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Mediatory Architectures in Immersive Exhibition Design: Structuring Perception, Emotion, and Knowledge

Zhineng Ding

Academy of Fine Arts, Northeast Normal University, Changchun, China
2024101681@nenu.edu.cn

Abstract. This paper theorizes immersive exhibition design as a form of mediatory architecture—a space that choreographs perceptual, emotional, and epistemic experience. Grounded in cognitive aesthetics, spatial theory, and media studies, the model offers an integrative approach to understanding how immersive environments structure meaning. It names four central mechanisms - Frame (spatial structure), Flow (emotional sequencing), Focus (interactive attention), and Feedback (embodied response) - as structural pillars of immersive experience, and offers a structurally rigorous model for exhibitions as knowledge-producing environments to replace spectacle-based readings of immersive art discourse. The research requires empirical validation in the form of space-syntax mapping, eye-tracking, and presence measurement, and directs attention to the ethical responsibility of designing cognitively and culturally meaningful experiences. Moving beyond spectacle-related interpretations, this integrative approach provides a formal model of exhibitions as epistemic environments.

Keywords: Mediatory Architectures, Immersive Exhibition Design, Cognitive–Epistemic Framework, Spatial Mediation, Presence&Embodied Feedback

1. Introduction

1.1. Locating the field and framing the question

In recent years, exhibition spaces that immerse people, like teamLab Borderless, are offering fresh ways to reconsider space within art presentations. Projected in teamLab using projection mapping and featuring AI-enabled interactive elements on a world-scale level, viewers can co-create experiences as they move through rooms and multi-sensorily engage with space and time [1]. As opposed to the boring“white cube, ” these design outcomes involve spaces being participant-driven. In Virtual Art: From Illusion to Immersion, Oliver Grau [2] describes it as “a high-grade feeling of immersion, of presence.” Similarly, Werner Wolf [3], in his book Aesthetic Illusion in Literature and Other Media, defines immersion as “an experiential, predominantly emotional diving into a represented world” (p. 23) and identifies aesthetic illusion as “a state of imaginary immersion” (p. 16).

By examining renowned exhibitions and reviewing numerous public accounts shared on official platforms, I began to critically consider the processes of meaning-making within extraordinary

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landscapes. In particular, within the medium of immersive exhibition spaces, how do individuals' aesthetic experiences, emotional responses, and perceptual processes emerge and interact? How are these dimensions generated, and in what ways do they mutually influence one another? Furthermore, what role does the spatial medium itself play as an active mechanism in shaping these experiences?

1.2. Literature review

At present, researchers mainly focus on immersive exhibition design from a variety of perspectives, including media interaction, spatial cognition and collaborative participation. Qi and Wang [4] proposed a comprehensive design, development and evaluation framework for immersive and collaborative interactive exhibitions in the cultural heritage field. They emphasize that through well-designed spatial layout, interactive technology and participation mechanism, the audience can go beyond passive observation and gain individual and collective experience. The framework integrates sensory, cognitive and social dimensions, highlighting the core role of meaning co-creation and sharing consciousness in effective immersive exhibition design. Likewise, the research carried out at MDPI reveals that the Continuity project built by teamLab aims to construct multisensory projection ecologies together with people to co-create the spatial awareness and relational awareness; besides, a shared experience plays an essential role there.

In art exhibition studies, Chen et al [5] extend the service-theatre frame into a digital space where the dramaturgical staging of an environment's space, agency, and performance structure the immersive attention and imagination. Mondloch [6] critiques spectacle-driven immersion in favor of an"attention–experience economy", in which one also attends to reflection and depth over aesthetic impact, as described earlier.

The following studies also lend support to the theoretical framework on VR and SP: Zheng Wei et al.,[7] did a comprehensive analysis of the three kinds of presence (spatial, social and cognitive) in terms of their mediation of learning outcomes under diverse tasks and subjects; a meta-analysis of teaching from grades K-6 illustrated that immersive VR has an extremely large influence (ES = 1.11) compared with semi-immersive (ES = 0.19), and non-immersive systems; but other research warned that high spatial presence can hinder recall once the cognition burden is too heavy [8]. A recent Frontiers study [9] corroborates that immersion VR contributes significantly to the acquisition of spatial ability knowledge yet at the same time it might induce motion sickness, increasing cognitive load (CL), and thus hampering the training effect.

