



‘The Tree’: Deliberating User Experience Design in Augmented Reality Art Creation

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Abstract. Augmented reality (AR) art presents a new form of artistic expression that allows artists to integrate virtual objects into the physical environment. Although there is an increased interest in using AR in the art domain, many artists are still hesitant to explore the technology, due to the perceived complexity in developing it and uncertainties of its impact on viewers’ experience. In this paper, I present the design process of creating an AR artwork with the consideration of user experience design. The paper is a part of a wider study evaluating user responses to AR art in gallery settings. It contributes to creative practice in art, where it advances knowledge about integrating new technology into the art domain.

Keywords: Art · Augmented reality · Design process · User experience

1 Introduction

Art and digital technology were previously seen as two distinct disciplines. While art was traditionally considered the production of physical artefacts like stone sculptures or oil paintings on canvas, its application today extends to the virtual world, such as 3-dimensional (3D) painting in virtual reality and non-fungible tokens (NFT) marketplace in the metaverse. Interest in digital arts has increased in recent years, with artists experimenting with new digital tools to project their artistic visions to evoke the viewer’s senses and feelings [1]. In fact, recently, high paying jobs for artists were found to relate to digital art in technology sectors [1]. Digital tools and platforms have transformed art creation and present vast opportunities for artists to create, showcase and sell their digital artworks to a wide range of audiences.

Among the digital technologies that are gaining traction in the art domain is augmented reality (AR), an immersive technology that possesses the ability to combine physical and digital objects in real-time [2–4]. AR enhances physical object visualisations by allowing users to interact with digital objects embedded on it [5]. While there are several ways to experience AR, such as through wearable and stationary devices, the ubiquitous mobile devices—specifically smartphones—makes it extremely easy for the public to access AR content. With features that allow the phone camera to scan physical images or objects, and the screen to reveal an overlay of digital content, mobile phones serve as a versatile tool to experience art in AR.

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To maximise the impact of an AR artwork, user experience (UX) design needs to be considered [6]. UX refers to all aspects of a user's interaction with a technological product, interface, system, or service. UX is defined as:

“...a consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.)”. [7]

The goal of UX is to create conditions that are likely to result in a favourable impression of the technological product. Despite artists' increasing interest in exploring digital arts, many are still unsure how to create AR artwork that could positively impact viewers' experience [8]. For this reason, I created an artwork entitled 'The Tree' that considers UX in the design and development of the physical artefact and AR application. This paper, the first part of a wider study to examine user responses to AR artwork, describes the design process of the artwork creation with reference to a UX model by Hassenzahl [9]. The aim of the AR artwork was to enhance art gallery visitors' experience of the artworks on display.

2 Theoretical Background

2.1 Augmented Reality Art

AR art is a form of artistic expression that extends the common conceptions of visual arts [10]. It offers an opportunity for artists to express themselves through interactive digital experiences that complement their physical artworks. It enables artists to place digitally created work (e.g., 3D models, animation, video) into their physical space, frequently in 3-dimensions, making it possible for viewers to experience it via digital devices such as a smartphone or tablet. For example, when a viewer scans a painting with their smartphone camera, they can see an overlay of digital graphics and animation materialise in their immediate environment through the smartphone screen. Through AR, artists can tell stories which are otherwise impossible because of the constraints of a canvas.

Previous studies have investigated AR's impact in the tourism context including in art galleries [e.g., 8, 11, 12], heritage buildings and museums [e.g., 13, 14], and archaeological sites [e.g., 15]. AR applications were found to enhance visitor experience within the tourism context as it increases visitors' learning vis-a-vis a particular display [11, 16] and provides enjoyment [8]. The study by Aitamurto, et al. [8] found that art gallery visitors' liking of the paintings on display increased when AR was used compared to referring only to the guidebook provided. However, the authors also found that the visitors experienced fatigue from holding the mobile device used during the interaction. This shows that AR can impact visitor experiences with an artwork cognitively, emotionally, and physically.

