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Review

Healing Spaces as a Design Approach to Optimize Emotional Regulation for Patients with Mood Disorders

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Abstract: Healing spaces have played an important role in human history as arenas for healing and restoration of physical health. Current research from across disciplines identifies that engagement with space for people with mental illness can reduce emotional stress and thus improve health. This research leads to the central question of this paper: How do people with mood disorders achieve emotional regulation through healing spaces? In response to this question, this paper investigates the effects of sensory experience and architectural space on emotion regulation, with a particular focus on healing spaces. It proposes a model to analyze and explain how the design and use of healing spaces can create emotional experiences that stimulate patients' senses and facilitate emotional regulation in individuals with mood disorders. The study emphasizes the importance of understanding how elements of healing spaces affect patients' senses and contribute to the quality of emotion regulation. The paper argues that healing structures can effectively enhance the emotional experience of a space by creating a positive spatial atmosphere, thereby aiding in the healing process for patients with mood disorders. This paper's analysis of the existing literature identifies key mechanisms by which healing spaces promote emotion regulation-healing structures-and breaks them down into three main structures: (a) Safety Guarantees Physical and Mental Development; (b) Functionality Supports the Treatment Process; (c) Ambiance Promotes Emotional Comfort, this study examines existing evidence to determine how healing structures promote emotionally regulated treatment. The study also explores representative examples of healing spaces and how they utilize spatial elements to stimulate the patient's senses. This research results show that healing structures directly influence or facilitate eight primary spatial elements (color and form, light, sound, air and temperature, nature, materials, play and games, and activity and communication) which incorporate one or more dimensions of healing. Therefore, this paper aims to enhance our understanding and awareness of the correlation between interior space, human senses, and healing structures.

Keywords: healing space; healing structure; emotional regulation; sensory experience

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1. Introduction

The practice of health and design was formerly the responsibility of medical design professionals, but now it is no longer the exclusive domain of medical design professionals [1]. The increasing demand for wellness has influenced the field and made it a focal point for architectural design. Architects are now focused on designing, creating, and improving spaces and measuring the recovery and healing effects of spaces by analyzing data related to the progress of patients' physical recovery, and they have found that spaces evoke cohesion between body and mind and have developed the design concept of healing spaces [2]. This concept aims to support the well-being of both the users and those who utilize the space [3]. But, before delving into this topic, it is essential to comprehend the factors within the space or environment that are most likely to enhance physical, mental, emotional, and spiritual

healing. These factors are crucial in meeting the recovery needs of patients suffering from mental and psychological illnesses, which are becoming increasingly prevalent [4].

Healing encompasses not only physical well-being but also mental and spiritual aspects. It is worth noting that humans have specific sensory sensitivities to indoor environments, such as hospitals, which often evoke stressful emotions in patients [5]. Consequently, human perception is inherently psychological, and it is particularly noteworthy that children are likely the most socially sensitive age group [6]. When patients are in a comfortable, safe, and welcoming environment for healing, it can promote cognitive and emotional relaxation [2], which in turn can contribute to psychological and spiritual healing. At the same time, pro-nature strategies that reconnect people to their natural environment may help to mitigate this negative health impact [7–9]. Research has shown that the physical space itself plays a role in individuals' overall health and well-being, including their cognitive performance and behavior, and it has been found that mental health can be evaluated by considering how individuals perceive their environment using all of their senses [10].

Emotional health disorders, including mood disorders such as anxiety disorders and depression, are increasingly prevalent and pose a significant burden on individuals and society [11,12]. Individuals with emotional health disorders experience distinct challenges in terms of emotional well-being, social functioning, and overall quality of life, leading to further negative effects [13]. Positive emotional regulation plays a crucial role in the clinical treatment of mood disorders and other mental health conditions [14]. Additionally, research has demonstrated that conscious activation of different sensory organs (such as the eyes, ears, nose, and skin) can influence emotional experiences [15]. And the experience of architectural space is strongly connected to human emotions [16]. It involves the internal perception of space, which emphasizes the stimulation of human senses and spatial elements to regulate emotions. This paper argues that the interaction between spatial stimuli and the physical senses plays an important role in facilitating emotional regulation and improving the quality of sensory experience. Therefore, it is valuable to investigate how healing spaces facilitate emotion regulation, in order to establish an emotional connection between space and perception. Ultimately, this can aid in the recovery and healing process of patients with mood disorders.

In this regard, some architects and designers are reducing stress, tension, anxiety, depression, and other negative emotions by creating spaces that promote relaxation and improve patients' mental health [17]. While this healing space is usually achieved by providing soothing stimulation to multiple senses of the human body [18]. So, this paper explores the different elements of healing spaces that contribute to enhancing sensory experiences and promoting emotional regulation and uses qualitative analysis and literature research to explore the following questions:

- What spatial stimuli are associated with sensory experience and emotion regulation in patients with mood disorders?
- How do people with emotional disorders achieve emotion regulation through healing spaces?

Thus, the purpose of this paper is to identify an analytical framework for analyzing the design features of healing spaces and their relationship to stimulating patients' emotionally regulated senses, as well as to review the background of its related literature in order to explore the connections between space, senses, and emotions, and to explore how healing spaces can be useful. Moreover, it synthesizes the characteristics of convalescent spaces and their impact on mental health, summarizes the processes by which convalescent spaces influence emotional regulation, and presents a model that shows how space, human senses, and healing structures contribute to emotional regulation.

2. Healing Spaces Designed to Optimize Health, Well-Being and Recovery

2.1. Healing Framework of Space

This section examines various frameworks and models that discuss the role of space in facilitating cure and healing. It specifically emphasizes the material aspects of spatial

influence. By delving into these theoretical frameworks, the aim is to understand what architectural design elements of spaces can contribute to emotional healing.

Since 2004, architectural spaces, including interiors and exteriors, have been identified by the Samueli Institute (Drs. Sakallaris and Jonas, Ms. MacAllister, and Ms. Smith) as having a significant impact on treatment [19]. They developed a comprehensive conceptual model called the Optimal Healing Environment (OHE), which encompasses the physical environment, interpersonal relationships, and health-promoting behaviors [20]. This model aims to stimulate and support all three aspects of healing for patients, families, and caregivers [19,21]. The OHE framework consists of eight concepts and four environments: internal, interpersonal, about behavior, and external (Figure 1). This framework provides guidance for optimizing the potential for healing. It focuses on enabling medical and rehabilitation organizations to effectively understand how to promote patient healing and improve the relationship between patients, medical practitioners, and the environment. The OHE framework serves as a macro-level concept of environment and healing, laying the theoretical foundation for creating a more complete and healing-friendly therapeutic space in the future.

