

From Interaction-Driven to Experience-Driven: Exploring a Conceptual Framework for XR Interactive Space Narrative Design

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Abstract. With the development of Extended Reality (XR) technology, virtual space is transforming from a traditional information display medium into a digital environment with immersive, interactive, and experiential elements. Current XR design research largely focuses on dimensions such as technical implementation, interaction methods, and immersion levels, whereas the ways in which space influences users' emotions, behaviors, and experiential memories remain underexplored. This paper, from an environmental design perspective, explores experience-driven design methods in XR interactive spaces, reinterpreting the narrative role of space in digital environments. This paper takes an individual's XR interaction project as the research object, and analyzes the spatial organization, emotional creation, and user experience in the design process. On this basis, it proposes the Experience-Driven Spatial (EDS) conceptual framework, which establishes the design logic from experience intention to user perception through six levels: experience goal, player motivation, spatial narrative, interaction loop, behavior feedback, and experience memory. This paper does not attempt to verify the effectiveness of the framework, but rather proposes an experience-oriented approach to XR space design. This research argues that XR space design should focus not only on how users interact, but also on why they have certain experiences and how those experiences are shaped by the space. This framework offers a new direction for exploring environmental design methods within the field of digital experience design.

Keywords: XR, spatial narrative, experience-driven design, environmental design, conceptual framework

1. Introduction

With the rapid development of Extended Reality (XR) technology, virtual environments are undergoing a profound transformation from visual simulation to experience creation [1, 2]. Current XR design research focuses on dimensions such as technical implementation, interaction methods, and immersion measurement. However, the extent to which space itself affects user emotions, behavior, and experience memory warrants further exploration [3, 4]. From the perspective of environmental design, space is always closely related to human behavior and emotional experience -

spatial organization, path design and atmosphere creation in real environments have been proven to affect people's psychological feelings [5, 6]; Nevertheless, a systematic design method for intentionally employing spatial strategies to guide user experiences in XR environments has yet to be established [7]. Traditional XR design usually starts with interactive functions, following a linear logic of interaction, system, and finally experience [8]. However, this process may lead to users completing the operation tasks but lacking emotional experience and deep memory [8].

Based on the above problems, this paper explores the experience-driven design method in XR space from the perspective of environmental design, and proposes the EDS (Experience Driven Spatial) conceptual framework. It establishes the design logic from intention to perception by integrating experience goals, spatial narrative and interaction mechanisms [9]. The study adopts a combination of design practice reflection and case analysis, and uses XR interaction projects with personal participation as the object for verification and discussion [10]. This study aims to provide an experience-oriented design thinking method for XR spatial narrative, and at the same time provide a new exploration path for environmental design methods to intervene in the field of digital experience.

2. Proposal of the Experience Driven Spatial (EDS) framework

Based on the analysis above, this paper proposes a conceptual framework for Experience Driven Spatial (EDS). It should be noted that EDS is not a complete theoretical model that has been experimentally verified, but a conceptual framework based on design practice, which aims to provide a new way of thinking for XR space design [1, 2]. In the traditional design process, designers usually consider functional requirements first - "what operations do users need to complete", while experience-driven design focuses on "what feelings do users want to get in this space". This shift marks a transition of the design goal from functional completion to experience creation [5].

The EDS framework consists of six interconnected levels, forming a complete deductive chain from design intent to user perception: Experience Goal → Player Motivation → Spatial Narrative → Interaction Loop → Behaviour → Memory

The six levels of the EDS framework and their logical relationships are shown in Figure 1.

