

IJACT 24-3-33

Research on Storytelling Elements in Augmented Reality Cinema through the Process of Image Abstraction: A Case Study of 'AR Campus Diary'

Tae-Eun, Kim

Professor, Department of Performance Art and Multimedia DongYang University, Korea
taeunmap@dyu.ac.kr

Abstract

The "AR Campus Diary" project innovates in the realm of art through integrating augmented reality (AR) with interactive storytelling, fostering personal and interpersonal development through artistic expression. This artistic endeavor metaphorically represents the growth and fruition of individual stories, facilitated by a series of progressive art activities that emphasize continual interaction between self and others. Set against the backdrop of a university campus, the project employs AR markers designed to unfold stories in phases through a dedicated application, allowing participants to experience and influence the narrative uniquely. Diverging from traditional film editing techniques, "AR Diary" offers viewers the autonomy to navigate through story segments of their choosing, marking a departure from conventional cinematic storytelling by leveraging marker-based plot progression. This project not only showcases the fusion of technology and art but also pioneers a participatory form of art education based on engagement and play.

Keywords: *Augmented Reality (AR), Interactive Storytelling, Interpersonal Interaction, Art Education, Narrative Autonomy, Marker-Based Storytelling, Participatory Art*

1. Introduction

In the era of the Fourth Industrial Revolution, learners must go beyond merely acquiring external technological skills in areas such as artificial intelligence, AR, VR, and robotic art. Instead, there is a crucial need for artistic imagination that can merge technology with art, enabling free thinking. Moreover, in an age characterized by rapid changes in communication methods, especially in a predominantly non-face-to-face context, it's important to expand diverse circuits of thought through relationships with others. This facilitates self-reflection and an understanding of one's role during these transformative times. This project seeks to articulate these themes through art, drawing an analogy between the growth of stories and the farming process, thereby studying communication that evolves through the concept of 'farming'. The objective is to foster mental healing by visualizing images based on the development of stories with others and enhancing mutual understanding through imagination.

AR technology has broadened its applications into art, education, and entertainment, notably with the widespread adoption of smartphones and tablets, leading to the popularization of AR applications. This shift has highlighted significant differences from traditional cinematic storytelling in terms of content length and modes of expression [1]. Storytelling with AR technology distinguishes itself from traditional film narratives

Manuscript received: January 26, 2024 / revised: February 17, 2024 / accepted: March 2, 2024

Corresponding Author: taeunmap@dyu.ac.kr

Tel: +82-31-839-9055, Fax: +82-31-839-9042

Professor, Department of Performance Art and Multimedia DongYang University, Korea

by enabling audiences to actively participate in and influence the storyline [2]. This is possible because audiences can dictate the story's next phase by scanning an AR marker at specific locations or performing certain actions.

Unlike traditional films, where the narrative is linear and predetermined by the director and editor, AR-based storytelling grants audiences the freedom to impact the story's progression and outcomes [3]. AR storytelling demands physical engagement from the audience, such as visiting specific sites or scanning AR markers to unlock subsequent parts of the story. While technology in traditional films mainly focuses on visual effects and editing, in AR storytelling, it plays a direct role in transforming the audience's experience [4]. This necessitates a departure from the multiple techniques typical of cinematic expression, as images must be simplified or abstracted to convey the story succinctly while maintaining engagement before transitioning to the next stage.

Next, we aim to explore the process of abstracting images for effective AR storytelling production and examine the completed storytelling that results from this research.

2. Project Description

2-1. The Evolution of the Story: A Three-Stage Framework

This project unfolds in three distinct stages: the 'Seed Germination Stage,' where structured ideation and artistic imagination plant the seeds of thought; the 'Exchange Growth Stage,' which fosters the transformation and growth of narratives through interaction; and the 'Fruit Harvesting Stage,' where stories matured through imagination and exchange are reconstituted into various augmented reality media forms. In this initial phase, participants focus on structuring their ideas and thoughts, cultivating them with artistic imagination.