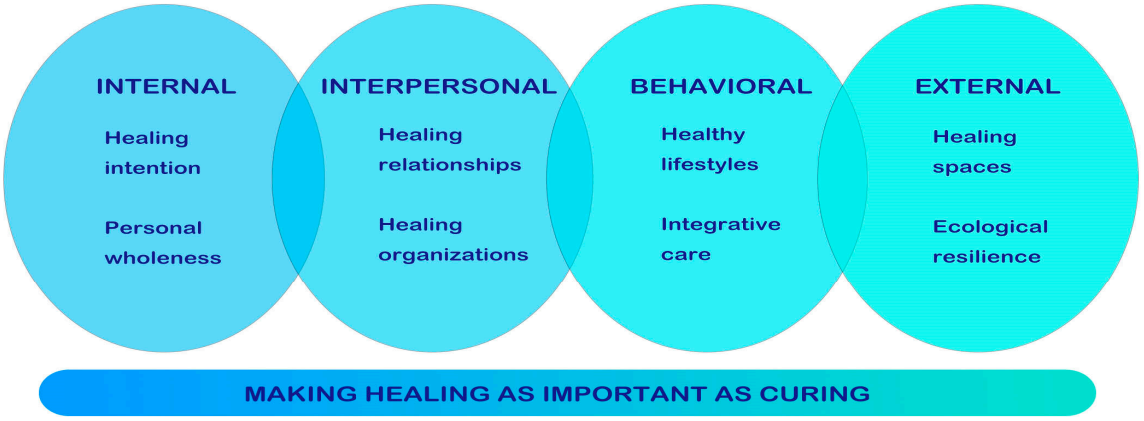


Figure 1. Optimal Healing Environments (OHE)framework [20].

In 2018, Zhang conducted an in-depth study about the link between healthcare buildings and health based on the OHE framework, in which the researcher found that a complete framework requires an integrated consideration of the interplay of various environmental, resident, and health factors on patient recovery and healing [22]. Building on the OHE framework, the researcher proposed the Environment-Occupant-Health (EOH) framework, which provides an integrated perspective on how the essential features of hospital buildings impact the health and healing outcomes of residents, and these environmental features are interrelated [23]. The EOH framework includes three design principles, namely a comfortable environment, well-functioning and healing spaces, and a relaxing atmosphere (Table 1). In addition, the framework includes 10 parameters (ventilation, air quality, noise, temperature, light, polyphony, natural sound, odor, safety, and flexibility) that have different effects on health outcomes and form 31 sub-parameters that can effectively guide designers for healing environment design. By utilizing this framework, architects can comprehensively assess the different characteristics of healthcare-built environments and measure the impact of building elements on occupant health outcomes. This contribution aids in the design and research of future healthcare-built environments.

Table 1. Healing-Built-Environment (HBE) Framework [22].

	Design Principle	**Parameter**	**Sub-Design Parameter**
Healing built-environment (HBE) characteristics	Comfortable Environment	Light	Daylight, Electrical light, Control
		Sound	Material, Noise, Isolation
		Heat	Temperature, Control
		Air quality	Ventilation, Air-filtering system
	Well-functioning Space	FF&E (furniture, fixtures, equipment)	Surface, Water supply, Ergonomics
		Flexibility	Size, Patient room, Acuity-adaptable room, Nursing station, Family zone, Seating, Staff zone
		Patient-centered care	Beds per room, Facility control, Social support
	Relaxing Atmosphere	Display	Signage, Color, Art
		Links to nature	Indoor greenery, Window view, Garden
		Multi effect	Music, Odours

In a recent study on interior spaces for healing, Younis (2021) introduced the Design Strategies for Healing Internal Environments (DSHIE) theoretical framework [24]. This framework, the first of its kind since the EOH framework, focuses on the interior elements of healing spaces and emphasizes the creation and design of healthy lifestyle interior spaces that facilitate and empower patients' healing process. The DSHIE framework incorporates three key design strategies: a support strategy, which utilizes specific elements to enhance physical and mental health; a balanced strategy, which aims to harmonize these elements; and a nourishment strategy, which addresses emotional, spiritual, and soul aspects (Table 2). The three strategies of the DSHIE framework affect the people who occupy and use these spaces. The support strategy and balanced strategy encourage the use of elements such as natural light, fresh air, and greenery, which have been shown to have a beneficial effect on physical health [25]. The nourishment strategy is the most complex of the three, as it encompasses the emotional, spiritual, and soul aspects of healing. This strategy emphasizes the importance of creating an interior space that promotes positive emotions and feelings of well-being. Artwork, music, and other sensory stimuli can be utilized to achieve these strategies, as well as the creation of quiet contemplative spaces where patients can reflect and connect with their inner selves [7]. Younis's research is interesting in that while many scholars have focused on the physical role of the external natural environment, few have considered the internal space of the building as the potential for being a therapeutic environment.

Table 2. The Design Strategies for Healing Internal Environments (DSHIE) Framework [24].

	Basic Strategy	**Sub-Strategies**	**Specific Parameters Affected**
Design strategies	Support Strategy	Physical support	Space character, Space components character, Relationship of a space character
		Vital support (life-energy)	Harmony with nature, Aspects of natural metaphors, Living wall
		Psychological support	Phenomenal impressions, Prevent implicit passive feelings, Sensitive responses, Change of character
	Balance Strategy	The balance of life components	Balance of basic components lifestyle
		Balance of dynamic life experience	Lifestyle, Space impression
		Balances and components of the environment	Nature and quality of the environment
	Nourishment Strategy	Soul nourishment-Life factor nourishment	Genius loci, Renovation meaning derived from the cosmic renewal of nature, Orientation and the biological clock
		Emotional nourishment	Brightness of daylight, Brightness of color, Nature elements

In addition to these three frameworks, there are other researchers on healing space theory. For example, Taheri and Sichani studied the effectiveness of children in establishing therapeutic spatial factors for improvement and recovery [26]. Mahmood confirmed the

usefulness of three basic strategies for indoor appearance, privacy, and a comfortable therapeutic environment by fielding 312 patient questionnaire data [27]. The study by DuBose et al. identified six environmental variables of environment, view and nature, light, noise, accessibility, and layout that directly affect healing or promote healing aspects and extend the findings of the EBD framework [2]. The biophilic design framework first proposed by Cramer and Browning in Biophilic Design (2008) consists of three categories, Nature in the Space, Natural Analogues, and Nature of the Space, and aims to capture the positive psychophysiological and cognitive benefits of biophilic design interventions in space [28]. This emergent parameter of biophilic design has since been elucidated in architectural terms by Ryan et al. in terms of visual exposure, persistence of health responses, repetition of experience, and the scope and scale of the intervention, which provide important references for the study of space to promote emotional regulation [29]. The analysis of these theoretical frameworks reveals that healthcare building designers consider both physical and natural factors as important resources in creating a therapeutic environment through spatial design. However, they prioritize factors such as maintenance, environmental comfort, services, and natural and restorative criteria. This result highlights physical design attributes and their relationship to patient health, and more meaningfully, the extent to which all of these frameworks focus on mental health factors, as summarized in Table 3. The table provides strong evidence for current research on the ability to regulate emotions in the therapeutic space and demonstrates the spatial factors that promote patients' mental health.

