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Portal Lore - The Immersive Experience: Evaluating the Diverse Impacts of Integrating New Technology (XR) into Narrative Illustration

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ABSTRACT

A narrative illustration shows a frozen moment in time, with its hero or protagonist at the end of the destination, or perhaps at the beginning of the journey. The beauty of fantasy illustration is in the way each creative piece can be differently interpreted by each person, even though the illustrator may have had a very specific concept or vision in mind. Digital animation provides the necessary tool to bring the storytelling to life, exactly how the illustrator imagined. Current practices and future trends indicate that there is a huge shift to video content consumption rather than still images in this digital era. Thus, Extended reality (XR) that includes augmented reality (AR), virtual reality (VR) and even mixed reality (MR) are being implemented in many art exhibitions and museums to aid in enhancing the interactive experience of the viewers, and nurturing artistic inspiration. These new technologies are the bridge between the physical artwork and its digital layer, allowing the audience to become participants and connect to the illustrator on another level. The aim of this thesis is to research and evaluate the effectiveness of using XR with narrative illustration, to enhance viewer engagement and create immersive experiences.

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Introduction

The idea of extended reality [XR] is a concept that the new generation grew up expecting to be part of daily life. There has been a long anticipation for the virtual and physical worlds to collide and merge into a sci-fi utopia. Apple revolutionary headset, Apple Vision Pro, creates an immersive spatial view within one's own physical environment, where the user can interact naturally with the digital projections (Apple, 2023). Apple also announced the next-gen XR tool, Scenery, which builds on its successor the Scavenger app (Scenery, 2024). It allows creators to take their immersive storytelling to new heights on different iOS platforms (Scenery, 2024). Hearing that, makes one imagine what an illustrator could create, when the world is an unlimited canvas. Different fields of study constantly look for new ways to evolve through new technology, and surely one of them would be illustration.

Even before that, Meta made a bold statement at Facebook Connect 2021, announcing that they are building a future where people across the world can meet virtually in the metaverse (Sherr & Wong, 2021). The future of technology is about interacting through digital worlds, which in turn encourages new types of business, art, music, etc. (Sherr & Wong, 2021). Their newest headset Meta Quest 3 introduced a breakthrough feature, the high-fidelity color Passthrough that allows the virtual world to blend seamlessly into the physical one, creating a one-of-a-kind mixed reality [MR] experience (Meta, 2023).

Museums also started implementing technologies such as augmented reality [AR] and virtual reality [VR] to create an entirely new perspective to their creative exhibits. One of the best examples of this is Van Gogh: The Immersive Exhibition that's been touring around parts of America, Europe and Asia since 2017 (n.d.). It has been awarded "best 2021 immersive experience by USA today" and "ranked among the 12 best immersive experiences in the world by CNN" (n.d.). The illustrations are presented digitally through screens, virtual reality and 360 projections (n.d.). John Zaller, the executive producer of the exhibition, described it as an experience appropriate for our age, incorporated with animation, movement and energy that bring the stories of the artworks to life (PBS NewsHour, 2022, 0:49). Van Gogh's works often had passionate narratives, such as how Starry Night is said to be the view from his window, but with exaggerated artistic expression. Associate professor of Art History in the University of Washington, Marek Wieczorek, visited the exhibition and expressed how he observed people enjoying themselves and participating together in this creative space, just how any art experience should be about (PBS NewsHour, 2022, 4:06). He also urged the audience to think about what may have been lost from the original paintings in translation from the print to digital medium (PBS NewsHour, 2022, 4:58). To him, the experience felt different rather than the familiar or accurate representation of Van Gogh's brush strokes, colors, textures and overall look of his paintings (PBS NewsHour, 2022, 5:23). The previous two contrasting comments spark a research opportunity to find out how new technologies contribute or detract from experiencing art. Hence, this paper aims to research the impacts of new XR technology on narrative illustration and assessing how it can be used to enhance viewer experience and storytelling, as well as evaluating the positive and negative implications of new media on illustration.

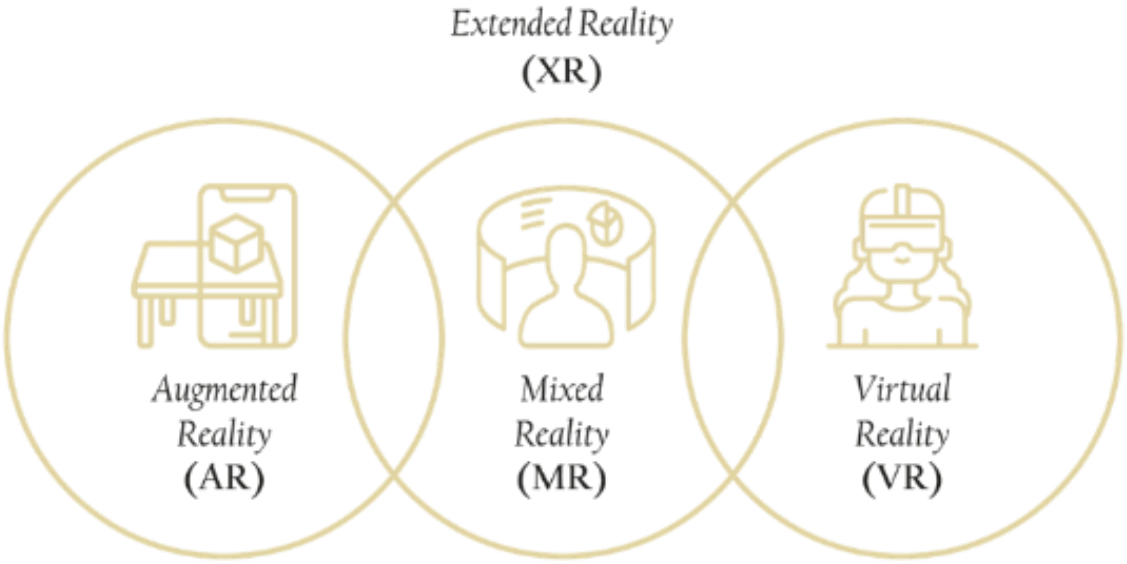
Research Background

Definitions

First off, augmented reality is a new digital technology that integrates or overlays virtual information with the real world, by calculating the position and angle of the device camera (Deng & Wang, 2023, pg. 5). On the contrary, virtual reality refers to the use of computer-generated virtual world technology that gives participants direct access to visual, aural, and tactile stimuli and enables them to engage and observe interactively (Deng & Wang, 2023, pg. 5). Users can experience VR through special headsets and equipment to see the 3D graphics of the virtual environments (Deng & Wang, 2023, pg. 5). It replaces the user's perception of the real world with a simulated one, as the user's view is completely secluded by the headset (Sylaiou, 2018). Mixed reality allows for intuitive and natural interactions between people, machines, and environments by fusing the real world with the virtual one (Huang, 2016, as cited in Chunfa et al, 2022). This means that AR would be located closer to the real-world setting, VR at the alternative end, and MR meets them in the middle (Cabero-Almenara, 2022). Finally, Extended Reality is the umbrella term that groups all immersive technology that adds digital components to alter reality (Dow, 2022).

Figure 1. A summary diagram representing the flow between the different terminology

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Note. Adapted From What Is the Difference Between VR vs. AR vs. MR vs. XR?, by Keith Dow, 2022, Metaflix (https://www.metaflix.com/what-is-the-difference-between-vr-vs-ar-vs-mr-vs-xr/). Copyright 2023 Metaflix Media LLC.

There are three types of AR in regards to the way they spawn:

Marker-based AR

This type needs user-defined images that are easily recognizable and scanned by cameras to activate or trigger an augmentation, such as an animation, text, video, etc. (Digital Promise. n.d.). Markers are visually distinct from their surroundings, such as a printed QR code, magazine image or special signs (El Filali & Salah-ddine, 2018). This type of trigger was used in the first stage of this thesis project.

