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Practical Exploration of Embodied Cognition and Spatial Reconstruction within the Digital Media Perspective: Taking TeamLab's Interactive Installation 'Formless Cloud' as an Example

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ABSTRACT
In the contemporary context where digital technology is profoundly reshaping artistic creation, immersive interactive installations have emerged as pivotal mediums for reconfiguring human-space relationships. This study examines TeamLab's seminal interactive work Borderless Clouds through the theoretical lenses of embodied cognition and interactive narrative, employing a combined methodology of literature review and case analysis. It systematically investigates how digital media reconstructs the relationship between humans and space through multisensory experiential design. The findings reveal that Borderless Clouds utilizes the synergistic effects of cloud physics simulation, real-time light-shadow tracking, and auditory feedback to construct an embodied illusion of "floating amidst clouds." This transformation shifts the audience from passive "observers" of space into active "participants" and "co-creators of meaning," thereby dissolving the boundaries between the virtual and the physical. This research not only contributes to interdisciplinary theoretical discourse in embodied cognition and interactive narrative but also provides actionable insights and methodological references for future creative practices in digital interactive installation art.

KEYWORDS
Digital media art; Interactive installation; Embodied cognition; Spatial reconstruction; TeamLab; Formless clouds

1 Introduction

Since the 21st century, the rapid advancement of digital technology has catalysed fundamental transformations in artistic forms, propelling digital media art from the "periphery" of traditional art to the "centre stage".Unlike traditional art forms such as painting and sculpture, which rely on "static carriers," digital media art employs computer technology, sensor technology, and projection technology as core tools. It emphasises "dynamic interaction" between artistic creation and the audience, forming an entirely new "immersive" and "participatory" artistic experience model. Among these, immersive interactive installations stand as a pivotal branch of digital media art. Through the digital transformation of spaces and the integration of multi-sensory stimuli, they transcend the traditional limitation of "separation between viewer and artwork." This allows audiences to "enter" the work itself, engaging in real-time interaction through physical movement and sensory perception, thereby achieving unique spatial experiences and emotional resonance [1].

Within contemporary immersive interactive art, the Japanese collective TeamLab stands as one of the most representative creative groups. Founded in 2001, TeamLab comprises multidisciplinary professionals including programmers, designers, mathematicians, and architects. Its core creative philosophy centres on "connecting people with nature, space, and one another through digital technology," asserting that "art is not an isolated work, but a dynamic relationship generated by interactions between people, space, and others.". Unlike traditional art collectives centred on the "artist's personal style," TeamLab emphasises "collective creation" and the "deep integration of technology and art." Their works are typically characterised by large-scale, multi-sensory, and highly interactive installations, enabling audiences to experience an "immersion beyond reality" within specific spaces. This has sparked profound discussions within the art, design, and academic communities regarding "how digital media reconfigures space," establishing TeamLab as a "pioneering" collective in contemporary interactive art[2].

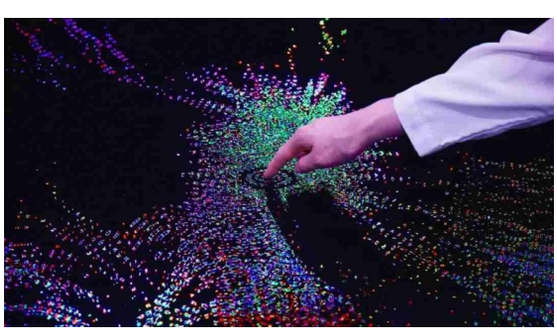

Figure 1 TeamLab, Living Crystallised Light, 2025, from the series Living Crystallised Light, 2022–present, installation, sound: teamLab, © teamLab, image courtesy of Pace Gallery