Table 3. Spatial factors found in a literature review by frameworks of healing space (Drawn by the authors).

Spatial Elements	Sub-Elements	Available Frameworks Support
Color and Form	Blue and green space	[22,24,26,28,29]
	Geometric shapes/Patterns	[22,24,26,28,29]
Light	Daylight	[2,22,28,29]
	Electric light	[22,26,27]
Sound	Music	[22,24]
	Quiet instead of noise	[2,22,27]
Air and Temperature	Ventilation	[22,24,27]
	Aromatic odors	[24,27–29]
	Room and object temperature	[22,24]
Natural Elements	Plants	[2,22,24,27–29]
	Natural Light	[2,26,28,29]
	Natural sound effects	[22,28,29]
	Natural odors	[28,29]
Materials	Materiality	[22,24]
	Texture	[24]
	Touch of different materials	[27–29]
Play and Games		[26]
Activities and Communication		[24,27]

Thus, through these studies of the physical characteristics of space and their relationship to patient health, the healing nature of space can be understood and elucidated, to support the process of physical healing and emotional restoration for patients. These findings provide foundational guidance for exploring how the sensory experience of healing spaces can be realized to promote emotional regulation.

2.2. Healing Structure of Space

Architects and researchers are interested in the healing structure of architectural spaces since it explores the relationship between recovery, space, health, and design [30]. This means that healing structures play an essential role in promoting patient recovery and healing. In this sense, McLaughlan states that creating spaces with a sense of pleasure, safety, and comfort significantly affects patient recovery [31]. This means that one of the most fundamental considerations for a healing space is its safety, such as the presence of toxic gases and chemicals in the space or other safety factors, and whether there are any adverse effects on the physical and psychological health of the human body. Borowczyk also argues that ensuring a safe and stimulating environment is crucial, particularly for patients with multiple disabilities, as it significantly influences the effectiveness of treatment [32]. Furthermore, in the previous section discussing Zhang's EOH framework, they highlighted the importance of comfortable environments, well-functioning spaces, and relaxing atmospheres [22]. Singh et al. also support this notion and emphasize that the functionality and safety of the space play a crucial role in enhancing the patient's recovery experience by creating a sense of reliability and reassurance [33]. This further underscores the healing function of the therapeutic space in the patient's recovery, which involves communication between the space and the body. In this regard, MacAllister understands space as the structure of being cared for, comfortable, and experiencing familiarity or healing such as in a home [34]. These results suggest that patients support their recovery process through the perception of architectural space. The interior spaces not only interact with patients but also contribute to a sense of safety, comfort, and efficiency, thereby establishing an emotional connection that aids in patient recovery.

The interior space has a healing nature that fosters a safe, comfortable, and harmonious atmosphere [35]. The concept of 'promotion of healing' encompasses not only the functionality and safety of the space but also the restoration of the patient's mental well-being. For instance, spacious and open healing spaces have been found to uplift patients' emotions and aid in their recovery. This means that indoor spaces can promote physical recovery as well as mental health, reducing anxiety, depression, stress, and other psychological problems [36]. According to Simonsen, healing spaces are characterized by relaxation, low stress, and contact with nature. Indoor spaces can contribute to the comfort and relaxation of individuals with mental illness, promoting healing in the spiritual dimension [30]. This means that it is important for indoor spaces to facilitate healing in the physical, psychological, and spiritual aspects of patients, with the emotional experience of the space playing a significant role. Dobkin further supports this notion by suggesting that healing spaces foster body-mind harmony, reducing anxiety and stress in patients [37]. In other words, the emotional experience of a healing space has a positive impact on individuals with psychological and mental illnesses, providing effective healing. It demonstrates a way of psychological and spatial communication. Spatial stimulation can also alleviate psychological and emotional stress and contribute to the restoration of the patient's sense of self [38]. Furthermore, patients exhibit cognitive and emotional responses to the spatial environment they inhabit, as the design elements of healing spaces effectively mitigate tension and psychological stress [39]. This suggests that targeted spatial design elements are important in promoting emotional stability and psychological well-being for people with mental illness. In line with this notion, Tuszynska-Bogucka emphasizes the importance of creating healing spaces that offer a user-friendly environment, promoting positive emotional stimulation and ensuring both physical and emotional safety. This perspective highlights the possibility of achieving emotional comfort, safety, and functional efficiency in space through the application of design principles and process recommendations [40]. In order to promote the holistic health of patients, it is essential to consider not only physical recovery but also mental and spiritual recovery and healing. These concepts underscore the significant relationship between architectural space and the well-being of the body, mind, and heart.

The findings of the above analysis indicate that the interior space's healing structure reflects safety, functionality, comfort, and psychological well-being. This characteristic of the healing structure can translate into a sense of safety, efficiency, comfort, and stress relief, which in turn helps regulate the patient's mood. Figure 2 illustrates the key aspects of the healing structure of the space, highlighting the significant impact of the internal space on the mood of individuals with mental illness. Therefore, the healing structure of the space can be experienced through the spatial form, the interaction between space and the body, environmental experiences, and sensory stimulation. These factors collectively contribute to the effect on mood through the healing structure.