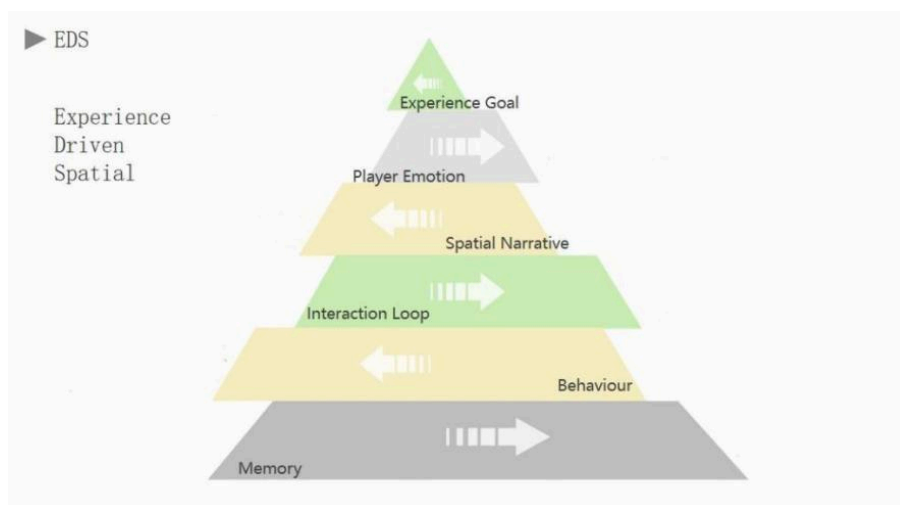


Figure 1. Six-layer structure diagram of the EDS framework

The logical relationship between each level is as follows: first, the designer establishes the experience goal—defining the desired emotional resonance for the user [8]; based on the goal, think about what factors can drive the user to actively explore the space [2]; then construct the spatial narrative through spatial organization, light and shadow, materials and sound [3]; on this basis, design the user's interaction cycle so that the user can continue to participate in the process of exploration-interaction-feedback [10]; verify the effectiveness of the design by observing whether the user produces the expected behavior; finally, all the above links work together to leave the experience memory left by the user after leaving the space, which is the final destination of the experience design [7].

The specific meanings of each level are as follows: The experience goal is the starting point of the design process. Designers need to clarify what kind of feelings users should have after entering the space (such as curiosity, calmness, nostalgia, warmth, etc.) and focus on the psychological experience that users ultimately obtain rather than the completion of functions [8]. User motivation examines the factors that attract users to enter and drives continuous exploration, which may stem from an innate desire to uncover the unknown or the thrill of discovering hidden content [2]. Spatial narrative emphasizes the use of spatial layout, circulation design, light and shadow changes, material expression and sound environment to express information, making the space a medium connecting users and stories [3, 6]. The interaction loop acts as the feedback mechanism within the experience, creating a continuous cycle of exploration, interaction, feedback, and further exploration, which transforms the experience from a one-time behavior into a continuous process [10]. Behavioral feedback focuses on whether users have produced the behavior expected by the designer. It is a verification link connecting design and users. Experience memory is the final landing point of the framework - the sensory memory and emotional residue left by users after leaving the space, rather than the cognitive record of task completion. It is the final standard for measuring whether the experience design is successful [7].

The EDS framework is not intended to replace existing XR design methods, but rather to provide an experience-oriented thinking tool to help designers clarify experience goals and user motivations before starting modeling, rather than directly entering into technical implementation [1]. It repositions interaction design as a feedback mechanism for the overall experience, ensuring that technological choices consistently serve experience goals rather than dictating the design direction [4].

3. Practice-based reflection on the EDS framework through an XR interactive project

This article takes an XR interactive space project designed by the author as a case study for practical reflection. The project is a small house space installation with gauze as the main material (hereinafter referred to as the "Search project"). By constructing a digital environment with an emotional atmosphere, it guides users to form an emotional connection with the space during the exploration process [3]. The spatial atmosphere of the Search project is shown in Figure 2, and its gauze material and lighting effects. Unlike traditional game design, this project does not focus on complex task mechanisms or high-intensity interactive operations, instead aiming to stimulate users' desire for exploration directly through the spatial environment itself.