2 Theoretical Framework

2.1 Embodied Cognition: Cognition as Embodiment

The theory of embodied cognition, emerging in the 1980s, posits that "cognition is not an isolated process occurring within the brain, but rather the product of the body interacting with its environment" – that is, "cognition is embodied". This theory challenges the traditional cognitive science perspective of "disembodied cognition" —— where traditional cognitive science views the brain as an "information processor," positing cognition as the brain's "encoding, storage, and retrieval" of external information, while neglecting the roles of the body and environment. Embodied cognition theory, conversely, emphasises that the body's structure, sensory experiences, and motor capabilities directly influence cognitive formation, and that environmental characteristics also influence cognitive processes through bodily perception [3]. Representative scholars of embodied cognition, George Lakoff and Mark Johnson, propose in their work Metaphors We Live By that human abstract cognition (such as concepts, thought, and emotion) originates from concrete bodily experiences. For instance, the concepts of "up" and "down" stem from the bodily experience of standing upright ("above" being the direction reachable by raising one's arm, "below" being the direction of one's feet),while the emotional concept of "warmth" stems from the bodily tactile experience of being embraced. They contend that "metaphor" serves as the bridge connecting bodily experience to abstract cognition, with all metaphors ultimately rooted in the "body". Another leading scholar of embodied cognition theory, Maurice Merleau-Ponty, emphasised from a phenomenological perspective in Phenomenology of Perception that "perception is not the brain's representation of the external world, but rather the 'intertwining' of the body with the world." For instance, our perception of a "table" encompasses not only its shape and colour (visual experience), but also the texture we feel when touching it (tactile experience) andand the spatial position changes when walking around it (kinesthetic experience). These experiences collectively constitute our cognition of the "table" [4].

2.2 From Traditional Linear Narrative to Non-Linear, Generative Narrative

Narrative serves as a vital means for humans to convey information and express emotions, its form continually evolving alongside advancements in media technology. Traditional narratives (such as novels, films, and plays) predominantly employ "linear narrative," where the story unfolds chronologically through "beginning – development – climax – conclusion." The narrative content is predetermined by the author, leaving the audience to "passively receive" the narrative information without altering its course.

With the advancement of digital media technology, narrative forms have progressively shifted from "linear" to "non-linear" and "generative" structures. Non-linear narrative disrupts the temporal sequence of traditional storytelling, allowing audiences to select their reading/viewing path according to their preferences [5]. For instance, in interactive fiction like Choose Your Own Adventure, readers encounter branching choices (such as "go left" or "go right") during reading. Different selections lead to divergent plotlines, enabling readers to "actively choose" the narrative path. Generative Narrative takes this further: narrative content is not predetermined by the author but is instead "generated in real-time" by a system based on the audience's interactive actions. Every action taken by the audience influences the narrative's development, making each audience member's narrative experience unique.

2.3 Digital Media and Spatial Perception

Digital technology fundamentally alters human spatial experience through the "digital transformation" of space. Traditional physical spaces possess clear boundaries (such as walls, doors, and windows), confining human spatial perception to "physical limits." Conversely, digital techniques like projection mapping and virtual reality (VR) transcend physical boundaries, rendering space "boundaryless."For instance, in Formless Clouds, mist and light flow seamlessly across walls, floors, and ceilings, blurring the distinction between "wall and floor" for viewers. Through variations in light intensity and the density of mist, some spectators perceive "vast expanses, as if suspended in boundless skies,"while others perceive "a confined space, as if within a narrow chamber," demonstrating the "variable nature" of spatial scale [6].

3 Case Study: TeamLab's 'Formless Cloud'

3.1 Work Overview

Borderless Clouds is a central installation within TeamLab's Borderless Art Museum series, created in 2018 and first exhibited at Tokyo's TeamLab Planets museum.The core creative concept of the Borderless Art Museum series is to "break down the boundaries between artworks and space, between artworks themselves, and between the audience and the artworks," transforming art into a "boundaryless, fluid, dynamic entity that interacts with the audience." Borderless Clouds is a quintessential embodiment of this philosophy.

Since its inaugural exhibition in 2018, Formless Cloud has been presented in TeamLab exhibitions across multiple global cities, including TeamLab Borderless Shanghai (2019), TeamLab Borderless New York (2021),and TeamLab: Between Art and Science in London (2023). Each iteration undergoes "adaptive adjustments" tailored to the scale and characteristics of the local exhibition space (such as spatial dimensions and equipment layout), while maintaining consistent core sensory experience design and interactive mechanisms. According to TeamLab's official data, "Clouds

Figure 2 TeamLab, 2020–, installation, sound: Hideaki Takahashi, © TeamLab

Without Form" ranks among the installations in the "Formless Art Space" series with the longest visitor dwell times and most favourable experiential feedback.