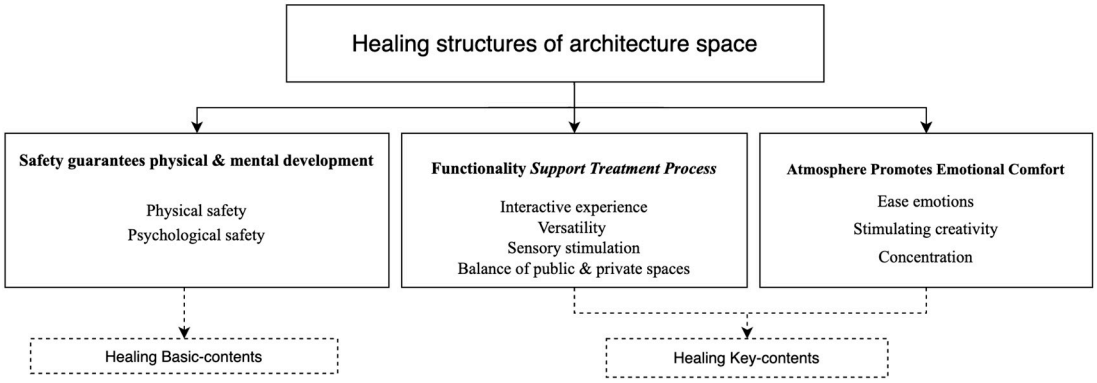


Figure 2. The healing structure of architectural space (Drawn by the authors).

3. Healing Spaces for Emotional Regulation

The previous section explored the strong connection between healing spaces and emotions and presented a healing structure for spaces specifically designed for patients with emotional disorders. This development of a healing structure serves as a valuable framework for understanding how various elements of healing spaces can impact emotions and aid in emotional regulation for individuals with mood disorders. However, it is important to note that the discussion on the topic of space-induced emotional healing is still in its infancy, primarily due to the limited number of studies available on the subject. This section will explore the role of the human senses in the regulation of patients' emotions in spatial design. Additionally, it will discuss various architectural examples that demonstrate a healing connection between sensory experiences of space and emotions.

3.1. Space Regulates Emotions through Sensory Stimulation

In the reality of the world environment, human perception is undoubtedly sensory-centered and continuously scans the surrounding environment [41]. When a human being exists in a moving body, there is a continuous interaction between the whole body and the information sources of the environment. This interaction allows us to quickly gather information about our physical surroundings [42]. The human senses act as active receivers and seekers of environmental information, and the senses are constantly detecting and receiving stimuli from the environment, just as with radar. This emphasizes that the senses are constantly detecting and receiving stimuli, and then the brain processes the sensory information to form perception [43]. Here there is an interactive process between the spatial elements and the senses (Figure 3), in which the body perceives space through the senses to form sensory stimuli, which are then fed back to the bodily senses. In this process, the value of spatial environmental stimuli exceeds a certain threshold before they are perceived by the patient's senses and then transferred to the brain through "external to internal processing", acting on the emotional state.

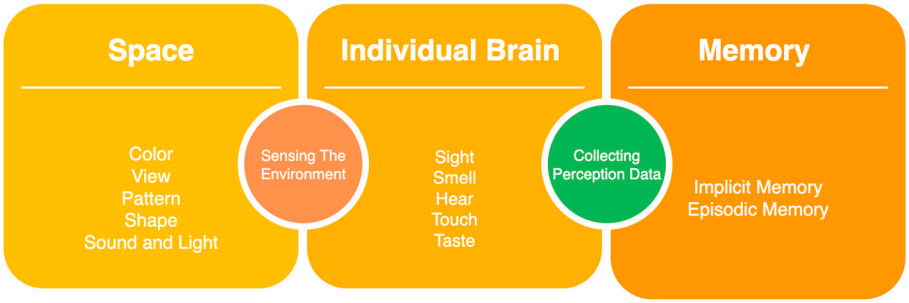


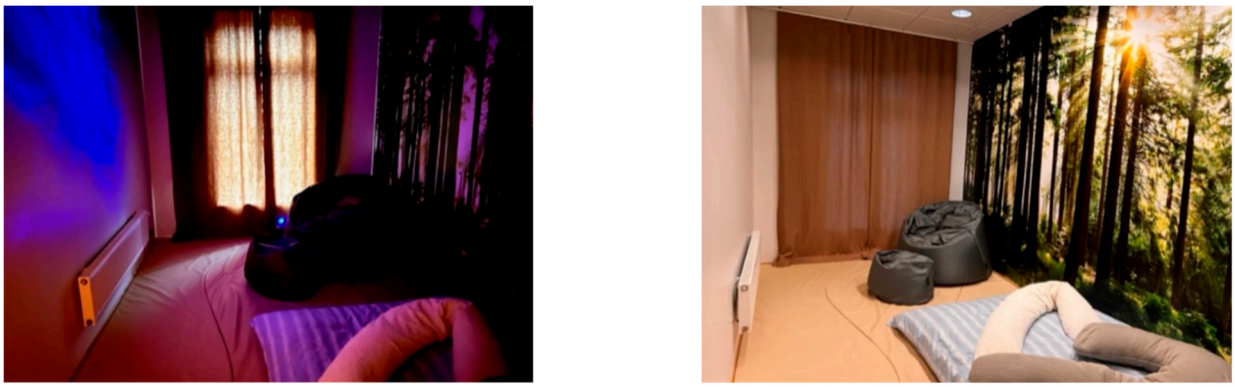
Figure 3. The process of interaction between human senses and the environment [43].

Canbeyli has shown that experiences involving the visual, auditory, olfactory, and gustatory systems significantly impact individuals' emotional and affective states [44]. These modalized experiences can sometimes be perceived as distinct sensory stimuli and have the potential to alleviate symptoms associated with mood disorders, such as anxiety, depression, and low mood. A recent study further supports the notion that the senses can serve as a tool for regulating emotions and modulating their intensity [15]. The paper suggests that sensation, as a rapid and relatively effortless form of emotion regulation, can effectively regulate emotions. For example, seeing green and blue spaces can be effective in reducing anxiety and depression [36], with red, black, etc. increasing symptoms of anxiety [32]; listening to music can enhance positive emotions [45,46] and noise can diminish them [47]; smelling aromas can promote emotional calm [48], with irritating smells (e.g., smelly, chemical smells) causing anxiety and agitation [49]; and touching soft objects (e.g., cuddly pillows or weighted blankets) can feel comfortable and enhance feelings of well-being [50,51], touching cold, sharp objects (e.g., spikes, metal knives) can lead to negative emotions of fear [52], etc. This interdisciplinary evidence suggests that sensory stimuli can activate hormonal responses in the brain through the five sensory modalities (sight, touch, hearing, smell, and taste). These stimuli have the potential to affect emotional and psychological states, providing a quick and relatively easy method for emotion regulation.

3.2. Spatial Elements Create Emotional Atmospheres

There is substantial evidence from various interdisciplinary sources suggesting that sensory stimulation can play a significant role in promoting emotion regulation. Consequently, it is essential to investigate the elements of space that can enhance human senses and facilitate emotion regulation. In this regard, it is worthwhile to examine several architectural projects, specifically sensory rooms in psychiatric hospitals and rehabilitation centers for patients with diverse psychological disorders. By analyzing the spatial stimulation elements present in the interiors of these facilities, we can gain insights into how they promote emotional healing.

