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A Pilot Study of an Immersive Folktale User Experience

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A PILOT STUDY OF AN IMMERSIVE FOLKTALE USER EXPERIENCE

by

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ABSTRACT

Immersive media provides new avenues for preserving and sharing traditional folktales. To keep up with modern generations and continue to cultivate an interest in the arts as well as different cultures, this researcher argues that storytellers need to keep on adapting by conveying stories in new ways. Virtual Reality (VR) offers an interesting medium to present and preserve folktales. The goal of this study is to evaluate the user and learner experience of an immersive digital media application design using a think aloud protocol, surveys, and tests to document what worked and what did not in the design, including if any informal learning was achieved. To study the design, the investigator re-created a scene of a folktale using immersive technology. For the study, one scene from the new narrative was selected to investigate. The narrative is based on the story type, ATU 480: The Kind and the Unkind Girls, a wonder tale type in the Aarne-Thompson-Uther (ATU) Index, which is a catalog of folktale types used in folklore studies. For this pilot study, 26 participants, primarily Games and Interactive Media (GaIM) students at the University of Central Florida, were gathered. The prototype entitled "The Daughter," was mainly influenced by a Romanian version of the tale and made for the Oculus Quest VR headset. The surveys and tests showed that learning was perceived as well as achieved and that users did feel a sense of immersion, presence, etc., but low audio issues plagued some users. The practical implications of VR storytelling include the potential for discourse about new service strategies and design guidelines, inspired by an iterative design, as embodiment and an increased sense of immersion may aid in digital storytelling. This study also continues the conversation on preserving digital folktales and the role that authenticity plays.

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CHAPTER ONE: INTRODUCTION

According to Jan H. Brunvand, most of Romania is itself a “living ethnographic museum,” where handcrafting of necessities continues to be an integral way of life (Brunvand, 1972). To this day, many Romanians still live countryside in homes they build themselves and participate in activities such as spinning, dyeing, weaving, embroidering, carving wood, making ceramics, brewing beer, and distilling spirits by hand. Many villagers continue to own traditional costumes, and folk instrumentalists, singers, storytellers, and specialized artisans are easily located. Romania additionally has many folk museums that curate ethnographic pieces. The people still enjoy sharing folk tales; although, much of it is now shared in books rather than verbally. Many of the most famous Romanian folktales have been collected and shared by two individuals – Petre Ispirescu and Ion Creangă. Meanwhile, the use of technology is ever expanding as Europe has taken enormous steps toward supporting the interconnection of culture and technology (Poulopoulos & Wallace, 2022). Romania opened its first virtual reality gallery during the pandemic and projects like iMapp Bucharest, a video mapping competition where winners project their digital and cultural artworks onto Romania’s capital building, shows how technology has already been impacting the community. When reading about the rich culture and collections in Romania, the researcher of this thesis, Romanian herself, was inspired to create an immersive experience based on the Romanian version of a folktale. The prototype created for this thesis is a re-told scene from the Romanian version of the folktale, written down by Ion Creangă, entitled “Fata Babei şi Fata Moşneagului” in the Romanian language or “The Old Man's Daughter and the Old Woman’s Daughter,” in English, sometimes called “The Widower's Daughter and the Widow's Daughter.” There is also another version entitled “Fata Moșului cea Cuminte” or “The Old Man's Kind Daughter” written by Petre Ispirescu. This tale has been

translated into many versions in different countries and comes in many names; for example, one of the most well-known renditions of the story is the German Grimms version titled “Frau Holle.” Although the Romanian versions more heavily influenced this prototype compared to the other versions, as the researcher has Romanian descent and wanted to incorporate aspects of Romania into the design, it is essential to the construction of the tale and the research that some of the folkloric designations be touched upon.

Some storytellers embellish their tales while others give more concise accounts. Some change the wording, while others keep it more intact. These stories have crossed regions and empires. The prototype of the re-telling, created in VR, works to reiterate the story to a modern audience like storytellers have done in the past, constantly evolving with humanity itself and adapting to contemporary ways. It also brings back the aspect of telling the story orally by having audio be the primary source of story deliverance while captivating audiences in new ways. Virtual reality can open doors to storytellers as a modern space to tell lesser-known tales.

In the deep and dark forests of Romania, many myths and legends began. Imminent disasters like earthquakes, epidemics, and war felt too close to home. They jeopardized the lives of the Romanian folk. But the sharing of tales featuring fierce monsters and uplifting heroes gave people, especially the children, hope and understanding. Often, hardships such as poverty provide the basis for many folktales. Children frequently learn to deal with difficulties through these tales. This is reminiscent around the globe. In Hansel and Gretal, “the parents are poor, and finally, they can ‘no longer get their daily bread,’ which brings out the mother’s cruel nature where she thinks of herself instead of the children and wishes to abandon them as she doesn’t have the means to feed them anymore (Lüthi, 2010, p. 64). Folktales signify an irreplaceable and unique kind of literature that produces emotion in most people – young and old. Adults and kids

still flock to these stories as the folktales they hear or read brings them in closer to the culture of their people and helps them understand more about the culture of others. There is great value to engaging people through stories and respecting the stories of others, as narratives hold the potential to illuminate various lifeways and lifeworlds (Willox, et al., 2012).

Moreover, folktales are meant to be an experience. Storytellers traditionally tell tales by speaking, singing, drawing, dancing, and acting. One of humans' defining characteristics is the "need to tell stories and to pass those stories along from one person and one generation to another" (David Adams Leeming, 1997). Stories are an entertaining path to better understanding the nature of one's being and the world around them. As new technology brings forth new affordances, interactive media adaptations of oral or literary fairy tales can be presented in various digital media formats. Social media was one force that brought a paradigm shift around, as technology began changing everyday culture and how people share it. The ways that museums have been utilizing various technologies also points to how people can use these technologies to impart knowledge. Digital collections and the spreading of virtual heritage are just a few examples. Educational technology tools that can aid in learning and which foster engagement are constantly sought by teachers, researchers, museum curators, and more. Culture and cultural heritage management remains in the discussion of how people deal with these new tools. But the discussion doesn't end there.

It can't be denied that this world is altered and shaped by advances in technology. People communicate and exchange information universally. Technology can help us identify culture and create never-ending connected experiences (Poulopoulos & Wallace, 2022). To keep up with new generations and continue sharing these stories, storytellers can continue conveying their stories on different platforms to continue increasing interest in arts and culture by attracting

people in a variety of new ways. This can be seen in the paper Fairy Tale Trans-Migrations: The Case of Little Red Riding Hood, where the author argues that “fairy tales are the perfect feedstock for transmedial storytelling, due to their malleability, their archetypical nature and the fact that they already exist in the mind of their audience” (Tosca, 2013). It is essential to look at what is gained and lost when it comes to adapting folktales into a VR narrative.

Virtual heritage has been explained as virtual reality applied to cultural heritage, and the digitization and creation of this prototype would go along with this. Erik Champion is among the current leading researchers studying virtual heritage. An advantage to using a media format is that audiences can interact with locations in a way that may not be possible in real life, which can be utilized to teach about foreign places. Another advantage is that the immersive technology allows for the oral experience of a folktale to be preserved while including a modern twist to excite new audiences and garner fresh attention.

The primary objective of this study is to evaluate the user and learner experience of an immersive digital media application design using a think aloud protocol to capture any errors or features that are working well in the design. A think aloud protocol is a method often used to gather data in usability testing in product design and development, where users are observed using a product and during that time, they continuously make comments or “think aloud.” This project is a case study of the user experience, informing the audience of what worked and what did not in the design. This is similar to playtesting a game or to conducting user experience testing but instead evaluates the creative work as an experience. The investigator wanted to gain insight into the design and examine any improvements that can be made to provide better retention of foreign folktales. To do so, the investigator re-created a scene from a Romanian folktale using immersive technology (i.e., VR headsets) and embedded information that can be

gained. The technology used was the Oculus Quest headset and controllers. During this VR experience, users can use the joysticks to move around and change their point of view of the environment, almost as if controlling the viewpoint or camera of the narrative. This way, the audience has more control over what they can see while the scene unfolds, almost becoming a part of the production itself. The embedded content is treated as informal learning material that can be evaluated in pre- and post-test measurement instruments. Informal learning is the learning that occurs outside of the classroom, which can aid in formal education. The objective is to build an immersive environment prototype to aid informal learning acquisition. The tests look to see if any informal learning is perceived as well as achieved. The study also measures user experience and attitudes from experience through pre-post surveys.

The purpose of this research is primarily to investigate the design of an immersive cultural narrative. The investigator wants to gain insights into the design of the prototype and examine improvements that can be made. Projects like these can be utilized in museums and accessed on home devices. The project focuses on re-telling the Romanian version of a folktale entitled “Fata Babei şi Fata Moşneagului” in Romanian or “The Old Man's Daughter and the Old Woman’s Daughter” in English. The prototype, created in the game engine Unity, will aid the research on digitizing and distributing folktales for future generations. This researcher makes the argument that by digitizing folktales, stories can continue being shared to modern audiences in new ways, similar to the way oral folktales move to paper or film, and this digitization allows for the continued preservation of these tales in additional avenues. Interactive technologies may offer new possibilities for learning through enhanced immersion and a feeling of presence, which this researcher also wanted to investigate.

CHAPTER TWO: LITERATURE REVIEW

Research examining immersive virtual environments has mostly emerged in recent years. This researcher argues that with the development of new technologies comes a need for storytellers to test out novel mediums to continue attracting new eyes and ears.

Folktales are meant to be experienced. Traditionally, narrators have spoken, sung, drawn, danced, and acted out tales. Numerous researchers agree that the most significant advantage of a VR learning environment is its ability to arouse feelings of presence and immersion. In this study, presence is defined as a "sense of being there;" or a sense of being in one place or environment (i.e., a virtual environment) even when one is physically in another (Berkman & Akan, 2018). When presence is prompted by immersion, it influences flow, allowing users to become even further immersed in the experience. Presence is often a powerful predictor of flow and empathy felt. In this portion, exploration will go into how VR users play a significant role in adapting and responding to VR stories using empathy and embodiment. As technology evolves, folktales can be produced in various mediums to allow people to speak up about modern issues and to keep up with the interests of audiences while essentially keeping ideals of the original tale intact and creating a space to learn more about the lives of the people sharing these tales. By keeping many of the aspects of the traditional story, but incorporating modern issues, it allows for an understanding of what was important to the people in the past, and what is currently important as well. New technology such as VR may provide a refreshing medium for cultural engagement and this research adds to the growing discussion.

Technology and Immersion

In this paper, fully immersive VR is defined as the use of virtual reality with a head-mounted display. Within the term VR, "virtual" refers to the digital representation of something, whereas "reality" indicates an environment that is close to the real world but essentially unreal since it is generated by technologies (Slater & Wilbur, 1997). Schwienhorst (2002) proposed a distinction between low immersive environments, which typically present the virtual environment on a computer monitor with a limited field of view, versus highly immersive environments, which utilize a head-mounted device, enabling a more immersive experience with a wider field of view. Immersion is a user's engagement with a VR system that results with being in a flow state (Schwienhorst, 2002) and this flow state will be further touched upon.

Virtual environments (Slater & Usoh, 1994) are increasingly present in society to inform, educate, or entertain audiences. However, despite the learning affordances of immersion, most of the literature has focused on the low-immersive version in education, whereas research investigating immersive virtual environments has mainly only emerged in recent years (Berti, 2021). This researcher wants to continue the discussion on creating meaningful and contextualized learning experiences by teaching about a foreign language and culture using a re-telling of a folktale in VR. Virtual Reality is among those emerging technologies that offer authentic and situated learning experiences, placing students within the cultural context where the foreign language is spoken and producing a sense of being physically present in a setting (Blyth, 2018). Despite differences in definitions of VR, it is generally agreed that this technology promotes contextualized learning (Chen, 2009, Llyod, Rogerson, & Stead, 2017; Schott & Marshall, 2018), provides authentic experiences (Blyth, 2018; Jacobson, 2017), fosters engagement (Allcoat & von Mühlenen, 2018; Shih, 2018), and increases motivation (Huang, Rauch, & Liaw, 2010). Information has only begun being gathered on telling folktales in this

medium and the cultural learning that may be attained from it. Given the gap in the literature on immersive virtual environments used for cultural education, this study adds to the preexisting literature and fills in some current research gaps. Highly immersive VR has the advantage of immersing learners in culturally authentic contexts that produce a sense of actively being there. This may aid in informal learning practices. Informal learning is learning that occurs in addition to formal learning gained in a structured, formal classroom environment.