This stage lays the groundwork for creative thinking, serving as the inception point where the seeds of thought are sown and nurtured. During this phase, participants share and exchange their stories, experiencing the transformation and growth of their individual narratives. They have the opportunity to 'sell' or 'collect' stories from others, creating their own unique spaces in the process. Each participant constructs their narrative space, which, when amalgamated, forms a collective story structure within the community.

In the final phase, stories that have evolved through imagination and exchange are reconstituted into various forms of augmented reality media. The narratives are depicted on a mapped location using images created with sound, video, and symbols, representing the culmination of the Seed Germination and Exchange Growth stages. Ultimately, the <AR Campus Diary> project offers an immersive experience of appreciating stories through specially designed markers via an augmented reality application. This entire process is a collaborative endeavor, resulting in a shared outcome created by all participants and members.

2-2. Seed Germination Stage

2.2.1 Relay Drawing

In the relay drawing exercise, groups are allocated a specific timeframe to rapidly produce drawings, thereby enhancing their cognitive agility. Participants observe associative triggers, engage in discussions, and conduct debates, fostering a collaborative environment for idea exchange. This drawing activity extends beyond mere cerebral ideation, incorporating tactile stimulation to manifest concepts. Foil, chosen for its malleability, serves as a medium to create tangible representations of abstract ideas. Participants craft

specific objects from foil, then venture out to locate corresponding real-world items. These items are photographed, and the images are juxtaposed with the foil creations in a comparative display. This process involves shaping abstract foil forms into concrete drawings, bridging the gap between abstract thought and tangible representation. Figure 1 is a result of drawing and photo research on images evoking imagination. Photographs resembling objects or artifacts similar to the abstract appearance of aluminum foil were juxtaposed, considering the symbols inherent in its abstract form.

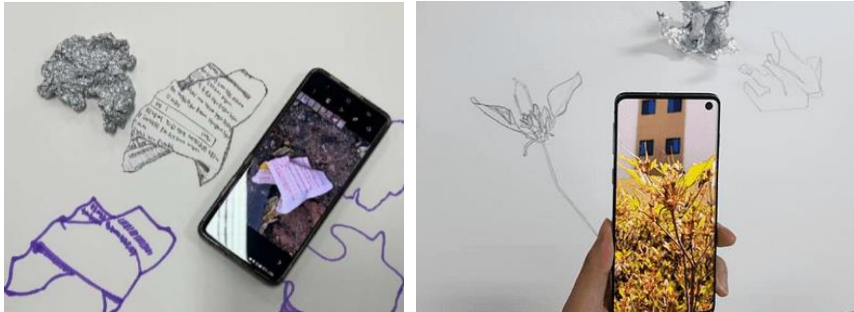


Figure 1. Relay drawing for associative thinking

2.2.2 Narrative Walks and Media Collection

Participants are divided into several teams and embark on walks through various landscapes and courses while listening to music. The activity is conducted both with and without music, and participants create drawings based on each experience. Upon completing the walks, participants share images and stories that emerged during their journey.

The outcomes are expressed through freeform drawings and shared among the group. This project effectively demonstrates the characteristics of interactive art by immersing participants in the artwork, thereby inducing engagement without the constraints of a specific location. In the Seed Germination Stage, stories gathered become the foundation for creating a 'Story Market,' where participants can buy and sell narratives. Following the 'Image Market Sale,' participants decorate their spaces with images and stories acquired from others. These personalized spaces are then showcased in a show-like format, facilitating sharing and interaction among participants. Figure 2 is the result of an abstraction process aimed at eliminating the texture of researched objects by collecting them with transparent tape and projecting them onto optical slides to reveal only their simplified forms.