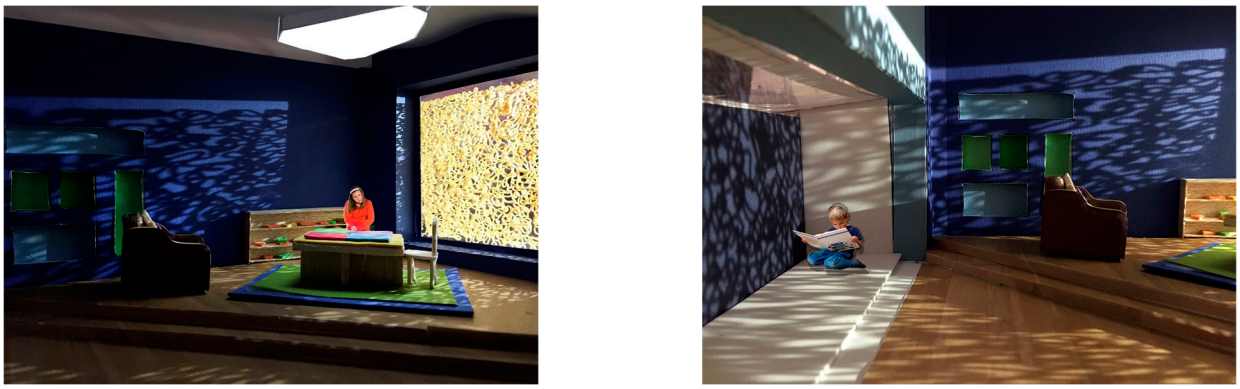
In a study by Lindberg, 28 patients with mental illness were analyzed for their experience of using a sensory room (a space that provides different sensory objects to help regulate emotions, as Figure 4) in a psychiatric hospital [53]. The sensory stimuli in the sensory room in this study included relaxing music or nature sounds, soft lighting, plush blankets, aromatic oils, a comfortable recliner, and a scenic photo wall, which were shown to have positive mood regulation effects on most participants in terms of enhanced well-being, reduced anxiety, increased self-management, and increased self-esteem. The experiment by Ilioudi et al. demonstrated the authenticity and effectiveness of the sensory stimulation factors in this space and further expanded the experimental sample by inviting 60 participants [54], further confirming that the effect of the sensory room in virtual reality VR had the same effect as that of the physical sensory room. Of course, the sensory rooms in psychiatric hospitals, although helpful for patients with severe mental illness, are not scaled up, and the small size of the space, layout and spatial functionality are not sufficient for multiple users and the special needs of patients.



(**a**) (**b**)

Figure 4. Sensory rooms in psychiatric hospitals: (**a**) creating a claustrophobic spatial atmosphere; (**b**) creating a pro-nature atmosphere (photographs by Lindberg).

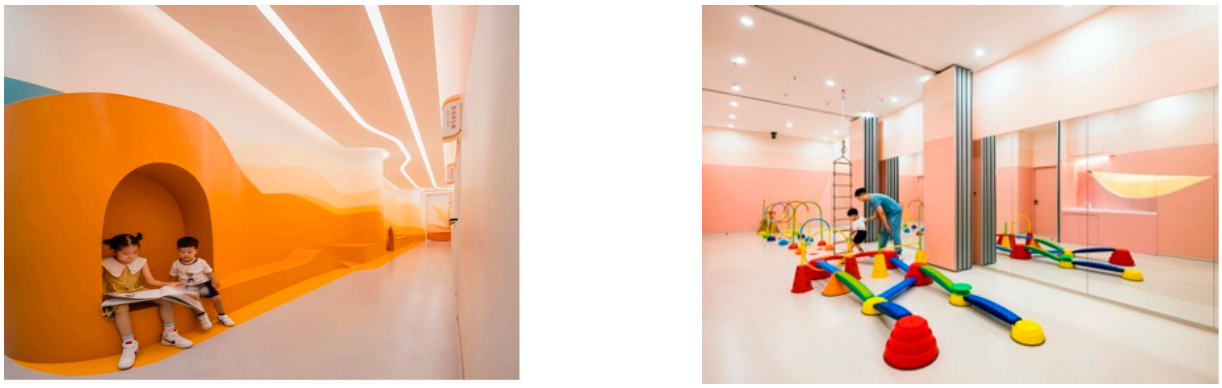
Mennatallah Elbana and Shaimaa Jabr collaborated to design a healing space focused on addressing post traumatic stress disorder (PTSD) (Figure 5). The architects created the healing space to promote emotional relief based on the trauma-focused therapy used to treat PTSD patients, which is based on a blue, yellow, and green color palette since research has demonstrated the effectiveness of exposure to green and blue spaces in preventing and relieving anxiety and depression in patients [36]. The space also uses sensory stimulating elements such as natural patterns, warm light sources, wooden floors, and clay walls to create a natural and calming atmosphere. These parameters have been shown to have excellent emotional regulation, such as light therapy has been shown to have a significant stress-relieving effect on patients with affective disorders [55]; elements of the pro-natural environment can improve patients' cognitive abilities and promote emotional calm [7].



(**a**) (**b**)

Figure 5. PTSD Healing Space: (**a**) nature-like atmosphere created by the use of leaky nature patterns on the walls; (**b**) green and blue color scheme to promote a sense of calm in the space (co-design from Mennatallah Elbana and Shaimaa Jabr).

UNStudio collaborated with FlySolo to design a rehabilitation center for children with speech and language disorders, using a soothing palette and rolling patterns throughout the space (Figure 6). The space meets basic healing functions while infusing the space with safe materials, multifunctional spaces, movable wall panels, soft light, and interactive seating. The increased participation in the space for children satisfies their need to play, explore, and discover, as the building with its spatial experience function allows participants to interact and gives them positive energy and feelings that lead to actual healing [56].



(**a**) (**b**)

Figure 6. FlySolo Rehabilitation Medical Centre. (**a**) Waiting area outside the treatment room; (**b**) The treatment rooms have flexible partitions and the room layout can be adjusted at any time (photographs from www.unstudio.com accessed on 25 March 2023).

