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EXPLORING THE AESTHETIC EXPERIENCE AND INTERACTION IN INTERACTIVE INSTALLATIONS

The article is dedicated to the issues of aesthetics and interaction design in interactive installations that integrate modern technologies and actively engage users within the framework of "human-computer" interaction. The research included a detailed analysis of video demonstrations of interactive installations, which were classified based on key aesthetic, technical characteristics, and interaction forms.

The results of the study revealed that the physical involvement of users, ranging from simple gestures to complex manipulations of objects, is a key element that ensures the uniqueness of each interaction in interactive installations. The analysis of installations presented at events and exhibitions in various countries during 2010-2020 showed that interactive installation design frequently incorporates themes such as the underwater world, natural landscapes, and abstract animations synchronized with musical accompaniment. These themes promote relaxation, engagement, and stimulate creative activity. For instance, the underwater world theme evokes a sense of calmness and wonder; natural landscapes foster harmony with nature, while musical installations stimulate creativity and social interaction.

The importance of storytelling as an effective method of emotional immersion is emphasized, where the sequence of audio-visual accompaniment is tied to user interaction. The research highlights the significance of integrating aesthetic and sensory elements into the creation of interactive installations, fostering a more meaningful and captivating user experience.

Thus, the work opens new horizons in exploring the synergy of aesthetics and technology in the field of interactive installations, offering prospects for their further improvement and popularization. This study can be beneficial for designers, artists, and researchers striving to create innovative interactive projects with profound aesthetic and emotional content.

Key words: *interactive installations, aesthetics, user interaction.*

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ВИВЧЕННЯ ЕСТЕТИЧНОГО ДОСВІДУ ТА ВЗАЄМОДІЇ В ІНТЕРАКТИВНИХ ІНСТАЛЯЦІЯХ

Стаття присвячена питанням естетики та взаємодії в дизайні інтерактивних інсталяцій, які об'єднують сучасні технології та активно залучають користувачів у межах взаємодії "людина-комп'ютер". У рамках дослі-

дження було проведено детальний аналіз відео демонстрацій інтерактивних інсталяцій, які класифікувалися за ключовими естетичними, технічними характеристиками та формами взаємодії.

Результати дослідження показали, що фізична участь користувачів, яка змінюється від простих жестів до складних маніпуляцій об'єктами, є ключовим елементом, що забезпечує унікальність кожній взаємодії в інтерактивних інсталяціях. Аналіз інсталяцій представлених на заходах та виставках в різних країнах світу у 2010-2020 рр. показав, що у дизайні інтерактивних інсталяцій активно використовуються теми, такі як підводний світ, природні ландшафти, абстрактна анімація, що відповідає ритму музикального супроводження. Такі теми сприяють релаксації, залученню та стимулюванню творчої активності. Наприклад, тематика підводного світу надає почуття спокою та зачудування, природні пейзажі сприяють гармонії з природою, а музичні інсталяції стимулюють креативність і соціальну взаємодію. Підкреслено важливість сторітелінгу як ефективного чуттєвого занурення, де послідовність аудіо-візуального супроводження пов'язана із взаємодією.

Дослідження демонструє значення інтеграції естетичних, сенсорних елементів у створених інтерактивних інсталяціях, які сприяють більш осмисленому та захопливому користувацькому досвіду. Таким чином, робота відкриває нові горизонти у вивченні синергії естетики та технологій в галузі інтерактивних інсталяцій, пропонуючи перспективи їхнього подальшого вдосконалення та популяризації. Ця робота може бути корисна для дизайнерів, художників і дослідників, які прагнуть створювати інноваційні інтерактивні проекти з глибоким естетичним та емоційним змістом.

Ключові слова: інтерактивні інсталяції, естетика, взаємодія з користувачем

Purpose: The primary aim of this study is to delve into the aesthetic experiences and interactions facilitated by interactive installations, a domain where technology and user engagement intersect profoundly within human-computer interaction (HCI). This research seeks to elucidate how aesthetic designs and thematic elements within these installations influence user perception, emotional engagement, and cognitive responses.