The writings state that immersive design should address the aspects of sensory architecture, interactive dramaturgy and psychological presence, however very few of the works which study these aspects have synthesised them together to produce a architecture as mediator such as one found in this paper, which details a cognitive-epistemic model, unifying spatial syntax, affective sequencing, trigger-based attention, and embodied feedback into a single theoretical framework on intermediary architecture for immersive exhibitions.

1.3. Theoretical framework: symbolic space, spatial mediation, and immersion

To address the aforementioned question, the study relies on three overlapping traditions.

Symbolic(or virtual) space, according to Langer [10], feeling and form: art as creative form, is affective and constructed—"space of logical possibility" rather than the inert backing suggestive of"space of logical possibility" space in the objects of space.

Hillier's [11] theorem of space syntax, in which layout characteristics such as integration and choice drive patterning of attention and movement.

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Affective mediation and immersivity in Giuliana Bruno's Atlas of Emotion (exhibition becomes "sensorial memory architecture"), and Freitag et al [12]. concept of immersivity, where structural generation of immersive experience, not only reception, comes into play.

This model is the product of a synthesis across the disciplines of architecture, media studies, and cognitive science. Rather than being confined within disciplinary silos, the study builds a cross-field vocabulary to conceptualise immersive exhibition spaces as epistemic spaces. As such, it is an integrative interdisciplinary approach, bringing together spatial syntax and affective turn sequencing, and embodied interaction into a single cognitive-epistemic framework.

1.4. Chapter structure overview

After the introduction above:

The second chapter applies immersive design principles (service theater staging, affective scripting, minimal vs. spectacle mediation) through case studies of teamLab SuperNature and Rain Room.

In the third chapter, we describe mediation channels, including flow, focus, frame, and feedback, and develop the interface between cognition and immersive environments.

The fourth and final chapter draws these together into a coherent cognitive-epistemic model of immersive design, in which the meaning formation is actively mediated by the immersive design framework.

Conclusion revisits theoretical implications, contributions, limitations, and future directions.

2. Immersive design principles as cognitive architecture

2.1. Structuring experience: the servicetheater model

Immersive exhibitions can be understood through theatrical models of service delivery, such as the “work is theatre” metaphor introduced by Pine and Gilmore [13] in the Experience Economy, and further elaborated in cultural and exhibition contexts by later scholars [14,15]. This model stipulates that immersive experiences arise from the interaction of three structural dimensions: environment, actors, and performance. Chen et al. [5] show that teamLab SuperNature in Macau employs spatial set-ups, interactive digital agents, and structured triggers to shape visitors’ mental imagery and presence across entertainment, aesthetic, educational, and escapist modalities [5].

This aligns with Bruno’s [16] concept of exhibition space as a performative device, one that choreographs affective and cognitive flow. Immersive exhibitions, then, are best understood as staged environments—spaces where visitors participate in scripted interactions shaped by architectural and technological design.

2.2. Case study: TeamLab SuperNature Macau

TeamLab SuperNature in Macau exemplifies this theatrical design. Visitors wear sensor-equipped vests that trigger interactivity between digital projections, soundscapes, and motion-sensitive visuals. For example, one room gradually transitions from dim light to a radiant forest of floating orbs as visitors approach [5].

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Figure 1. TeamLab SuperNature: immersive forest room with motion-sensitive orbs

Note. Screenshot from teamLab official website.(https://www.teamlab.art/e/supernature/.)Used under fair use for educational and research purposes.

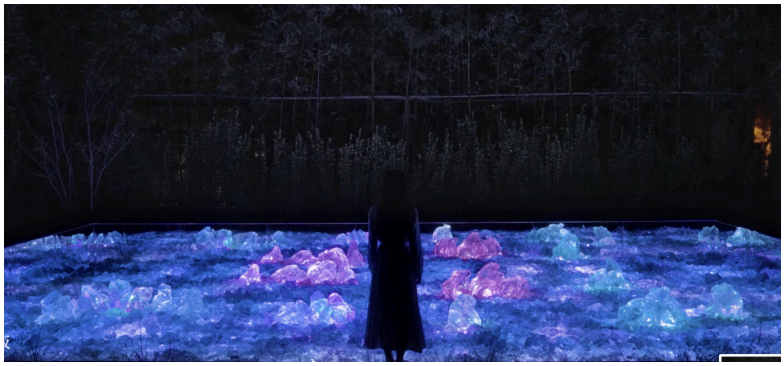

Figure 2. Unsupervised by Refik Anadol in MoMA lobby display

Note. Screenshot from The Museum of Modern Art website (https://www.moma.org/calendar/exhibitions/5537).Used under fair use for educational purposes.