Along with the development of technology in recent years, VR has been increasingly "employed in various fields such as vocational training, education, and entertainment" (Martín-Gutiérrez, Mora, Añorbe-Díaz, & González-Marrero, 2017). Current research focusing on VR is mostly in science education with some empirical studies examining language learners' perception of VR for educational purposes as well as the potential impact that highly immersive VR may have on language education. Vesisenaho et al. (2019) agrees with Theodora Pistola et al., that the most significant advantage of a VR learning environment is its ability to arouse feelings of presence and immersion in its users. Another advantage of an immersive environment is that this technology preserves the oral experience of a fairy tale while including a modern twist – an experience like never before. Folktales are meant to be an experience as traditionally, narratives have been conveyed by mythmakers who have spoken, sung, drawn, danced, and acted out tales. The more that technology advances, folktales should continue to be presented in varied digital media formats to keep up with the development of humanity and the interests of modern audiences. In the article Communicating Culture in the 21st Century, author Maggie Burnette Stogner (2015) expresses that there is also an increasing acceptance that digital media can be used to rejuvenate interest in arts and culture by attracting people in a variety of new ways and promising completely new experiences. Novel storytelling techniques and technologies, from

books and films to virtual production and virtual reality, have constantly helped to redefine how people engage with art and culture. The challenge is in figuring out how they can be used to both broaden and deepen cultural engagement. But immersive technologies can potentially help with garnering interest and engaging audiences. The surveys distributed help investigate how virtual reality renderings of folktales can help improve cultural engagement through immersive narratives. Immersive technologies, particularly when combined with powerful narrative, may be used to engage users. As an attempt to spread the knowledge of folktales and create an immersive informal learning experience, the significance of this research is that it adds to the literature on informal learning and looks to answer the question of how an immersive environment may impact the re-telling of folktales. More than ever, audiences can truly enter stories using technology, which allows them to see and hear the focal setting and even experience the moods and feelings accompanying it. This researcher is interested in learning if the immersive qualities of VR folktales can help to increase learning outcomes.

Research Professor of Visual and Media Studies, Victoria Szabo, has been exploring digital and visual representation of landscapes, structures, environments, history, culture, architecture, events, and populations with her work. Szabo's work with augmenting urban experiences is an example of using technology to create a cultural experience. Another aspect, among many others, where VR and immersive technologies are beginning to be utilized is in the news. News producers are increasingly experimenting with news in virtual reality, which is often presented as the ultimate form of immersive journalism since it provides viewers with a first-person experience of a news event (Kristin Van Damme, Anissa All, Lieven De Marez & Sarah Van Leuven, 2019). The New York Times, for example, created a VR project on child refugees: The Displaced (Shin, 2017). Baobab Studios and Saffron Interactive are also two examples of

those beginning to use VR to tell compelling stories and teach users. Through comedic timing, beautiful art, and compelling stories, Baobab Studios states that it aims to create VR animation that everyone can enjoy – regardless of age, background, or personal experience. Youtube is also full of published VR short stories that can be accessed online with a computer or VR headset. However, the only immersive folktale experience this investigator could find on VR Youtube was "Jack and the Beanstalk Immersive 360 tour." It told the story of Jack and the Beanstalk through a narrator and then a 360-video experience. Unfortunately, the animations did not move in the experience; they only stood in place. While this made it more book-like, the medium could have been better utilized to create more of an experience by including some movement. Since few folktales have been created using the game engine Unity, this innovative narrative will be ahead of the game. As an increasing number of researchers utilize technology as an innovative method for digital learning, this study fills in gaps about how an immersive environment might affect the digital learning of a foreign folktale, keeping many of the original key points intact while also presenting modern problems of modern people to a modern audience. This pilot study will begin to address critical issues in the design of tools for informal learning and will look at the connection between learning, emotions, and attitude.

Virtual Heritage

Experts in virtual heritage had – until quite recently – established the reconstruction of tangible elements like artifacts, buildings, and landscapes as the principal aim of virtual heritage; yet, this takes into account only a small portion of human culture "and ignores the expressive and interpretative potential of VR" as a form of digital media (Champion & Pujol, 2011). Fortunately, the field is now taking into consideration the meanings, purposes, and processes behind physical elements, along with symbolic elements, human activity, and dynamic

interaction as integrated components of the virtual world, seen in the research of those such as Champion and Sekiguchi (2004) as well as Jacobsen and Holden (2007). The folktales and stories of the people can't be ignored when it comes to painting an entire cultural picture. The aim of VR research to create a feeling of presence both effectively and consistently, and the aim of cultural heritage to develop understanding and awareness of otherness, can be viewed as drivers to the following concept of cultural presence. Cultural presence combines the notion of 'being there' with the communicational, social, and contextual goals of heritage through the addition of symbolism, explicit expression of self-identity, and learning (Champion and Pujol, 2011).

Empathy and Embodiment

VR is a computer-generated experience that can simulate physical presence in real or imagined environments (Kerrebrock, Brengman, & Willems, 2017). VR storytelling can be an effective tool for sharing experiences. It is noted in previous research that virtual embodiment can lead to "spatial experiences, gameplay mechanics, and cinematic communications particular to VR" (Tabatabaei, 2020). In a screen-based medium, the size of an entity is not only determined by its proportions relative to its surrounding entities, but also the viewing scale or size relative to the screen frame. However, the "framelessness of the medium" when it comes to VR makes it an interesting storytelling tool (Tabatabaei, 2020). While a frame-based medium always situates the player outside of the virtual world and the frame becomes a slight barrier of embodiment, the removal of this frame offers more of an embodied experience. In a virtual environment, viewers who are close to characters or sharing the same space may also feel their

emotions or situations more strongly, largely depending on the level of naturalism in the simulated world. To absorb oneself in VR may be one way to stimulate empathy, or the capacity to understand what another person is experiencing. Stimulated empathy with others in VR can make the virtual environment seem more realistic to users. Empathy frequently arises in discussions of VR and storytelling (Shin & Biocca, 2017). In addition to embodiment, people can understand and empathize more when they comprehend another person's subjective experience and environment. Empathizing can help to more strongly combine VR and physical reality, producing higher credibility (Beadle, Brown, Keady, Tranel, & Paradiso, 2012). Becoming engrossed in VR experiences may stimulate empathy. Stimulated empathy in VR can increase a user's overall empathy and the perception that a virtual environment is realistic depending on the level of naturalism found in the simulated environment. Through empathy, users can feel a sense of embodiment or embodied cognition based on the stories. Arousing empathy and embodiment have almost always been at the core of storytelling despite the medium. In VR, storytellers have simply found a new tool to give viewers an even closer physical sensation of another person's lived experience or their stories. When presence is triggered by the level of immersion, it influences flow. Users cognitively assess such presence and flow. If they believe them to be worthwhile, they internalize those qualities by putting themselves into the VR stories. The mechanism works only when technical qualities are appropriately translated into their associated cognitive qualities. Accepting immersion is a sensemaking process by which people give some meaning upon 3D objects and related experiences. VR users play a significant role in adapting and responding to VR stories using empathy and embodiment. It can be inferred that VR experience follows a two-tiered process of immersion and empathy; although, the two components are built upon one another and can be

clearly differentiated. The two-tiered process of immersion comprises presence and flow, which are experienced by users in the first place (user experience) and then empathy and embodiment, which are selectively experienced by users (quality of experience). Flow refers to a state of mind characterized by focused concentration and elevated enjoyment during intrinsically interesting activities (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003). Flow may link the two processes; the consequence of the two-tiered process is engagement. It can therefore be said that flow plays a certain role in the two-tiered process mediating presence and empathy. It is worth examining a potential underlying mechanism that might account for the effect of flow on empathy and embodiment. It may be inferred that, in a VR context, flow works independently from technological quality, being influenced by the users' own will, mood, and disposition. VR enables people to rediscover and explore. The practical implications of VR storytelling include the potential for new service strategies and design guidelines. Understanding how users are immersed in VR stories will allow a VR developer and designer to work more efficiently and effectively.

There are a few challenges involved in producing VR work in a storytelling context, and it is important to keep these in mind as well. One implication is that no matter how functional and advanced the technology, the key is to focus on the story, not the technology itself or any special 3D effects. To boost the immersive experience of VR stories, engaging and authentic content needs to be developed. Immersion alone is not enough to generate a desired feeling; emotions must go along with it (Shin, 2017).

CHAPTER THREE: APPLICATION DESIGN

To increase interest in learning more about foreign locations and stories, the folktale is a great place to start thinking about possibilities. Traditionally, "the penetrating research of many scholars has sought to account for the structure and history of folktales and the ways in which tales are transmitted and diffused" (Lüthi, 2010). Linda Dégh's book entitled "Folktales and Society: Story-telling in a Hungarian Peasant Community: Expanded Edition with a New Afterword," presents the idea that folktale research has had a two-pronged aim: interest in the nature and origins of oral narration and in folk culture as expressed in the content and form of the folktale. In the book, another Eastern European country's relationship to folktales was studied, providing a foundation to this researcher's study. It is essential to look at what is gained and lost when it comes to adapting folktales in various mediums. Oral folktales used the power of the narrator to portray the story and make it come to life. In the prototype, audio recordings were instead used to make the story come to life. This is similar to how films will use actors to embody a character; yet in virtual reality, the embodiment mainly comes from the overall environment of the medium and the accompanying feelings. In Dégh's book, it states that "the mere text of a folktale is lifeless and can be truly observed only during the telling," (Dégh, 1989) which is supported by Max Lüthi, (Lüthi, 2010) who speaks about the flatness of folktales when he writes, "in its essence… [folktales] lack the dimension of depth." Any and every medium for storytelling has its pros and cons. When it comes to passing down stories verbally through a narrator, people can see the narrator's body language and expressions when telling the tale, which creates an experience. With books, much of the experience is left to the imagination of the readers. With films, cinematography adds to its experience. Virtual Reality provides an

interesting medium that allows folktales to come to life, adding a layer of dimension, where audio recordings can act as the narrator.

Folktales are changed a little depending on the orator or writer, but typically, the bigger pictures and ideals remain the same throughout time. The small details of a story aren't usually remembered; thus, the big details and overall themes are instead kept through renditions as they are better retained. This way, the ideals remain unchanged or similar to previous versions while presenting new ideas too. As expressed by Dégh, "narratives arise from different conditions, depending on time and place [but] they all have something in common: they have their origin in a social need" (Dégh, 1989). Since the researcher is of Romanian descent, it was a goal of the researcher to create a design that would be reminiscent of a Romanian home, and to express some of the difficulties that people of Romanian descent struggle with. Even certain words learned in Romanian, such as "copac" for tree, helps to further the theme of environmentalism and community. The concept of the young girl having to leave her house to go work because her father can't afford it anymore and then the girl falling into an alternate reality is a modern interpretation of societal issues. Folk music was used in the background at the end and many small details were added to represent Romanian facts. For example, sunflowers grow abundantly there as Romania is a main exporter of sunflowers, sunflower seeds, and sunflower oil, so sunflowers were incorporated into the visual design. All of the details were deliberate and worked to portray visual information about Romania, presenting information as accurately, authentically, and engagingly as possible, keeping the affordances of Unity in mind. As stated in previous research, "Virtual reconstructions are also culturally embedded interpretations of elements belonging to society" (Champion & Pujol, 2011). Thus, virtual reconstructions help

social groups represent their identity to themselves and to others, as they are part of cultural heritage and not just impartial communication tools.

