulation of salutogenic and cognitive design attributes for restorative environments, specifically for addressing psychological stress. Fig. 4 shows the design attributes comprising three primary stimuli which are *Adaptive, Restorative* and *Assertive*. *Adaptive* stimuli are environmental factors that help us focus and perceive our surroundings. Clear signage, different elements such as colours and plant species, and incorporating nature can all be used to create engaging and calming spaces. These design choices promote concentration, navigation, and positive emotions for individuals. *Restorative* stimuli refer to elements in a space that promote inner reflection, relaxation, and self-focus. These spaces emphasise calm, silence, and minimal distractions so that individuals can immerse themselves in the natural environment and have a quiet and contemplative experience. *Assertive* stimuli refer to elements that attract a person's attention and evoke sensations and emotions associated with a particular place. The visual features of the landscape, cultural traditions, memories, and sensory experiences such as touch, sounds and smells all contribute to an individual's perception of and attachment to the place. These elements unconsciously create a sense of connection and belonging.

Fig. 4: The Salutogenic and Cognitive Restoration Design Attributes.
(Source: Authors, 2022)

5.0 Discussion

Interviewees agreed that green spaces could be a healing environment in urban settings. This study raises questions about the application of cognitive behavioural therapy (CBT) in landscape architecture and the potential of neighbourhood parks to reduce stress. According to interviewees, people tend to shift from negative to positive behaviour when they have hope for improvement. A study by Pouyanfard et al. (2020) demonstrated this in multiple sclerosis patients who underwent mindfulness-integrated CBT. These patients learned to accept their illness and make behavioural changes for better self-care, believing there is hope for betterment if they adhere to strict treatment to control the disease's severity. This highlights the importance of infusing optimism into the design of neighbourhood parks, creating an environment that motivates and inspires people during their visits. Certain landscape elements could induce brainwaves associated with mindfulness and mental recuperation. Trees, shady paths, water reflections, and diverse sensory stimuli enhance mental concentration, eye movement coordination, and spatial reasoning.

"Brain stimulation will rely on visual coordination. Even looking at trees can be "cognitively restorative" and promote involuntary directed-attention system to rest and recover, thus, reducing mental fatigue..." (Interviewee 6).

Implementing landscape design principles is crucial for creating a pleasurable neighbourhood park. This is supported by research into the psychological impact of landscape design at Lahore's Safari Villa Park (Farooq, 2020). The park provides a visually stimulating and picturesque view by applying principles such as unity, balance, harmony, and repetition. Ample plants and benches enhance the experience and allow visitors to engage socially while enjoying the surroundings. The park serves as a meeting place for people of all ages and provides opportunities for exercise, relaxation, and positive mental health effects. Besides design principles, researchers also emphasize the importance of the visibility of neighbourhood parks to create a sense of safety and reduce fear of perceived crime (Abdul Kadir & Wilastrina, 2023). Planting trees with clear trunks, avoiding dense bushes, and eliminating hazardous elements contribute to safety (Thompson et al., 2016). According to a study by Dugrusoy and Zengel (2017) on the perception of safety in Büyükpark and Hasanaga Park in Izmir, Turkey, most park visitors believe that the park's safety and security should be effectively maintained. Büyükpark, with good wayfinding and visibility, reported higher satisfaction in safety among users compared to Hasanaga Park users. Their study also suggests that well-maintained, easily manageable, and activity-rich urban parks in smaller sizes tend to be safer.

Interviewees also agreed that green spaces are an ideal social space to foster person-to-person connection and person-to-place bonding. Thompson et al. (2016) found that neighbourhoods with low social cohesion and high social disorder are associated with increased anxiety symptoms, while deprived areas lacking physical comfort can exacerbate anxiety. In urban environments, the lack of green space as a social link can contribute to feelings of social isolation and lack of belonging (Alcock et al., 2014; Thompson et al.,

2016). This can reduce positive emotions and hinder residents' ability to socialize in their neighbourhood, leading to a weaker sense of community connectedness.

"Social support means we can be alone, or we can be with family or friends. The facilities in the park should be provided to support the social system" (Interviewee 2).

Researchers also emphasized the importance of user comfort in restorative design. This can be achieved if the layout and facilities of the park are adapted to local needs and preferences. The landscape design elements should emphasize the needs of the local community, what they want to see in the park and what types of activities they enjoy most when they visit the park. This understanding can guide landscape professionals in harnessing the healing potential of outdoor spaces and determining the scientific value of design aesthetics in stimulating cognitive restoration.

6.0 Conclusion and Recommendations

The study concludes that human psychology and the environment are essential for psychological well-being. Psychological approaches emphasize internal factors, while landscape design emphasizes external factors to create restorative environments. By integrating psychological and landscape principles, a comprehensive approach can be taken by considering internal and external factors when designing spaces promoting mental health. This study offers a new perspective on incorporating salutogenic and cognitively restorative stimuli into the design process. Future studies should explore the effectiveness of integrating psychological and landscape principles in designing spaces for optimal psychological well-being.

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Paper Contribution to Related Field of Study

This paper presents a novel design approach for mental restoration that integrates the salutogenic concept, cognitive behavioural therapy (CBT), and human-centred design principles into landscape architecture. It provides valuable insights and practical guidance for designing neighbourhood parks as healing spaces that reduce stress and cater to physical and psychological needs.

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