Marker-less AR

Here, the user has the most control with AR because they can decide where they want the virtual content to be placed at real-life scale (Digital Promise. n.d.). The AR experience can be started by clicking a link, choosing a feature in an app, or visiting a website (Aircards, 2021). The two most important categories of marker-less AR are:

Location-based AR. This marker-less category uses smartphone features to detect and pair data from cameras, GPS, compass, and accelerometers with points of interest, providing relevant information and virtual objects when the user's device data matches the location (Digital Promise. n.d.). The most famous example for GPS-based AR is the popular smartphone game Pokémon Go, utilizing the current surroundings and overlaying digital information in a way that promotes social interaction (Marques et al, 2019, p. 202). This game was all the rage when it came out in 2016. It had a very unique concept at the time, especially that it encouraged outdoor gaming activity to catch the beloved 3D illustrated Pokémon characters.

Superimposition-based AR. Upon object recognition, the original view gets replaced and "superimposed" with AR, fully or partially (El Filali & Salah-ddine, 2018). The best example for that is the IKEA Catalog app, which allows users to place virtual furniture in their rooms before buying (El Filali & Salah-ddine, 2018). Another familiar example would be the use of filters across different social media platforms (Digital Promise. n.d.). In other words, this type of AR recognizes faces and surfaces/planes to place virtual elements. This was the chosen category for the second stage of the thesis project.

Web-based AR

WebAR is gaining popularity, especially with entrepreneurs and brands, as it eliminates the need for expensive apps and user downloads (Aircards, 2021). It prompts the user to simply tap a link on their device camera to take them to the AR experience on the web browser (Aircards, 2021). There are many websites available that provide the needed tools to build WebAR experiences. Zappar for example, documents Kellogg's Frosted Flakes 'Mission Tiger' campaign as one of their top 10 WebAR experiences (Vassallo, 2020). Through mini-games and amusing face filters, the experience was created to motivate kids to join sports in schools (Vassallo, 2020).

Brief History

The American writer L. Frank Baum unintentionally introduced AR in 1901, describing special eyeglasses that enable its wearer to see letter marks on others' foreheads (Sünger & Çankaya, 2019). Next, the Sensorama was designed by Morton Heilig in the 1950s, and later turned

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into a prototype in 1962, which included stimuli like wind, 3D visuals and audio (Rheingold, 1991, as cited in Boas, 2012). Displaying a movie of a moving motorcycle in Brooklyn streets, it became known as one of the earliest examples of an immersive experience and virtual reality (Boas, 2012). In 1966, Electrical Engineer Ivan Sutherland began developing the first head mounted display [HMD] called the Sword of Democles, which can track the user's position and eyes, updating the stereoscopic view image accordingly (Sutherland, 1968, as cited in Sünger & Çankaya, 2019; Boas, 2012). The 1960s saw the development of digital media art, which underwent a new digital phase in the late 1990s (Ye & Li, 2022). Without the introduction of computers that revolutionized the world, a connection between digital illustration and technology wouldn't have cojoined.

Literature Review

An immersive art exhibition is one in which the audience is completely involved in the artistic experience (Li & Huang, 2023). This can be done through a variety of methods, including virtual reality, interactive features, and immersive surroundings (Li & Huang, 2023). It is frequently created to be "interactive", enabling viewers to interact with the works of art in a way that is not feasible in conventional exhibitions (Li & Huang, 2023). It offers a special quality of allowing users to be absorbed hands-on, fostering a sense of connection, appreciation and deeper understanding to the art and the concepts behind it (Li & Huang, 2023). It focuses on the art experience rather than the artwork as presented objects, and for that, design strategies and a framework have been formulated to create a successful immersive art experience (Li & Huang, 2023). According to the flow theory, immersive experiences are marked by a state of "flow," where the user is fully immersed in the activity, losing track of time (Nakamura & Csikszentmihalyi, 2009, as cited in Li & Huang, 2023). It suggests that users will most likely enjoy the experience when the engagement is meaningfully challenging; not too easy or too difficult, or they might become bored or frustrated, disrupting the flow state (Li & Huang, 2023). The four key elements for the design framework are story, space, technology, and interactivity (Li & Huang, 2023). The story holds the "narrative" or theme of the experience and includes storytelling components such as the setting, characters, plot and audio, to allow the audience be part of it all (Li & Huang, 2023). Space refers to the physical environment where the experience occurs to guide the user in a way that makes sense, encompassing layout, lighting, aesthetics, props, walls, etc. (Li & Huang, 2023). Choosing the appropriate technology that will elevate the themes of the project and enhance the user experience is crucial, and that can include projections, sound, lighting, VR or AR, interactive displays, sensors, and tracking technologies (Li & Huang, 2023). Interactivity is planning how the user will engage with the artworks, such as physical interactions with movement and touch, as well as making decisions (Li & Huang, 2023). This novel technological paradigm lets traditional art explore new narrative techniques, but it may create a vortex of overwhelm and self-consciousness and puts the audience on the spot (Gao, 2022, p. 9).

In Nick Muffet's thesis, he researched and explored the effectiveness of integrating AR with poster design (2022). Specifically, he was looking to test memory recollection of viewers after engaging with the posters (2022). This paper conducted a formative survey to gauge public perceptions of AR, followed by designing three AR posters to investigate the next steps (2022). A gallery display was used as a case study and environment for observation and user interviews to research general effects of AR (2022). Three augmented reality posters were produced to be the markers, aka trigger for the AR. The methods used for evaluation were user observations, interviews, and surveys (2022). The results showed that an increased level of engagement, but did not translate to improved information recall, unless the information was surface level (2022). Once viewers trigger the augmentations, they move their focus from the printed composition to the new elements that appear (2022). Thus, they don't consider revisiting the printed content to decode its information after the AR experience is over (2022). Finally, the participants expressed that downloading the Artivive app to view an informative poster felt like an extra chore (2022, p. 54). For testing 3D augmentation, Instagram was the chosen platform; participants felt familiar (2022).

Alternatively, Yasmine El-Saidy research reaped contrasting results, revealing that AR aids in the creation of interactive advertisements that boost product sales and alter the advertiser's shopping behavior (2021, p. 128). It allows the user to stop and analyze the information from multiple angles around the design in 360 degrees (2021). The anatomy of AR is explained, containing 3 components (2021, p. 109). First, is the target or marker, as in the image, word or object that triggers the AR animation to appear, called overlay (2021, p. 109). There has to be instructions somewhere as well to notify viewers how to see the animations, such as a code to download a certain app (2021, p. 109). This paper studied multiple print mediums such as catalogs, newspapers, magazines, packaging designs and posters (2021). It mentioned famous brands such as Pizza Hut, Burger King and Oreo who used AR in their marketing

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campaigns and packaging designs (2021). Using such technology that can be integrated quite easily in branded packaging, poster ads, etc. allows the buyer to develop a relationship with the company beyond passively buying products (2021). The world is moving more towards full digital consumption, and so AR gives a chance to static publications like newspapers and magazines to become hybrid multimedia (2021, p. 116).