3.2 Analysis of Sensory Experience Design Strategies

3.2.1 Visual: Cloud Generation and Real-Time Light-Shadow Dynamics

Visually, 'Clouds Without Form' employs cutting-edge real-time generation technology to construct a continuously evolving visual landscape. The installation utilises water vapour particles produced by a high-density atomisation system as projection carriers, combined with a precisely calculated laser projection system, to create an intensely immersive visual environment. Unlike traditional projection art, the work's uniqueness lies in its visual forms not being pre-set, but generated in real-time through complex algorithms.As visitors move through the space, their bodily motions disturb the distribution of mist. This disturbance is detected by a motion-capture system, triggering corresponding alterations in the projected content. This dynamic visual feedback mechanism fosters a unique visual dialogue: each visitor's movement 'draws' the spatial visual form, while the ever-shifting landscape guides their path, creating a cyclical, interactive visual narrative [7]. More exquisitely, the work employs precise light and colour control to evoke rich emotional layers. Cool-toned light and shadow, often paired with low-frequency soundscapes, cultivate a tranquil, profound spatial sense; while shifts in warm hues frequently accompany undulating sound effects, fostering a warm, intimate atmosphere. This cross-sensory collaborative design not only amplifies the work's emotive impact but also subtly guides the audience's emotional experience at a subconscious level.Notably, while the visual elements undergo constant transformation, they maintain a consistent aesthetic unity. This coherence stems from the team's deep integration of colour theory, visual psychology, and digital algorithms.

3.2.2 Auditory: Low-Frequency Rumble, Ambient Soundscapes and Psychological Implications

The sound design of Formless Cloud demonstrates TeamLab's profound understanding of auditory psychology. Employing a multi-layered approach, the foundational layer comprises a sustained soundscape of low-frequency waves. These frequencies, ranging from 20-60Hz, are not only perceptible to the auditory system but also induce deep physiological responses through bodily resonance.This embodied sound design enables audiences to perceive the spatial presence not only aurally but also physically. The intermediate layer comprises ambient soundscapes that shift in response to visitor movement. These sounds achieve precise spatial localisation through an 8.1 surround sound system, creating directionally defined auditory experiences. The highest layer delivers real-time auditory feedback for specific interactions, with these sound elements maintaining strict synchronisation with visual changes to heighten the interactivity's realism.

Particularly noteworthy is the work's innovative application of the 'soundscape' concept. While traditional art installations often treat sound as a background element, Formless Cloud elevates sound to an artistic language of equal importance to the visual. Sound not only reflects the state of the space but actively shapes its character. As visitors traverse the mist, shifts in the direction, intensity, and texture of sound weave a unique spatial narrative. This narrative bypasses linear linguistic expression, instead engaging the viewer's consciousness through direct, intuitive auditory perception. This non-verbal communication transcends cultural boundaries, enabling the work to forge profound emotional connections with audiences from diverse backgrounds [8].

3.2.3 Tactile / Kinesthetic: Humidity, Air Pressure and the Sensation of Bodily Floating

On the tactile and somatic level, Formless Cloud demonstrates digital art's groundbreaking exploration into the realm of physical perception. The installation employs a precise environmental control system to construct a unique microclimate within the exhibition space.A temperature control system maintains the space within a comfortable range of 22-24 degrees Celsius, while a humidity system employs ultrasonic humidifiers to regulate air moisture between 80%

-90%. This meticulous environmental management not only ensures the stability of the cloud and mist effects but, crucially, provides visitors with distinct somatic cues. Upon transitioning from conventional exhibition areas into the installation space of Formless Cloud, visitors' skin first registers a pronounced shift in temperature and humidity. This physiological sensation subconsciously reinforces the psychological suggestion of "entering another world".

