Inclusive User Engagement in Artistic Installation Development: A Framework for Future Creative Endeavors

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Abstract

This paper presents a case study of end users actively engaging and contributing to developing and refining an artistic installation. The study included end users throughout the development process, from initial ideation to presentation in art galleries. End users, representing the public audience, were observed, and surveyed regarding their user experience (UX) with the installation. Their feedback was systematically integrated into each phase of development and improvement. The main contribution of this paper is the presentation of a comprehensive framework derived from this process, which can serve as a valuable guide for future artistic endeavors aiming to incorporate user perspectives and enhance overall user engagement.

Keywords

Artistic installation, End User, Identities, Memories, User experience, Nature, and Technology

1. Introduction

Artistic installations serve as platforms for creative expression and interaction, suppressing the boundaries between art, technology, and audience engagement. Traditionally, the development of such installations has been driven by the vision and expertise of artists and designers, with limited direct involvement from end users. However, embracing a user-centered approach can enrich the creative process and result in installations that resonate more deeply with their intended audience.

The development of the artistic installation followed a participatory design approach, involving iterative cycles of ideation, prototyping, testing, and refinement. End users were recruited from diverse demographic backgrounds to ensure representative feedback. Observation sessions were conducted during public presentations of the installation in art galleries, supplemented by structured interviews and surveys to gather qualitative and quantitative data on user experience.

Analysis of user feedback revealed insights into various aspects of the installation, including aesthetics, interactivity, accessibility, and emotional impact [1]. End users expressed preferences, suggestions for improvement, and interpretations of the artwork,

providing valuable input for iterative refinement. Key themes that emerged from the data informed the development of the framework, encompassing principles such as inclusivity, accessibility, engagement, and co-creation.

The framework presented in this paper extracts the iterative process of user engagement and integration of feedback into a systematic approach that can be applied in future artistic installations. It consists of guiding principles, methodologies, and best practices for involving end users throughout the development lifecycle [2], [3]. Key components include *Inclusivity:* Ensuring diverse representation and accessibility to engage a broad range of end users [4]. *Co-creation*: Collaborating with end users in the ideation, design, and evaluation stages to foster a sense of ownership and connection [5]. *Iterative refinement:* Incorporating user feedback into successive iterations of the installation to address usability issues and enhance the overall user experience. *Empathy-driven design:* Understanding the perspectives, needs, and emotions of end users to create meaningful and engaging interactions [6]. Continuous evaluation: Monitoring user engagement and satisfaction through observation, surveys, and feedback mechanisms to inform ongoing improvements.

By presenting a framework derived from developing an artistic installation with active end-user engagement, this paper highlights the potential for integrating user-centered principles into creative endeavors. The framework offers practical guidance for artists, designers, and cultural institutions seeking to enhance user experience and audience engagement in future artistic installations. By prioritizing inclusivity, co-creation, and iterative refinement, stakeholders can create immersive and meaningful experiences that resonate with diverse audiences and contribute to advancing art and technology integration.

2. End-users in the Digital Age

In the contemporary digital age, the term "end user" refers to individuals who utilize digital technologies, software, and services for various purposes, ranging from personal to professional endeavors [7]. They are crucial in driving innovation, shaping technology, and influencing consumption patterns. Understanding their characteristics, behaviors, and needs is essential for designing user-friendly interfaces, developing effective digital solutions, and ensuring user satisfaction.

End users in the digital age encompass a diverse demographic spectrum, including individuals from different age groups, socioeconomic backgrounds, cultures, and geographic locations. While younger generations are often early adopters and proficient users of digital technologies, older demographics are increasingly becoming adept at utilizing digital tools for communication, entertainment, and productivity. End users display a wide range of characteristics and behaviors influenced by factors such as digital literacy, technological proficiency, socio-cultural norms, and individual preferences. Those who have grown up surrounded by technology, known as digital natives, tend to be more comfortable with complex digital interfaces and adaptive to technological changes [8]. On the other hand, digital immigrants, who have adopted technology later in life, may face challenges in navigating digital platforms but often exhibit resilience and eagerness to learn.

The adoption of digital technologies has significantly transformed various aspects of daily life, including communication, entertainment, education, commerce, and healthcare [9].

End users leverage digital platforms and devices for social networking, content consumption, online learning, e-commerce transactions, remote work, telemedicine consultations, and more. The widespread availability of digital tools has facilitated the seamless integration of technology into various domains, enhancing convenience and efficiency for end users [10].