Ana Aragão, an architect and professional illustrator, was preparing for an exhibition by the name No Plan for Japan that would be on display at Museu do Oriente – Fundação do Oriente between November 5, 2021, and February 14, 2022 (de Sousa, 2022). She describes her illustrations as "a meeting between the real and the imaginary" (de Sousa, 2022). João Alves de Sousa and his team approached her for a collaboration, to animate her analog illustrations to study the effectiveness of this proposed strategy in benefiting the museum experience (de Sousa, 2022). After agreeing to the idea, the budget and technical restrictions of the museum were discussed, and the final decision reached was using AR, through the Artivive app (de Sousa, 2022). It was also a successful decision in reflecting the keywords of her illustrations, the "real" and the "imaginary", through external technology (de Sousa, 2022). Four animation students were selected to animate 18 illustrations, which took over 3 months (de Sousa, 2022). That is because it was very time consuming to digitally separate the traditionally drawn layers, and they were still solving how to create this mixed-media experience (de Sousa, 2022). This effective partnership encouraged individuals who were intrigued about the usage of animation as well as those who were interested in Ana Aragó's work to visit the exhibition (de Sousa, 2022). The museum representatives were doubtful at first, afraid technology might shift the focus from the exhibited artwork, but they realized it enriched the visitors' experience (de Sousa, 2022).

On the other hand, VR has been integrated in Art History teaching to enrich students' experience. In James Hutson and Trenton Olsen case study, they aimed to explore educational advantages, technical difficulties, and the best methods for integrating VR technology in the Art History curriculum for both students and faculty perspectives (2022). VR provides the creative ability to transport students to any historical site in the world and immerse them in its culture and heritage (2022). That includes iconic monuments that can be seen and engaged with, and famous paintings can be examined closely and contrasted in virtual museums (2022). Surveys were distributed to students regarding their use of VR, its purpose, familiarity, potential drawbacks, whether they completed it for class or extra credit, and how helpful they thought it was in comparison to other media-based learning activities (2022). The faculty was surveyed as well to understand their point of view about the challenges that they may face when integrating VR technology in teaching (2022). Students who participated in the learning through VR reported increased excitement and motivation, allowing them to grasp the information better (2022). Both faculty and students weren't resistant to the introduction of VR to the Art History courses (2022).

In 2020, a study was conducted to explore the difference in viewing paintings physically or through head-mounted display [HMD] VR or desktop VR (Chen et al). For that, 12 paintings (seven landscapes and five abstract) by an amateur artist, Sandy Lee, were used to evaluate the three experiences (Chen et al). Participants viewed physical works in an exhibition room or participated in one of the two VR experiments to avoid learning effects (Chen et al). Seventy-eight university students participated in this study; 26 in each version (Lin et al). Both VR versions offered cursors to zoom in on paintings and descriptions (Lin et al). The participants of each version were asked to rate their experiences from one to five in a questionnaire to test pleasure, calmness, attractiveness, favorite painting, etc (Chen et al). The results showed that viewing a painting through Desktop VR or HMD VR had similar psychological effects and preferences as viewing the original paintings, as there was no significant difference in the participants' feelings (Chen et al). But, the HMD VR had the lowest scores for image size differentiation and rated the most favored abstract painting in the other two versions as the lowest; probably because of the headset's convex lenses, which can affect the viewing quality (Chen et al).

Spampinato and Carticalà believe there is a lack of research on the connection between contemporary visual arts and VR (2021, p. 122). Artists readily embrace new mediums like film, radio, video, and the internet to discover relationships with their audience (2021, p. 122). The authors discuss mainly two artists' work, Jon Rafman and Jordan Wolfson, who create disorienting and alienating narrations with 3D graphics (2021). Rafman's View of Pariser Platz is a VR installation created in 2016, featuring a dark and foggy atmosphere, dummy-like creatures falling from the terrace, transforming into a surreal universe controlled by an invisible force (2021, p. 124). Wolfman designs eerie scenes with animatronics, such as in his 2016 Colored Sculpture, the viewers can walk around a larger-than-life figure being dragged around by his chains (2021, p. 125). The past years saw the birth of several companies that introduced art to their VR productions, such as Khora

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Contemporary, VIVE Arts and Acute Art, being the most well-known of the three (2021, p. 127). This phenomenon brings out a new hybrid artist who emphasizes innovation and communication with programmers and technicians, while also presenting a critical viewpoint and challenging the tech industry to re-evaluate its objectives (2021, p. 127). Marina Abramović, one of the artists who worked with Acute Arts, produced Rising in 2018, to make users feel the impacts of climate change by witnessing her avatar drowning in a glass tank (2021, p. 128). She used VR to awaken users' consciousness through an emotional narrative, hoping they'd still feel an impact after removing the headset and take action (2021, p. 131). In all these scenarios, the user is passively seeing another world and cannot move or escape as with movies or TV (2021, p. 132).

While Jeganathan explores WebAR's impact on the marketing 4Ps (product, price, place, and promotion), similar principles are clearly influencing the art world, especially in terms of accessibility, immersion, and audience interaction (2024). He believes AR has established itself as one of the 21st century's most revolutionary technologies (2024). Illustrators can become marketeers and experiment with new storytelling and promotional strategies, expand the place of exhibition beyond galleries, and produce interactive products that change based on audience feedback (2024). Just like furniture retailers use it to let customers visualize pieces in their homes, Illustrators can use WebAR to place interactive artwork directly into a viewer's space. By removing the requirement for specialized apps, WebAR makes it possible for artworks to open directly within browsers, hence removing barriers of participation (2024). It also saves organizations the headache of app maintenance and updates, followed by the users downloading the new versions, occupying phone storage (2024). The literature does point out several gaps, though, including a lack of hands-on studies observing the long-term effects on audiences, technological limitations, and ethical concerns about data and authorship (2024). All things considered, WebAR emerges as a potent but little-studied instrument for promoting accessibility, artistic expression, and engagement.

Research Objectives and Questions

Research Question 1 (RQ1)

How might augmented reality assist in visualizing the protagonist's journey in a fantasy illustration exhibition, to re-imagine the illustrator's storytelling?

The first objective focuses on amplifying storytelling with AR specifically, to involve the viewers within the illustrator's narrative intentions for each illustration. The goal is to verify to what extent adding AR features, showing animations of the illustration posters, would assist in clarifying the character journey, while allowing the viewers to experience the illustrator's point of view and unique imagination.

Research Question 2 (RQ2)

What are the positive and negative aspects of utilizing XR technology to create immersive illustration experiences?

The second objective is to practically test and evaluate the technicalities of using certain XR technology and programs to contribute to enhancing viewer experience and storytelling. Then, analyze the results to filter out the pros and cons of using XR technology as an extension of the illustrations. Everything has advantages and disadvantages; thus, the differences will be weighed whether new media might take away or greatly complement the experience.

Methodology

Portal Lore is a practice-based interdisciplinary project in of itself, created to research and evaluate the usage of new technology with illustration. The research is qualitative in nature, but also introduces quantitative date. It all started with intensive research to come up with the world building for the illustrations. All the important information gathered were put together in separate essays to inspire ideas later on. To answer the research questions, the process consisted of many parts: Gathering primary research by observing events around Egypt that included XR, expert interviews, joining masterclasses with professional practitioners and finalizing the practical illustration and design phases for displaying in exhibitions as case studies, to observe and collect data.

Practical Stage One

The case study was divided into two stages. The first stage focused on meticulous research and sketching, delving into world-building inspired by strange archaeological locations, brought to life through seven digital illustrations. In each illustration, there is a different character related to the place, who portals in to create a change or witness a fairytale sight. They are a personal imaginative visualization of the various lores, myths, as well as facts surrounding these phenomena. Therefore, the name of the project ended up being Portal Lore and all the branding identity was designed to fit the theme. Each poster was animated to narrate the protagonist's journey and clarify the illustrator's point of view. They were put together in a short AR zine activated by Artivive (2023 version). The first exhibition was held on Monday 29th May 2023, on the campus of The

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German University in Cairo [GUC]. Students visited the exhibition hall and were guided to scan the illustrations through the Artivive App. After they were done engaging with everything at the exhibit, they were asked to participate in a one-question on-spot survey to evaluate their experience. The question asked was:

Was augmented reality effective in narrating the storytelling?