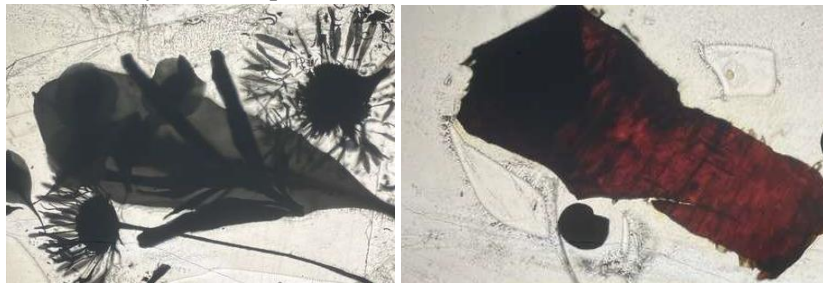


Figure 2. Abstraction of objects collected during narrative walks

2-3. Exchange Growth Stage

2.3.1 Story Bargain Sale

In this innovative phase, a marketplace is established where participants can buy and sell stories gathered during the Seed Germination Stage. Following the Image Market Sale, individuals personalize their spaces

with images and narratives acquired from others. These personalized spaces are then showcased, promoting an interactive sharing experience among participants. This marketplace not only fosters a dynamic exchange of creative content but also encourages the cultivation of personalized narrative environments.

2.3.2 Story Apartment

Building on the concept of the Story Bargain Sale, participants further develop their individual spaces into more complex narrative structures, akin to apartments within a larger story-building. This "Story Apartment" concept allows for the aggregation of diverse narrative elements, creating a multifaceted storytelling environment. Each apartment showcases the unique amalgamation of stories and images, reflecting the individual's creative interpretation and contribution to the communal narrative landscape. Through this process, participants not only engage in creative storytelling but also in the collaborative construction of a collective narrative edifice. Figure 3 is the outcome of drawing pictures in the form of doodles on the wall using real-time video drawing techniques after sharing the story.



Figure 3. Installation of story apartments created through graffiti wall technique

2.4. Fruit Harvesting Stage

2.4.1 Drawing with Light

In this phase of the project, photosensitive paper is utilized to capture the essence of objects placed upon it, leaving imprints based on their exposure to sunlight. This process triggers actions inspired by the physical world, facilitating a comparison between the initial inspiration and the resulting artifacts. The texture of objects placed on the photosensitive paper disappears in the final product, leaving only the contours, which effectively enhances the imaginative interpretation of what these objects represent. Participants further develop their creativity through discussions about these objects, investigating their potential as symbols for augmented reality storytelling.

The images provided below showcase examples of symbols obtained through the interaction with light on photosensitive paper. This innovative approach not only bridges the gap between tangible objects and abstract representation but also enriches the narrative layer of the AR storytelling, inviting participants to delve deeper into the symbolic meanings and their implications within the augmented reality context. Figure 4 is the result of a process that extracts the abstract appearance of a specific object by adjusting the exposure of light on a photosensitive surface.

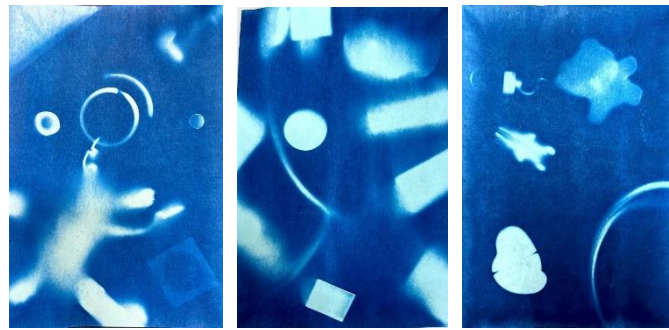


Figure 4. Abstraction of objects using photosensitive paper

2.4.2 AR Storytelling (AR Campus Diary)

Utilizing augmented reality (AR) for storytelling, this phase transforms the outcomes obtained from all previous stages into narrative form. Five participating teams each crafted a story based on the paths derived from their walks, culminating in the creation of an omnibus-style sequence of interconnected video narratives through filming and editing processes. Below are captures of stills from each team's story and video. Figure 5 is a scene where an AR marker is placed on a spatial path map drawn for AR storytelling.