Methodology: This study employed a qualitative content analysis approach to systematically examine and categorize the aesthetic experiences depicted in 127 demo videos of interactive installations. Each video was reviewed to identify key themes related to aesthetic styles, technical characteristics, and user interactions. Videos were sourced from online databases and exhibitions, ensuring a diverse representation of installations from various cultural and artistic contexts. Keywords were assigned to each demo to facilitate thematic analysis and identify patterns in the aesthetic execution and user engagement strategies. This coding process helped in highlighting prevalent themes such as undersea settings, natural environments, and music creation spaces, as well as examining the use of storytelling within these interactive experiences.

The scientific novelty: This research introduces novel insights into the integration of aesthetic elements and user interaction within the realm of interactive installations. Unlike previous studies, which predominantly focused on either technical execution or isolated user responses, this study emphasizes the holistic and dynamic interplay between aesthetic design, user engagement, and embodied experience. It highlights the repetitive use of certain aesthetic themes that resonate deeply with users and the pivotal role of storytelling in transforming user interaction from passive observation to active participation.

Practical significance: This study's findings have significant practical implications for designers and creators of interactive installations. By illustrating the effectiveness of integrating body interaction, immersive storytelling, and repetitive aesthetic themes, this research provides actionable insights that can enhance the design and execution of future installations. Specifically, it underscores the importance of creating environments that not only engage users physically but also resonate with them on emotional and cognitive levels. This can lead to more engaging, meaningful, and memorable user experiences. Additionally, the insights into how specific themes like natural environments and music creation can be leveraged to evoke specific emotional responses offer valuable guidelines for tailoring content to audience preferences and enhancing the overall impact of interactive installations in public, educational, or artistic settings.

Introduction: The aesthetic experience, a pivotal element in human-computer interaction (HCI), significantly contributes to shaping a positive user experience. This fusion of technology and user interaction in interactive installations provides a unique platform to study the aesthetic experience, highlighting the importance of understanding how users perceive, interact with, and are affected by these systems. In the domain of interactive installations, the aesthetic experience is not just a passive reception but an active, embodied interaction that combines cognition, physical engagement, and emotional response. The complexity of this interaction opens up new research avenues exploring the intersection between cognition, embodiment, and interactivity, which are crucial for designing more intuitive and engaging interactive systems.

However, this interdisciplinary nexus also presents challenges, particularly in understanding

how these elements synergize to influence the user's aesthetic and overall experience. Addressing this gap is essential for advancing the design and implementation of future interactive installations, making them more engaging, accessible, and meaningful for users. This paper aims to explore these dynamics by examining recent advancements and studies in the field, identifying trends, challenges, and opportunities, and proposing directions for future research at the intersection of aesthetic experience, HCI, and interactive installations.

Analysis of previous researches. Interactive installation is a highly practical discipline, which emphasizes the application of theory to the design of interactive works. As the papers and practical works accumulated, many scholars wrote literature reviews about this area. Scholars explored the enaction and embodiment in interactive installations. (Duarte et al., 2021) They explicated the aspects about interactive installations: Technology (actuator, microcontroller, display, embedded, NUI, robotics, sensor, tabletop, tangible, wearable, wirelless), interaction (embodied interaction, full-body interaction, gaze, gesture, motion, physiological information, tangible interaction, voice), embodiment (body actions, body movements, embodied action, embodied cognition, embodied interaction, full-body interaction), enactive (action, autopoiesis, embodied cognition, embodied mind, sense-making, ontogenetic drift, perception), social (social awareness, collaboration, competition, conversation, coordination, group behavioral changing, group interaction, social fiction, social interaction), interaction installation (art installation, cinema installation, educational installation, emotional installation, enactive installation, multimodal installation, music/sound installation, playful installation, public space/installation, tangible installation, wearable installation). The authors concluded that the ubiquitous technologies will affect everyone everywhere to form new experience of interaction. Therefore, appropriate models and paradigms to understand the current technological systems have to be invented. Duarte et al. (2022) review many studies on embodiment that are carried out in public spaces or exhibitions rather than controlled laboratory settings. The authors categorized the embodiment experience into body movement, body tangibility, body signal, and artificial body. To be specific, the key elements involved in the user experience include gesturing, presence, walking, dancing, jumping and running, manipulating, wearing, touching, pulse, breathing, muscle, brain, virtual presence, robotics, and artificial intelligence. As claimed by the authors, the user experience is