They had four answers to choose from:

Yes, it connected me to the illustrator's thought process (green color)

Somewhat agree, it served as entertainment and inspiration (yellow color)

It was unnecessary, the posters' themes were already clear (orange color)

No, it distracted me from appreciating the artwork up-close (pink color)

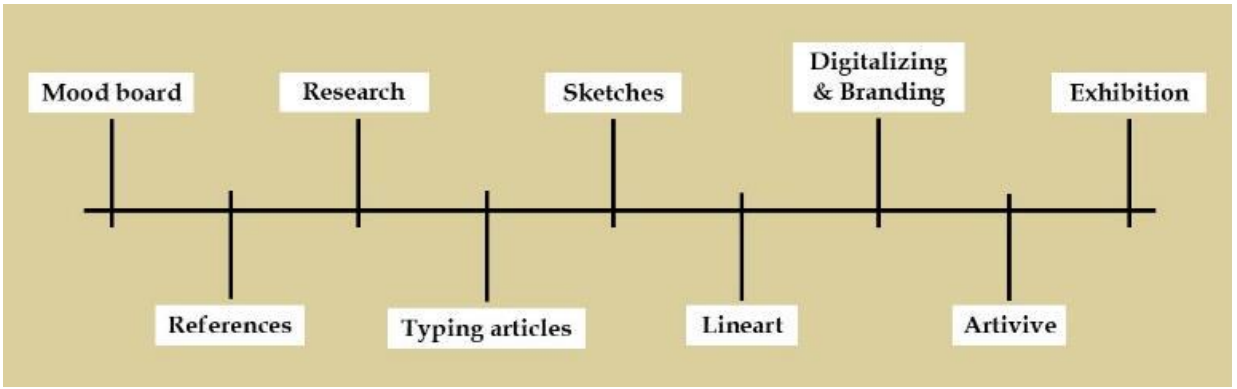
Figure 2. A compilation of visuals from stage one



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Note. To watch logo animation, speed paint and Artivive animations, enter the YouTube link: https://youtu.be/p17hl15aCyg?si=Hy3mvvzxlZS_zTQ6

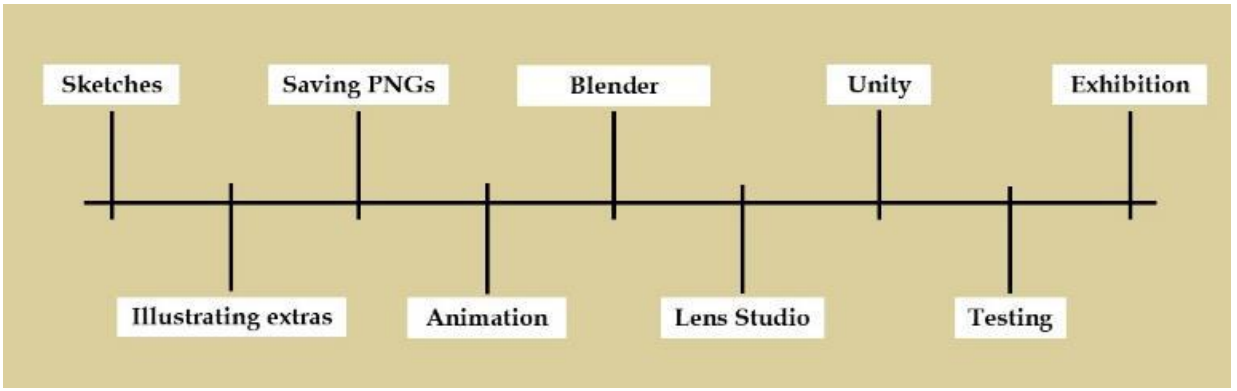
Figure 3. Stage one timeline running from February 2023 until the exhibition held on 29th of May, 2023



Practical Stage Two

The first objective of the second stage was to collect qualitative research through literature reviews, expert interviews, masterclasses, field observation, focus groups and a larger exhibition to finalize the research. Secondly, the project was expanded beyond 2D posters, to become an immersive experience that invited people to interact with detailed environments, characters and narratives. The program that was best suited for the AR experiences was Snapchat Lens Studio [LS] (version 4.55.1). Any required 3D modelling was done on Blender (version 4.1). Fourteen AR filters were created; seven for the rear camera and seven face filters. Figure 7 lists the Snapchat codes of all the filters. Three unique VR experiences were designed for the Meta Quest 2 headsets using Adobe Photoshop and After Effects, Unity (version 2022.3.39f1) and Stornaway interactive video web platform. The final exhibition was hosted in Princeton School in New Cairo on Wednesday, 19th February 2025. A poster and an Instagram video ad were made to advertise the event. The venue had five blocks of empty walls and windows; perfect for separating the illustrations' themes into distinct areas. On the left was a pathway, and so was on the right. These pathways were used to highlight the two most interactive VR experiences. Those side walls were covered with big themed banners, one of which was an interactive map that allowed users to add stickers to their dream travel destinations. The management provided six tables to hold different things like screens, giveaways, VR headsets and props. There were arrow stickers already on the floors, which was exploited to help design the exhibition as a linear experience. Eight laser-cut foam arrows were designed to guide visitors from one area to the other, as if travelling in a connected journey around the world. The final touch was sticking laser-cut themed platforms on the floor that represent the beginning of a new illustration area. Upon entering, visitors were given a summary of what the theme is about and how to navigate through the exhibition. There was also a roll up banner at the entrance explaining the instructions and hints for a smoother technical experience. There were three other researchers aside from myself, responsible for different checkpoints and recording observations. Once visitors were done scanning the codes and trying the VR experiences, a selected few of varying ages participated in an online detailed survey for evaluation.

Figure 4. Stage two timeline running from October 2023 until the exhibition held on 19th of February, 2025



Note. To watch video content of the full practical project enter the YouTube playlist link: https://www.youtube.com/playlist?list=PLQkfSIBLkGe6hhUINY-WLbYpdLgew3M3_

To test and download the VR and AR experiences, visit the download link: https://www.dropbox.com/scl/fo/k9da53s2r5l2t6mbju87f/ABjDSVwbrcvo7l9kqlH0KAc?rlkey=uxy5hrbrecvb7wh7jeuh38wkg&st=ford5gkp&dl=0

Expert Interviews

Figure 5. Six expert interviews were conducted, either by writing or live on Google Meet



Note. See Appendix A for detailed questions and answers.

Table 2. A chart summarizing the field observation research

Observational Study of Egyptian Events

Date	Event Name	Type of Experience	Main Takeaways
17/09/2023	Medrar's XR Extended Ecologies Exhibition	VR experiences	• Explored various imaginative VR worlds • Observed strong user immersion • Felt Dizzy overtime• Suggested visual decor to enhance the venue
17/11/2023	Art D'Egypte:Forever Is Now 3	Outdoor art installations	• Reflected on AR replacing art guides • Considered AR creation cost and accessibility • Saw potential for illustrated extensions
17/11/2023 (evening)	Pyramids Sound and Light Show	Audio-visual projection show	• Turning static monuments into dynamic audio-visual storytelling surfaces• potential for merging AR to create MR experiences
08/12/2023	Grand Egyptian Museum:Tutankhamun Immersive Exhibition	360 immersive experience	• Evokes powerful physical and emotional reactions• Narration vs visuals balance• Suggested AR filters as post-show interaction
29/02/2024	Cairo Design Week (Heliopolis)	Multi-location design exhibitions, including displays, projections and holograms	• Studied projection setups • Witnessed high visitor social engagement • Learned from diverse spatial design layouts
19/10/2024	Cairo International Art District (Edition 04)	Mixed-media art exhibition with AR elements	• Experienced QR-triggered AR art • Making sure codes are visible to the audience• Inspired by merging painting and animation

Masterclasses

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Table 3. The learning outcomes from the two masterclasses I joined with XR experts.