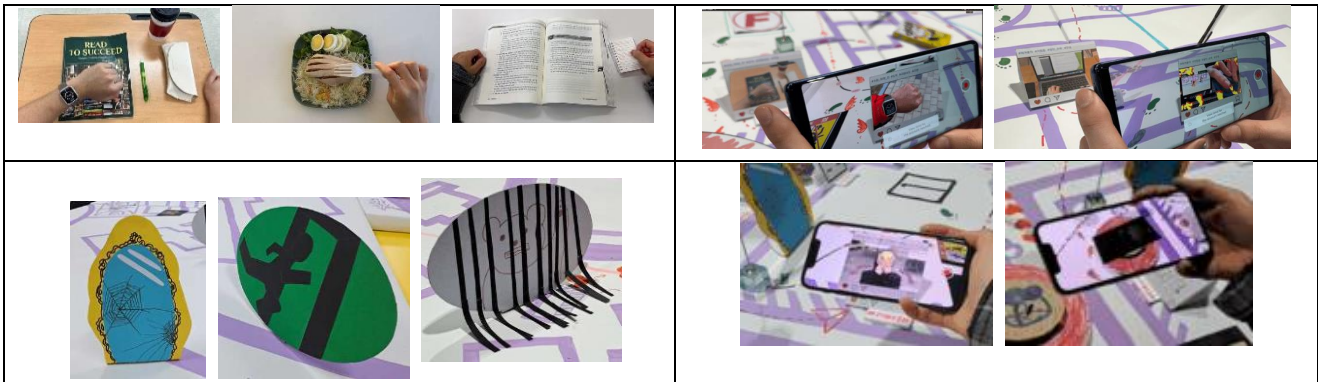


Figure 5. Creating maps for AR marker installation

Based on these narratives, a comprehensive map of the entire space was developed, with markers placed in sequence according to the unfolding of story spaces. The design of each marker was tailored to reflect the genre and characteristics of the stories formed by each team, as well as the personalities of the characters involved. These markers were installed at narrative waypoints, and videos triggered by accessing the AR program at each marker were edited to include sound, enriching the storytelling experience. Table 1 categorizes short video narratives based on specific locations and AR marker designs suitable for augmented reality (AR) implementation.

Table 1. Marker Design and Film Story Still Images for Augmented Reality Cinema

Marker Design	Movie Image



3. Analysis and Discussion

Interactive storytelling, implemented in this project, allowed spectators to directly participate in and influence the unfolding of the narrative [5]. Unlike traditional linear storytelling, this approach offers various endings and story paths, providing a personalized experience for the audience. The choices and actions of the audience have a direct impact on the direction and outcome of the story, making the storytelling experience more immersive and interactive. Through relay drawing and the use of photosensitive paper images, we explored the abstraction of concrete images, effectively applying these techniques in designing markers for augmented reality content. The combination of abstract symbols as markers and concrete videos proved effective in increasing audience engagement, allowing the narrative to be imagined solely through the combination of symbols [6]. However, challenges were encountered when markers containing stories overlapped on a single map, leading to difficulties in marker recognition.

Future research is needed to explore methods of separating markers for the audience's convenience and to avoid overlay in design. Viewer testing revealed discomfort with longer story lengths, indicating that durations of 10 to 30 seconds are preferable. The introduction of AR technology in the field of art education has provided new dimensions of educational interaction and creative expression. By utilizing AR, learners can explore art concepts and artworks more deeply and perform creative tasks in an environment where virtual and real elements merge. This technological approach has been shown to enhance learner engagement and enrich understanding and appreciation of art.

4. Conclusion

In conclusion, the storytelling elements in an AR environment can be summarized as follows:

- 1. Interactivity:** This feature allows the audience to directly participate in and influence the story. The choices and actions of the audience can affect the development of the story, providing a more immersive experience[7].
- 2. Spatial Context:** AR cinema combines real environments with virtual content, allowing the audience to experience the story within actual spaces. This makes spatial context a crucial element of storytelling, offering different narrative experiences based on location. In this study, the map of a university campus served as the designated space.
- 3. Enhanced Visual Elements:** AR overlays virtual images, text, and sound onto the real environment, enabling visually rich and layered storytelling. Within the markers and filmed videos, symbols were interconnected and functional[8].

4. Multiple Perspectives: AR cinema provides opportunities to explore the story from various viewpoints. Experiencing the content from different angles or locations deepens the audience's understanding and interpretation of the story.