3. Research Methods

The data collection methods were approached, with flexibility including interviews, observations, field notes, and questionnaires. While maintaining technical accuracy in their procedures, the data collection process was adaptable to methodologies that best suited the study's objectives, guided by questions or research problems rather than hypotheses. The integration of user experience and Human-Computer Interaction (HCI) methods was not constrained by practical assumptions; instead, it is a summary from a methodological framework capable of comprehending a broader context, as evidenced in studies that combine methodologies [11], [12], [13], [14].

These authors' works emphasized fostering empathy and engagement through users' participatory actions, employing a playful approach to design study.

4. The SeaGrains Artistic Installation

The SeaGrains artistic installation exemplifies immersive technology, which encompasses various perceptual and interactive technologies bridging the gap between the physical and digital realms. It serves as an innovative means to connect people and places on a profound level. Utilizing a diverse array of sensory inputs, humans perceive and engage with their environment. It specifically, focuses on auditory memories—oral narratives and sound snippets—gathered from different locales across Portugal, with the intent of exploring the personal bonds influenced by the sea's symbolic significance in fostering a sense of belonging.

SeaGrains takes the form of a listening box, inviting participants to immerse themselves fully in the audio landscape. By concentrating on the spoken word or various sound sources—both conventional and unconventional—manipulated beforehand, individuals are guided along diverse narrative pathways. This results in a unique appropriation of memories previously unearthed. Moreover, participants aren't merely passive listeners; they become active narrators, co-authors, and producers of the auditory experience. Everyone holds the agency to reconstruct their sonic environment, thus crafting a personalized auditory realm. This engagement extends beyond mere auditory immersion to encompass multisensory experiences, enriching the overall encounter.

In essence, SeaGrains facilitates an immersive journey into the interplay between sound, memory, and personal connection to place. Through active participation, users not only investigate submerged auditory experiences but also actively contribute to the co-creation of their sonic narratives.

5. Results and Discussion

The application of various methods and methodologies provided valuable insights into the user experiences with the interactive artistic installation. Employing an ethnographic approach, we closely observed interactors' actions with prototypes and versions of the installation across different spaces and interaction scenarios, utilizing qualitative instruments to gather rich data.

Constructing the methodological framework necessitated a deliberate immersion into conceptualizing a subjective experience. The production of the artistic installation involved research exploring social and community knowledge, expressed through experiences in and with the world. This catalyzed reflective thinking, fostering intersubjective knowledge conducive to both contemplation and world transformation [15]. Interactors' involvement in appropriating the SeaGrains widened access paths to unique interpretations, transcending physical space.

Participant engagement was captured through recordings, visually and verbally, although the primary focus remained on recording sound productions of lived or recalled experiences. This registration step was crucial for studying the installation and considering narratives as an artistic framework. Evaluating the artistic experience through methodological procedures was an integral part of this ongoing process, highlighting the importance of understanding the immersive experiences felt by interactors [16].

In immersive experiences, the duration of the experience and the spatial area covered by the installation influenced the activity of SeaGrains. Each interactor established their immersion levels with the box, resulting in diverse multisensory experiences shaped by tactile paths. The installation facilitated the overlapping of sound paths from different sources, allowing for the correlation, deepening, and extension of understanding of the original theme. It embodies an active and continuous poetic process, fostering individual apprehension of new soundscapes and expanding ways of experiencing identity relationships with the sea.

5.1. Engaging the End User: Driving Changes in the SeaGrains Installation

The interactive installation was evaluated and analyzed during different exhibitions until the final one according to the participants' comments. During one of the evaluation moments, the data collected was analyzed from two different points of view: observing participants randomly and taking notes. We took 10 daily interactions from 30 observed participants for three days. The second aspect was through the recorded information from participants.

The results of this phase suggested that: The installation information was read after the first interaction attempt; The profile of the interactors who were most interested in the information about the installation before starting the interaction consisted of adults and the elderly; The instructions could not be clear regarding the usage procedures; The stone was one of the elements that motivated curiosity among the younger interactors (children and adolescents); Many interactors tended to focus their hands on specific areas of the box,

leading to sensor inactivity in other parts; This behavior made it challenging for subsequent interactors to engage with the entire installation, often prompting them to instinctively trigger the central sensor (marked by a stone) to restart the box; Interactors unintentionally created content due to their actions, likely due to misunderstanding the function of the red recording button.

The SeaGrains installation underwent significant improvements and resolutions based on participant interactions and feedback across multiple exhibitions, table 1.