Date	Masterclass Name	Hosted By	Main Takeaways
04/04/2024	How To Make Your XR Content More Recognizable On Social Media	@StudyXR:Maria Martinez@lens.list:Ola and Jana	• Try multiple effects, skills and niches to know your desired specialty • Develop a unique art style to be recognized by• Clever marketing is needed to create a buzz
08/05/2024	Immersive Storytelling	@StudyXR:Maria MartinezGuest Speaker:Jimena Tormo	• Know the target audience and design a storytelling experience tailored to them• Design a persona chart, find inspiration and research methodology• A strong art direction plays a main role in elevating the experience• AR has the potential to be more engaging and easily accessible with smartphones, but VR is more immersive• XR dilemma: the users who didn't design the XR experience have to interact with it, leaving the fate of its success in others' hands.

Figure 6. Example with one of the world filters and face filters

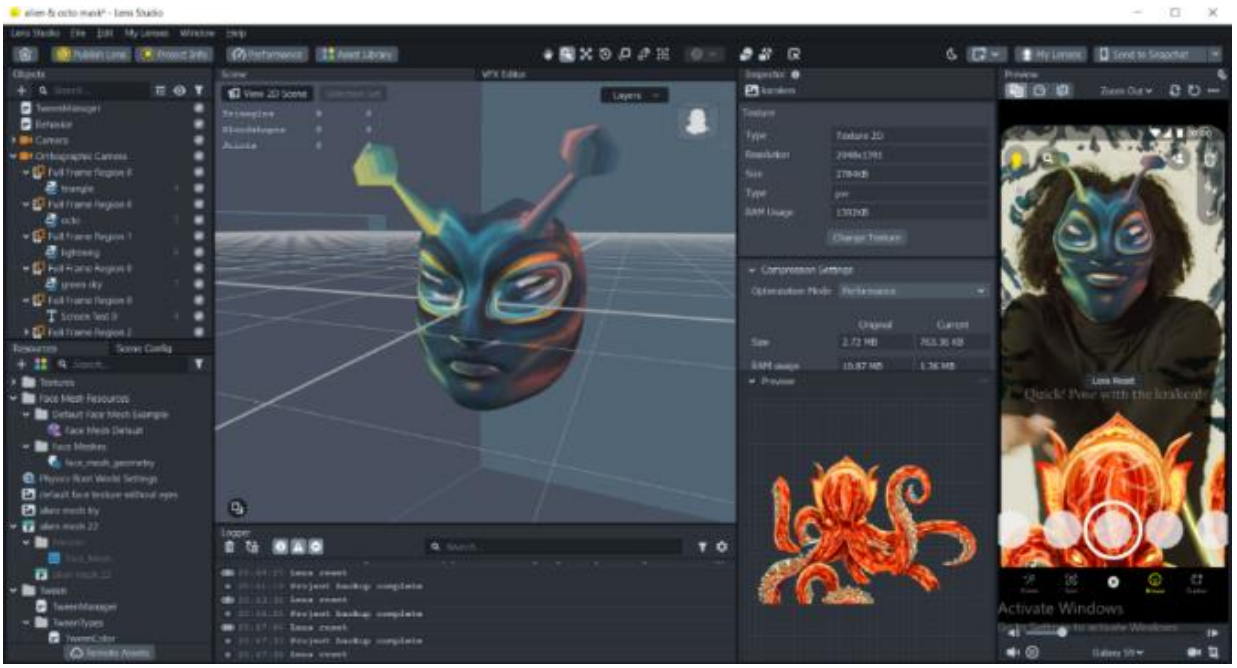




Figure 7. All 14 Snapchat codes



Figure 8. The Twilight Zone 360 2D animation video



Figure 9. First scene leading to the Eye of the Sahara scene in Unity

Note. To watch the video enter the YouTube link: https://www.youtube.com/watch?v=9Yca5brLZeE

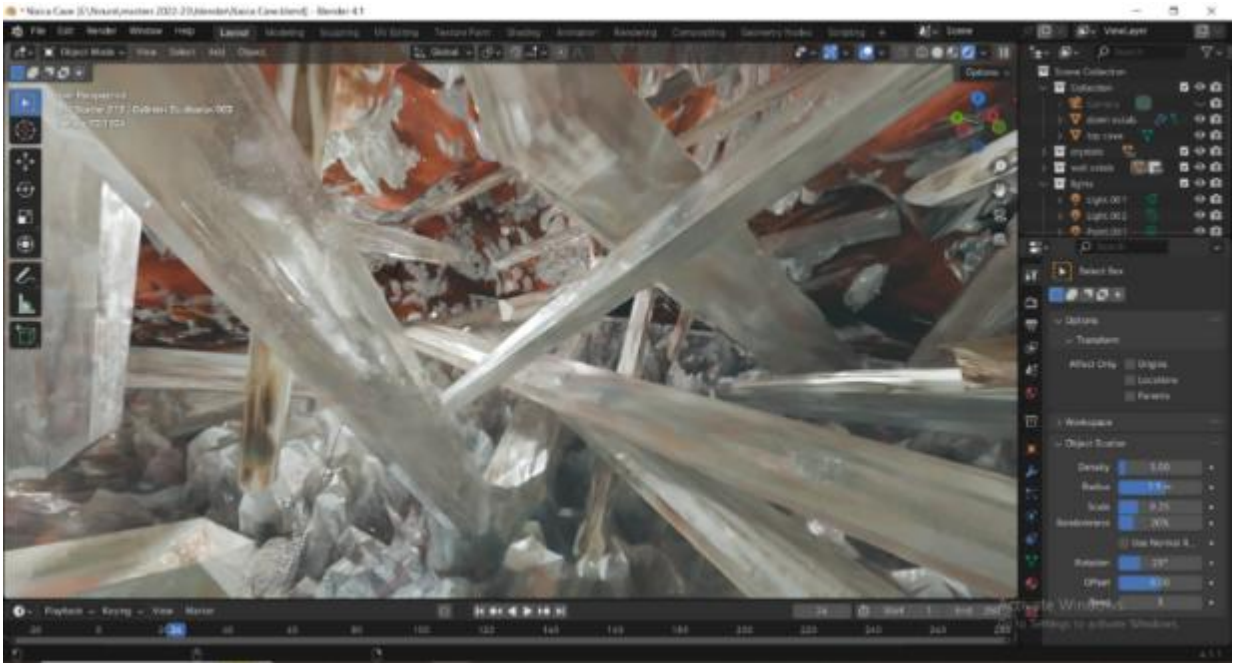
Resolution: up to 8k – frame rate: 30fps – published in May 2024



Figure 10. Detailed closeup of the 3D modelling of Naica cave on Blender and testing the Stornaway Unity plugin

Note. To watch the playthrough enter the YouTube link: https://youtu.be/cmBE-cgvp5s

This experience was 3D modelled on Blender and built on Meta Quest 2 (v68) in August 2024