While the prototype created for this experiment was mainly based off the Romanian tale, "The Old Man's Daughter and the Old Woman's Daughter," other versions also exist and should be touched upon. For example, the Grimms' version is called "Frau Holle." The Tale of the Kind and Unkind Girls (Tale Type 480), is more of a well-known tale in Europe than America. ATU 480: The Kind and the Unkind Girls, formerly known as ATU 480: The Spinning-Women by the Well, is a wonder tale type in the Aarne-Thompson-Uther (ATU) Index. The Aarne–Thompson–Uther Index is a catalog of folktale types used in folklore studies, which divides tales into sections with an ATU number for each entry. The ATU Index is the product of a series of revisions and expansions by an international group of scholars, created by Finnish folklorist Antti Aarne in 1910. Although the versions vary slightly, many of the instances and overall themes remain the same. A step-daughter, or less favored of two daughters, leaves home seeking employment, or is sent to retrieve water with some object that is impossible to collect water with, or is sent into the woods to look for some fruit that doesn't typically grow at that time of the year. The girl encounters several animals, persons, and objects that need help because they're neglected, and the girl helps them. She finally reaches a house where she's hired as a servant. Since she's hard-working and caring, she's given the option to choose a payment of luxurious rewards or more humble ones, and the girl always chooses the humble one, which ends up surprisingly being the most luxurious. In some versions, she's not allowed to go in some chamber, but does so when the witch is gone for a little while. The room is full of treasures, and the girl takes some of them and runs away. The witch follows her, but in the path, the same animals and objects that the girl helped at the beginning of the story pay her back by assisting in

her escape from the witch. Seeing that her step-daughter has returned successfully, the step-mother sends her own daughter expecting her to return with the same results, but because she doesn't help anyone when she's asked and always chooses the most luxurious rewards, she receives the worst gifts possible, or is overtaken by the witch when she tries to escape her house. This tale type belongs to the category Supernatural Tasks, which means that the heroine has to accomplish several tasks of supernatural nature. It tends to have predominantly female protagonists and antagonists in almost of all its variants. In the Aarne–Thompson–Uther Index, this tale is known as The Tale of the Kind and Unkind Girls (Tale Type 480) and has been told in different versions from Germany to Spain to the Philippines and India to the USA.

The prototype was mainly influenced by Ion Creangă's version of the story. Creangă was one of the storytellers who began keeping written records of folk tales in Romania. Childhood Memories, his novellas, short stories, and anecdotes are among his best-known works. He was one of the first people in Romania to begin collecting folktales by writing them down. At the time, not many others were doing that there. The prototype begot alongside this thesis is a retelling of this story that fits the themes of modern fantasy for today's audiences and the script was created with the affordances of Unity in mind as Unity was used to create it. Friedrich Ranke, Mackensen, Peuckert, and the Swiss Richard Weiss in addition to the Schwieterin school and to Henssen and his disciples, have frequently reiterated "that it is important to research the social conditions of folklore" (Dégh, 1989). It is imperative to recognize the importance of this story during its time in history and analyze what it tells about the Romanian people and what they hold dear to their hearts. By keeping the ideals of the original story intact, but speaking upon modern issues, modern retellings offer a place where discussions can continue as societal issues grow and change.

In the Romanian version of the folktale, an old woman marries an old man, each one already having one daughter. The hard-working daughter belongs to the old man, and the lazy daughter belongs to the old woman. The good daughter leaves the house after the woman is unhappy with her. On her walk in the forest, she meets a dog, fountain, oven, and a pear tree who she helps along the way even though they don't know what to offer her in return at that moment. The lesson of being kind to others who can do nothing for them is an important one. Although in some versions the characters that she meets are different, this researcher enjoyed the specific use of the characters in the Romanian version. The good daughter helps the dog which seems to symbolize being kind to all others. Assisting the tree appears to symbolize caring for the earth while cleaning the oven and fountain symbolizes taking care of one's home. She eventually arrives at the house of Saint Sunday, who is a wise old woman. The woman says she needs help taking care of her babies, who turn out to be strange creatures of the forest. However, the child is not afraid of the strange animals and cares for them. Saint Sunday then asks her to go upstairs in the attic and choose a box that she thinks is worthy of her work. The child picks the smallest box, and then returns to her house. On her way home, all of the characters that she helped on the way to the house of Saint Sunday – the dog, fountain, oven, and the pear tree – offer her help on the way home, such as giving her food when she's famished. When she arrives home, she opens the little box, where many cows, horses, chicken, pigs, orchards, and crops magically appear. The old woman and her lazy daughter are envious, so the lazy daughter decides to go out and bring back some treasure for themselves. However, on her walk, the lazy daughter refuses to help the dog, fountain, oven, and pear tree. When she arrives at Saint Sunday's house, she doesn't help much but then chooses the biggest box, golden and shiny, as her reward. The story ends with the lazy girl opening the large box, where nothing can be found but huge monsters that appear.

In the VR re-telling of the story created by the researcher for this thesis, the main character is a girl named Anca, who is about to walk through the forest to her aunt's house as her house is being sold since her father can no longer afford it. These folk tales help children deal with aspects and emotions tied to hardships such as poverty, which their parents may not know how to deal with communicating about in everyday life. Anca goes around to meet a magically talking tree, dog, and oven which help her after she helps them. The dog embodies taking care of oneself and those around them, which is an important lesson to be learned. The oven then embodies taking care of one's home, as having a clean home can aid in bettering one's mental and physical health. The tree embodies taking care of one's earth, or the environment. The part of the prototype that was looked at for this pilot study includes the meeting with the magical talking tree. In the prototype, the main character Anca walks around and sees trash everywhere. Then, she realizes that there is a talking magical tree, which says that he can't do anything for her but asks if she can please pick up some trash. Anca then picks up some trash, and as she does so, strikes a conversation with the tree who eventually reveals that he may be able to help her in return after all, by giving her coordinates to find golden apples.

Some key design features in the story includes Bran Castle on a hill in the distance as Bran Castle is an iconic castle in Romania. It is more typically recognized as one of "Dracula's castles." The story of Dracula was inspired by historical accounts of the 15th-century Romanian prince Vlad Tepes, or Vlad the Impaler, so this castle was a key feature in the aesthetics of the prototype as it is perhaps his most well-known castle, and he is a notorious figure known worldwide. The wooden cabin and outhouse seen in the design is what would typically be found in more rural areas of Romania. The sunflowers in front of the house were added because Romania is a considerable distributer of sunflowers, seeds, and sunflower oil. While these small

details all aim to tell a bigger story, it would be helpful to incorporate these facts into the story and make them more apparent in future iterations. The trees were part of a European expansion pack found on Unity. The magical talking tree, while more reminiscent of Norse mythology, was the most magical looking tree that could be found in Unity and helped to create more of a memorable experience. In future iterations, the creator would like for users to be able to explore the castle and for there to be more interaction.

Iterative Product Design Process

The iterative user centered design process is an approach that designers, developers, educators, and others use to improve a design or product with feedback loops from users and stakeholders in a collaborative co-design process. Application designers will often create a prototype to express their ideas and test it with people who represent the typical users. The feedback from those individuals is documented, and then used to redesign the next version of the prototype. This process of design, build, and test is repeated until they reach a solution. Such a process is important to ensure usability before measuring learning informal learning outcomes (Harrington, 2021).

When deciding on the product design, the prototype was heavily influenced by the work done in the article "The Turkey Maiden Educational Computer Game." Thinking about the affordances of the medium, and how the main character in this ATU story type is typically female, helped in the creation of the prototype. Similar to the design of the game in The Turkey Maiden Educational Computer Game (Underberg-Goode, 2008), feminist game-design principles were the foundation of the narrative design.

The production of the folktale with an active female protagonist into a narrative involved looking at feminist game design principle (i.e., gender differences in play), and understanding how features of digital environments (i.e., spatiality and interactivity) affect storytelling and game play. These aspects were inspired by "The Turkey Maiden Educational Computer Game." As expressed in "The Turkey Maiden Educational Computer Game," a significant factor to be taken into account during creation is "feminist game-design principles, such as understanding the role of emotional stimuli and the importance of story" (Underberg-Goode, 2008). Considering the look of an age-appropriate and positive female game character was foundational in this design. 3D Models from Mixamo, the Unity Asset store, Turbosquid, and Sketchfab were looked at and downloaded to incorporate into the narrative. As the prototype isn't a finished product and only includes a small clip of the main character helping a tree character along her journey, already-available 3D models were utilized. Nevertheless, for the final prototype to be finished in the future with intel from this study, more art drawn by the developer will be incorporated into the design and further pondered over.

According to Shari Ray, who authored "Gender Inclusive Game Design: Expanding the Market" (2004), male stimulation response is often motivated by visual stimulus that leads to a physical response, and this is thus the stimulus generally employed in popular computer games. However, females, according to Ray (2004), additionally require emotional and tactile stimuli, which can be generated through storytelling, "and, it is here that story's importance to feminist computer-game design figures significantly." She also advocates the building in of elements like Non-Player Characters (NPCs) and backstory to help develop an emotional hook. Folkloristic insights are used in the project to advance gender-inclusive game design and adapt linear

narratives to spatial digital environments. Although the prototype created is not interactive, there are plans for the final design to eventually be more game-like.

The design was also influenced by Dégh's insights, who mentioned that the simultaneous interaction of three principal factors is essential to the existence of the folktale and its research: tradition or the communal contribution of past bearers of tradition, the present storytelling community, and the narrator. As told by Dégh, tradition "originates through the chain of individual contributions" (Dégh, 1989). Narrators are described as those who keep the folktale alive, embroider it, and popularize it in the community. In the VR prototype, recorded audio from the narrator keeps the folktale alive.

Product Design Principles

The prototype entitled "The Daughter," was created in Unity, a cross-platform game engine developed by Unity Technologies. Some of the design elements can be seen in the following figures (Fig.1, Fig.2, Fig.3).

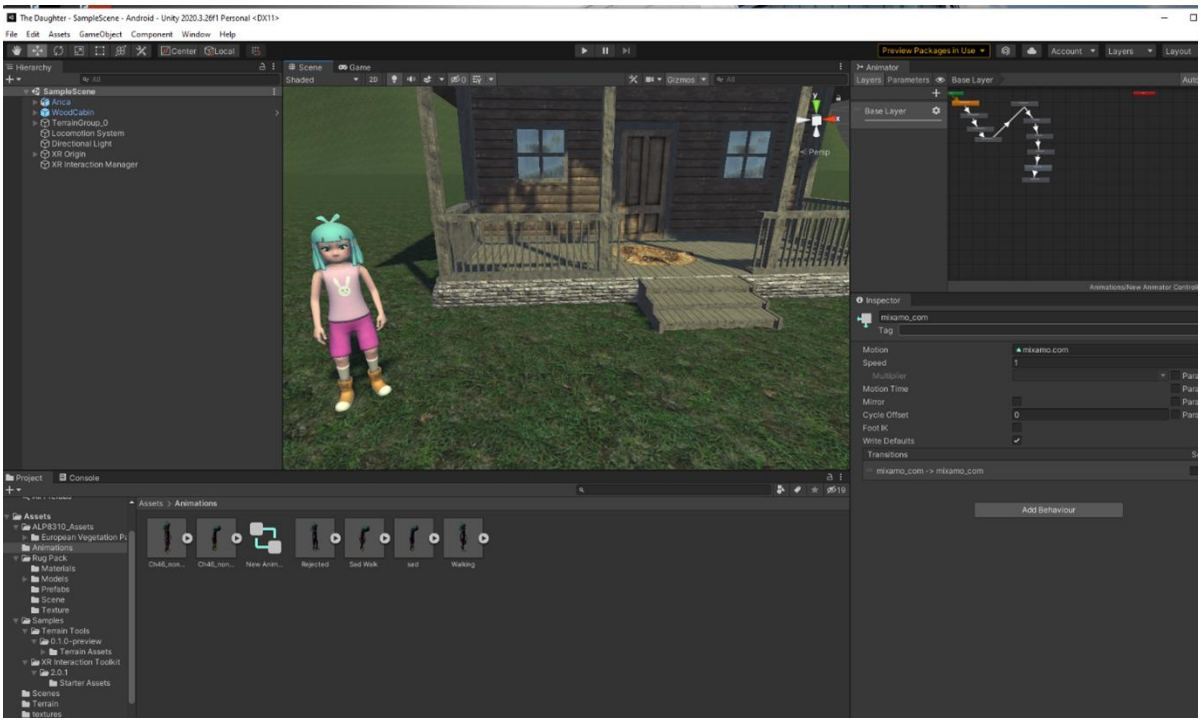


Figure 1: An Early Version of the Prototype

Figure 2: Playing the Game

Figure 3: Demonstrating how to use the VR Headset

Unity allows users to construct and animate 2D and 3D renderings. Unity has AR and VR functionalities, so projects can be paired with mixed reality devices. Oculus Quest headsets were utilized to build and view the prototype for this project. First, the thought of whether a 3D or 2D prototype would be better was assessed. After looking at VR research, it was decided that a 3D prototype would be better as VR tends to be a more immersive environment. Additionally, the aspect of incorporating a sense of realism was introduced in history by different "film theorists… each trying to explain the formal and social elements which could transport the audience into the fictional world" (Tabatabaei, 2020). In VR, this sense of realism and naturalism is achieved with assets. By implementing realistic assets into the simulated environment, such as the European expansion pack for the trees that included trees native to that location, a level of naturalism was achieved with the aesthetics.

