

Research on Art Healing Space Design Based on Embodied Cognition Theory--Taking TeamLab Massless Beijing as an Example

Siyu Nie

College of Fine Arts, Henan University

Abstract. In contemporary society, where mental health is a prominent issue, as a non-pharmacological intervention, art healing is gradually becoming a hotspot of interdisciplinary research by virtue of the multidisciplinary integration of art forms to promote the unity of people's minds and bodies and to satisfy people's psychological needs. Through the theoretical research on embodied cognition and art healing space, analyse the digital space design case of interactive art teamLab from four dimensions, namely, non-verbal expression and emotional release, multi-sensory integration and cognition, reshaping and enhancing immersive experience and context, and embodied interaction empowered by perceptual technology, to explore the necessity of the intervention of embodied cognition in art healing space, and summarise the principles and methods for designing art healing space. This research will enhance the psychological healing effectiveness of users, promote their emotional resonance, and provide new research ideas for the innovation of art healing space in the digital era.

Keywords: embodied cognition; art healing; space design; teamLab

1. Introduction

Globally, mental health issues have escalated into a public health crisis (WHO). Traditional psychotherapy relies on linear verbal expression and biochemical regulation through pharmacological interventions, facing challenges such as inadequate integration and limited applicability. In this context, art healing, as a non-pharmacological therapeutic approach, has increasingly garnered attention in interdisciplinary studies encompassing psychology, mathematics, and digital media art, due to its multi-modal perceptual stimulation and metaphorical emotional expression. Current research on art healing space emphasises the interplay of vision, materials, light, and shadow within spatial contexts while overlooking the dynamic role of the body as a perceptual entity. The application of embodied cognition theory elucidates the characteristics of spatial healing performance and offers novel opportunities for art healing environments. This article analyses case studies of teamLab's works to explore their strategies and methods. Within the context of digital technological innovation, it employs an embodied cognition theoretical framework to investigate art therapeutic space, which holds significant practical implications for the synergistic development of "embodiment" and "art healing".

2. Current Status of Related Theoretical Research

2.1 Research on Embodied Cognition Theory

The theory of embodied cognition originated in the twentieth century as a new framework based on the fields of psychology, neuroscience, philosophy, and computer science. The central assertion is that the body plays a crucial role in cognitive processes, advancing philosophical enquiries into the mind-body relationship, and positing that individuals' perceptions of the world emerge from the interaction between the body and the environment. Merleau-Ponty's work, *The Phenomenology of Perception*, offers a comprehensive examination of embodied cognition, positing that the body serves as the locus of perception; that perception, the body, and the world constitute an integrated whole; and that individuals acquire knowledge of the world through their corporeal experiences, thereby challenging conventional mind-body dualism [1]. Ye Haosheng examines the emergence

and theoretical foundation of embodied cognition through a psychological lens, asserting that "cognition is both embodied and embedded; the brain is situated within the body, and the body is situated within the environment, forming a cohesive cognitive system." [2] The theory of embodied cognition posits that the body influences cognition via sensorimotor engagement, whereby an individual fully engages with the environment to attain mind-body unity, thereby enhancing experiential depth and fostering novel perceptions and insights.

2.2 Research on Art Healing Space

The initial studies on art healing space mostly stemmed from the influence of the medical environment on patients. Hospitals and medical institutions focus their attention on the spatial environment of hospitals so that the wards have enough ventilation and light to provide patients with comfortable convalescence and promote their health [3]. On this basis, foreign scholars have deeply explored the influence of spatial design on human emotional states and health levels. Esther Sternberg introduced the concept of "healing space" in her book *Healing Spaces: The Science of Place and Well-Being*, exploring the importance of physical space in the recovery process and emphasizing the impact of the surrounding environment on health [4].

In Europe and the United States, the practice of art healing offers a distinctive and innovative approach, with numerous experts engaging in comprehensive study on the integration of art healing and space design. Researchers have included artistic creativity in the architecture of public areas, using narrative art techniques to alleviate the emotional trauma of individuals. The integration of art healing and space design fosters a comfortable and healing space for individuals through a well-designed physical environment. The art healing space employs art as a non-verbal psychotherapeutic technique by crafting the spatial environment, eliciting patients' psychological insights through images, dance, and other artistic expressions. This approach effectively transcends psychological defence mechanisms, stimulates the individual's physical and mental awareness, provokes profound emotional resonance, and ultimately facilitates emotional release and psychological adjustment, enabling patients to attain healing through the artistic process.