Muktangan Mitra, which was designed by Ar. Shirish Beri as a drug rehabilitation center for patients suffering from drug addiction, has an open space that connects the interior spaces (Figure 7). This semi-enclosed space is constructed using natural stone materials with different greenery and the introduction of natural light, which creates a biophilic environment. At the same time, the environment provides a platform for meditation and rich natural sensory stimulation for the patients. In other words, patients can focus their attention through meditation in order to feel the natural sensations in the environment. Through a series of natural sensory stimulation, such as viewing natural scenery (e.g., plants, natural-like shapes), listening to natural sounds (birdsong, running water), smelling natural aromas (e.g., the odor of flowers, wood), and feeling natural touch (e.g., the mechanism of stones), it can effectively help patients recover from restlessness and anxiety [57,58].

(**a**) (**b**)

Figure 7. Muktangan Mitra Drug Rehabilitation Center: (**a**) Semi-open space connected to nature to create a biophilic environment; (**b**) Multi-sensory experience through meditation to relieve stress (design from Ar. Shirish Beri).

The above analysis of three cases of actual healing spaces shows that if a healing space wants to influence the patient's emotions and thus achieve healing, then specific elements in the space inevitably interact with the senses. This means that the spatial experience is a combination of physical, sensory, and emotional experiences. The stimuli of the space found through these three case studies are as follows (see Table 4). As the table shows, healing spaces focus on specific elements that stimulate and stimulate the patient's senses,

and these specific elements promote positive emotions to achieve relief from anxiety and stress. For example, sensory rooms in psychiatric hospitals and PTSD Healing Spaces focus on objects or devices that utilize different sensory experiences to provide patients with multimodal sensory experiences. On the other hand, FlySolo Rehabilitation Medical Centre focuses more on specific elements of play, exploration, and interaction based on satisfying the sensory experience and respecting the playful and social needs of the patients. The atmosphere created by these space-specific elements helps patients to perceive the space in a specific way and generate positive emotions.

Table 4. Healing Spaces Stimuli for Promoting Emotion Regulation (Drawn by the authors).

	Spatial Stimulus Elements							
	Color and Form	**Light**	**Sound**	**Air and Temperature**	**Natural Elements**	**Materials**	**Play and Games**	**Activities and Communication**
Sensory room from a psychiatric hospital	*	*	*			*		
PTSD Healing Space	*	*	*	*	*	*		*
FlySolo Rehabilitation Medical Centre	*	*	*	*		*	*	*
Muktangan Mitra Drug Rehabilitation Center	*	*	*	*	*	*		*

* This represents the elements that have been used in these spaces.

4. Findings

Through the analysis of the design framework of the healing space, the healing structure, and the analysis of the space to stimulate the senses and the senses to promote emotional regulation, it is found that many factors of the healing space can stimulate the human senses in a purposeful, planned and directed way, and this sensory information will produce positive emotional results thus to the purpose of emotional regulation. Among them, Figure 3 shows the interaction process between senses and environment [43], Canbeyli, Rodriguez and Kross, and others have shown that perceptual experience influences emotional experience [15,44]. This paper through three cases demonstrates the process that the elements of space can interact with the human senses to stimulate them to produce perceptual information and eventually influence the brain's emotions. Specifically, this process (Figure 8) can be divided into four steps: (Step 1) Sensory stimulation elements of the healing space can provide sensory and interactive experiences; (Step 2) Spatially specific factors interact with the human senses, allowing patients to see, smell, hear, touch and other spatially specific factors in the spatial interaction experience and stimulate the human senses to produce perceptual information; (Step 3) This perceptual information can be systematically directed and evoke positive emotions in the individual through the healing structure, by creating a positive spatial atmosphere evoking positive emotions in the patient; (Step 4) Finally, the positive emotions promote the patient to regulate his or her emotions and achieve a process that aids in healing the patient. The healing structure of the space plays an important role in this process by both directing the sensory elements of the space to purposefully stimulate the human senses and by guiding the sensory information to evoke positive emotional atmospheres (refer to Figure 9).

As shown above, in the process of promoting emotional regulation in patients, healing spaces limit and guide the spatial stimulus elements according to a healing structure. This deliberate arrangement aims to stimulate and influence the patient's senses. That is, a specific healing space is designed and furnished according to the three principles of healing structure (Figure 2) to engage and create sensory interactions that optimize the sensory experience of the space to influence the patient's mood. Consequently, the healing space offers an emotional environment that can be perceived by the patient's senses. As suggested by Huisman, the healing space is considered to be a space that promotes spiritual harmony, thereby enhancing its healing effect and the patient's sense of well-being [59].

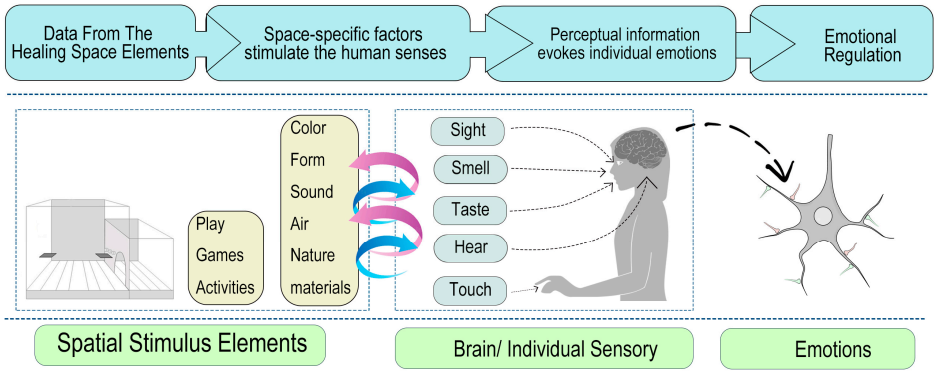


Figure 8. The Process of Healing Space to Promote Emotional Regulation (Drawn by the authors).

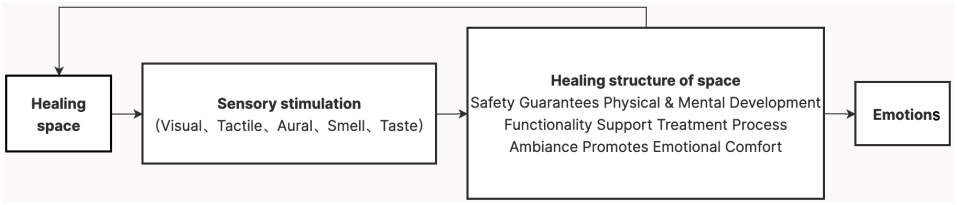


Figure 9. The Role of Healing Structures in the Process of Spatial Influence on Emotions (Drawn by the authors).