The Making of The Immersive Folktale

The prototype created was of one scene out of the entire story the author plans to make. The scene introduces users to the character of Anca and is particularly about the part where Anca meets the magical tree in her travels through the forest. Anca is a younger child characterized by having light blue-green hair. On her pink tank top, there is a bunny whose eyes are x's, adding a modern layer of edge to her look. Although her character has a cartoon look to her, she is memorable and is also an appropriate height for her age. In the folktale re-telling, Anca is seen in a forest, with her home, a cabin house, behind her, and Bran Castle on a hill in the distance in front of her. Her body movements (i.e., kicking the dirt) show that she is upset, and her internal monologue that can be heard tells the reader that she's heading to her Aunt Cornelia's house where her and her father will be staying since they can no longer afford their home. Using Bran Castle as a reference point, she heads to Aunt Cornelia's house. On her way there, she stumbles into an alternate universe and is now in a magical forest. Anca then encounters the magical tree character, a tree which speaks telepathically to her with a dry, old voice. Romanian words such as "copac," which translates to tree, and "fata" which translates to girl are used. These words were chosen because they are words that are often used in everyday language. The magical tree asks her to help clean up and mentions that he doesn't know if he has anything to repay her with. Anca tidies up and makes conversation with the tree so they can become better acquainted. She tells him of her problems and as he realizes she needs gold – a frivolous human thing – he instructs her with the knowledge he has of golden apples. This prototype is just one scene out of the entire story, chosen for its mesmerizing and emotion-evoking qualities. The author's hope was that the empathetic scene, albeit short, would still allow participants to better retain the information. As different problems continue plaguing communities, it's vital to capture these modern issues in modern versions of tales. The concept of taking care of your home, your earth

and others adds to the overall theme. The scene in the prototype concentrated on taking care of our earth. The sentiments that came along with the original folktale were preserved since much of the story was the same, but it also touched upon modern issues that audiences can relate to and become more aware of. At the end of the experience, folk music played while the background of the story was explained a bit more to help with the preservation of the tale and increase situational understanding for anyone accessing it in the future.

This researcher wanted to show all that can be done with Unity, so when creating the prototype, its affordances were kept in mind. The design was mainly created with Unity features such as the Unity Timeline to establish character movement and voice. The Unity Asset store was also heavily utilized. Additionally, by allowing users to control the camera angles, the researcher intended to allow the audience to become a part of the production itself.

CHAPTER FOUR: METHOD

In the Method section, the research design, participants, procedures, and measures are looked at. Participants, mainly Games and Interactive Media (GaIM) students at the University of Central Florida, were asked to follow COVID safety guidelines and adhere to safety protocols during the research study. The Maker Space at UCF Downtown, in room 178 of the Communication and Media Building, was chosen as the study location.

Research Design

This research study is a simple one-group pretest-posttest design, without a control condition. This is a mixed methods research design using quantitative data and qualitative data on effects from exposure to the virtual folktale. It was decided by the researcher that the study would include a pre- and post-survey as well as a pre- and post-test. Supplementary think aloud protocols, where subjects were audio recorded only, added depth and context to many of the survey answers received. The purpose was to gather data on the effect of exposure to a virtual folktale and inform the design that led to that experience.

Research Question 1: Using the immersive folktale will result in learning gain from exposure to the application.

H0: No difference between the pretest scores and the posttest scores
Pretest = Posttest

H1: Difference between the pretest scores and the posttest scores
Pretest =/= Posttest

*Paired sample t-tests are used to evaluate the test score data

Participants

The user profile population was Games and Interactive Media (GaIM) students at the University of Central Florida, which there is a total study population of about 1,500 GaIM students. A volunteer sample of 26 participants (n = 26) participated in this IRB approved pilot study. Most participants were 25 years old (*Mode* = 25), and 14 identified as male, 11 as female, and 1 as non-binary. According to Cohen, a sample of 26 is sufficient (Cohen, 1992) when a large Effect Size is expected. All 26 participants experienced the same condition. No power analysis is required for the think aloud protocol.

Participants were asked to follow COVID safety guidelines, such as wearing masks. They were assigned to sit at tables socially distanced from others. Participants were required to be 18 years of age or older to take part in this research study, be able to read, understand, and sign a consent form in English, and have normal vision as well as hearing. In the pre-survey, data was collected on age and gender as well as familiarity with VR, motivation to learn, and experience with immersive folktales. In the post-survey, engagement, presence, interest, immersion, and UX were evaluated.

Procedures

This study uses a pre- and post-survey as well as a pre- and post-test to gather information from participants. Think aloud protocols also occurred, where subjects were audio recorded only. The participants recruited were mainly UCF students and they completed the pre- and post-survey as well as the pre- and post-test in person. To complement the qualitative case study, an experimental research design was used to gather data on the learning gains and attitudes. The learning gains were measured in a simple, one group pretest-posttest design. Attitudes were also measured in a simple, one group presurvey-postsurvey design. The study

location chosen was the Maker Space at UCF Downtown, in room 178 of the Communication and Media Building, and the study was held over one week. Volunteers arrived at their scheduled day and time for the study. The consent process was administered by the investigator, and all forms were afterwards secured in the investigator's locked office, in a locked cabinet, at the end of the study each day. In the Maker Space at UCF Downtown, there was room made for social distancing by having at most 6 students participate in a day over the course of a week. The Oculus Quest headsets were cleaned and there were items to clean the lenses if needed as well. Eye masks for the Oculus Quest headsets were also distributed if users wanted any. Participants who consented to the study were issued an ID#. Participants were given a pretest and a presurvey with each participant's ID# marked on each document. No names were recorded. In the Maker Space, there are around 10 Oculus Quest headsets total, so there were extras in case one wasn't working properly. The audio was recorded using the computers in the Makerspace. The investigator demonstrated how to use the immersive folktale application and reviewed the think aloud protocol with the audio recording device. Everyone was assigned to sit at tables socially distanced. The tables held a pre-test, pre-survey, and an Oculus headset with an eye mask. After the consent process was initiated, participants took a presurvey and pretest. Once they were completed, the researcher assisted everyone on how to use the Oculus headset. The researcher then demonstrated how to use the immersive folktale and demonstrated the think aloud protocol. The researcher helped participants put on the headset and turned on the audio recording device for each participant. Participants were audio-recorded during the experience and had a maximum of 30 minutes to explore the immersive folktale. After viewing the prototype, participants were asked to take a post survey and posttest.

Measures

Actual learning is measured as the percent change in pre- and post-test scores on facts and concepts whereas perceived learning is subjective. In this study, both were measured to gain a better understanding of the informal learning achieved. Three UX questions were based off the System Usability Scale (SUS) but modified to better match the study. The System Usability Scale is often used to help UX designers gain feedback.

CHAPTER FIVE: RESULTS

The results support that perceived learning was achieved as well as actual learning. The posttest scores (M = 75.38, SD = 18.162) were statistically significantly higher, $t(25) = 11.295$, $p < 0.001$, than the pretest scores (M = 22.31, SD = 20.651). Most participants were 25 years old (M = 25.1923, SD = 2.34980) and 14 identified as male, 11 as female, and 1 as non-binary.

Descriptive Data

Table 1; Data Gathered from Survey and Test Questions

Question	Mode	Median	Mean	Standard Deviation
Pre Survey				
"How familiar are you with using the virtual reality headset?"	1	4	3.5	2.285
"Rate your level of motivation to learn about the cultures of other countries."	7	6	6.15	1.156
Post-Survey				
"I was curious about how the story would progress."	7	6.50	6.27	.919
"I felt deeply engaged by the story."	6	6	5.96	.916
"I felt present in the narrative."	7	6.50	6.15	1.12
"I was not distracted while using the virtual reality headset."	7	7	6.38	1.061
"I wanted to learn more about the culture as a result of this experience."	7	6.50	6.38	.697
"I'm excited to share this immersive experience with a close friend."	7	6	6.15	.881
"I'm excited to repeat this story to a close friend."	6.50	6	6	.894
UX				

Question	Mode	Median	Mean	Standard Deviation
"I thought the system was easy to use."	7	6.50	6.08	1.164
"I think I would need the support of a technical person to be able to use this system."	2	2	2.85	1.87
"I felt very confident about using the system."	7	6	5.65	1.468
Heuristics				
"The narrative offers something different in terms of attracting and retaining the players' interest."	6	6	5.88	.993
"The game utilizes instinctive audio and visual content to further the players' immersion in the game."	6	5	5.19	1.674
"The audio is clear and easy to understand."	5	5	4.35	1.648
"Visual layout is efficient, integrated, and visually pleasing."	6	6	6.15	.732
"Art is consistent, professional, and compelling to the themes."	7	5	6.08	1.055
"The story encourages immersion."	7	7	6.27	.962

As seen in Fig.4 below, most participants considered themselves unfamiliar with the VR headsets (*Median = 4, SD = 2.285*) but they were highly motivated to learn (*Median = 6, SD = 1.156*).

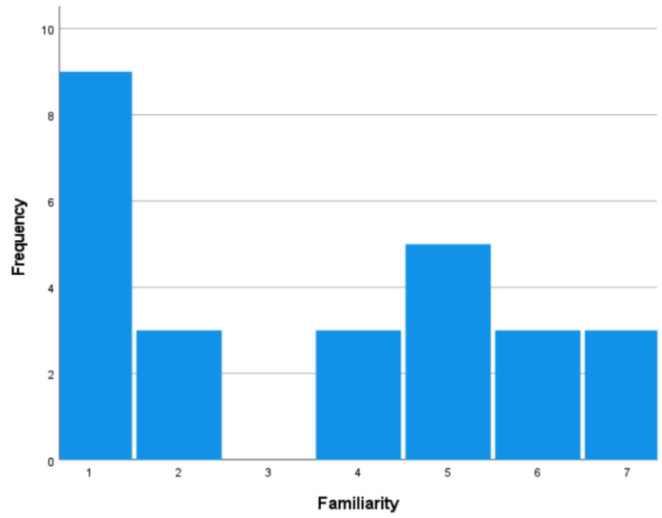


Figure 4: Histogram for Familiarity Question

The presurvey question on motivation asked users to: “Rate your level of motivation to learn about the cultures of other countries.” A 7-Point Likert Scale ranging from “Highly Motivated” to “Highly Unmotivated,” was used. Most participants shared that they were highly motivated to learn about foreign cultures (*Mode* = 1, *Median* = 6) as can be seen in Fig. 5.

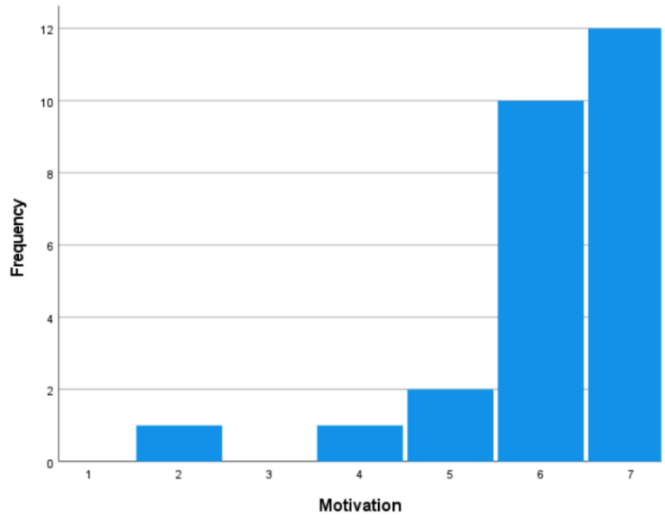


Figure 5: Histogram for Motivation Survey Question

Post Survey

Post survey question 1 stated: “I was curious about how the story would progress.” A 7-Point Likert Scale ranging from “Strongly Disagree,” to “Strongly Agree” was used. As seen in the following Figure 4, most participants shared that they strongly agreed with the statement (*Mode* = 7, *Median* = 6.50).