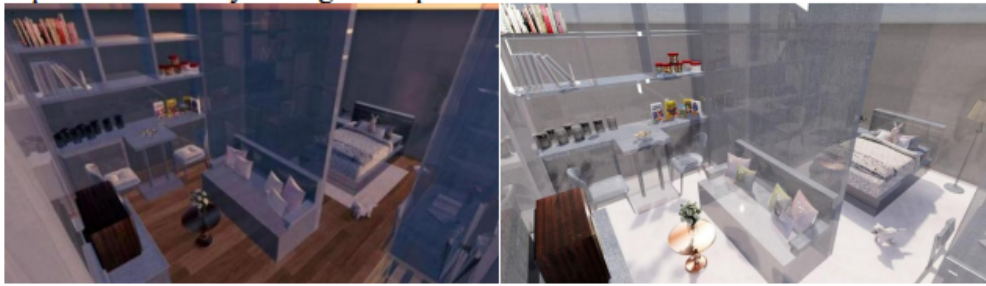


Figure 2. Overall atmosphere of the search project space and search project: gauze material and spatial lighting effects

The six levels of the EDS framework are subsequently applied to conduct a systematic retrospective analysis of the Search project. The core experience goal of this project is not to have users complete specific tasks, but to let users feel "the interweaving of warmth and memories" - a soft, hazy, and enveloping emotional atmosphere [5]. To encourage users to enter and explore, curiosity is harnessed as the core user motivation: the semi-transparent texture of the gauze causes the interior to shift between visibility and obscurity, preventing users from seeing everything at a glance and thereby sparking an innate desire to explore [2]. In terms of spatial narrative, the project uses gauze as the main material - its translucency symbolizes the haziness of memory, its semi-transparency suggests the hidden content, and its gentle movement conveys a sense of warmth [3]. The user's interaction cycle is: touch the gauze → push it aside to pass through → discover hidden objects → touch it again, and each "discovery" strengthens the motivation to continue exploring [10]. In the actual experience, the user's behavioral feedback has undergone observable changes: no one pulls the gauze hard, and everyone gently pushes it aside; the walking speed is obviously slowed down. The experience memory that users remember most often after leaving is not a specific object, but "the effect of the gauze changing with the light" - a holistic sensory impression [7].

Based on the retrospective analysis of the EDS framework, this article further proposes a transformation idea and reorganizes the experience into five progressive stages: the entrance stage is guided by wind sound and light and shadow to stimulate curiosity; the exploration stage guides users to actively search through the arrangement of hidden objects; the interactive stage uses touch to trigger light or image changes as feedback; the immersion stage uses light, shadow and sound to create an emotional atmosphere; the aftertaste stage allows users to take away personal memories and discoveries when they leave [4]. The core of this redesign strategy lies not in adding equipment or altering the physical structure, but in systematically reorganizing the spatial experience through the EDS framework to forge a more cohesive experience journey within the existing space.

Although the EDS framework can help to reorganize the design logic of XR space, it remains a conceptual framework that lacks large-scale user testing or quantitative data validation [9]. This article can only show that it has certain reference value as a design thinking method. At present, there are the following shortcomings: First, there is a lack of user feedback data. In the future, it is necessary to observe the impact of different design strategies on user behavior and emotions through user experiments; Second, the number of cases is limited. The current framework mainly comes from the practice of a single XR project; Third, the dynamic adaptability is insufficient. In the future, the XR environment may be further combined with artificial intelligence to adjust the spatial content in real time according to user behavior [6].

4. Toward adaptive narrative space: AI and future XR experience design

With the development of artificial intelligence technology, the future XR space is expected to transform from an environment composed of fixed content to an adaptive space that can dynamically change according to user behavior [8]. Traditional XR experiences are usually set by designers in advance with fixed scenes, fixed plots and fixed interaction methods, and users experience the space according to the preset logic after entering the space. The integration of AI empowers spaces with real-time responsiveness - by analyzing user behavior data (including dwelling position, exploration path, attention content and interaction method), the system can adjust the spatial layout, light and shadow changes, sound environment and content presentation in real time [5, 10]. This change means that the future XR narrative may shift from "fixed narrative" to "adaptive narrative".