Moreover, the emotional atmosphere created by the healing structure can further stimulate positive emotions in patients. This means that healing spaces offer emotional experiences that combine different emotional atmospheres. For example, Buttazzoni's study found that architectural design seems to provide more opportunities for adolescents to feel comfortable and positively emotionally engaged within a given space [60]. In this sense, healing structures enhance people's sense of identity and safety in space, provide soothing, pleasant, warm, and balanced emotional support, and enrich sensory and emotional experiences. Thus, spatial stimulus elements, bodily senses, and their connection to healing structures can enhance the quality of emotional regulation and facilitate the healing process. Figure 9 illustrates the connection between spatial stimuli, bodily senses, healing structures, and emotion regulation. It showcases eight sets of spatial stimulus elements derived from the analysis presented in Table 3. These elements include Color and Form, Light, Sound, Air and Temperature, Natural Elements, Materials, Play and Games, and Activities and Communication. The diagram demonstrates the multiple relationships between these eight elements (which are further divided into seventeen sub-elements) and the five human senses, as well as the three healing structures (which are further divided into nine sub-structures). This depiction emphasizes the significant role that healing spaces play in facilitating emotional healing.

At the same time, the Figure 10 illustrates that spatial stimulus elements do not have a one-to-one correspondence with human senses, but rather a cross-modal relationship where one variable can impact multiple senses. Cross-modal correspondence refers to the intriguing association that individuals experience between sensory stimuli and perceptual dimensions [61]. For instance, touching a green plant not only stimulates the sense of touch but also evokes the sensation of green in terms of sight and even smell. The interaction between the same eight variables and the nine sub-healing structures enhances the emotional atmosphere in the space, as architectural space has the potential to facilitate patient healing through various mechanisms [2]. In this respect, the spatial stimulus elements indirectly impact the recovery process, with the healing structures playing a significant role in creating a therapeutic emotional atmosphere within the healing space. This, in turn, influences the overall healing experience.

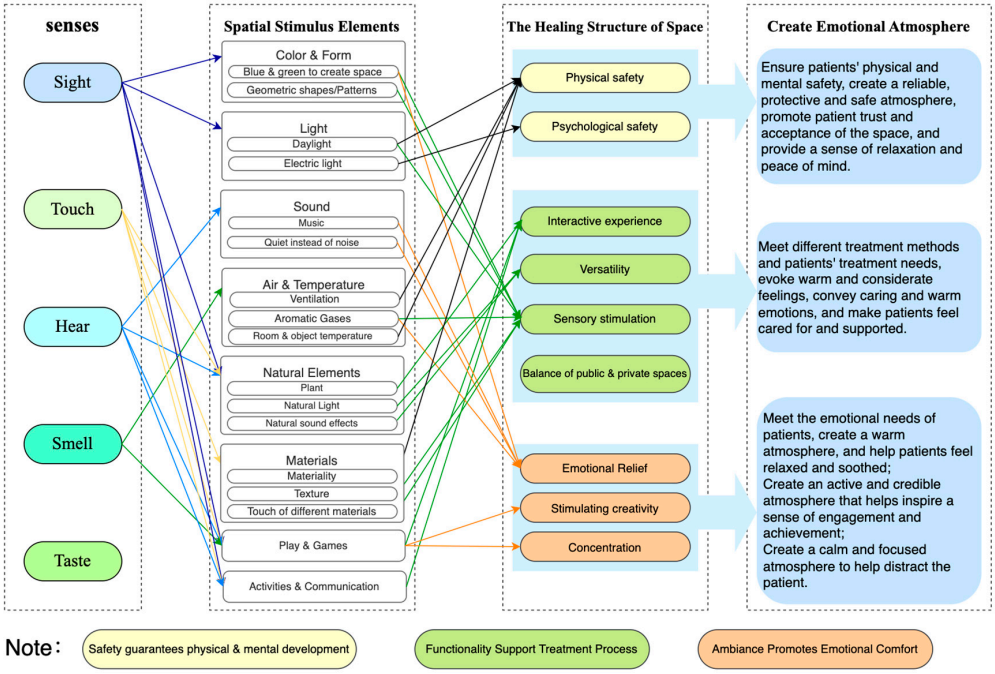


Figure 10. The relationship between sensory and spatial stimulus elements, healing structure, and emotional atmosphere (Drawn by the authors).

5. Discussion

This review highlights that while there is emerging research on the connection between architectural spaces and sensory experience, only a limited number of studies directly explore the impact of architectural spaces on emotions. By creating an interactive experience that engages the body's senses and incorporates specific spatial elements guided by a healing structure, it is possible to evoke specific emotions that promote emotional regulation, such as feelings of safety, relaxation, or pleasure. Similarly, by providing rich natural sensory stimulation to help people recover from stress and enhance mental health and well-being, it is possible to improve the comfort of indoor environments and promote a sense of connection with nature. As well as participants feeling less stressed in each of the sensory experiences of the biophilic spaces. This implies that the combination of body senses, healing space, and healing structure serves as a foundation for enhancing the spatial atmosphere to regulate patients' emotions. In this experiential process, the healing structure plays a crucial role in establishing a meaningful connection between the disordered spatial elements and the purposeless perception of the human senses. The healing structure not only guides the physical arrangement and healing of the spatial elements but also influences the emotional ambiance experienced by the human senses within the perceived space. This highlights the significant role of the healing structure in shaping the patient's overall experience of the healing space. Therefore, it is clear that the interplay between the physical space, human senses, and healing structure contributes to emotional regulation (see Figure 11).

The results of this study have significant implications for the field of healing architecture as it uncovers the underlying mechanism that enables spaces to facilitate patient emotion regulation through sensory stimulation. Table 5 builds on Figure 2 by incorporating further biophilic design standards and summarizing the key components of this mechanism, including the specific parameters of the therapeutic architecture and its impact on specific moods. The specific parameters of the healing structure consist of three main aspects: Safety guarantees physical and mental development (including physical safety, and psychological safety); Functionality Supports the Treatment Process (including Interactive experience, Versatility, Sensory stimulation, and Balance of public and private spaces); Ambiance Promotes Emotional Comfort (including Emotional Relief, Stimulating creativity,

Concentration) and Biophilic Interventions Optimize Experience (including Pro-natural application, Pro-natural convergence, and Pro-natural simulation). In addition, Table 5 does not determine the 'best fit' method as the impact of each specific parameter on mood can vary. Nevertheless, the healing structure supports designers and recovery planners who can combine these parameters to enhance health and well-being through space design and planning. The empirical evidence showcasing the effectiveness of spaces in regulating mood can be applied to healing spaces for individuals with mood disorders, thereby contributing to the existing theoretical research on healing spaces.