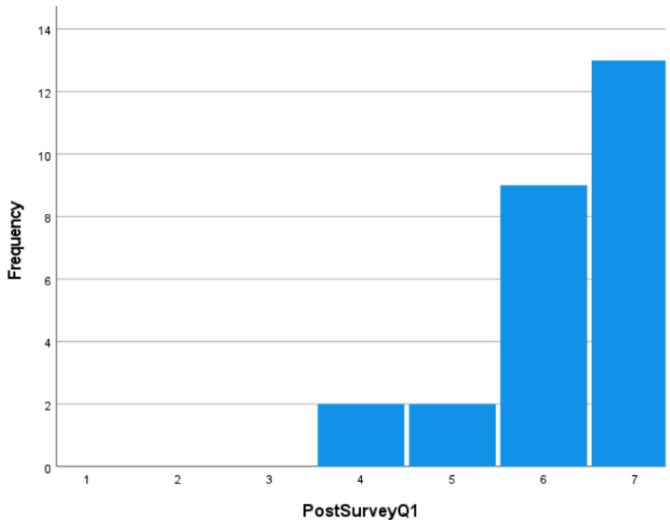


Figure 6: Histogram for Post Survey Question 1

Post survey question 2 stated: “I felt deeply engaged by the story.” A 7-Point Likert Scale ranging from “Strongly Disagree,” to “Strongly Agree” was used. Most participants shared that they agreed with the statement (*Mode* = 6, *Median* = 6.00), which can be seen in Fig. 7.

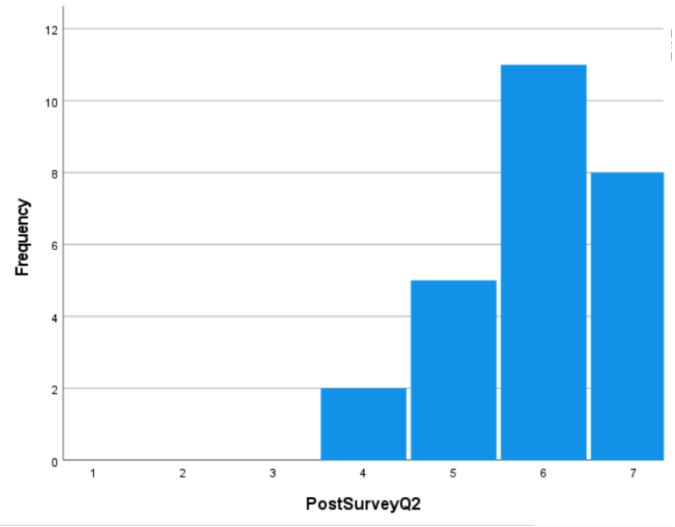


Figure 7: Histogram for Post Survey Question 2

Post survey question 3 stated "I felt present in the narrative." As seen in Fig.8., most participants strongly agreed with this statement (*Mode* = 7, *Median* = 6.50).

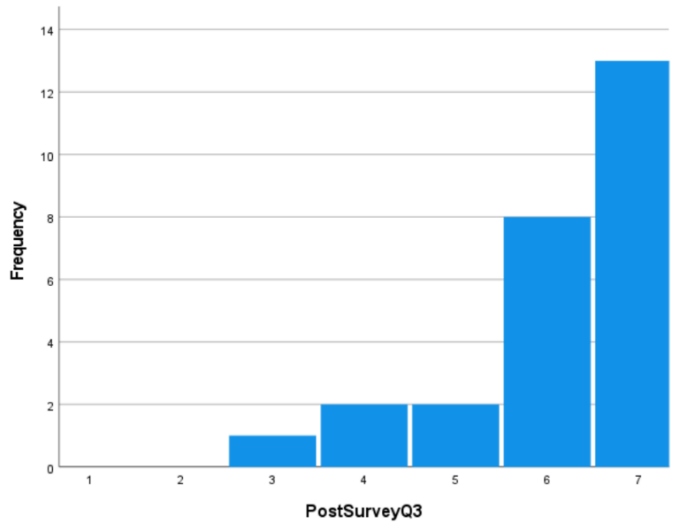


Figure 8: Histogram of Post Survey Question 3

As seen in Fig. 9, post survey question 4 stated “I was not distracted while using the virtual reality headset.” Most participants strongly agreed with this statement (*Mode* = 7, *Median* = 7).

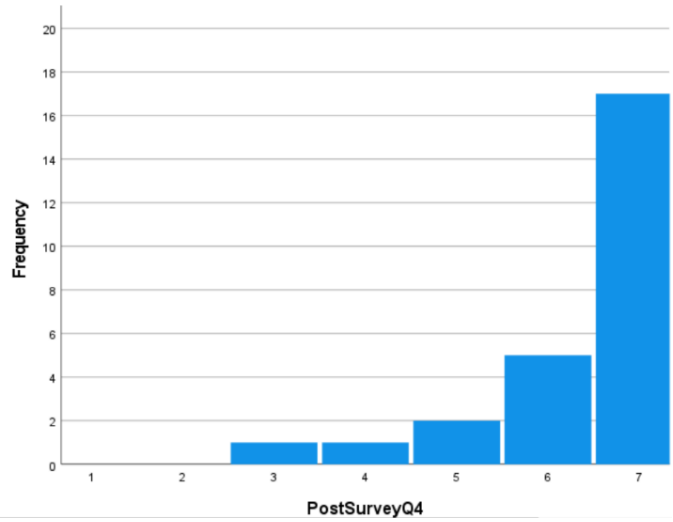


Figure 9: Histogram for Post Survey Question 4

Post survey question 5 stated “I wanted to learn more about the culture as a result of this experience.” As shown in Fig. 10, most participants strongly agreed with this statement (*Mode* = 7, *Median* = 6.50).

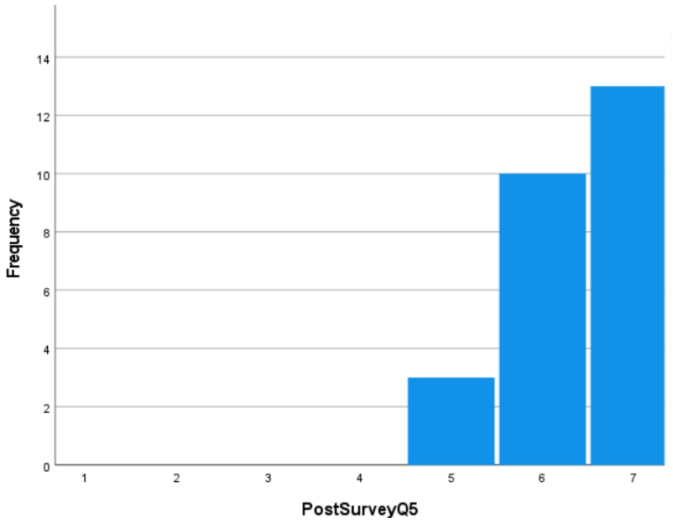


Figure 10: Histogram for Post Survey Question 5

Post survey question 6 stated that "I'm excited to share this immersive experience with a close friend." Most participants either agreed or strongly agreed with this statement (*Mode* = 7, *Median* = 6.00).

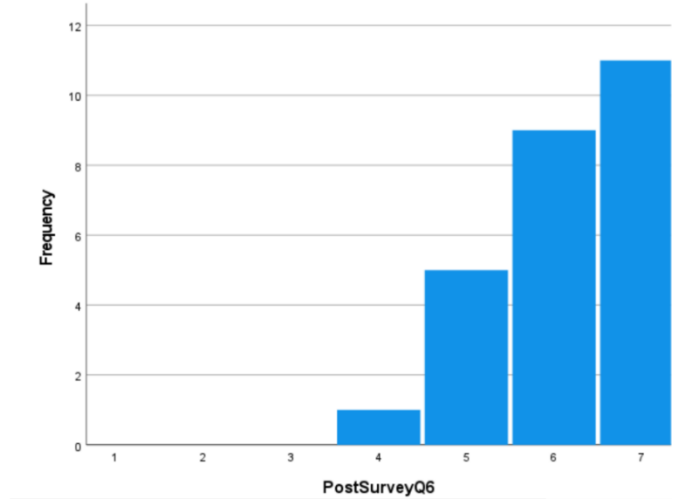


Figure 11: Histogram for Post Survey Question 6

Postsurvey question 7 stated that “I’m excited to repeat this story to a close friend.” Most participants either agreed or strongly agreed with this statement (*Mode* = 7, *Median* = 6).

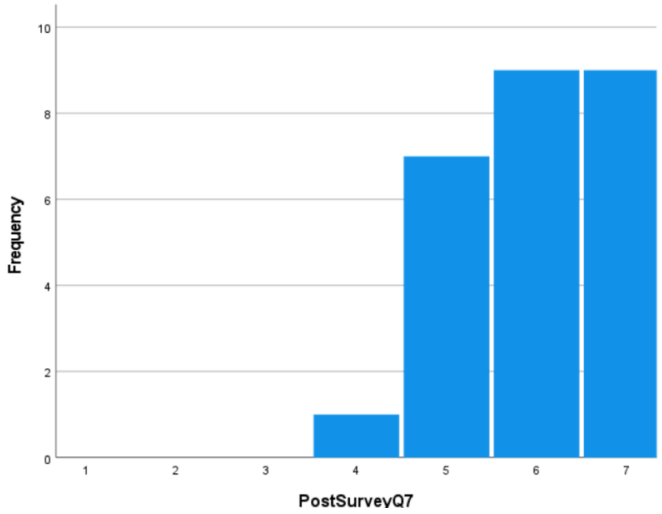


Figure 12: Histogram of Post Survey Question 7

Postsurvey question 8 asked users to “rate [their] level of enjoyment of the interactive narrative.” Most participants gave the narrative a ranking of 6, indicating that they enjoyed the narrative (*Mode* = 6, *Median* = 6) which can be seen in Fig. 13. However, as the wording of this question and the bubbles were messed up, this question was ultimately thrown out.

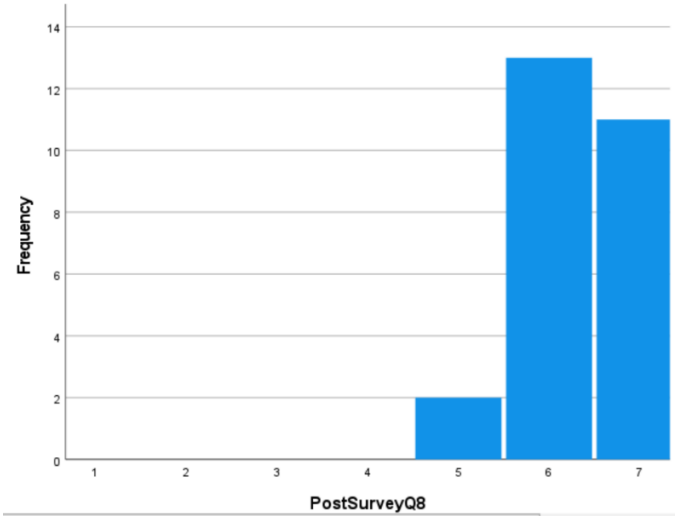


Figure 13: Histogram of Post Survey Question 8

UX Questions

UX question 1 on the post survey stated that "I thought the system was easy to use." Most participants strongly agreed with this statement as can be seen in the left-skewed histogram in Fig. 4 (*Mode* = 7, *Median* = 6.50).