Specifically, AI's role in XR space is reflected in three levels: First, behavioral data drives design iteration—AI collects users' behavioral trajectories in the space and feeds them back to the Behaviour and Memory levels of the EDS framework, helping designers to judge whether the experience goal has been effectively conveyed; Second, context-aware spatial adjustment—AI adjusts spatial parameters in real time according to user behavior patterns, so that the space adapts to the individual differences of users within the preset experience framework; Third, personalized narrative generation allows AI to produce customized narrative branches based on interaction history, crafting a tailored experiential journey [8]. Based on the above analysis, this paper proposes the concept of "Adaptive Narrative Space" (ANS): Driven by AI, XR space can dynamically adjust the spatial narrative content and rhythm according to the user's real-time behavioral data, so that each user may experience a different story in the space [1]. ANS does not negate the EDS framework, but rather extends it into the AI era: EDS addresses how experience is designed, whereas ANS explores how experience is generated in real time. EDS provides the design logic and structural framework for spatial experience, while ANS uses AI technology to make the structural framework have dynamic response capabilities, moving from the preset execution of design intention to the real-time activation of design intention [9]. Under this concept, the six levels of the EDS framework are not replaced by AI, but each obtains a new way of implementation: the experience goal is preset by the designer, and the AI flexibly adjusts the implementation strategy according to the user's state; user motivation, spatial narrative, interaction loop, behavioral feedback, and experience memory are enhanced by the real-time analysis, dynamic adjustment and personalized generation of AI [7]. Rather than becoming obsolete in the AI era, the EDS framework acquires new dimensions of application, evolving from a static model where "design ends at completion" into a continuous process where "design remains active and experience continues to grow."

5. Conclusion

This paper explores the development direction of spatial narrative design in XR interactive space from the perspective of environmental design, proposing a shift in design thinking from interaction-driven to experience-driven paradigms. Through a review of the development process of XR space, this paper argues that although the traditional design approach that starts with function and interaction can achieve user operation, it may ignore the influence of space on emotions, behavior and memory. To this end, this paper proposes the EDS conceptual framework, which establishes the design logic from experience intention to user perception through six levels: experience goal, user motivation, spatial narrative, interaction loop, behavioral feedback and experience memory [3, 5]. This paper further reflects on the application of the EDS framework throughout the design process

of a personal XR project. In the project, each layer of the framework found a corresponding design focus: the experience goal is "warmth and memories", the user motivation is driven by curiosity, the spatial narrative is based on gauze, the interaction loop is reflected in the repetitive behavior of touching-walking-discovering, the behavioral feedback is reflected in the user's slow pace and gentle movements, and the experience memory is deposited as the overall impression of the gauze and the change of light [2, 7]. At the same time, this paper also points out the current limitations of the EDS framework - it has not been verified by user testing, the number of cases is limited, and the dynamic adaptability is insufficient - and proposes future improvement directions [9]. It must be emphasized that EDS is not yet a fully verified theoretical model, but a practice-grounded conceptual framework. The main contribution of this paper is to propose an experience-oriented approach to XR space design, rather than to provide a set of verified design methods [1]. Future research can be carried out in the following directions: First, collect behavioral and emotional data through user experiments to verify the causal relationship between the various levels of the EDS framework; Second, apply EDS to more types of XR projects to test its applicability in different scenarios; Third, explore the combination path of the EDS framework and AI technology to further promote the adaptive narrative space from conceptual idea to design practice [8]. For the discipline of environmental design, XR is not a replacement for traditional space, but an extension of spatial design methods in the digital field. By synthesizing spatial organization, emotion shaping, and user experience, environmental design can unlock novel possibilities for future immersive digital experiences [6].

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