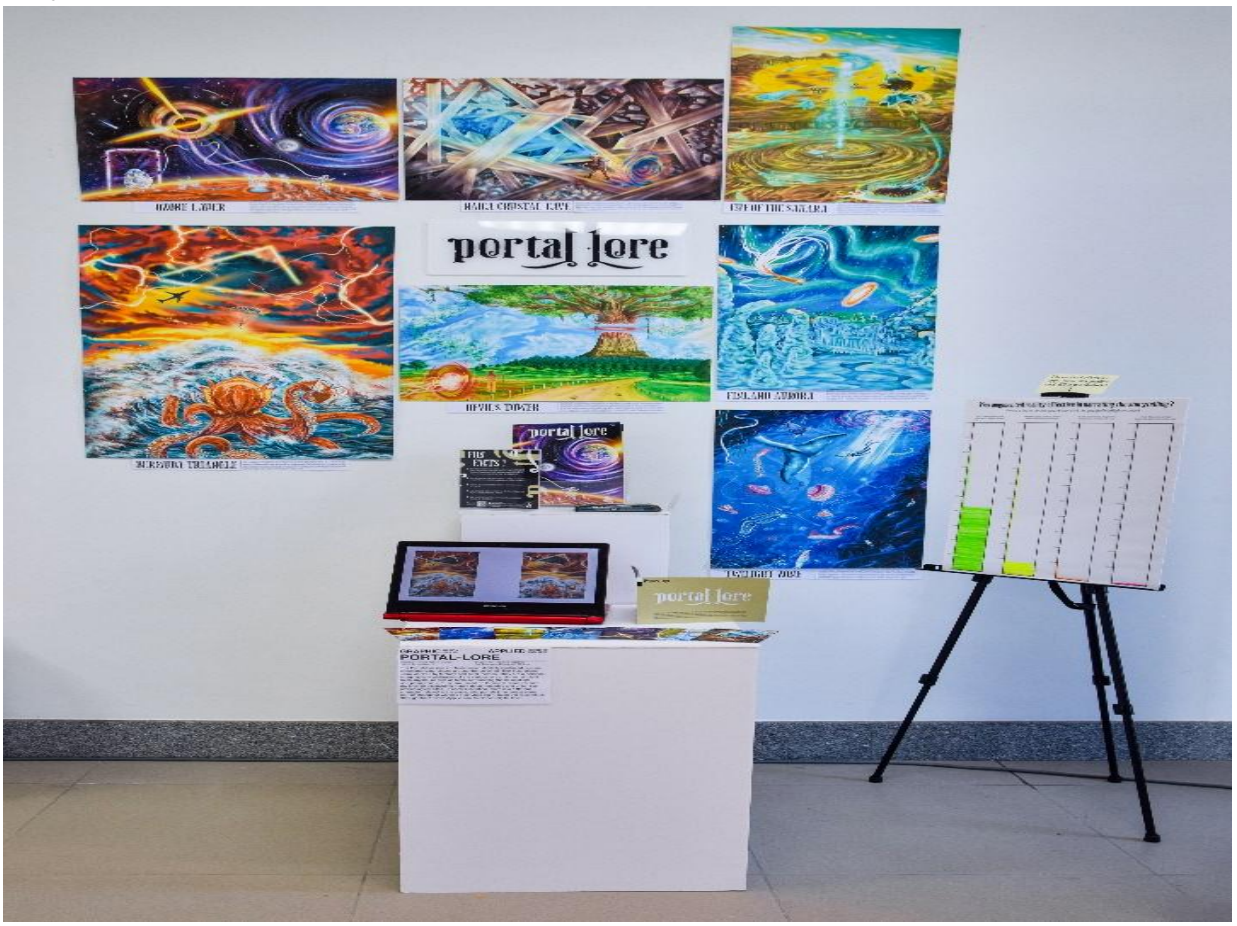
Note. To play the movie on the web browser enter the link: https://player.stornaway.io/watch/d43646c5

This interactive documentary experience was built on Meta Quest 2 (v72) in November 2024

Findings

Stage One Results

Figure 11. Stage One final exhibition booth



Fifty-three GUC students (freshmen to seniors) volunteered to participate in the on-spot survey during the Premasters exhibition between May 29th and June 5th 2023. The goal of the one-question survey was to evaluate how effective AR is in pulling in the viewer to the storytelling and character's journey. Forty-three students expressed that the AR animations positively connected them more to the illustrations story by

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following the character's journey through the portal, as if being in their shoes and imagining seeing what they see. By that, it served in allowing th e audience to connect to the illustrator's thought process while illustrating each piece. Eight students enjoyed the AR animations as a form of entertainment, rather than thinking too deep about their purposes in reinforcing storytelling. One person thought AR was unnecessary since the posters were clear enough after the oral explanation, while the last one preferred appreciating the artwork as it is, without any technological distractions. These results answer RQ1, that AR can be a strong visual aid for the viewer on the underlying fantasy themes and character narratives imagined by the illustrator. Over 800 views were recorded on the Artivive bridge by the end of the exhibition week; most likely including individual scanning of the postcards giveaways afterwards.

Figure 12. The final highlighted results of the on-spot survey at the exhibition



Stage Two Results

User Interview Survey

Fifteen participants who tried the full exhibition experience were recruited to fill in their feedback. The Survey contained 25 questions, 17 of which were mandatory. The eight optional short answer questions' purpose was to gather terminology used by the audience to express their choices. Six males and nine females ended up volunteering with ages from 15 to 51+. The full survey is included in Appendix B.

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Ten people expressed that this was a new art experience for them. Most of them have an idea about AR with social media filters and mobile apps. The top back camera lens was the Space Ozone Portal and the top front camera lens was the Sahara Eye Quiz. Nine people used android and six used iPhone. Generally, during the exhibition a few android users seemed to have an issue scanning codes if the phones were older models that didn't support automatic QR detection (earlier than 2017). In that case, they were shown the AR filters by one of the researchers. iPhone users encountered no issues. Most of them faced a slight learning curve placing the lens on the floor and interacting with it without causing glitches. When asked directly however, for the most part, they found the AR experiences intuitive overtime. Eleven people strongly agreed that AR increased engagement and enjoyment within the exhibition space, three just agreed, and one person was neutral. As for VR, most people were quite familiar with the concept, but not used to its side effects like motion sickness. The Eye of the Sahara VR experience came on top, followed by Naica Crystal cave short movie and then the Twilight Zone 360 video. Fourteen people enjoyed VR more than AR at the end; a major win. All of them believed XR relayed the stories of the illustrations to them, even if just a little bit.

Exhibition Observational Notes

VR attracted visitors immediately a lot more than AR.

Very excited reactions within the friends' groups could be seen when they looked around or succeeded in interacting with things inside the VR.

Not everyone unfortunately got to try the VR for as long as others, or not at all due to the high demand and long waiting lines.

There was a bit of a learning curve with using the VR controllers for most students, even more so with the older visitors, like parents and teachers.

The Eye of the Sahara had the highest difficulty of struggle and dizziness.

The Twilight Zone 360 video was the easiest to engage with and most people got to see it because it wasn't time constrained. It was pleasant seeing people's smiles and gasps being up close with the eerie sea creatures. Some people lost their balance when looking down and felt they were being sucked into the depths of the blue hole.

Not everyone got to finish the Naica movie due to the crowds. There were however many reactions of awe when they saw the 360 animated illustrations and 3D scenes in the VR, even if briefly.

The screen showing a playthrough of the Eye of the Sahara VR experience served as a visual distraction to pull the audience in while standing in line to try the headset. It was something that wasn't available with the Naica VR area for not spoiling the storyline choices.

Some individuals wearing eyeglasses found it difficult to focus on the text and graphics since they had to take them off in order to wear the headset.

Not everyone present was an art lover, so there were mixed reactions. Those who weren't that interested were passive observers or didn't engage with everything. Art lovers or curious people who loved to learn asked to know more and got one-on-one tours.

Despite explaining how to navigate through the exhibition, many people scanned some of the AR codes, but not all. Some even passed them all by and idly looked at the posters until the VR areas piqued their interest.

Some people needed extra guidance to place the AR filters in the world and how to maneuver around them.

Students who didn't have their phone watched the world filters like they've never experienced something like this when the researchers showed them.

The audience seemed curious about the world filters more than face filters.

Almost everyone started with the world filter of the first illustration in the tour, the Ozone Layer. After that, they'd focus more on the three VR areas (Sahara, Twilight Zone and Naica Cave) and not as much on the leftover three AR areas (Devils Tower, Finland Aurora and Bermuda Triangle).