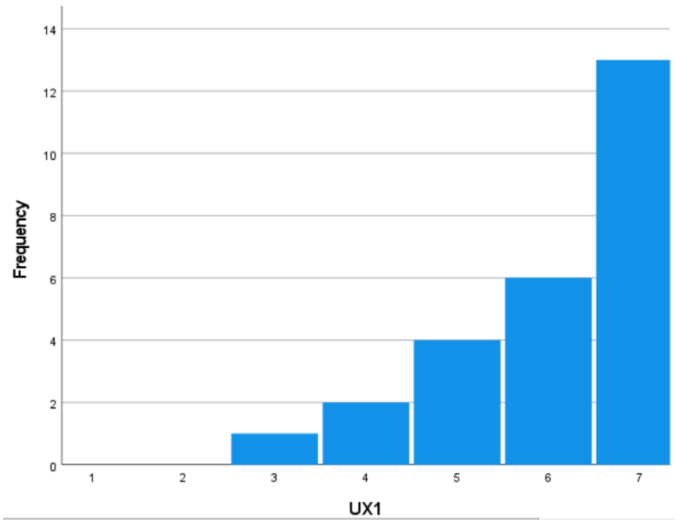


Figure 14: Histogram of UX Question 1

UX question 2 stated that "I think I would need the support of a technical person to be able to use this system." Most participants disagreed with this statement (*Mode* = 2, *Median* = 2).

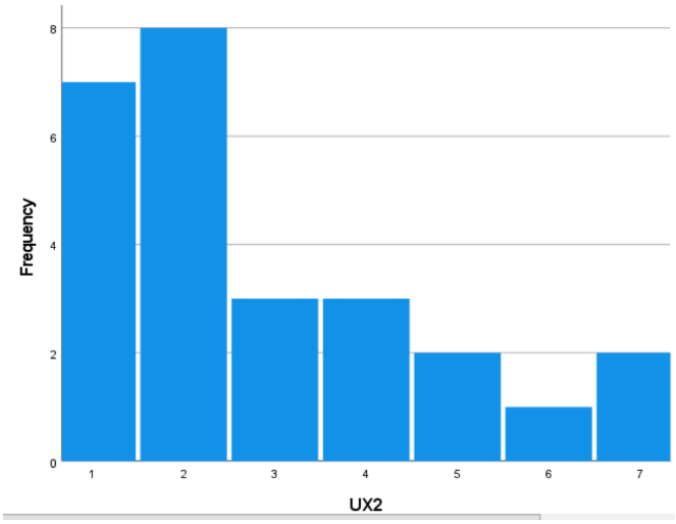


Figure 15: Histogram of UX Question 2

UX question 3 stated that “I felt very confident about using the system.” Most participants strongly agreed with this statement (*Mode* = 7, *Median* = 6.00).

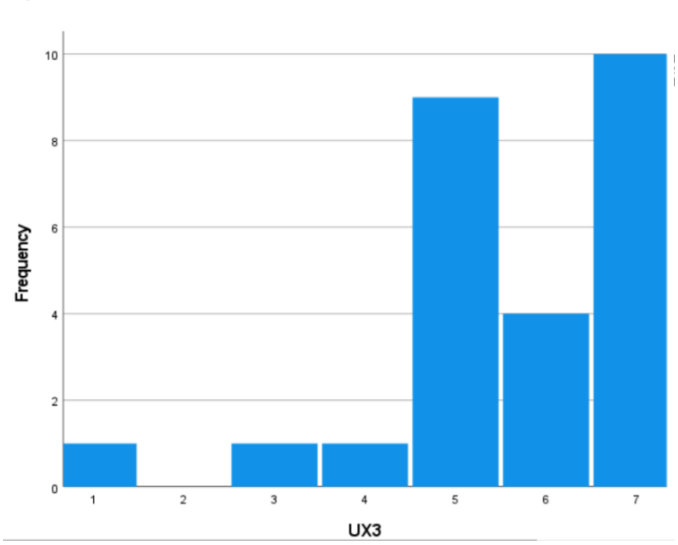


Figure 16: Histogram of UX Question 3

Heuristics Questions

Heuristics question 1 stated that “The narrative offers something different in terms of attracting and retaining the players’ interest.” A 7-Point Likert scale from “Strongly disagree” to “Strongly Agree” was utilized. The data gathered from question 1 shows that most agreed to the statement (*Mode* = 6, *Median* = 6).

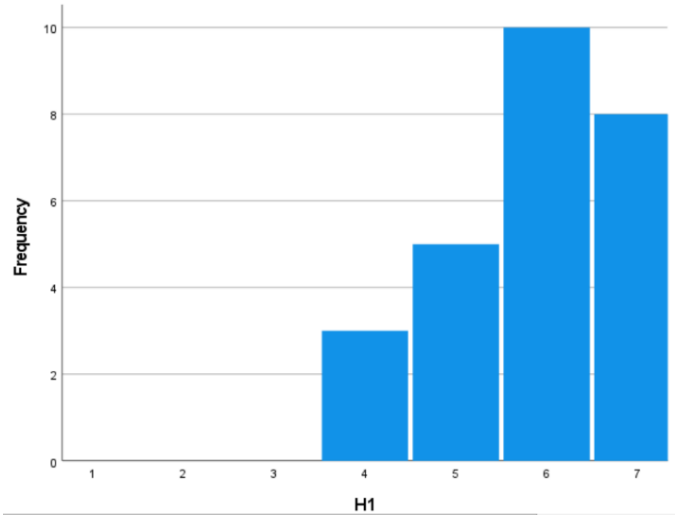


Figure 17: Histogram of Heuristics Question 1

Heuristics question 2 stated that "The game utilizes instinctive audio and visual content to further the players' immersion in the game." The histogram of Heuristics question 2 shows some diversity in responses. Most either somewhat or strongly agreed but each individual responded differently from negative to positive (*Mode* = 5 and 7, *Median* = 5).

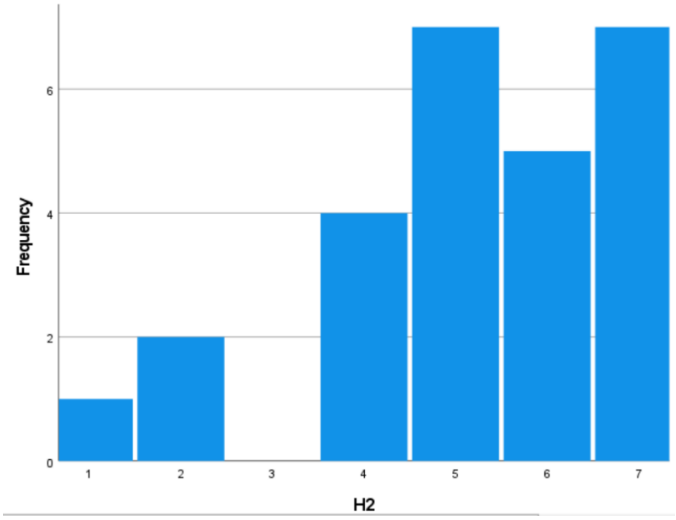


Figure 18: Histogram for Heuristics Question 2

Heuristics question 3 stated that “The audio is clear and easy to understand.” The histogram for Heuristics question 3 shows some more diversity in responses. Most somewhat agreed but each individual responded differently from negative to positive (*Mode* = 5, *Median* = 5).

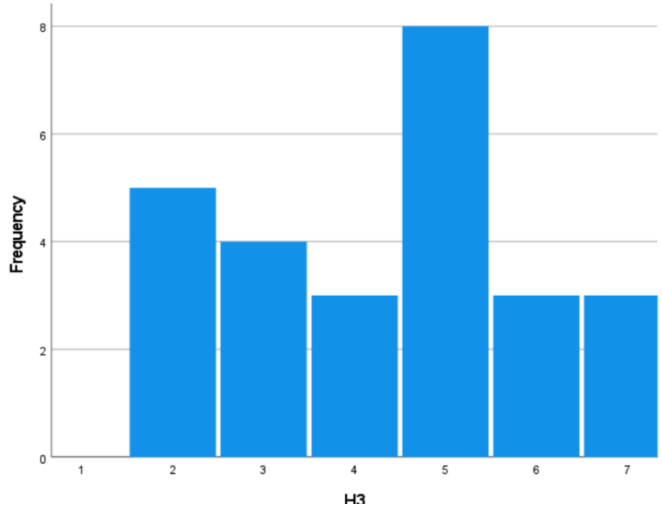


Figure 19: Histogram of Heuristics Question 3

Heuristics question 4 stated that the “Visual layout is efficient, integrated, and visually pleasing.” The histogram for Heuristics question 4 on the postsurvey which can be seen in Fig. 20 revealed that most participants agreed with this statement (*Mode* =6, *Medium* = 6).

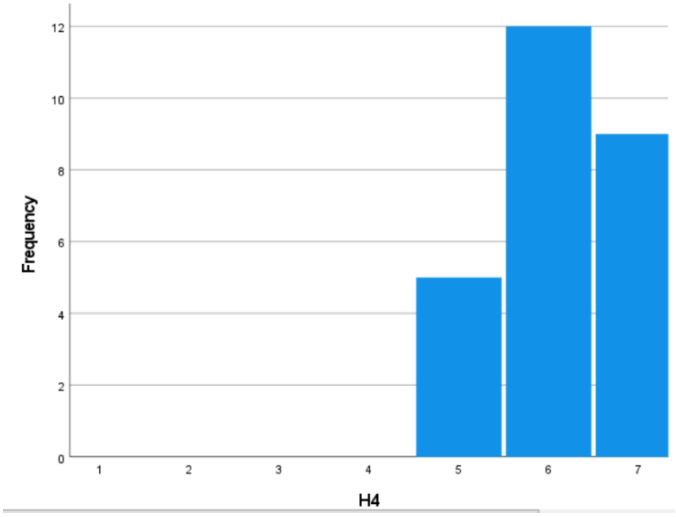


Figure 20: Histogram for Heuristics Question 4

Heuristics question 5 stated that "Art is consistent, professional, and compelling to the themes." The left-skewed histogram of Heuristics question 5 on the postsurvey revealed that most participants strongly agreed with this statement (*Mode* = 7, *Median* = 5.00).

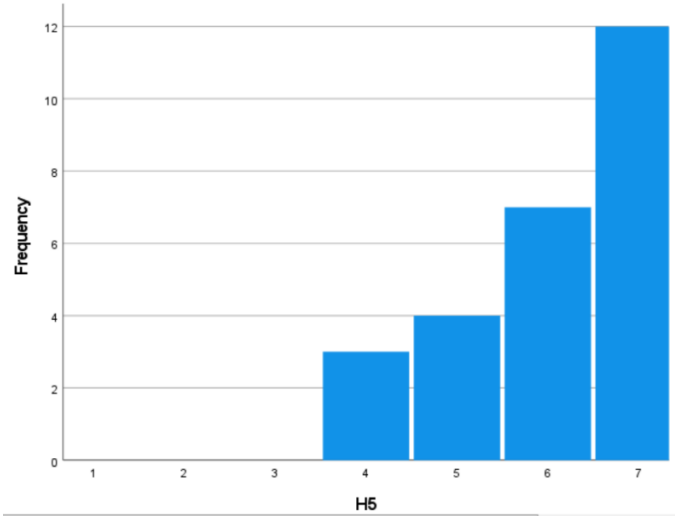


Figure 21: Histogram for Heuristics Question 5

Heuristics question 6 stated that “The story encourages immersion.” The left-skewed histogram of Heuristics question 6 on the postsurvey revealed that most participants strongly agreed that the story encouraged immersion (*Mode* = 7, *Median* = 7.00).