2.2 Overview of UX Model

UX focuses on the pragmatic and hedonic attributes of a product on its users. The pragmatic attribute concerns the utilitarian quality of the system, that is, its usability and ability to fulfil users' needs, while the hedonic attribute refers to the system's ability to provide pleasure (a positive affective quality), involving feelings such as joy or wonder. Jordan [17] indicated that a product needs to fulfil user's functional needs before hedonic needs can take effect. However, it can be argued that, in the context of art, the hedonic attributes would play a greater role than pragmatic attributes as the aesthetics of the artwork (which could induce a hedonic attribute) is the first impression of the viewer of the artwork. Furthermore, the context of use would determine the importance of pragmatic and hedonic influences on the users [7]. While pragmatic attributes would be useful in delivering information about an artwork, hedonic attributes would be more effective in stimulating user imaginations to appreciate the artwork's beauty [12].

Hassenzahl [9] developed a process-oriented model that explains UX from a designer and user perspective (Fig. 1). The model explains that the design of a system is a combination of features (content, presentation, functionality, interaction) to communicate an intended product character (pragmatic, hedonic attributes). When users use the system, they observe the features presented and create a perception of the product character—whether it is interesting or easy to use. The model indicates that the main source of pragmatic attributes is manipulation (e.g., the product's ability to be manipulated to complete tasks), while the main sources of hedonic attributes are stimulation (e.g., the product's novelty), identification (e.g., the product's professionalism), and evocation (e.g., the product's ability to recall a feeling or memory). These factors contribute to how users evaluate and respond to the system.

From the user perspective, Hassenzahl [9] emphasised that a product character could mediate various consequences, including how the product appeals to the user based on its functions, and how it affects them emotionally through the creation of pleasure and satisfaction. These consequences were deemed essential in delivering a positive user experience with the system [9, 18]. However, the outcome of the consequences would vary from one individual to another, depending on the situation of the interaction. Often, it would rely on users' standards, expectations and their experience with the system over time [9].

Given that this paper aims to present the design process of creating an AR artwork, only the designer perspective factors will be discussed. While there are variations of UX models [e.g., 7, 17, 19], Hassenzahl [9] model was deemed most suitable to provide the theoretical background of this paper as it emphasises not only the user perspective but also the designer perspective.

3 The Design Process: Product Features

This section presents how I created 'The Tree' AR artwork based on the process-oriented UX model [9]. It explains the steps taken to create the artwork according to the designer's perspective of product features (i.e., content, presentation, functionality, and interaction), and how those features contribute to the intended product character (i.e., pragmatic and hedonic attributes).

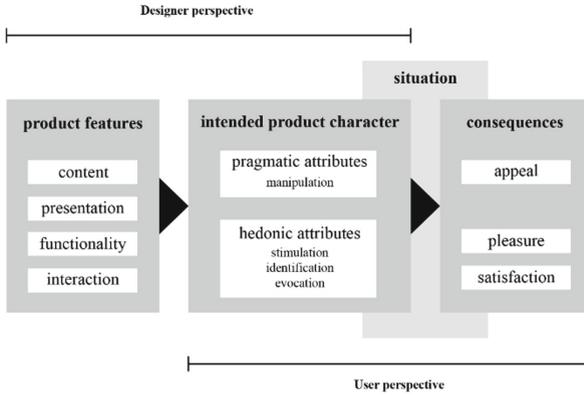


Fig. 1. Process-oriented UX model from a designer and user perspective (adapted from Hassenzahl [9]).

3.1 Content

Content refers to the elements or substance present in a particular media, such as text, images, music, and illustrations [20]. For ‘The Tree’ artwork, I created a digital painting of a tree (printed on canvas) that triggers an animation about a metaphor of my life’s journey, accompanied by background music. These elements are presented in 3D in AR. A description is given below of the process of creating the digital assets, namely, the graphics, their animation, and their organisation into a composition in AR.

3.1.1 Graphics

The idea for the artwork came as an expression of how I see life reflected by the essence of a tree: a symbol of growth, death, and rebirth. And so, I drew a lush colourful tree that signifies the vibrant and rich episodes of my life. The drawing was done in Procreate, with each leaf colour group separated in different layers (to create the spatial effect in AR later). Some adjustments and effects were added to the drawings in Adobe Photoshop. I also drew vector birds in Adobe Illustrator as an element to be animated later. Vibrant colours were used to evoke specific emotions of wonder and delight. The drawing of the tree served as the image marker¹ that triggers the AR content.