Table 1 – Example of changes

Problems	Solutions
Initial design of SeaGrains limited to bass sounds	Expanded design to allow for varied interactions and affective experiences with the box
Weaknesses in interactive system hardware and sound	Improved hardware selection and equalization settings, addressing volume discrepancies
Limited immersion due to small space and duration	Expanded the box design to involve the interactor more fully, providing a more immersive experience
Lack of control over audio playback	Implemented controls to stop and skip audio playback, enhancing the interactor's experience
Inhibition of interactors due to external equipment	Reconsidered setup to minimize intimidation and discomfort, encouraging more active participation
Limited observation for potential interactors	Provided additional viewing opportunities, enhancing engagement and interest in the installation
Structural damage to the installation during exhibitions	Reinforced construction and protective measures to prevent damage, ensuring longevity and reliability
Confusion over functionality of buttons	Enhanced labeling and instructional materials to clarify the purpose of buttons and features

Based on the provided information, it's evident that the SeaGrains installation underwent significant evolution and encountered various challenges throughout its exhibition journey. Here's a summary of the key points:

Prototype Development: The installation progressed from prototype 1 to prototype 2 based on interactions with participants and feedback gathered from different exhibitions. **Adaptation of Resonance Box:** Initially designed for emitting bass and intense vibrated sounds, the resonance box was later adapted to offer diverse interaction possibilities and affective experiences. **Weaknesses in Interactive System:** Issues such as audio output and input hardware selection and volume discrepancies in sound fragments were identified as weaknesses and were addressed. **Sand Movement Mechanism:** The installation utilized piezoelectric sensors triggered by sand movement, communicating with Arduino to activate random audio playback. **Participant Interaction:** Each participant's immersion level with the installation varied, influenced by factors like time, space, and tactile experiences, leading to different multisensory experiences. **Design Adjustments:** Changes in design, including expanding the box shape to involve participants more and suggestions for incorporating additional compositional elements like shells or marine rocks, were made based on feedback. **Technical Issues:** Various technical problems were encountered, such as the inability to stop audio playback, discomfort with external equipment like speakers and microphones, and damage to the installation components during exhibitions.

Observational Element: The installation's design allowed observers to witness interactions, potentially affecting their engagement. **User Misinterpretation:** Despite instructions, users sometimes misunderstood certain elements of the installation, such as mistaking the record button for a call button. **Sensor Sensitivity:** Adjustments to sensor sensitivity were necessary at different times to improve responsiveness.

Overall, the SeaGrains installation underwent iterative improvements driven by participant feedback, addressing technical issues, and enhancing user experience.

5.2. End User-Driven Iterations: Evolving the SeaGrains Installation

The narratives from participants emerged either spontaneously or inadvertently, resulting in divergent yet generally positive outcomes. This is primarily because they revealed how interactors engaged with the installation without external influence, merely guided by a summary of the piece or intuitive curiosity. Additionally, the recordings encompassed various languages (Portuguese, English, Spanish, Italian, and Dutch), indicating a broad range of interactors. Despite potential misunderstandings, the content remained comprehensible.

The focus was on addressing issues related to the recording device and instructions, as SeaGrains relies solely on the interactor's comprehension and involvement to generate new recordings. Emphasizing the central role of the end user in shaping the artistic installation's design, the development process unfolded through keen observation of user experiences. These experiences encompassed emotional interactions, active user participation in creating and narrating various sound sources, diverse perceptions of the sea, and the creation of a dialogue space within different sensory contexts.

The primary contributions of this research turn around a transdisciplinary approach within the realm of Human-Computer Interaction (HCI) and interaction design. This approach involves integrating a technical paradigm, focusing on interactivity and digital technologies as design materials, with a cognitive paradigm aimed at understanding how individuals perceive digital materiality to inform interactive design. Additionally, the research promotes HCI and design relationships, particularly in connection with nature.

The user-centered design and design experience, which are foundational concepts within HCI, were integral to the entire design process. From the initial stages, narratives about the SeaGrains system were sourced from fishermen and residents living near the sea, drawing upon their memories and experiences. The installation was subsequently refined and evolved based on ongoing user experiences and feedback gathered during exhibitions (Figures 1 and 2).

5.3. Framework for Incorporating User Perspectives in Artistic Activities

The developed framework comprised key principles that aimed at adopting user-centric design and enhancing overall user engagement

Placement of the end user at the forefront of the design process:
This principle emphasizes the selection of user's needs, preferences, and experiences in artistic creation.

Utilization methods such as interviews, observations, field notes, and questionnaires:

These methods are employed to gather insights into user behaviors, emotions, and perceptions, ensuring that the design process is informed by user input.

Comprehensive user engagement model:

This model outlines various facets of user engagement, including emotional interactions, active participation, and sensory experiences, providing a framework for understanding and optimizing user engagement.