2.3 The Connection Between Embodied Cognition and Art Healing Space

As an important paradigm in contemporary cognitive science, embodied cognition theory profoundly explains the intrinsic relationship between the body, the environment, and emotional cognition, emphasising that the body is not only the carrier of perception but also the cornerstone of cognitive formation. In the field of art healing, dance healing, theatre healing, painting healing and other common forms of art healing are used to promote and enhance mental health through individual participation in artistic activities. However, most of the current art healing practices tend to focus on the active participation of the body. Research indicates that the relationship between the environment and the body significantly influences brain plasticity, highlighting the body's essential role in shaping perceptions, the psyche, and the environment in art healing.

On the one hand, embodied cognition theory explores the interaction between the body and the environment, focusing on the relationship between psychosomatic and environmental cognition and movement. In the design of art healing space, multi-dimensional environmental design helps participants to mobilise body movements and multiple senses, to realise the deep integration of the environment and the body, and to understand that non-verbal expressions evoke sensory resonance. On the other hand, embodied cognition theory suggests that cognition is shaped by the perceptual movement of the body. Considering body perception as a key position in the design of an art healing space can create specific emotional space and narrative plots to provide an immersive experience of the healing space, and at the same time, through the dissection of the participants' behaviours and changes in expression, can convey information and establish participants' orientated behaviours to achieve self-expression and psychological healing. Therefore, the design of an embodied art healing space is also the design of users' feelings and experiences. The interaction between the participants' bodies and the environment, along with the changes brought about by

psychosomatic perception, can enhance art healing; simultaneously, participants will gain a new understanding of their emotions.

3. An Analysis Of the Application of Embodied Cognition Theory in the Teamlab Massless Art Exhibition

3.1 Overview of Teamlab and Teamlab Massless Beijing

teamLab is a multidisciplinary, interactive art creation team founded in 2001. The team is composed of experts from different fields, with the core concept of creating "immersive experience" space, continuously exploring the possibilities of social relations between human beings and the environment. The team uses groundbreaking digital interactive technology to liberate human perception from material carriers and create an experiential field with emotional healing value.

Its representative work, teamLab Massless, focuses on this concept. "Massless World" is a borderless, continuous art space in which people are no longer passive viewers but become participants in art creation through body movements, tactile feedback, and other in-depth interactions. When freely exploring this digital ecosystem, they achieve self-expression and establish subtle emotional resonance in the collective experience and ultimately achieve a complete experience of physical and mental healing.

3.1.1 Promoting non-verbal expression and emotional release

Vander Kolk proposes that art be considered an alternative "language" that can be used to express emotion through embodiment and to unite with the mind, thus overcoming the participants' difficulties in expressing emotion in words [5]. The teamLab Massless work "Forest of Flowers and People: Lost, Immersed and Reborn" uses a system of biological rhythm metaphors to illustrate the processes of birth, blooming, and withering of a flower. As participants enter the room, their touch and movement induce the wilting of the flowers; conversely, when they remain stationary, the surrounding blooms flourish more abundantly. Each bodily action constitutes a distinct language for engaging with the artwork, while the instantaneous feedback from the flowers' vitality influences the emotional fluctuations of the participants, creating a reciprocal cycle of emotional mapping. Participants comprehend the spatial environment via physical experience, and their perceptions are converted into psychological representations that facilitate the release of repressed emotions for self-healing and emotional rehabilitation. The project establishes a multifaceted art healing environment through embodied expression, converting the abstract objective of psychological intervention into a tangible experience. Providing emotional solace and motivation by alterations in materials, light, and shadow dynamics of the environment, evoking participants' non-verbal physical memory and emotional resonance[6].