The floor design exemplifies the team's profound understanding of sensory engineering. The installation employs a specially formulated elastic polymer material for the flooring. Its density is precisely calculated to produce moderate yielding and rebound under foot pressure, simulating the mechanical feedback of walking upon soft clouds. Simultaneously, a distributed airflow nozzle system embedded beneath the floor adjusts airflow intensity and direction according to the viewer's position and movement speed. When stationary, gentle air currents rise evenly from all sides; during rapid movement, supportive air curtains form along the direction of motion. This dynamic mechanical feedback synergises with visual and auditory elements to construct an illusion of bodily levitation, demonstrating the powerful potential of multisensory integration in crafting immersive experiences.

3.2.4 Spatial Construction and Audience Flow

The spatial design of Formless Cloud disrupts the static paradigm of traditional art exhibitions, constructing a fluid experiential domain. Employing a "multi-layered circulating" spatial layout, the core experience zone is designed as an open space without explicit directional cues, eliminating the linear viewing paths typical of conventional exhibitions. This design's profound significance lies in relinquishing spatial control entirely to the audience, where each individual's movement choices become pivotal in shaping their personal experience. Within the space, meticulously crafted visual cues and soundscapes generate natural "experience currents". These currents are not imposed by physical boundaries but emerge organically through subtle sensory guidance.

More innovatively, the work explores 'collective spatial perception'. A network of sensors within the installation monitors the spatial relationships and movement patterns of multiple visitors in real time, generating corresponding collective experiences through algorithmic processing. When audiences gather densely, the system adjusts the flow patterns of the mist to create more socially conducive open spaces; when individuals disperse, it enhances the sense of privacy by intensifying sensory stimuli in specific areas to deepen personal engagement. This dynamic spatial adaptability enables the work to simultaneously fulfil the dual demands of individual exploration and social interaction, demonstrating digital art's unique value in constructing novel social spaces.

4 Discussion from an Embodied Cognition Perspective

4.1 The Interactive Relationship Between Body, Space, and Medium

Within the theoretical framework of embodied cognition, Formless Cloud achieves a profound interpretation of embodiment. The work transforms the viewer's body from a traditional receptacle of perception into an active medium of expression, a shift of significant theoretical importance. According to the phenomenological theory of perception by the philosopher Merleau-Ponty, the body is our primary medium for perceiving the world and the origin point of all meaning. Through technological means, Formless Cloud translates this philosophical concept into an experiential artistic reality. Within the installation, the body ceases to be the endpoint of perception and instead becomes the starting point of meaning. Viewers engage with the space through everyday actions such as walking, waving, or turning. The sensory shifts triggered by these movements, in turn, shape the viewer's perceptual experience, fostering an ongoing dialogue between body and environment [8].

This design profoundly embodies the tenets of enactive cognition theory—that cognition is not abstract computation occurring within the brain, but rather emerges through real-time interaction between the body and its environment. Within Formless Cloud, the viewer's understanding of the work does not arise through rational analysis, but gradually surfaces through the body's exploration within the space. This shift in cognitive approach holds significant artistic merit, dismantling the "aesthetic distance" traditionally emphasised in art appreciation. It immerses the viewer directly within the artistic experience, achieving a profound fusion of perception, action, and cognition. Such deep embodied engagement not only enriches the language of artistic expression but also expands our understanding of human cognitive mechanisms.

4.2 Sensory Integration and Embodied Narrative

The innovative practice of sensory integration in Formless Clouds offers new possibilities for digital artistic narration. Through the coordinated design of multiple sensory channels—visual, auditory, and tactile—the work constructs a comprehensive perceptual system. This system differs from traditional multimedia layering by achieving profound sensory fusion through precise cross-modal correspondence. Visual brightness shifts synchronise with auditory frequency increases, while tactile softness reinforces visual blurred boundaries. This cross-sensory consistency enables disparate sensory information to coalesce naturally into a unified perceptual experience.