3.1.2 Animation

Two elements were animated: a flock of birds and falling leaves. The birds portray how people come and go in my life and how the encounter with them is merely momentary. The falling leaves represent how I leave behind painful memories so that I can focus on things that promote growth. The animation was done in Adobe After Effects, with the birds flapping their wings, and the leaves falling randomly using the particle effect. Melancholic music and the sounds of birds chirping were added to the birds’ animation.

¹ Image marker: An image that can be detected by an AR-enabled device that activates the AR features.

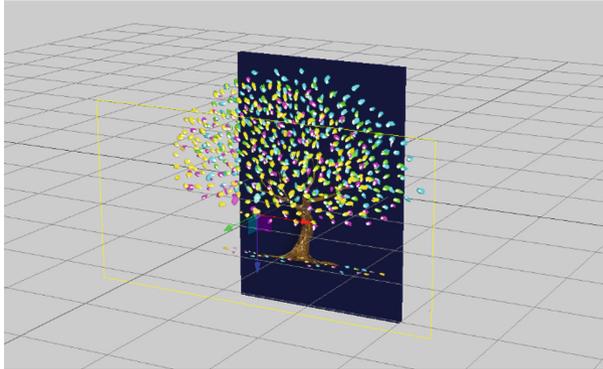


Fig. 2. Organising graphics into 3D layers in the Bridge.

The animation files were rendered separately into videos with a transparent background, to be imported into the AR development software later.

Given that hedonic and pragmatic attributes are important in AR applications [18, 21], for this artwork, I used the aesthetics of the graphics, animation, and music to embody hedonic attributes, and the story behind it to stimulate learning. However, I focused more on the hedonic attributes to generate an emotional experience, as it is considered the factor that makes visitors want to use the application again [21].

3.2 Presentation

When considering the content presentation, I aim for a simple graphical user interface (GUI). GUI is “a user interface that allows a computer user to interact easily with the computer typically by making choices from displayed menus or groups of icons” [22]. Due to the time constraint to develop an AR application from scratch, I opted for a non-technical, easy to use AR content creation tool, Artivive. Ease-of-use or usability is considered one of the pragmatic attributes that contribute to positive user experience with an application [9]. While the Artivive application itself is the visualisation tool, the content management tool that allows artists to create the digital layers and connects the physical artwork to the AR content is called the Artivive Bridge. I used Bridge to organise my graphics and animation into seven layers (five layers of static images, and two animated layers with audio (Fig. 2)). These layers result in a 3D composition that would create a spatial illusion when the users interact with the artwork.

The image marker (digital painting) was printed on an A2 size canvas (16.5 x 23.4 inches). For an artwork intended to be displayed in an art gallery, this size might seem small. However, the reason for the A2 size is to allow the users to experience the AR content from an acceptable distance (approximately 4 feet away). The larger the image marker is, the further the users need to be to scan the whole marker. This may not be practical within a small gallery space. After scanning the image marker, a 3D tree that extends beyond the size of the canvas appears, with animated leaves falling and a flock of birds flying (Fig. 3). The Artivive application enabled easy marker recognition and



Fig. 3. Final artwork experienced on a mobile device.

accurate tracking of the environment. A video demonstration of the final AR artwork can be viewed here: <https://www.youtube.com/shorts/pOJ4Hdpb3XY>.

3.3 Functionality

Functionality refers to the capabilities, operations, or features of the technology such as, “the options to navigate, save or filter information, as well as use multiple languages” [18]. While functionality would be essential in highly informative AR application, it may not necessarily be so when consuming art, due to the different contexts of use [9]. In appreciating AR art, the users experience linear storytelling set by the artist. Given that the objective of this artwork was to share my story, and that the Bridge does not offer interactive functions, the only option that is available for the users (to date) is to record the AR experience using a record button in the Artivive application. Upon downloading the Artivive application into the user’s smartphone, they can immediately experience the AR content by scanning the painting printed on the canvas. They can move their smartphone left and right, up and down, to observe the 3D AR content and record the situation for ten seconds.