This design is built to direct attention: atmospheres are formed gradually, sensory-pleasure spikes coincide with each other and breaks in intensity arise at defined spatial breakpoints – ultimately directing the engagement and overall flow of visitors as well as priming the visitors for their own type of epistemic engagement (taking knowledge personally).

2.3. The instagrammability factor and epistemic integrity

As immersive exhibitions scale globally, critics warn that many become little more than Instagrammable spectacles, prioritizing visual shareability over conceptual depth [17]. However, teamLab's design philosophy—as analyzed by Grassi [18]—suggests a dual agenda: encouraging playful co-creation, while embedding subtle ecological reflection and relational awareness [18].

This tension illustrates the challenge of maintaining epistemic integrity: immersive designs must resist the siren call of spectacle to cultivate reflective depth. This paper answers by highlighting mediator architecture as an example of meaning-based design rather than visual spectacle.

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2.4. Case study: Rain Room and minimalist mediation

While Rain Room [19] offers a completely different solution - a raining atmosphere, which, depending on the movement of visitors, creates pauses all around them. At least it emphasizes inner knowledge and internal proprioception over visual display.

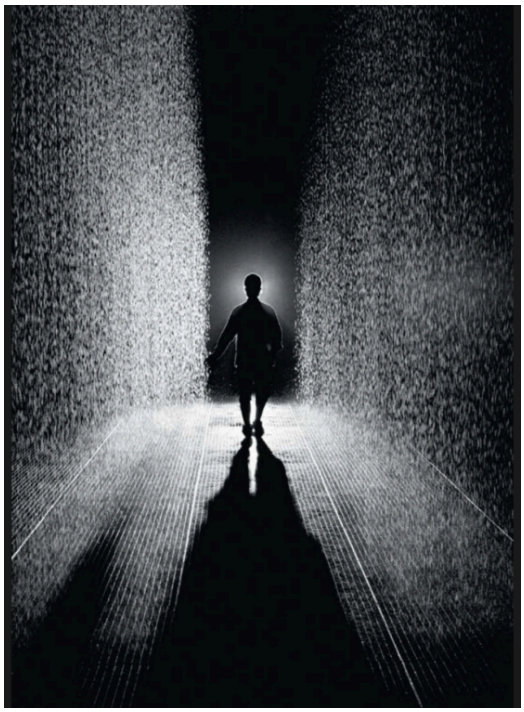

Figure 3. Rain Room interactive environment by random international

Note. Screenshot from Random International (https://random-international.com/work/rainroom/).Used under fair use for non-commercial academic reference.

According to co-founder Hannes Koch, the rain room is a place that forces people to step away from everyday distractions and pause so there is more 'human and less mediated' interaction [19,20]. It does this by throwing away technology-mediated parts and modeling a very simple perceptual system, where the mediation of space must now be experienced through our bodies rather than through our minds via computer games.

2.5. Comparative insights and design guidelines

By comparison, two competing models present themselves:

Immersive design (teamLab): multiple screens, playful co-creation, and multi-modal stimulation as key dimensions of spectacle-oriented immersion.

Minimalist spatial mediation (Rain Room): embodied perception as immersive design, unencumbered by visual overload.

This output can feed back into a mediatory architecture toolkit, whereby designers can sculpt experiences by modulating the magnitudes (spectacle vs minimal), the sensory density and the co-creative agency. Reflection or ecological insight (epistemic intent) can only be added by a carefully-constructed spatial dramaturgy derived from the service theatre model.

DOI: 10.54254/2753-7064/2025.BJ29464

3. Mechanics of mediator architecture

The first chapter and the second chapter showed the importance of the immersive exhibition space and how its dramaturgical design structures our experience. The third chapter was devoted to explaining spatial as a cognitive mediator according to the principle of design and detailed four interlocking mechanisms: Frame, Flow, Focus, and Feedback, that are vital to understanding the process of composition between space and thoughts or emotions.

3.1. Frame: structuring attention through spatial syntax

Frame is a concept based on space syntax theory for spatio-visual knowledge networks and configuration [11]. Integration values correspond to pathways with high traffic and potential for social interaction; high choice values denote nodes where navigation decisions are concentrated.