Narratively, the work transcends linear storytelling conventions to forge an embodied narrative rooted in bodily experience. This mode exhibits several defining characteristics: first, immediacy, where content generates in real-time

through audience exploration without predetermined scripts; second, individuality, as each participant crafts unique narrative threads based on their distinct movement trajectories and interactive choices; Finally, it is open-ended, with narrative meaning remaining perpetually unfinished, continually enriching and evolving as the experience deepens. This approach more closely mirrors the natural human process of experience formation, constructing meaning not through symbols or allegories, but via direct sensory engagement and bodily participation. This paradigm shift in narration not only transforms artistic creation but offers crucial insights for storytelling and meaning transmission in the digital age.

4.3 Reconfiguring Spatial Relationships

Through the innovative application of digital technology, Formless Cloud achieves a profound reconfiguration of traditional spatial concepts. This reconfiguration manifests across three interrelated dimensions: at the physical level, space transforms from a static vessel into a dynamic reactive system, its properties and states continuously shifting in response to audience participation; at the perceptual level, spatial boundaries become blurred and fluid, disrupting the conventional correspondence between physical and perceived space to create an elastic spatial experience; At the social level, space becomes a shared domain connecting individual experiences, where personal perceptions and actions mutually influence one another through the spatial system, forming a novel social topology [9].

The theoretical significance of this spatial reconfiguration lies in its vivid illustration of the phenomenological concept of 'spatiality'—space is not an objectively existing vessel, but a lived environment constructed through bodily interaction with the surroundings. Heidegger proposed the concept of 'dwelling', emphasising that space is imbued with meaning through human existence and activity.Formless Cloud translates this philosophical inquiry into concrete artistic practice. Within the installation, spatial meaning is indeed generated through the audience's act of dwelling and exploration. More significantly, the work demonstrates how digital technology expands our spatial experience, creating hybrid spaces that transcend physical constraints while preserving bodily authenticity. This spatial practice offers a crucial reference framework for understanding spatial experience in the digital age, exerting profound implications for future architectural design and spatial planning.

5 Conclusion

As a landmark work within the digital arts, Formless Cloud's theoretical value and practical significance extend far beyond conventional artistic innovation. Theoretically, through its sophisticated sensory design and profound technological integration, the work provides a vivid practical case study for embodied cognition theory, demonstrating the central role of the body in cognitive processes. This practice not only validates phenomenological theories of the body but also expands our traditional understanding of perception, cognition, and spatial comprehension.The "enactive aesthetics" demonstrated by the work provide a novel conceptual framework for digital art theory, emphasising that artistic experience is a dynamic, continuously generated process through the cyclical interaction of perception and action.

The successful realisation of Formless Cloud reflects a significant shift in human experience within the digital age.The hybrid spatial experience it creates resonates with the profound integration of physical and digital realms in contemporary life. Its emphasis on sensory engagement addresses a cultural need to counter digital abstraction, while its focus on interaction and participation embodies the deep-seated yearning for connection and co-creation in the social media era. These cultural dimensions elevate Formless Cloud beyond an art object to a cultural text for understanding the human condition in the digital age.

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References

[1] Zhang Xinjun. The Cross-Media Turn in Narratology [J]. Exploration and Criticism, 2020(1):12-28.

[2] Ye Haosheng. Embodied Cognition: A New Direction in Cognitive Psychology [J]. Advances in Psychological Science, 2010, 18(5): 705-710.

[3] Yu Chuanfei. Why Do We Build This Way? — New Narrative Approaches in Architecture for the Digital Age [J]. New Architecture, 2008 (3): 24-27.

[4] Ma Xiaoxiang. New Media Installation Art [M]. Nanjing: Nanjing University Press, 2013.

[5] Claire Bishop. Installation Art: A Critical History [M]. Hangzhou: China Academy of Art Press, 2022.

[6] Han Yirui. Research on the Development of Narratology in the New Media Context [J]. China Press, 2015 (10): 80-81.

[7] Lee L. Worlds Unbound: The Art of teamLab [M]. Intellect, 2022.

[8] Tseng C P. Toward a Borderless Connection: teamLab and a Quasi-Immersive Theatre [J]. The International Journal of Architectonic, Spatial, and Environmental Design, 2022, 16(2): 133.

[9] Stetz A R. Strangers Become Collaborators: An Interdisciplinary Analysis of the Disruptive Artwork of teamLab[J]. 2022.