3.4 Interaction

Interaction refers to how the user can access and manipulate the AR features. For ‘The Tree’ artwork, no interactive features were added as the Artivive application structure was straightforward, allowing quick comprehension of how the application works. Furthermore, I wanted the users to experience the same story that I had created and understand it easily. The only concern that I had was the accessibility of the application, as it depended on the internet connectivity. Any internet connection issue would disrupt user interaction with the AR content, affecting the application’s efficiency.

The accessibility and efficiency of AR applications are important in delivering a positive user experience [18], and that usability issues could negatively affect user responses

to the application [23, 24]. Additionally, users would find it cumbersome and risk feeling physical fatigue if they had to hold up their mobile devices for a long time [8]. Fewer interactive functions would allow enough time for the user to appreciate the art and lessen the need for time to try all of the functions available. As such, the decision to not include any additional functions was deemed appropriate to avoid potential usability issues.

4 Intended Product Character

A user's interaction with the features of the application could influence their perception of the product character, regarding how the application delivers the pragmatic and hedonic attributes, that is, whether it is interesting or easy to use [9]. However, there is no guarantee that the outcome of the experience would be exactly like the designer envisioned it to be, due to the different situations in which the user may experience it and the differences in individual expectations. Nevertheless, the product features—the content, presentation, functionality, and interaction feature of 'The Tree'—were devised to offer pragmatic and hedonic qualities. Through user interaction with the painting and AR application, I aimed to deliver an effective application that tells my story and provides pleasure when the users see the painting come to life. It was expected that manipulation could be achieved in the sense that the users are able to control their viewing angle and record the experience, stimulation through its novelty for first-time users, identification through the professional appearance and navigation of the system, and evocation, through the ability of the experience to evoke a feeling or memory.

5 Future Research and Conclusion

This paper presented the design process of creating an AR artwork with consideration of UX design. I described how the product features were created, and how they led to the intended product character. In the future, a user study will be conducted to evaluate the artwork's impact on art gallery visitors.

The process described here contributes to how new technologies can be adopted in the art domain. Artists interested in experimenting with AR art can begin by adopting the approach presented in this paper. Future research in this field could evaluate users' learning and enjoyment of interacting with AR art in greater depth and identify how AR's interactivity could affect those qualities.

Bibliography

1. V. Wang and D. Wang, "The impact of the increasing popularity of digital art on the current job market for artists," *Art and Design Review*, vol. 9, no. 3, pp. 242–253, 2021.
2. T. Hilken, J. Heller, M. Chylinski, D. I. Keeling, D. Mahr, and K. De Ruyter, "Making omnichannel an augmented reality: The current and future state of the art," *Journal of Research in Interactive Marketing*, vol. 12, no. 4, pp. 509–523, 2018, doi: <https://doi.org/10.1108/jrim-01-2018-0023>.