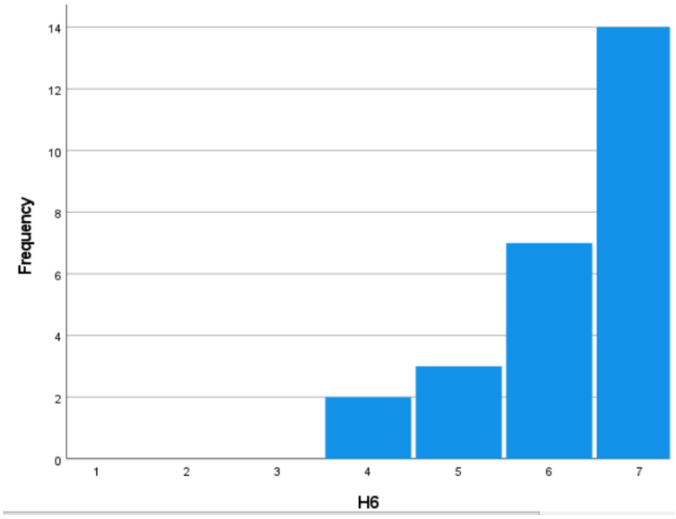


Figure 22: Histogram for Heuristics Question 6

CHAPTER SIX: DISCUSSION

The pre survey measured age, gender, previous familiarity with the VR headset, level of motivation to learn about other cultures, and experience with immersive folktales. Regarding age, it was found that most participants were 25 years old (M = 25.1923, SD = 2.34980). Additionally, 14 of the participants identified as male, 11 as female, and 1 as non-binary. In terms of familiarity, the distribution of the histogram was right skewed, as seen in Fig.4, showing that most people were unfamiliar *(Median* = 4) and therefore had little to no previous experience with using the VR headset. In terms of motivation, most participants (*Median* = 6) stated that they were highly motivated to learn about the cultures of other countries, which can be seen in Fig.5. The final pre survey question asked if participants had ever experienced an immersive folktale, a yes or no question in which every user answered with a resounding "no," accentuating the fact that immersive folktales are newer aspects.

The post survey questions first looked at engagement, presence, and interest using a 7-point Likert Scale. The data from the first post survey question, as shown in Fig.6, supports that users were curious about how the story would progress (*Median* = 6.50). This reveals that users were not only highly motivated to learn but also highly curious. The second post survey question looked at engagement. It is apparent from Fig.7 that most users agreed with the statement that they felt engaged by the story (*Median* = 6.00). The data for question 3, presented in Fig. 8, showcases the fact that users did feel present in the narrative (*Median* = 6.50). The researcher included this question to ensure that a sense of presence was felt. Users also mainly stated that they strongly agreed (*Median* = 7) they did not feel distracted while using the headset, in Fig.9. This assured a sense of presence was felt with little to no distractions. As shown in Fig.10, most users agreed and strongly agreed that they wanted to learn more about the culture due to the

experience (*Median* = 6.50) and as shown in Fig.11, they were excited to share this immersive experience with a close friend (*Median* = 6.00). This highlights the potential for retellings of folktales in VR to create engagement and interest in other cultures, but of course, this topic needs to be increasingly studied to learn more. Users mainly agreed or strongly agreed that they were excited to share this immersive experience with a close friend (*Median* = 6.00) which can be seen in Fig.11, and that they were excited to repeat this story to a close friend (*Median* = 6.00) which can be seen in Fig.12.

The System Usability Scale influenced the next set of statements in the post survey that was used to learn more about the usability of the system. A 7-Point Likert Scale was implemented for these set of statements as well. Although many participants stated that they were unfamiliar with the headsets in the pre survey, Fig.14 shows that a majority still strongly agreed that the system was easy to use (*Median* = 6.50). Fig.15 shows that most disagreed that they would need the help of a technical person to be able to use the system (*Median* = 2), while Fig.16 shows that most somewhat agreed and strongly agreed that they felt confident about using the system (*Median* = 6.00). These answers expressed to the researcher that after the demonstration of how to use the headset and taking a few moments to become adjusted, many felt that they were able to use it without issues.

The study then looked at Heuristics using a 7-point Likert Scale to gain more feedback on user experience and the design of the narrative itself. Users agreed with the statement that the "narrative offers something different in terms of attracting and retaining players' interest" in Fig.17 (*Median* = 6). The next statements, which looked to see if the game utilized instinctive audio and visual content to further the players' immersion in the game (Fig.18) as well as if the audio was clear and easy to understand (Fig.19) received more diversity in responses. Some of

the feedback gained in the think aloud protocol may explain these responses since several individuals mentioned the audio was too low during portions. As the researcher did not include text in this first prototype, the audio was all the users had to understand the narrative. This feedback will be kept in mind during future revisions, and implementing text is already next up on the list, as repetition may help with retention. It can be seen in Fig.20 that participants agreed that the art is efficient, integrated, and visually pleasing (*Median* = 6). In Fig.21, it can be seen that participants additionally strongly agreed that the art is consistent, professional, and compelling to the themes (*Median* = 5.00). When immersion was looked at, the data evident in Fig.19 showed a significant number of participants who strongly agreed that the story encouraged immersion (*Median* = 7.00). Then, participants were asked "Do you believe you learned during this virtual reality experience?" All of the participants answered yes, stating that they believed they learned using the virtual reality experience.

When pre and post test scores were looked at, it became evident that actual learning was in fact gained also; however, this was a design lacking a control condition so these results must be interpreted in that light. Actual learning is measured as the percent change in pre- and post-test scores on facts and concepts, whereas perceived learning is subjective. There were 26 (n = 26) valid responses. The posttest (*Mean = 75.38, SD = 18.162*) is higher than the pretest (*Mean = 22.31, SD = 20.651*), and is statistically significant, $t(25) = 11.295$, $p<0.001$, so learning did occur from this experience.

In the think aloud protocol, the most used words included: tree, castle, audio, girl, story, magic, and sunflowers. All the most popular words are displayed in the Word Cloud below (Fig.23). Word clouds are visual representations of text data, making it easier to visualize information.

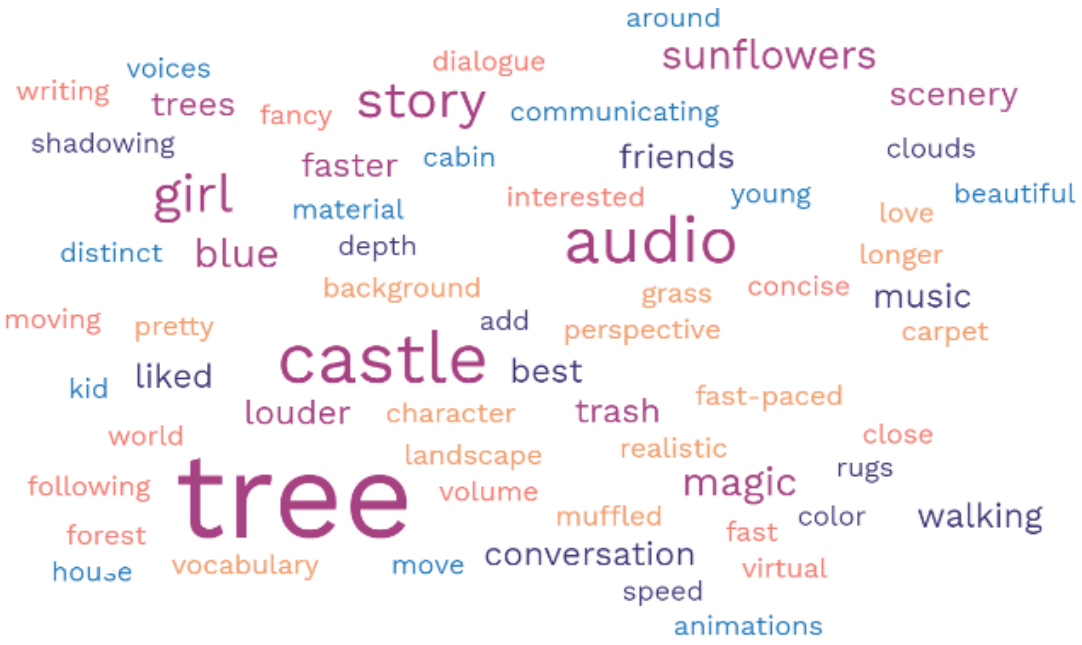


Figure 23: Word Cloud of Words Gathered in Think Aloud Protocol

The word audio was mentioned 7 times. Many specifically stated that the magic tree's audio was what they had trouble hearing. Comments included those saying, *"that the audio for the tree was a little muffled,"* while others mentioned that *"the voice is good…it just needs to be louder."* Some of the responses that the users had also included: *"I do like the girl's model, she sticks out a lot so you can see her among the forest,"* and, *"I like how concise the dialogue is,"* and a few noted the "*beautiful sunflowers."* Some expressed a desire to move a little faster, saying phrases like *"Maybe if I could walk a little faster or have a running button,"* and *"I wish I could move around faster."*

Some users mentioned the point of view and how they enjoyed the way that the view could be controlled. For example, one participant said that *"I like how I can move around while they're still having a conversation and I can look at the tree a little bit better, kind of see what's going on without being restricted."* Another mentioned that *"I like the perspective that it's at too*

because it feels like you're going on the adventure with her." By allowing the users to control the camera, the researcher was attempting to create more of a storytelling view where the users are now watching a story unfold before their eyes and can concentrate on what they want to concentrate on. One user also mentioned, *"I like how the audio is based off how close you are to the person, so it makes it more interactive."* The audio was deliberately attached to the character Anca, so that users were more inclined to follow her and had to stay with her to experience the scene.

Conclusion

The data supports that learning was achieved in this single case condition. Users both believed that learning occurred, and test results indicated that learning did occur. Since the *p*-value was significant, it can be concluded that the alternative hypothesis, that a difference can be seen between the scores, should be accepted while the null hypothesis, that no difference can be seen, is rejected.

One of the major responses perceived from the surveys was that the audio was not as loud as it could have been. This insight was strengthened when transcribing the think aloud protocol as 7 of the participants mentioned issues hearing the audio, especially for the tree character. A future enhancement will be to improve the audio because this is an important part of the narration. One of the many reasons why think aloud protocols are beneficial is that they can give more detailed answers and insight into survey responses, adding an additional layer of qualitative insight. Since many participants brought up topics such as the lighting and audio, it was apparent that these were some key issues to work on improving within the narrative in future iterations. The three-dimensional embodiment found in VR, along with an increased sense of immersion, may aid in digital storytelling and this is an aspect that should be studied further. From the

surveys, it was seen that presence and immersion were both felt, despite slight audio issues. Embodiment, particularly three-dimensional embodiment, in VR, and an increased sense of immersion may aid in digital storytelling and should therefore be further studied too. Folktales are constantly changing from one storyteller to the next and this VR version of the story is no different. The true preservation of the folktale stems from passing the feeling that accompanies the folktale and creating authentic expressions. Simply digitizing the folktale does not automatically make it come alive for the next generations, so new approaches are needed to pass these folktales to modern audiences. Novel technologies such as VR may offer possibilities of understanding, living, and increasing situation awareness of the past as well as the present through enhanced immersion and feeling of presence. More research needs to be collected, but this pilot study adds to the previous discourse (i.e., Slater and Usoh 1994; Berti, 2021; Chen, 2009, Llyod, Rogerson, & Stead, 2017; Schott & Marshall, 2018; Blyth, 2018; Jacobson, 2017; Allcoat & von Mühlenen, 2018; Shih, 2018; Huang, Rauch, & Liaw, 2010; Sih, 2015). Virtual Reality is also turning into a major and more accessible medium to spatial, interactive, and linear storytellers. One of the major affordances is the "framelessness" of VR which offers more of an embodied experience.

Folktales have been conveyed to others through experiences – whether sung, spoken, read, etc. And VR provides another avenue that stories can continue being conveyed in authentic ways. Given virtual heritage implies the use and reuse of projects, it has been suggested (Champion, 2021) that there are at least six components required for preservation: 1. The dataset (e.g. 2D, 3D, textures, sounds, scripts, etc.) of the virtual heritage itself. 2. The paradata that helped the research and development of the virtual heritage project. 3. The authorship, institutional links and accreditations, and teamwork. 4. The intentions of the authors. 5. The

metadata and system structure and any relevant classification data. 6. Evaluation data (e.g. audience tracking, usability studies, audience engagement results, and an attempt to capture usable and useful audience experience and feedback). Also, the user experience relies not only on technology and access to that technology but an experience of cultural heritage that is considered in some sense authentic and meaningful by the participant. When virtual heritage is seen as authentic, it could be seen as the safeguarding of ownership, identity, memory, craft, and art practices and so on. As expressed by Erik Champion (2021), the goals of virtual heritage preservation are to preserve: projects with related data, ideals, and specific generative and transmissive knowledge. If we follow UNESCO's stipulation of the importance of cultural significance, what is worthy of preserving is the useful, the unique, the memorable, and the inspiring. Therefore, we must aim to preserve the authentic.