Use of Flexible data collection methods:

Employing flexible data collection methods allows for adaptation based on study objectives and user group needs, ensuring that data collection is responsive to the context and goals of the research.

Transdisciplinary approach:

Embracing a transdisciplinary approach integrates artistic experience with methodologies from fields such as Human-Computer Interaction (HCI), fostering a holistic understanding of user engagement and enriching the artistic process with diverse perspectives.

Make an Iterative design process:

Implementing an iterative design process enables continuous refinement and evolution based on ongoing user feedback and experiences, ensuring that the artistic installation is responsive to user preferences and effectively engages its audience.

The Framework for future endeavors:

Presenting the developed framework as a valuable guide for future artistic endeavors encourages the adoption of user-centric practices within the artistic community, empowering artists, and designers to create immersive and impactful experiences that resonate deeply with their audience.

Figure 1: A moment of Interaction, [17]

Introducing the components of our framework, we prioritize placing the end user at the forefront of the design process. By centering our efforts around the needs, preferences, and experiences of users, we ensure that our solutions are relevant and meaningful. To gather insights into user behaviors and perceptions, we utilize a variety of methods including

interviews, observations, field notes, and questionnaires. This comprehensive approach enabled us to capture a holistic understanding of user interactions and preferences.

Additionally, we adopted a comprehensive user engagement model that outlines various facets of user engagement, such as emotional interactions, active participation, and sensory experiences. Our transdisciplinary approach integrates diverse perspectives and methodologies from fields such as design, psychology, and technology, fostering a collaborative and holistic understanding of user engagement. Furthermore, we implemented an iterative design process that allows for continuous refinement and evolution based on user feedback and experiences. Finally, we followed the framework guidelines for future endeavors, providing a valuable guide for ongoing and future projects seeking to incorporate user-centric principles and enhance overall user engagement.

Figure 2: End-user interactions during an exhibition [17]

5.4. Supporting Co-creation: Strategies and Methodologies Used

Co-creation, as described by [18], is a collaborative approach to value creation that involves stakeholders, including users, designers, and other relevant parties, working together to generate solutions, products, or experiences. This concept emphasizes the active involvement of end users throughout the design process, allowing them to contribute their insights, ideas, and expertise. Co-creation is a fundamental aspect of design innovation, highlighting its role in fostering collaborative relationships between users and designers [19].

Co-creation was facilitated through some strategies and, methodologies aimed at promoting collaboration, and innovation among end-users and designers. In the presented case study, the following key approaches were utilized:

Open Innovation: During the SeaGrains exhibitions, end-users actively contributed ideas, feedback, and solutions in a transparent and accessible manner. An important chore played input in driving change and improvement in each prototype.

Design Thinking Approach: The development team consisted of multidisciplinary contributors who utilized design thinking principles to explore and ideate solutions. Activities such as brainstorming, and prototyping were central to this approach.

User-Centered Design Processes: Research methods provided valuable data to prioritize end-users' needs and experiences. End-users were actively involved in hands-on activities

such as user research and usability testing, ensuring that the final product met their requirements.

Co-creation Spaces: Physical spaces were provided for stakeholders to collaborate and innovate, creating a conducive environment for creativity. These spaces were equipped with tools for ideation and prototyping, facilitating the co-creation process.

Participatory Design Methods: Users were engaged as active participants in the design process through techniques such as participatory meetings and ethnographic studies. This ensured that their perspectives and insights were integrated into the final product.

Overall, co-creation was achieved through a combination of strategies that emphasized collaboration, innovation, and active involvement of end-users throughout the design process.

6. Conclusions

The development of the SeaGrains artistic installation exemplifies the great impact of end-user involvement in shaping its design. Throughout the process, careful observation of user experiences played a central role, encompassing emotional interactions, active participation in sound creation and narration, diverse perceptions of the sea, and the establishment of dialogue spaces within various sensory contexts.

The significance of this research lies in its transdisciplinary approach within the field of Human-Computer Interaction (HCI) and interaction design. This approach integrates technical paradigms, focusing on interactivity and digital technologies as design materials,

The SeaGrains artistic installation showcases the impact of end-user involvement in design, emphasizing emotional interactions, active participation, diverse perceptions of the sea, and dialogue spaces. The research integrates technical and cognitive paradigms in Human-Computer Interaction (HCI) and interaction design, drawing insights from narratives of fishermen and residents near the sea. Continuous engagement with end users drives iterative refinement, highlighting the dynamic interplay between design and user experiences.

The extension of "Grãos de Mar" into an Artistic Project explores experimental practices in digital art within academic and community contexts. The project aims to create artistic experiences aligned with emerging themes, with a focus on the development of the "Emotion Signaler" digital art installation. This installation measures emotional intensities through biosignal sensors, providing users with a unique and immersive experience that captures and interprets their emotional responses visually and auditorily.