There were a few unenthusiastic remarks about pulling out their phones and scanning codes just to see Snapchat filters. They weren't aware of the possibilities beyond the usual face filters.

Happy reactions were visible when choosing giveaways at the end.

Some students understood the assignment and picked up the photobooths at the first and last area of the exhibition and took group photos.

The interactive map banner, where visitors pin their dream destinations, was ironically one of the most successful activities after the VR experiences.

Focus Group

Two focus groups were organized on the dates of 20th February 2025, right after the exhibition, and 31st of March 2025. The first focus group was made up of four

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participants (4 males - ages 24, 26, 28, 33), and five participants for the second (5 females – ages 16, 21, 23, 53, 54). They all had interest in art at varying degrees. They were shown the virtual exhibition tour previously created on artsteps. The linear tour guided them to each touch point in the exhibition, to look at every illustration and scan the Snapchat codes. They also tried the three VR experiences with the headset. They debated some of the answers from the survey as well. I recorded notes of their comments during the session. The original survey was condensed into the five most important questions to encourage discussion. Below are the answers recorded:

Favorite AR world filter & WHY?

Focus group 1

Bermuda Kraken x2 (interesting concept, simple interactions like tapping the plane to make the alien fall, cool kraken)

Finland Aurora (learned something new about the fire fox myth, fantasy vibes, the scenery looks pretty)

The Twilight Zone (Unique fish and colors, atmospheric)

Focus group 2

The Twilight Zone x2 (could actually learn the names of the strange sea creatures to connect more to the illustration)Finland Aurora (visually calming, the fox legend is memorable)Bermuda Kraken (very detailed art, illusion of depth created by the moving kraken tentacles and ocean animation)Space Ozone Portal (space lover)

Favorite VR experience & WHY?

Focus group 1

Eye of the Sahara unanimously won because it was the most interactive (had many things to do with hands, symbols and the desert felt real around them)

Focus group 2

Eye of the Sahara x3 (interactive and can touch the art layers, challenging in a good way, couldn't guess what will happen next)

Naica Cave and Eye of the Sahara were tied for one person (interesting to be part of the storytelling and learn, the interactivity is a fun element)

The Twilight Zone (calmest and easiest)

Is this your first time trying an art experience this way?

Focus group 1

Two of them said that it was their first time, one said no and the fourth had tried VR before, but not an art experience like this.

Focus group 2

One of them was familiar with the concept, but the other four were not. It was enlightening for all of them to interact with the illustrations.

Describe your overall experience using the snapchat world filters and VR? Any challenges?

Focus group 1

It was nice to see the little details of the illustrations with the VR headset, but it can cause eye strain. The moving cave scene made one person feel a bit dizzy. VR is also inaccessible to people without a headset, which is expensive, so Snapchat is more accessible. Using Snapchat filters has its own drawbacks though, such as the inconvenience of manually searching for the filter name when the scan feature doesn't work; one person's phone was incompatible. Some filters require larger spaces for walking around, such as Bermuda Kraken and Space Ozone Portal. If not available, glitching may occur or having to reposition the camera and drag the filter elsewhere. Face filters were brought up in the discussion, and they thought they were funny, but mostly aimed at younger people. Overall, they thought the illustrations were extremely cool and showed a lot of effort was put in. It was a new art experience made possible with technology's help.

Focus group 2

They all loved trying out the unique functions each Snapchat filter had, and even saved some of them to try out again in their own time. However, they acknowledged that the VR experiences will stay exclusive to the event it's being showed at. Two of the participants felt a slight challenge picking up the VR controls, but got used to it pretty quickly. The other three expressed frustration while trying to maneuver through the Eye of the Sahara simulation especially. One person felt a bit of impatience with the Naica Cave documentary, and wanted to scrub through the timeline, struggling to use the controller. Despite that, they were still mind-blown by the possibilities VR opened to experience art in a novel way, as if stepping into the illustration worlds. Even getting dizzy could be viewed as part of the experience and makes it feel real. They imagined if they were in the exhibition setting, presenting the illustrations with XR technology would get them interested to visit and check out the unfamiliar features. Being part of the

artwork is rewarding as if they joined in to make it come alive.

Did you enjoy AR or VR more?

Focus group 1

It was 50/50; two of them chose VR, and the other two chose AR.

Focus group 2

All five were very delighted with the VR experiences more than AR.

Takeaways: It is evident that every person searches for what attracts them and every illustration theme tailors to different people. Some people enjoyed the experiences that taught them something new, connected them to the art or made them interact, engage and ask questions. VR was again the prevailing champion despite its drawbacks, as it is less mainstream than AR, which gets people curious to try it.

Figure 13. Exhibition Hall at Princeton School





Note. To watch the exhibition ad, enter the YouTube link: https://youtube.com/shorts/_KSuyljPNEA

Analysis and Discussion

Pros

In the first stage, the overall response was overwhelmingly positive, from the beginning of

examining the illustrations and zine up close, to seeing the animations and taking giveaways. Many students expressed their appreciation for the hard work put in the illustrations and everyone got very excited and surprised when seeing the posters come to life through their phones, as they weren't sure what to expect. A few students were familiar with Artivive and already had the app installed on their phones. AR contributed to making the exhibition experience livelier and more engaging. One thing to worth noting, is that the negative effects were minimal in this case, feasibly because the students were given time to study the illustrations and listen to their narratives before getting occupied by the AR section. A usual argument is that AR takes away from art appreciation as the focus of the experience becomes about the "shiny moving objects" that appear, but when presented in a certain order, it can be hugely rewarding.

The second exhibition was a successful experimental phase full of important revelations. It attracted a diverse group of visitors from teenagers to adults. Almost everyone felt tempted to record the filters and expressed amazed reactions while wearing the headset, spurring conversations among their peers. Both AR and VR significantly increased visitor engagement, with VR in particular, eliciting enthusiastic and curious responses. Visitors were intrigued by the novel way of presenting art through technology. XR allowed them to learn the facts and myths that surround the illustrations, adding an educational dimension to the exhibition, while making the learning process more interactive and enjoyable. The Eye of the Sahara VR experience was the most immersive, allowing guests to interact with the artwork directly. The 2D-3D mixed environments combined with the interactive storytelling of the Naica Cave VR experience enthralled visitors. The 360 animated sea creatures of Twilight Zone VR experience made visitors feel both excited and cower away. Most people never tried or saw interactive world filters designed this way, showing surprised reactions when realizing the potential social media AR has in bringing art to the reality in front of them. AR also has the advantage of being accessible and can be replayed after the exhibition, since the filters get saved when used once on Snapchat. The Most popular world AR lens, the Ozone Layer, was a thrilling start line for visitors. They were fascinated that they can walk inside a portal door that's floating in the hall, and be surrounded by a 360 galactic scene, then turn around and walk out!

Cons

Providing the phone with the app immediately eliminated the reluctancy of installing a new app, as the audience isn't always sure if the experience will be worth the chore. Had that not been handled, the animations would've gone unnoticed by many; that's the unfortunate hindrance of relying on an outside component to complete the art experience. Adding to that, using Artivive requires a stable internet connection, as well as a strong device to run the AR. Before the exhibition opening, I thought I could provide an older model Samsung tablet for the viewers to see the animations, but they didn't run smoothy at all and froze every few frames. Not to mention, the lighting of the venue matters as it can affect the trigger recognition by the app. Moreover, not all artworks have the same high recognition level, as when uploaded to Artivive, it is given a rating out of five stars on one's account bridge editor. Dull or low contrast artworks may be very difficult to recognize when using the app on the printed poster later. In this project's case, the illustrations were very vibrant and had high contrast, and the exhibition hall lighting was decent, but it is something to consider. The illustrator should keep in mind these possible mishaps and test the exhibition functionality before the opening. Keeping the posters also in vicinity of the average height of a person's extended arms when holding a phone, should be taken in consideration to ensure a comfortable experience for the viewer. Artivive also allows users to record the screen while they are viewing the animation for just 10 seconds, which is unfortunate for AR videos longer than that.