shaped by both aesthetic design and technology. At the same time, the authors point out the importance of researching social interactions around interactive installations. De Queiroz et al. (2022) put forth the relationship between imagination and embodiment in the design of interactive installations. In their paper, they examined the previous works about how imagination was approached in interactive installation settings. From the context and audience, used technologies, interaction approaches, evaluation and data collection, video recording, interview, observation, and questionnaire, the authors categorized 3 aspects of embodiment (embodied interaction, action and perception, sense-making, embodied imagination) and 4 aspects of imagination (embodied imagination, situated imagination, metaphorical imagination, representational imagination). De Queiroz et al. (2022) concluded that the formation of meaning is directly linked to imagination. Users use their bodies to finish the narration with the installations, in this way they become “active meaning creators”.

Fraisse et al. (2021) shed light on the trends in interactive sound installations. Through the data analysis of the literature, the authors highlighted three aspects of interactive sound installations: artistic intention, interaction, and system design. To be specific, the artistic intention is highly related to the designer, a designer should consider context, lifespan, the role of sound, the visitor's position, intervention visibility lighting design, and sound design approach. Furthermore, the interaction aspect includes interactor, interaction type, feedback type, input and output degree of freedom, and musical control. In the system design part, one should consider the spatialization, sound generation, and type of input device. To conclude, the authors described the trends and conceptual framework by visualizing the systematic review. Ayad & Omayer (2022) discuss guidelines for enhancing social interaction in city centers through digital interactive installations. It emphasizes integrating technology and design to foster community engagement and interactive experiences in urban spaces. The authors proposed the concept of interactivity levels (static forms, dynamic forms, interactive forms, and participatory forms). Regarding the public installations, the authors stated four criteria classification: Space visitors, the urban space, surrounding activities, and digitalization. Based on the four criteria, one can judge the interactivity of the urban interactive installations.

In terms of the aesthetic experience in a virtual environment, Diodato (2022) proposed the concept of “the virtual body”. The author claimed that the virtual bodies are intermediate entities for two

reasons: First, the virtual body escapes the dichotomy between ‘external’ and ‘internal’. The virtual body is both external and internal. Second, the virtual body is neither simple images nor simple bodies, but body-images. It escapes the ‘objects’ and ‘events’. Under the description of the author, the virtual body aesthetic experience is a relative mixture of passivity and activity. It is an experience of object and subject, inside and outside. The participants construct and are being constructed in the virtual environment. Furthermore, from the user experience perspective, the author deduced that it is impossible to distinguish what it means to ‘have an image’, from ‘have a perception’. Spittle et al. (2023) reviewed the interaction techniques in the field of immersive environments, particularly, the VR, AR, and MR technologies. In the virtual immersive environments, the authors summarized the input methods as freehand, speech-based, head-based, and hardware-based and the tasks as pointing, selection, translation, rotation, scaling, viewport control, menu-based, and abstract. In the research of interactive environments, the authors categorized three types of study, which are elicitation (users were asked to define their own interaction methods), assessment (users were asked to use a specific input/task combination and researchers assessed usability and feasibility for a given application/parameter), and comparison (parameters were evaluated against a baseline or each other). In conclusion, the authors pointed out that it is going to move towards consumer-level immersive applications, and the interactive installations will be more intertwined with AR and VR technologies.