In the team-Lab Borderless installation, Haslem [21] describes the seamless movement of projection-based ecologies as moving between spaces, integrating spaces so that they become one experience, and eliminating visitors' traditional ways of spatially mapping the space. Visitors move through a“ceaseless subjective space” attention being continuously pulled through an environment guided by consistency of environmental quality [21].

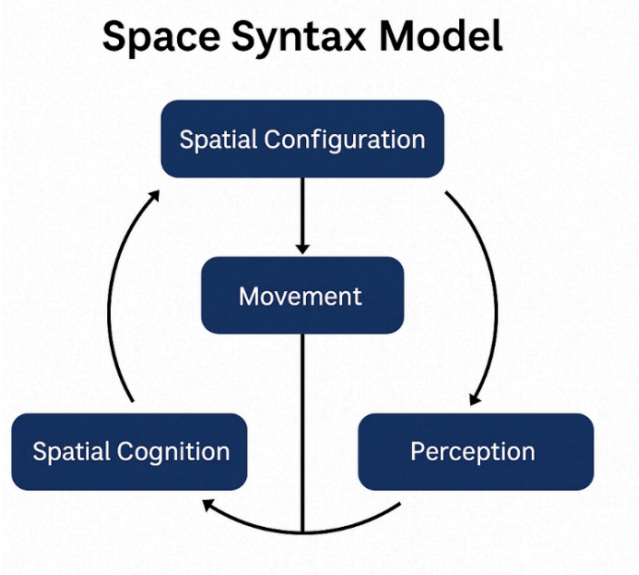

Figure 4. Space syntax model: configuration, movement, perception, and cognition

Note. Created by the author based on Hillier’s theory of space syntax (Hillier, 1996).

The frame thus specifies what region of interest people will focus on and how the spatial density within it may influence one’s perceptual interpretation.

3.2. Flow: sequencing atmospheres to script awareness

Flow refers to the temporal sequencing of atmospheres—light shifts, ambient soundscapes, sensory transitions—that encode emotional rhythm. Bruno [16] describes architecture as an affective surface through which emotional arcs are spatially orchestrated. “Perception is not something that happens to us, or in us. It is something we do. It is a kind of skillful activity on the part of the perceiver” [22].

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In Refik Anadol's Machine Hallucinations, darkness is successively displaced by wavering color fields. This rise in sensory value leads to a cognitive experience from the void into emergence through dissolution, with each of these phases carrying an increased level of emotional and reflective charge. The sensation of the audience mirrors the experience of the phases leading up to the reveal.

Flow thus choreographs emotional engagement, scripting journeys through designed atmospheres.

3.3. Focus: triggering attention through interactive nodes

Focus refers to trigger points where spatial interactivity captures attention—whether algorithmic, sensor-based, or visually salient. These nodes punctuate the immersive environment and draw interpretive focus.

In teamLab SuperNature and Borderless, sensors respond instantly to visitor presence, activating visual and audio feedback loops [18,5]. These responsive zones draw attention and invite interpretive action, prompting visitors to reflect on their role in the space.

Focus thus configures spatial salience; cognitively, it underscores the visitor as participant, not spectator.

3.4. Feedback: embodied looping through sensorimotor response

Feedback refers to embodied sensorimotor loops—when visitor movements affect the installation, which then reaffects the visitor, completing a perceptual circuit.

In Rain Room, participants ' movement halts rainfall above them, producing moments of intense bodily awareness and atmospheric contrast [23,24]. This dynamic forms a reflexive loop: movement triggers space, space modifies perception, reinforcing reflection.

"Embodied interaction is the creation, manipulation, and sharing of meaning through engaged interaction with artifacts. It relies not just on physical presence, but on how bodily actions and social context dynamically shape cognition."[25] Feedback thus sustains embodied cognition—each visitor's action activates spatial logic, and each spatial response returns meaning.

3.5. Interdependence of mechanisms

The mechanisms are deeply interwoven:

The frame establishes the structural groundwork for Focus nodes.

Flow contextualizes Frame through temporal rhythm.

Focus punctuates the journey with interpretive triggers.

Feedback completes the agency loop, reinforcing attention and meaning.