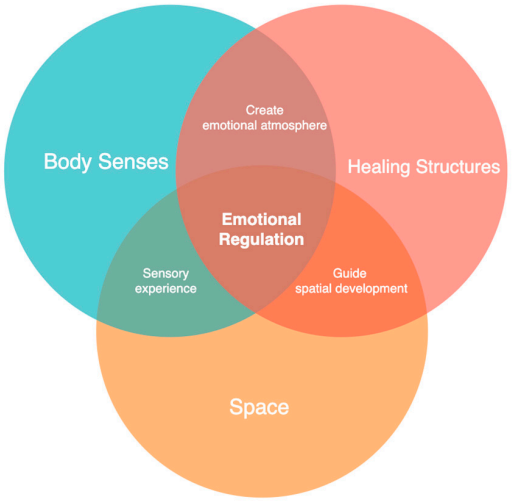


Figure 11. The model of healing space for emotional regulation (Drawn by the authors).

Table 5. Specific parameters of healing structures and their effects on specific emotions (Drawn by the authors).

	Healing Parameters	Sub-Parameters	Positive Correlation with Patient Emotional Health
Healing structure of space	Safety guarantees physical and mental development	Physical safety	Patients are guaranteed to be physically safe from harm.
		Psychological safety	Respecting individual rights and emotional needs mitigates fear and anxiety.
	Functionality Supports Treatment Process	Interactive experience	The space is easy to interact and experience with facilities and equipment that meet the patient's treatment needs.
		Versatility	The space serves various functions to accommodate diverse therapeutic approaches.
		Sensory stimulation	Sensory stimulation and calming elements are incorporated to support the patient's therapeutic process.
		Balance of public and private spaces	Treatment areas are designated for individual privacy, while also fostering opportunities for interaction and communication with other patients or staff, promoting mutual support and sharing.
	Ambiance Promotes Emotional Comfort	Emotional Relief	Creating a serene ambiance contributes to relaxation, alleviating stress and anxiety.
		Stimulating creativity	Infusing the environment with movement, vitality, and creativity stimulates patients' creative energy and vitality.
		Concentration	Fostering inner peace and concentration, the environment promotes a calm atmosphere that enhances focus and concentration.
	Biophilic Interventions Optimize Experience	Pro-natural application	Direct introduction of natural elements and natural materials to increase the tactile and visual sensation of nature.
		Pro-natural convergence	Indirect introduction of natural elements and nature-like patterns as well as imitation of nature's textures and shapes to create a sense of order in the space similar to that of nature.
		Pro-natural simulation	Simulation of natural environments to create landscape vistas in indoor spaces so that patients can enjoy the natural beauty of the outdoors while indoors.

6. Conclusions

This paper examines the impact of healing spaces on emotional regulation in patients with emotional problems, aiming to understand the emotional connections between architectural spaces and human senses. By integrating research from the interdisciplinary fields of architecture, medicine, and psychology, this paper presents theoretical research on healing spaces, healing structures, senses, and emotional regulation. The study explores the significance of healing structures within architectural spaces, which encompass spatial safety, functional support, and emotional climate. In addition to physical healing, the concept of healing spaces extends to the spiritual realm, engaging the patient's senses on a deeper level. This paper argues that healing structures can effectively stimulate emotional regulation in patients. The research findings highlight the importance of specific spatial elements in enhancing the emotional atmosphere of an interior space, which is considered crucial for emotional regulation. While spaces cannot directly heal patients with mood disorders, creating environments that prioritize emotional well-being can greatly enhance the effectiveness of staff treatment and improve patient recovery. Moreover, such spaces can elicit emotional responses that expedite healing and shorten the recovery process, thereby fulfilling the purpose of emotional healing spaces, which is also the value of this research paper.

While contemporary architecture research has increasingly focused on the healing nature of space, there has been limited exploration of how space can aid in healing patients' emotional issues. Most studies have primarily concentrated on the ways in which space supports physical healing. This paper aims to investigate the influence of spatial stimulus elements on enhancing emotional regulation by examining various design frameworks for healing spaces. It considers the role of healing structures and the impact of space in stimulating sensory experiences. As a result, the transformation of healing spaces can promote emotional healing and a shift in the perception of interior design, ultimately creating better healing environments for the growing number of individuals with emotional disorders. This paper presents three significant findings:

- An analysis of the process through which healing spaces facilitate emotional regulation (refer to Figure 8);
- A summary of the relationship between sensory factors, spatial stimulus elements, therapeutic structures, and emotional climate (refer to Figure 10);
- A conclusion that presents a model illustrating how healing spaces impact emotional regulation (refer to Figure 11).

This model has significant potential for the qualitative analysis of healing spaces in relation to emotion regulation. Further research and development of theories are necessary to explore how sensory experiences and the materiality of space impact emotional regulation in patients with mood disorders. This could involve conducting field surveys and experiments to test the model's applicability in real-world settings and to better understand the specific spatial stimulus elements. Therefore, additional empirical studies are required to provide further support and confirmation for the model. The study of the emotional healing properties of indoor spaces is an emerging area of research, particularly focused on the adolescent and children population. This is due to the increasing prevalence of mental health disorders in this group, which has become a matter of social concern. Therefore, this paper aims to enhance our understanding and awareness of how interior spaces can be designed and utilized to stimulate patients' senses, promote emotional regulation, and offer new insights for the architectural design of services aimed at treating patients with emotional disorders.

7. Future Vision

Future research could explore how biophilia can be incorporated more fully to enhance the emotional healing effects of spaces. Firstly, the role of biophilic elements in spaces can be further studied. For example, images of plants and natural landscapes, etc.; natural sounds, such as birdsong and running water, etc.; natural aromas, such as the scent of

flowers and the smell of wood, etc.; and natural materials, such as wood and stone, etc., and the elements and forms which are similar or mimic natural environments [62–65]. These elements can provide rich natural sensory experiences and help to improve the comfort of space [66], which is necessary in order to understand in more detail their impact on emotional regulation and mental health. Secondly, it could also cover the integration of technological innovations such as the utilization of advanced eco-technologies and sustainable building techniques further to enhance the natural experience and sustainability of the space. In addition, research could also explore the application of biophilic design in different types of therapeutic spaces, such as medical facilities, senior care centers, and mental health facilities, to develop more specific and individualized design guidelines.

By delving deeper into biophilic design, we hope to provide a better understanding of the design of future healing spaces and open up new possibilities for creating built environments that are more conducive to human health and well-being. Continued research in this area will provide designers, planners, and policy makers with valuable insights to help shape more humane, welcoming, and effective healing environments.

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