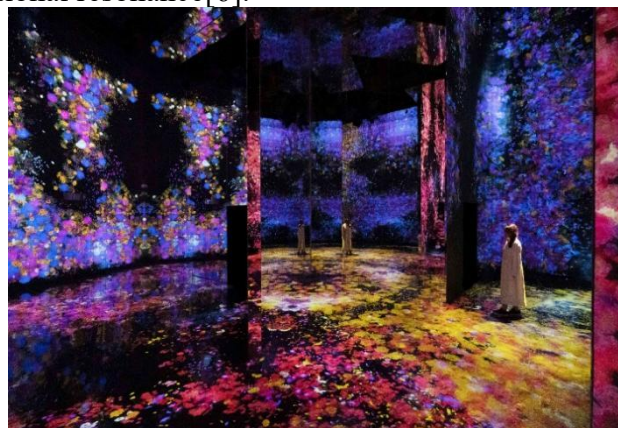


Figure 1: Forest of Flowers and People: Lost, Immersed and Reborn

3.1.2 Facilitate multisensory integration and cognitive restructuring

Embodied cognition theory and rubber glove tests demonstrate that the multimodal integration of individuals' bodies fosters self-awareness[7]. When visual, tactile, and other sensory inputs are incongruent, the brain recalibrates the body schema via multisensory integration. This finding establishes a neuroscientific foundation for embodied interaction design in art therapy. TeamLab's work creates a fusion of fictional and tangible space, enabling users to reshape their views of reality through the integration of multimodal spatial information. The "Motion Forest" panel is a physical habitat where bodily movements interact with the surroundings, eliciting visual effects via bodily perception and pressure feedback, hence stimulating subjective engagement. Typhoon Light Balls in the Forest of Resonating Spheres – 9 Blurred Colours and 3 Flattening Colours Utilises the luminous rolling sphere as the primary medium, employing the interaction between the limbs and the sphere to propel its rolling path, thereby activating the dynamic correlation between the colour alteration of the luminous sphere and the surrounding auditory effects, feeling the texture of the sphere as well as the feedback of its strength when rolling, to establish a cognitive domain of embodiment. The sphere forms a synaesthesia coupling in the light and shadow changes of 9 natural scenes, reminiscent of the morning sky and autumn maple leaves, to produce a surreal visual impression. Simultaneously, the distinct tones associated with each hue concurrently stimulate aural perception, creating a multi-sensory experience called "tactile-visual-auditory". Multi-modal interaction goes beyond normal sensory experiences, allowing people to feel happiness in space, rethink their relationships, awaken their feelings and thinking skills, and move from physical awareness to mental healing.



Figure 2: Typhoon Light Balls in the Forest of Resonating Spheres – 9 Blurred Colours and 3 Flattening Colours

3.1.3 Augment immersive experience and situational cognisance

Embodied cognition theory provides a theoretical basis for immersive experience design and situated perception design. From the standpoint of embodied cognition theory, upon entering the art healing space, participants engage with the equipment and virtual environment, activating bodily senses such as vision and touch and thereby facilitating a form of "immersion". This immersion stimulates participants' cognition and imagination, resulting in a more profound emotional experience that mobilises their thinking and creativity to achieve richer emotions. The team at teamLab creates an immersive spatial experience using lighting, projection, sound, and other methods, enabling people to perceive the world through their bodies. "Massless Clouds Between Sculpture and Life" takes the theory of embodied cognition as the underlying logic and uses digital technology to build an immersive art healing space, realising embodied cognition and emotional release through multimodal embodied interaction and metaphorical scenarios. The project converts rigid sculptures into dynamic, cloud-like patterns. Upon entering the space, participants will be enveloped by the cloud, engaging with it through body language, causing its form to fragment and regenerate, thus sculpting the spatial environment through their actions. In the immersive space,

participants are no longer passive observers but co-creators of the artwork, feeling the symbiotic relationship between the body and the environment through body movements and spatial feedback. The process of cloud production and dissipation serves as a metaphor for life's transience. Participants gradually think about life by physically exploring their surroundings, which also helps them connect emotionally and think more deeply. teamLab's work emphasises how we perceive our bodies, and by blending the body with the environment, it creates an engaging space that enhances awareness of the situation and reduces the stress and discomfort caused by society.