5. Personalized Experience: AR cinema can offer personalized storytelling experiences based on the audience's interests or actions[9]. Tailored storytelling thus delivers more meaningful experiences to each viewer.

6. Real-time Interaction: AR cinema enables real-time interaction between virtual elements and the real world. This creates dynamic interactions between the unfolding of the story and the participation of the audience.

The augmented reality storytelling content "AR Campus Diary" represents the culmination of the Seed Germination and Exchange Growth stages discussed earlier. This project transcends the conventional visualization found in typical films by leveraging audience-participatory augmented reality technology, visualizing ideas and influences within virtual spaces on a map. Utilizing augmented reality applications, the project actively employs technological advancements to overlay events in real spaces onto a virtual map, enhancing audience participation and enabling effective immersion in the artwork. Active audience engagement, facilitated by the use of diverse media, leads to the generation of outcomes that respond to audience demands, showcasing the emergence of narrative through interaction[10].

Furthermore, the intermediary process of the story market allowed participants to experience the social value of understanding market economy logic naturally, by buying others' stories and selling their own to decorate personal spaces. This aspect not only highlights the project's innovative approach to storytelling and art but also underscores its contribution to social learning and engagement.

ACKNOWLEDGEMENT

This paper has been studied with the support of the academic research support project of Dongyang University in 2021.

5. REFERENCES

- [1] O'Meara, J., AR cinema: Visual storytelling and embodied experiences with augmented reality filters and backgrounds. *PRESENCE: Virtual and Augmented Reality*, 1-58, 2013. https://doi.org/10.1162/pres_a_00376
- [2] Szita, K., & Lo, C. H.. Visual Storytelling and Narrative Experiences in Extended Reality: Guest Editors' Introduction. *PRESENCE: Virtual and Augmented Reality*, 30, 1-4, 2021. https://doi.org/10.1162/pres_e_00384
- [3] Pérez, B. J., Augmented illusionism. The influence of optical illusions through artworks with augmented reality. In 2020 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct) (pp. 158-164). IEEE, 2020. <https://doi.org/10.1109/ismar-adjunct51615.2020.00051>
- [4] Song, J., Wang, B., Wang, Z., & Yip, D. K. M, From Expanded Cinema to Extended Reality: How AI Can Expand and Extend Cinematic Experiences. In *Proceedings of the 16th International Symposium on Visual Information Communication and Interaction* (pp. 1-5), September, 2023. <https://doi.org/10.1145/3615522.3615556>
- [5] Shilkrot, R., Montfort, N., & Maes, P, nARratives of augmented worlds. In 2014 IEEE International

- Symposium on Mixed and Augmented Reality-Media, Art, Social Science, Humanities and Design (ISMAR-MASH'D) (pp. 35-42). IEEE, September, 2014. <https://doi.org/10.1109/ismar-amh.2014.6935436>
- [6] Hampshire, A., Seichter, H., Grasset, R., & Billinghurst, M, Augmented reality authoring: generic context from programmer to designer. In *Proceedings of the 18th Australia conference on Computer-Human Interaction: Design: Activities, Artefacts and Environments* (pp. 409-412), November, 2006. <https://doi.org/10.1145/1228175.1228259>
- [7] Raeburn, G., Tokarchuk, L., & Welton, M, Creating Immersive Play Anywhere Location-Based Storytelling Using Mobile AR. In *Augmented Reality, Virtual Reality, and Computer Graphics: 8th International Conference, AVR 2021, Virtual Event, September 7–10, 2021, Proceedings 8* (pp. 209-226). Springer International Publishing, 2021. https://doi.org/10.1007/978-3-030-87595-4_16
- [8] Wang, S., Zargar, S. A., & Yuan, F. G, Augmented reality for enhanced visual inspection through knowledge-based deep learning. *Structural Health Monitoring*, 20(1), 426-442, 2021. <https://doi.org/10.1177/1475921720976986>
- [9] Miller, C. H, *Digital Storytelling 4e: A creator's guide to interactive entertainment*. CRC Press, 2019.
- [10] McErlean, K., *Interactive narratives and transmedia storytelling: Creating immersive stories across new media platforms*. Taylor & Francis, 2018.