The "Emotion Signaler" serves as a research tool for studying the intersection of art, technology, and human emotions, offering insights into emotional reactions elicited by the installation. Collaboration between artists, technologists, and psychologists enriches the creative process, ensuring the effective capture and conveyance of human emotion complexities. Overall, the incorporation of experimental digital art practices aims to push the boundaries of artistic expression, engage with contemporary themes and technologies, and create meaningful experiences that contribute to digital art and emotion research.

References

[1] Lopes, A.G., (2018), Creative Activity Mediated by Technology–Artifacts, Technology and Ideas that Could Shape Our Lives in Advances in Intelligent Systems and Computing (AISC, volume 592), Springer International Publishing.

[2] Lopes, A.G. (2022). HCI Four Waves Within Different Interaction Design Examples. In: Bhutkar, G., et al. Human Work Interaction Design. Artificial Intelligence and Designing for a Positive Work Experience in a Low Desire Society. HWID 2021. IFIP Advances in Information and Communication Technology, vol 609. Springer, Cham. https://doi.org/10.1007/978-3-031-02904-2_4

[3] Lopes, Arminda, (2006). "Mixed Methods", in proceedings Methodological Issues and Ethical Considerations at Research Postgraduate Leeds Metropolitan University, 24th May 2006

[4] Bødker, S. (2000). Scenarios in user-centered design – setting the stage for reflection and action. Interacting with computers, 13(1), 61-75.

[5] Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. Co-design, 4(1), 5-18.

[6] Saffer, D. (2010). Designing for interaction: Creating innovative applications and devices. New Riders.

[7] Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research through design as a method for interaction design research in HCI. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 493-502).

[8] Norman, D. A. (2013). The Design of Everyday Things: Revised and Expanded Edition. Basic Books.

[9] Rogers, E. M. (2010). Diffusion of Innovations. Simon and Schuster.

[10] Van Dijk, J. (2012). The Digital Divide. Polity Press.

[11] World Health Organization. (2020). World Report on Disability. WHO Press. W3C Web Accessibility Initiative. (n.d.). Web Content Accessibility Guidelines (WCAG). Retrieved from https://www.w3.org/WAI/standards-guidelines/wcag/

[12] Gaver, W., Boucher, A., Pennigton, S., & Walker, B. (2004) Cultural probes and the value of uncertainty. Interactions - Funology. Vol 11 (5), 55-56. Goldsmiths Research Online. doi:10.1145/1015530.1015555 Available at http://research.gold.ac.uk/4720/

[13] Hoven, E. van den., Eggen, B. & Mols, I. (2014). Making Memories: A cultural probe study into the remembering of everyday life. In NordiCHI14 Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational. Available at https://dl.acm.org/citation.cfm?doid=2639189.2639209

[14] Mendes, M., Ângelo, P., Nisi, V., & Correia, N. (2012). Digital Arts, HCI and Environmental Awareness: Evaluating Play with Fire, NordiCHI 2012, Nordic Conference on Human-Computer Interaction. Copenhagen, Denmark, pp 408-417. doi.10.1145/2399016.2399079

[15] Santos, B. de S. (2001). A crítica da razão indolente: contra o desperdício da experiência. São Paulo: Cortez.

[16] Lopes, A.G. (2019). Research Methods – What Is Best for Developing and Evaluating Human Computer Interaction and Interactive Artistic Installations? Designing Engaging Automation: Revised Selected Papers of the 5th IFIP WG 13.6 Working Conference. HWID 2018 Barricelli, B. R. (ed.), Roto, V. (ed.), Clemmensen, T. (ed.), Campos, P. (ed.), Lopes, A. (ed.), Gonçalves, F. (ed.) & Abdelnour-Nocera, J. 2019

Cham: Springer. P. 229-241. (IFIP Advances in Information and Communication Technology, Vol. 544). Research output: Chapter in Book - https://www.springer.com/gp/book/9783030052966

[17] Moreno, Adriana; LOPES, Arminda Guerra; Mendes, Mónica (2018) - Grãos de Mar: uma poética imersiva em experiência artística interativa. Convergências: Revista de Investigação e Ensino das Artes. ISSN 1646 - 9054. Vol. XI, nº 22, p. 1-8.

[18] Prahalad, C.K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. Journal of Interactive Marketing, 18(3), 5-14.

[19] Sanders, E.B.N., & Stappers, P.J. (2008). Co-creation and the new landscapes of design. Co-design, 4(1), 5-18.