Figure 3: Massless Clouds Between Sculpture and Life

3.1.4 Technology-enabled embodied interaction

Toshiyuki Inoko, teamLab's founder, says technology is humanitarian and art can change how people interact with each other and their environment. "By integrating technology with art, it may be feasible to enhance the positivity of human existence." The embodied relationship in Dihde D's phenomenological technology holds that technology can embody practice and serves as the medium for the interaction between the body and the world [8]. Technology-enabled teamLab works can completely liberate sensory and physical experiences, enhancing perception and promoting profound immersion. The interplay between the body and technology not only enables enhanced experiences and changes in thinking and environmental perception, but it also enhances the multimodal expression and visualisation of participants' emotional transformations. For example, "Floating in the Falling Universe of Flowers", "Proliferating Immense Life—A Whole Year Per Year", and "Forest of Flowers and People: Lost, Immersed, and Reborn" are drawn in real time by a computer program to create a more immersive art healing space. The teamLab team makes extensive use of projection technology, computer programs to implement the drawing, sensors, virtual reality and other technologies dedicated to blurring the boundaries between art and technology. "Crystal Universe" is an immersive interactive installation composed of tens of thousands of LED lights which, through the in-depth integration of real-time capture, dynamic light and shadow algorithms and other technologies, builds a "living universe" that the audience can participate in through body movement and mobile phone control. The team created Interconnected Reality (IR) technology, which allows people to interact with physical spaces using digital devices, helping them express their feelings and experience visuals more fully. This technology enhances how we sense and create, allowing participants to better understand themselves and explore new ways of healing, like virtual reality methods. With the development of digital intelligence, the medium of art healing is no longer limited to flat or physical artworks. AR, VR, artificial intelligence, and brain-computer interfaces now help create art healing space, allowing participants to use technology to connect with their surroundings, enhancing their feelings and understanding how emotions are created, changed, and shared, which helps them heal psychologically in that space.

Examine teamLab's artworks through the lens of embodied cognition theory to create a multifaceted art healing environment that imparts emotional solace and spiritual resonance,

fostering participants' physical and mental equilibrium via the expressive language of art, enabling them to more effectively identify and articulate their emotions while experiencing the therapeutic qualities of the art space.

4. Design Strategies of Art Healing Space Based on Embodied Cognition Theory

4.1 The Bodily Behaviour Layer Enhances Multi-Sensory Situated Experience

The bodily behavioural layer is the external manifestation and practical pathway of embodied cognition. Merleau-Ponty's phenomenological theory of perception suggests that the body, as an integrated whole, interacts with the environment through multisensory and body movement coordination, establishes a connection between consciousness and the world, the body, and others [1], and thus acquires information from the outside world while also communicating its intentions and metaphorical thoughts to the outside.

In the design of art healing space, perception and feedback systems at the level of bodily behaviour play a central role. First, cognitive development theory and metaphor theory further reveal the dynamic coupling relationship between the body and the environment—people form cognitive schemas through the figurative encoding of bodily experiences. Secondly, in complex dynamic environments, there are obvious limitations of single sensory experiences. When the subject is in a special environment with low illumination, the restriction of visual senses triggers the body's multi-sensory compensatory mechanisms, such as auditory and tactile senses, as well as the synergistic mode of work, and this sensory compensatory effect sustains the exchange of information between the subject and the object. Eventually, by mapping concrete perception to the abstract conceptual field, new understanding and cognition are gained, and emotional cognition is regulated and transformed to achieve the healing effect. In the design of an art healing space, participants can mobilise their multi-sensory experience and body movement through the medium of intelligent interactive technology to engage with the healing environment, enhance the psychological condition, and attain the healing effect. Olfactory dimension: The human olfactory system is directly connected to the limbic system of the brain, which activates the emotional memories stored in the hippocampus by diffusing there [9]. For example, the odour diffusion system is set up during the healing process to release the odour of the air after the rain, which guides the participants to feel the childhood memories and release the psychological pressure. The auditory dimension: a natural soundscape can facilitate brainwave change and decrease cortisol levels, hence alleviating physical and mental fatigue. The auditory elements of natural water flow and descending leaves are compiled and incorporated into a tangible and immersive story environment, enabling listeners to experience the relaxation and solace provided by nature through a digital medium.

4.2 Material Situational Layer Guidance Emotional Embodied Interaction

The material situational layer highlights individuals' engagement with surrounding media and reveals the reliance of the human body on the material world. The body exists in physical space and simultaneously influences perception through interactions with the environment, thereby shaping its behavioural patterns and emotional cognitive framework. Within the paradigm of embodied cognition theory, environmental media serves not only as a conduit for information transmission but also as a crucial factor in eliciting bodily actions and synthesising sensory experiences. In the realm of art healing, environmental media encompass not just basic artworks on exhibit but also the behavioural acts and physical feelings of the body influenced by these media [10]. The brain integrates action and sensory information into a cohesive contextual perception, transforming individuals from mere "passive observers" to "active participants". This physiological and psychological synchronicity enhances the sense of belonging to the environment, forming an