3. S. N. Wafa and E. Hashim, "Adoption of mobile augmented reality advertisements by brands in Malaysia," *Procedia - Social and Behavioral Sciences*, vol. 219, pp. 762–768, 2016, doi: <https://doi.org/10.1016/j.sbspro.2016.05.077>.
4. J. Carmigniani, B. Furht, M. Anisetti, P. Ceravolo, E. Damiani, and M. Ivkovic, "Augmented reality technologies, systems and applications," *Multimedia Tools and Applications*, vol. 51, no. 1, pp. 341–377, 2011.
5. F. Bonetti, G. Warnaby, and L. Quinn, "Augmented reality and virtual reality in physical and online retailing: A review, synthesis and research agenda," in *Augmented Reality and Virtual Reality*, Timothy Jung and M. Claudia tom Dieck Eds.: Springer, 2018, pp. 119–132.
6. S. W. Gilroy *et al.*, "E-tree: emotionally driven augmented reality art," in *Proceedings of the 16th ACM international conference on Multimedia*, 2008: Association for Computing Machinery, New York, pp. 945–948.
7. M. Hassenzahl and N. Tractinsky, "User experience - a research agenda," *Behaviour & Information Technology*, vol. 25, no. 2, pp. 91–97, 2006, doi: <https://doi.org/10.1080/01449290500330331>.
8. T. Aitamurto, J.-B. Boin, K. Chen, A. Cherif, and S. Shridhar, "The impact of augmented reality on art engagement: Liking, impression of learning, and distraction," in *Virtual, Augmented and Mixed Reality*, J. Y. C. C. a. G. Fragomeni Ed.: Springer, 2018, pp. 153–171.
9. M. Hassenzahl, "The thing and I," in *Funology 2: From Usability to Enjoyment*, M. Blythe and A. Monk Eds., 2nd ed. (Human–Computer Interaction Series. Cham, Switzerland: Springer International Publishing, 2018, pp. 17–31.
10. A. S. Gould, "Invisible visualities: Augmented reality art and the contemporary media ecology," *Convergence*, vol. 20, no. 1, pp. 25–32, 2014.
11. M. C. tom Dieck, T. H. Jung, and D. tom Dieck, "Enhancing art gallery visitors' learning experience using wearable augmented reality: Generic learning outcomes perspective," *Current Issues in Tourism*, vol. 21, no. 17, pp. 2014–2034, 2018.
12. Z. He, L. Wu, and X. R. Li, "When art meets tech: The role of augmented reality in enhancing museum experiences and purchase intentions," *Tourism Management*, vol. 68, pp. 127–139, 2018.
13. N. Chung, H. Han, and Y. Joun, "Tourists' intention to visit a destination: The role of augmented reality (AR) application for a heritage site," *Computers in Human Behavior*, vol. 50, pp. 588–599, 2015, doi: <https://doi.org/10.1016/j.chb.2015.02.068>.
14. M. C. tom Dieck and T. Jung, "A theoretical model of mobile augmented reality acceptance in urban heritage tourism," *Current Issues in Tourism*, vol. 21, no. 2, pp. 154–174, 2018.
15. S. Blanco-Pons, B. Carrión-Ruiz, J. L. Lerma, and V. Villaverde, "Design and implementation of an augmented reality application for rock art visualization in Cova dels Cavalls (Spain)," *Journal of Cultural Heritage*, vol. 39, pp. 177–185, 2019.
16. M. Leue and T. Jung, "A theoretical model of augmented reality acceptance," *E-review of Tourism Research*, vol. 5, 2014.
17. P. W. Jordan, *Designing Pleasurable Products: An Introduction to the New Human Factors*. CRC press, 2000.
18. D.-I. Han, M. C. tom Dieck, and T. Jung, "User experience model for augmented reality applications in urban heritage tourism," *Journal of Heritage Tourism*, vol. 13, no. 1, pp. 46–61, 2018.
19. C. Jetter and J. Gerken, "A simplified model of user experience for practical application," in *NordiCHI 2006, Oslo: The 2nd COST294-MAUSE International Open Workshop "User eXperience-Towards a unified view"*, 2007: COST294-MAUSE, pp. 106–111.
20. Merriam-Webster Dictionary, "Definition of content," in *merriam-webster.com*, ed, n.d. .

21. B. Stangl, D. C. Ukpabi, and S. Park, "Augmented reality applications: The impact of usability and emotional perceptions on tourists' app experiences," in *Information and Communication Technologies in Tourism 2020*, Julia Neidhardt and Wolfgang Wörndl, Eds., 2020: Springer, pp. 181–191.
22. Merriam-Webster Dictionary, "Definition of graphical user interface," in *merriam-webster.com*, ed, n.d.
23. A. Poushneh and A. Vasquez-Parraga, "Customer dissatisfaction and satisfaction with augmented reality in shopping and entertainment," *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior*, vol. 30, pp. 1–22, 2017.
24. M. Y.-C. Yim, S.-C. Chu, and P. L. Sauer, "Is augmented reality technology an effective tool for e-commerce? An interactivity and vividness perspective," *Journal of Interactive Marketing*, vol. 39, pp. 89–103, 2017.

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