In the next exhibition, a few participants with incompatible phones struggled with scanning the Snapchat codes, which unfortunately led to searching for the filter names manually or one of the researchers had to demonstrate on their phone. There is always the possibility of the filters not responding accurately or appearing differently (color shifts, vibrancy, surface-tracking, etc.) on every phone. AR also needs a spacious area for the users to walk around comfortably. The order the illustrations were presented in seemed to have affected the engagement level for AR. Visitors were more active for the first and second illustrations' AR codes, but then got distracted with the VR areas to even follow the arrows. This made the AR codes in the middle go under the radar, especially the ones for Devils Tower, and Finland Aurora. Had they been rearranged, would visitors' survey choices have differed? Many visitors also experienced motion sickness and dizziness from the headset, or unclarity without their eyeglasses; still, they were determined to push through the discomfort. Sadly, VR can only be viewed at the exhibition, unlike AR, so those who didn't get a chance to try it won't be able to afterwards. While the VR experiences were captivating, some visitors showed little interest in AR codes,

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associating them with common social media face filters. Mixed reactions emerged, with some being passive observers and others actively engaging depending on their attachment to art. This is one of the unpredictable problems of making the audience part of the art experience; if they don't use it the way the illustrator expected, it defies the point. The focus shifts from appreciating art on the walls to being isolated behind screens and headsets, trying to find which experience they missed or figure out how to interact properly. This may put an amount of pressure on some visitors who easily feel anxious in unfamiliar situations, as they might feel the responsibility relies on them. The use of XR technology, while innovative, also created barriers for some visitors who may not have had their smartphones with them, didn't have Snapchat installed or were unaccustomed to using the AR and VR controls effectively. Finally, creating with social media AR can be limiting when having to follow each platform's guidelines, such as censorship and filter size limit.

Takeaways: VR headsets cut the users from the outside world, where they feel physically transported into the illustration worlds without any distraction to the flow. This high level of immersion is the primary driver of the rewarding sense of immediate feedback. With AR, digital content competes with real-world stimuli and the social setting, often lacking the occlusion and isolation needed to generate full presence. VR experiences involve physical movement (moving controllers, looking around) and sensory feedback (fear, excitement). The artwork becomes an active event rather than purely visual, experienced and understood through the body's actions. AR can also support embodied cognition, but its impact is less memorable when limited to a smartphone flat screen.

Recommended Immersive XR Exhibition Design Checklist:

AR:

Maintain even moderate lighting across the venue to support AR trigger.

Assign enough walkable space tailored to the themes of the experience and mark paths with arrows to guide the movement of the user.

Stick printed QR codes on the walls at a comfortable eye level, including filter names for manual search if scanning fails.

Position researchers/guides at key points to guide users and show them the filters in case any of them faced issues scanning the codes.

Provide clear signage or printed instructions for navigating the exhibition.

Include video previews of the illustrations on screens for passive viewing.

Test AR recognition and maneuverability in the venue before the exhibition.

Test filters on multiple phone models to check compatibility.

VR:

Save time by setting the space boundary for every headset in its designated area before the start of the exhibition.

Offer sanitizing wipes to clean headsets between uses.

Design the area with printed visuals, such as posters, giveaways and banners, to establish the tone of the experience for users prior to VR immersion.

Have a researcher/guide at every VR station to explain the instructions

If possible, mirror the headset on a monitor for everyone to witness each user's gameplay. Or, show a recorded playthrough video of the experience to entertain the users waiting to try it.

Provide seatings for users that experience dizziness from VR.

Organize the waiting lines and set a maximum gameplay time to ensure fairness for everyone as much as possible.

Ensure the headsets are fully charged, and pack chargers, as they will definitely run out from overuse.

Conclusion

Portal Lore, is a multilayered project that seamlessly merges illustration, technology, and storytelling. Through meticulous research, it delved into world-building inspired by archaeological peculiar locations, brought to life through seven detailed digital illustrations. The project incorporated XR technology to enhance engagement, with digital animation activated by Artivive, AR filters published on Snapchat and VR experiences on Meta Quest 2 headsets. By blending 2D and 3D spaces, layered animations, sound effects, and responsive interactivity, an immersive experience was created that invited people to explore unique environments, characters and narratives. It aimed to collect primary qualitative research through interviews, observation, focus groups and two exhibitions testing different phases.

Overall, the results showed that XR technology stands as a futuristic way to design memorable and engaging experiences, vividly conveying the illustrator's vision.

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This expansion of conventional art forms not only enriches traditional media but also opens new avenues that resonate with a wide audience, particularly through its capacity to enhance storytelling and foster social interaction. VR allowed visitors to feel deeply connected to the art through elaborate environments and interactive narratives, while the accessibility of social media AR filters enabled visitors to play the animations and filters directly on their phones.

Despite its benefits, XR poses challenges like technical dependencies on expensive devices, stable internet, proper lighting and a spacious layout. Relying on AR apps adds barriers, as some visitors hesitate to download or use them. VR headsets may cause discomfort, and the unfamiliarity of the controls can lead to uncertainty for some attendees. The exhibition experience would be deemed incomplete without engaging with all the XR components. Thus, the focus on interactive elements sometimes overshadows traditional art appreciation.

The rapid evolution of the field, exemplified by Meta Spark's shutdown, underscores the need for workflow adjustments and continuous learning. As an illustrator, the process of acquiring new skills to effectively utilize XR technology is crucial for staying relevant in this dynamic landscape. The lack of galleries in Egypt supporting XR experiences and education points to a broader issue of accessibility and infrastructural support for wider adoption. On the other hand, the dilemma of what constitutes the "real" artwork versus its digital extension raises philosophical questions about the nature of art in the digital age. It is essential to recognize the blurring lines when defining VR, MR, and AR as technology advances, which presents a challenge in standardizing terminologies. The positive and negative aspects of using XR in immersive art exhibitions highlight the potential for innovation and the need for thoughtful consideration of its implications.

Limitations and Future Research

Possible limitations could be considered in this thesis. Firstly, the order of placement of the AR codes around the exhibition may impact the participants' experiences and choices. Future studies may test various configurations to determine the most effective arrangement for enhancing visitor engagement. Secondly, experiencing AR fully also relies on stable Wi-Fi, high-performing phones, proper lighting and empty space, as well as the varying familiarity of each participant with the medium, which might influence the outcomes. Thirdly, conducting the exhibition in a different venue specifically targeting art lovers could yield more relevant and insightful feedback from a focused audience. Fourthly, utilizing a controlled environment with a larger sample size would ensure the reliability and validity of the results, thereby enabling more generalizable conclusions. Lastly, employing other methods of gathering responses, such as single page forms, during the exhibition could provide a faster and more comprehensive understanding of visitor experiences and preferences.

Future research should explore the potential of MR, which combines both AR and VR, to further enrich the visitor experience and offer new dimensions of immersion. The integration of high-end gadgets such as Snapchat Spectacles and Apple Vision Pro presents exciting possibilities for incorporating MR into exhibitions and capturing real-time responses from visitors. Additional senses like touch, sound, and even smell, might be included into XR experiences and examined. Moreover, it would be intriguing to design XR experiences that are socially, politically, or culturally significant in order to gauge visitors' awareness, emotions and reactions, while promoting and normalizing XR as a relevant expressive medium. These innovative approaches show that in order to fully realize XR's promise for improving art exhibitions, future research must maintain rigorous methodology and modern technological advancement.

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