Problem statement. Despite the growing significance of aesthetic experiences in interactive installations, a comprehensive understanding of how users respond to and are affected by these systems remains elusive. While existing research emphasizes the integration of cognition, physical engagement, and emotional response, the complex dynamics of these interactions present significant challenges. These include a limited theoretical framework to address the nuanced interplay of technology, design, and user experience. Consequently, there is a critical gap in the current literature regarding how these elements synergize to enrich user engagement and inform the design of more intuitive and accessible interactive installations. Addressing this gap is essential for advancing the design and implementation of future interactive installations, making them more engaging, accessible, and meaningful for users.

The results of the research and their discussion. 127 demo videos of the interactive installation were reviewed and analyzed. This was classified by subject matter, aesthetics, style, and technique of demonstrations to gain insights into the aesthetic experiences and interactions they promote.

The demos frequently showcased installations where body movement and physical interaction were integral to the experience. These ranged from simple gestures, like waving or walking, to more complex interactions involving full-body engagement, such as dancing or manipulating objects (Fig. 1). This reliance on body interaction serves multiple purposes: By requiring physical involvement, users become active participants rather than passive observers,

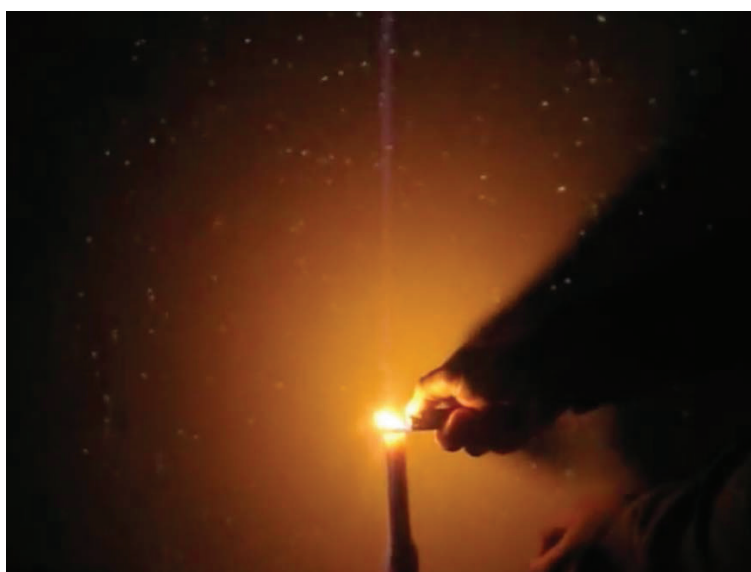


Fig. 1. The interactive installations “Memory II”. Petros Vrellis, Greece, 2009

deepening their engagement with the artwork. Each user's interaction uniquely influences the installation, meaning no two experiences are exactly alike. This personalization makes the experience more memorable and impactful.

Embodiment in these installations is not merely about physical presence but involves the integration of cognitive, emotional, and sensory experiences. This holistic approach ensures that the interaction is not just physical but resonates on multiple levels. First, many installations are designed to evoke specific emotional responses or cognitive reflections through the physical activities they engender. This could be through narrative elements, responsive audio-visual feedback, or the thematic content of the installation itself. Second, the use of technology to enhance sensory feedback – through sound, light, or even tactile responses – makes the embodiment more profound, creating a multi-sensory environment that fully captivates the user. The analysis identified a significant repetition of specific aesthetic settings across the reviewed demo videos, particularly emphasizing three primary environments: undersea, natural green environments, and music creation spaces. These recurring themes suggest a preference for settings that either evoke a deep connection with nature or facilitate users' creative expression. To be specific, many installations recreate an undersea experience, utilizing visual and auditory elements to simulate the calm and immersive aspects of marine life. This setting often employs blue and green light filters, soft ambient sounds, and visuals of marine flora and fauna, aiming to induce feelings of tranquility and wonder. The immersive quality of these installations not only captivates the audience but also subtly highlights environmental messages, drawing attention to the beauty and fragility of ocean ecosystems. Another prevalent theme is the incorporation of natural green settings, which use elements like visual representations of forests, meadows, and gardens, often accompanied by natural sounds such as bird chirps or rustling leaves. These installations provide a sensory escape to a serene, verdant environment, promoting relaxation and a sense of being close to nature. The repeated choice of this theme underscores a collective yearning to reconnect with the natural world amidst our technology-driven lives. Several installations focus on music creation, where interactivity is channeled through musical instruments, sound boards, or motion-activated musical notes. These environments are designed not just for entertainment but to stimulate creative engagement and collaboration among participants. The repetitive use of music-themed installations points to the universal appeal of music as a powerful form of artistic