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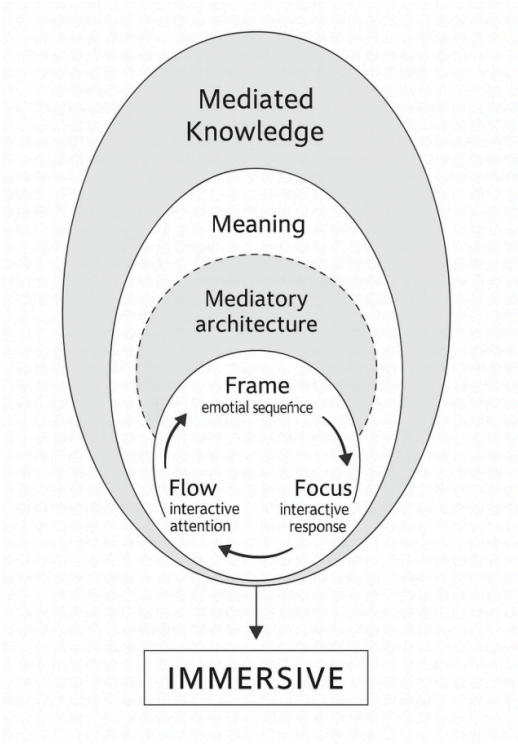

Figure 5. Integrative model of mediatory architecture in immersive exhibition design

Note. Created by the author to visualize the cognitive–epistemic framework integrating Frame, Flow, and Focus as mediating elements of immersive experience.

This synergy moves immersive space beyond spectacle into cognitive architecture, a designed environment where perception, emotion, and understanding are structured.

4. Toward a cognitive–epistemic model

4.1. From mechanisms to model: framing epistemic architecture

Based on my understanding and reading of the case studies, I identify four interdependent mechanisms: Frame, Flow, Focus, and Feedback, outlined in previous chapters. Immersive exhibition spaces become epistemic architectures intended to generate understanding and reflection through the design of an environment that facilitates learning instead of merely displaying information to visitors.

4.2. Deep-dive case: unsupervised at MoMA

4.2.1. Frame

The 24*24 feet LED display on the Garden Lobby of MOMA, showing objects from 138,151 archive records trained on through AI feeds visitors' eyes and organizes their movement [26].

4.2.2. Flow

Visual content evolves in response to ambient data—light, sound, weather—creating a temporal arc from silence and abstraction to complexity and multisensory dynamism.

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4.2.3. Focus

Algorithmic triggers—visitor motion, environmental shifts—punctuate the visual narrative, making guests co-creators. Many report the installation feels“alive”.

4.2.4. Feedback

Viewers average 38 minutes of engagement—far exceeding typical art viewing—signaling strong embodied feedback loops.

Figure 6. Visual Interface of Refik Anadol’s unsupervised installation at MoMA

Note. Screenshot from The Museum of Modern Art website (https://www.moma.org/calendar/exhibitions/5537). Used under fair use for educational and research purposes.

4.3. Model integration & theoretical reflection

Unsupervised integrates four types of mechanisms within its epistemology: spatially-grounded (Frame), emotionally-indexed(Flow), cognitively-activated (Focus) and behaviorally-reinforced (Feedback). It is built upon two sides: to serve as an impressive spectacle and a thought-provoking commentary on data-driven interaction.

4.4. Empirical support & future directions

Psychological presence research supports the model’s premise: more immersive environments correlate with stronger self-location and copresence—all mediators of cognitive and affective empathy [27]. Future studies could test the model via: Space-syntax analysis to quantify Frame effects. Eye-tracking and physiological measures to evaluate Flow and Focus [27]. Presence metrics and narrative empathy tools to assess Feedback loops.

5. Conclusion

This study redefines immersive exhibition spaces as epistemic architectures—spaces that influence not only sensory experience but also perception, emotion, and meaning-making. Drawing on the theories of Langer, Hillier, and Bruno, it proposes a framework based on four mechanisms: Frame, Flow, Focus, and Feedback. These elements work together to structure how visitors engage with the space. The analysis of Refik Anadol’s Unsupervised at MoMA shows how spatial design, AI

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systems, and interactive feedback loops can guide attention and support reflection. Instead of treating immersion as spectacle, this study presents it as a structured and intentional process, grounded in spatial cognition and affective sequencing.

Although the model is theoretically supported, it still needs empirical testing. Future research could include space syntax analysis, eye-tracking, and presence metrics to explore how the model works in practice. It is also important to consider ethical concerns, especially the role of design in shaping interpretation and belief. Designers and curators should ask whether immersive exhibitions promote understanding or simply entertain. As immersive technologies become more common, grounding them in cognitive and cultural responsibility will be essential. This paper suggests that exhibitions can act not just as display spaces, but as active systems for learning, reflection, and knowledge mediation.

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