authentic, immersive loop of experience. Starting from the material scenario layer, the construction of an art healing space that integrates the physical and digital environments needs to be considered from multiple dimensions. Functional planning of the intelligent space: based on the emotional needs of the participants, a flexible story path is used to allow them to make their own choices. Scene changes happen through body movements, helping to move steps and change scenes, which encourages participants to take part and feel emotionally involved while reducing feelings of being left out. Secondly, sophisticated algorithms can be used to modify environmental parameters, such as sound and light, to align with the user's emotional state, thereby transforming information transfer from one-way communication to reciprocal dialogue, establishing a feedback loop for embodied cognition, and consequently enhancing the healing effect. The healing mechanism of spatial materials: as a significant carrier of material scenarios, various materials possess distinct qualities. The judicious application of softness, hardness, and texture of materials will influence the psychological alterations of participants and can establish their tactile exploration mechanisms; for instance, wood imparts a sensation of warmth and naturalness, whereas metal conveys a feeling of coldness and coolness. Variations in colour and light interaction create distinct spatial emotion; for instance, low-saturated colours help reduce anxiety and improve psychological perception. The design of the material scenario layer overcomes the limitations of one-way information transmission and static viewing modes in traditional spaces; by utilising the intelligent response of material-environment media, it fosters synergy between materials and senses, creates dynamic narrative interactions, increases participants' sense of experience and emotional engagement, and ultimately enhances healing efficacy.

4.3 Cognitive Experiential Layer Facilitates Cultural Narrative Integration

People's cognition is not a separate brain activity but is formed through the experience of multiple senses in the situation[11]. The cognitive experience layer, a crucial component of the art healing space, represents the immediate feelings and experiences of participants as they interact with their physical behaviour and the environment; this interaction establishes the cognitive level, which relies on the dynamic coupling of "body-space-cognition" and creates emotional resonance within a unique cultural narrative experience.

The theory of embodied cognition asserts that cognition is the result of the synergy between the body, the environment and the brain and relies heavily on the unconscious nature of cognition. Conceptual metaphor theory further reveals that people understand abstract emotions through embodied experiences, providing theoretical support for the symbolisation of emotions in art healing space. Emotion and visualisation: the art healing space can precisely record changes in body and physiological expression with the aid of Kinect, infrared perception, and other technologies. It can also turn abstract emotions into perceptible art representations, such as creating geometrical dynamics of disorderly collision and vibrational feedback to mimic "pulling" when anxious. In the calm state, the fluctuation of oriental ink particles and the synchronous change of sound are activated, which is a metaphor for the ups and downs of emotions and suggests the change of body rhythm. Emotional Feedback Closure: F. J. Varelar et al. argue that the theory of embodied cognition emphasises that the formation of cognition relies on the body's experience of interacting with the world and is rooted in biological, psychological, and cultural contexts [12]. The purpose of cognition is to guide bodily behaviours, and the field of bodily sensations and meaning generation in art healing space allows participants to become cognisant and reflective of their emotions; the cognitive system provides regulatory strategies through real-time feedback technology to guide participants to make positive choices and better achieve psychological interventions. The design of art healing space needs to transform abstract emotions into perceptible and adjustable embodied practices, making them an important aid in the field of mental health.

The design of an artistic healing space must consider participants' physical behaviour, situational perception, and emotional cognition. Based on this, construct the embodied cognition model for an art healing space of "body-situational-cognitive" so that the theory of embodied cognition can be

transformed into an operable healing strategy and create a progressive healing experience that activates physical behaviour, enhances situational perception, and fosters cognitive development.

5. Summary

As a non-pharmacological therapeutic intervention, art therapy possesses extensive potential applications in the realm of mental health. The innovative application of embodied cognition has opened up a new design paradigm for art healing spaces, guiding healing objects to more deeply understand the relationship between the body, environment, and emotions, overcoming the limitations of the "disembodied view", and providing more effective theoretical support and practical pathways for intervening in mental health problems. In the midst of the digital revolution, art healing spaces are undergoing experiential innovation and intelligent upgrading. The theory of embodied cognition has yet to be fully applied in art healing spaces, and there are numerous areas that require further investigation, including the creation of a quantitative assessment system. These research directions will promote the development of art healing from empirical practice to an evidence-based discipline and provide more scientific and personalised solutions for mental health services.

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