expression that transcends cultural and linguistic barriers. An example of such installations is the work of The Navy Pier – Enchanted Waters, which was presented at the Children museum in Chicago in 2018. This installation was an aesthetics of the underwater world, where the interaction with the user was carried out through the movement of the user, and the installation reproduced movements using images of light glare and fish (Fig. 2).

The Role of Storytelling in Enhancing Engagement in Interactive Installations: The research indicates that storytelling is a crucial element in the design of interactive installations, significantly enhancing user engagement and emotional involvement. The demo videos showcased a variety of narrative techniques that transformed passive viewers into active participants, deeply involved in the unfolding story. Many installations utilize complex narratives that invite participants to step into a story that unfolds through their actions.

This can be seen in installations where users trigger events or reveal parts of the story through their physical interaction with the environment. For example, walking through a horrific setup might unveil hidden evil characters or unlock adventure messages that piece together a larger story. Such immersive storytelling captivates users, making the experience more personal and memorable. We also want to point out the emotional connection in the storytelling. Effective storytelling in interactive installations often builds a strong emotional connection. The narratives are crafted to evoke specific feelings such as curiosity, joy, or nostalgia, which enhances the overall impact of the experience. For instance, installations that recreate historical events or personal memories can generate a profound emotional response, driving deeper engagement with the content. There are also innovative interactive dialogues in these demos. A unique aspect of storytelling in these installations is the creation of a dynamic dialogue between the installation and the user. Unlike traditional passive media, interactive installations offer a two-way interaction where the story changes and adapts based on user input. This dynamic narrative structure keeps users engaged as they feel their actions have a direct impact on how the story progresses. An example of such installations is the work of designer Luo Yu. This interactive light installation converts static pipes into virtual dynamic objects using emitted light from projectors and sensors. Viewers can communicate with the light installation through sensors that are placed in the pipes. When the audience enters the room where the installation is installed, it experiences a virtual journey that interacts between different sections, between each interactive



Fig. 2. The interactive installations “The Navy Pier – Enchanted Waters”. Dogstudio, USA, 2018.



Fig. 3. The interactive installations DELUSION. Luo Yu, 2011 p.

experience it will consist of different animations with an abstract plot (Fig. 3).

Conclusions. This study underscores the profound impact of aesthetic experiences in interactive installations, as demonstrated through an extensive analysis of 127 demo videos. Our findings reveal that the fusion of physical engagement, immersive embodiment, repetitive aesthetic themes, and narrative depth not only enhances user interaction but also elevates the sensory and emotional resonance of these installations. Particularly, the aesthetic themes of

undersea, natural environments and musical creation have emerged as pivotal in forging deep connections between the installations and their audiences. These themes consistently engage users at a deeper level, blending familiarity with novelty to evoke strong emotional and cognitive responses. This research highlights the critical role of aesthetic design in making interactive installations more accessible, engaging, and meaningful, suggesting a focused direction for future explorations to optimize the synergy between aesthetic appeal and interactive technology.

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