Each new technology offers a myriad of various benefits. Innovation to modern technology can support the educational system with tremendous amounts of opportunities. While learning about culture in the foreign country and within the classroom cannot be ignored, VR may offer an additional resource to understand more about foreign cultures, the people, and their stories. These exciting finds within this pilot study illustrate the importance of such research on technologies for future use in and outside of the classroom. It also opens up the need for further discourse on such matters and on creating authentic experiences to aid in the preservation of virtual heritage. Since VR is a newer technology, not as much research has gone into how these high immersive environments can help people try to learn about new cultures, languages, and folktales. While this paper adds to the discourse, it also expresses that more research should be done on this topic. Research on topics like this can also aid in the creation of new service strategies and design guidelines when it comes to VR storytelling. It is important to recognize the

strategic plan of the universal cultural institutions. For example, the Smithsonian Institution has clear goals for the future of culture: engage, inspire, and impact. These goals are fulfilled by having a digital-first strategy, understanding the 21st century audiences, driving visionary interdisciplinary research, preserving natural and cultural heritage, providing a more efficient administrative infrastructure, and by looking out-of-the-box on a global level.

Limitations

One limitation that occurred was that, with a sample size of 26 students, this pilot sample is considered small. Another study could be done with a larger sample size in the future. Using a control would provide stronger results as well. Another limitation was that not many Romanians in the community were consulted to help guide the design, and for future iterations of the prototype, it would be ideal to speak with more members of the community about modern issues they face that the immersive folktale experience could help bring more attention to. As professors, museum curators, researchers, parents, and more continue learning about utilizing virtual environments, they should also consider how a specific VR experience may aid learners through the use of an additional learning avenue. A limitation of VR to consider is accessibility, the risk of causing motion sickness to users, and the fact that the headset may not properly fit all users.

Future Research

Future research may include looking further at how the design of virtual reality folktales can help teach users about culture and language through immersion, presence, etc. While much

research has been devoted to low immersive environments, the use of highly immersive VR is not as well documented, and more research can be done in this area.

This prototype is the first step in an iterative design process. As this pilot study was done on a portion of the entire story, it would be helpful to run more studies while the narrative continues to be built. A future study with a larger sample size would be beneficial to the design process. Additionally, Romanian words such as “copac,” which translates to tree, and “fata” were used, chosen because they are common words often used in everyday language. But VR could also be used to teach about common idioms, sayings, and expressions specific to a location, which will be thought about in future iterations as it would be interesting to study. Including interactivity within the narrative would be fascinating as well.

This researcher argues that storytellers should continue trying to develop tales in different formats as more technology is created, so that the tales can be kept in various records and continue to be passed onto modern audiences. Immersive technologies may aid in garnering attention of young audiences while providing a fresh medium for creatives to utilize various assets for world building and storytelling. In the same way that films may convey information from a different point of view compared to novels or video games, VR offers a spatially engaging virtual venue to tell stories in a new light.

Including more insight from the community would also be helpful. As folktales are often crafted in a communal approach, the researcher also asked for the input of the prototype from Romanian friends and hopes to include even more of the Romanian community in future iterations. Since folktales tell the stories of the community, it is always best to ask them what ails them at the moment, so future prototypes can focus through an even more modern lens that points out additional current issues.

Researchers also describe how single modality redundancy is important to learning (Mayer, 2014). Thus, the immersive environment is aiming to include visual content and audio as well as repetition of facts and words in the future. Although there was only audio included in this first prototype, it would be ideal for there to also be words that appear on screen in forthcoming iterations. This may help with the overall learning and aid with any audio issues.

Virtual Reality gives individuals the chance to experience complete immersion within a digital environment, engaging each user's physical senses in a virtual context. With the future integration of additional accessories, this technology will only increase in its immersive qualities, engaging all senses. As accessories continue to be introduced and added, exploring how they can benefit storytelling techniques could be highly beneficial as well.

APPENDIX A: IRB APPROVAL

UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

APPROVAL

February 10, 2022

Dear Iulia Popescu:

On 2/10/2022, the IRB reviewed the following submission:

Type of Review:	Initial Study, Categories 6 and 7
Title:	A Pilot Study of an Immersive Folktale User Experience
Investigator:	Iulia Popescu
IRB ID:	STUDY00003880
Funding:	None
Grant ID:	None
IND, IDE, or HDE:	None
Documents Reviewed:	• HRP 251, Category: Faculty Research Approval; • Confirmation Email, Category: Recruitment Materials; • HRP 502, Category: Consent Form; • HRP 503 Form, Category: IRB Protocol; • Narrative , Category: Other; • Post Survey , Category: Survey / Questionnaire; • Pre Survey, Category: Survey / Questionnaire; • PrePostTest, Category: Test Instruments; • Recruitment Email, Category: Recruitment Materials; • Study Script, Category: Other

The IRB approved the protocol from 2/10/2022.

In conducting this protocol, you are required to follow the requirements listed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the IRB system. Guidance on submitting Modifications and a Continuing Review or Administrative Check-in are detailed in the manual. When you have completed your research, please submit a Study Closure request so that IRB records will be accurate.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Katie Kilgore
Designated Reviewer

APPENDIX B: SURVEYS AND TEST

ID#_____ Date:_____ Time:_____

Pre survey:

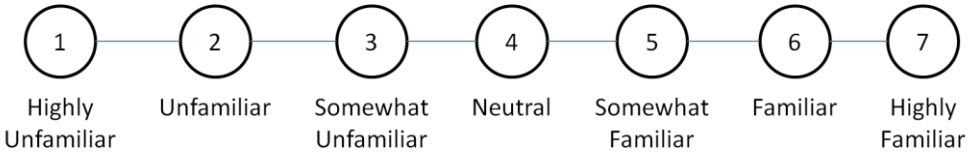
1. **Age of adult participant: _____**

2. **Gender: (M | F | Non-binary | Choose to self-describe**): _____

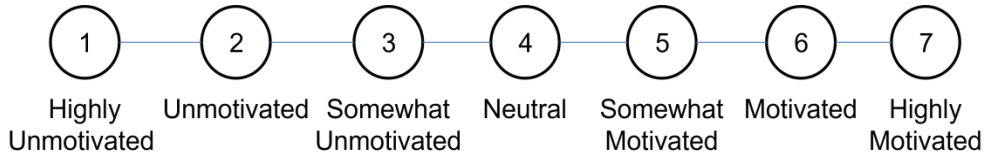
Instructions

This study is about informing design of an immersive folk tale. We are interested on the user and learner experience. Please rank the following on a scale of 1-7:

1. How familiar are you with using the virtual reality headset?



2. Rate your level of motivation to learn about the cultures of other countries.



3. Have you ever experienced an immersive folktale? Y / N

ID#_____ Date:_____ Time:_____

Post Survey Questions:

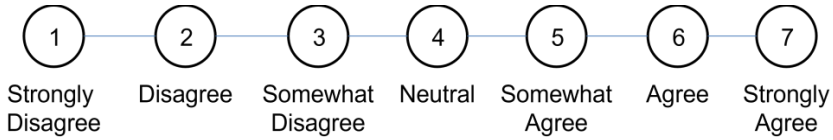
Instructions

This study is about informing design of an immersive folk tale. We are interested on the user and learner experience.

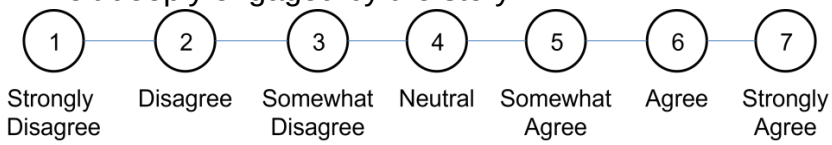
Engagement, presence and interest:

We are interested in learning about the amount of presence, engagement and interest users experienced with the narrative. Use the 7-Point Likert Scale for the following statements:

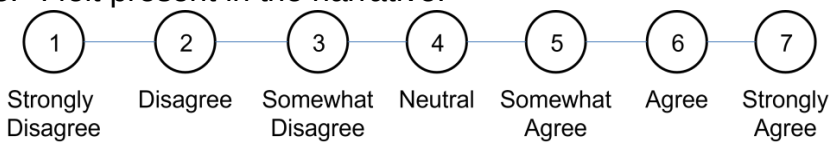
1. I was curious about how the story would progress.



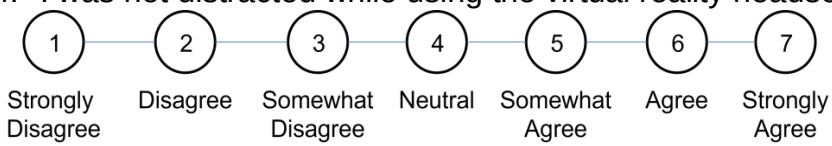
2. I felt deeply engaged by the story.



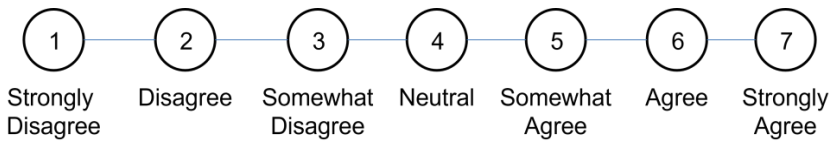
3. I felt present in the narrative.



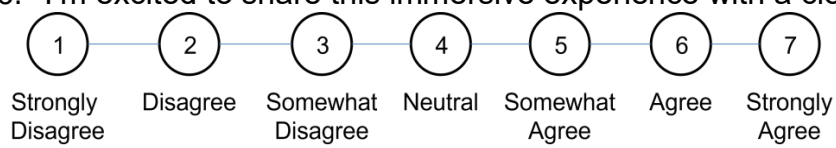
4. I was not distracted while using the virtual reality headset.



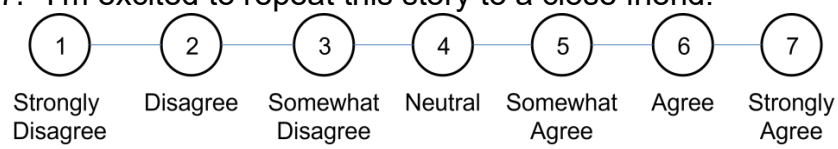
5. I wanted to learn more about the culture as a result of this experience.



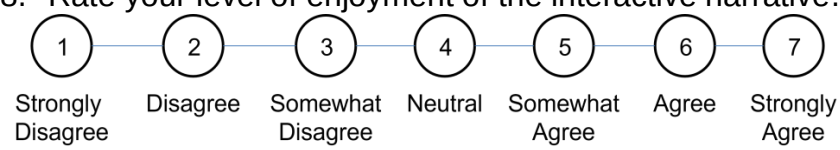
6. I'm excited to share this immersive experience with a close friend.



7. I'm excited to repeat this story to a close friend.

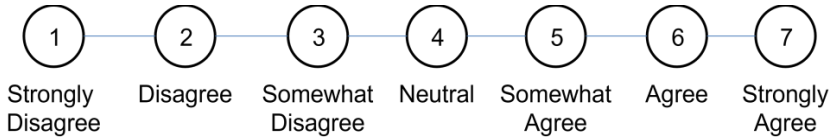


8. Rate your level of enjoyment of the interactive narrative.

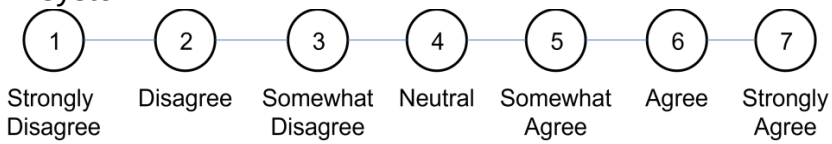


UX Questions:
We are also trying to learn about the usability of the system. Use the 7-Point Likert Scale for the following statements:

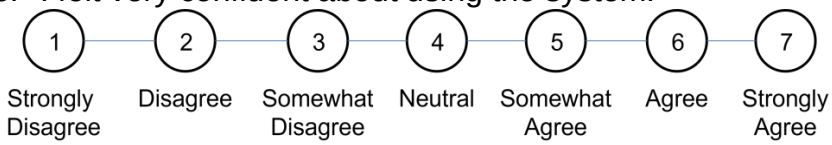
1. I thought the system was easy to use.



2. I think that I would need the support of a technical person to be able to use this system.



3. I felt very confident about using the system.

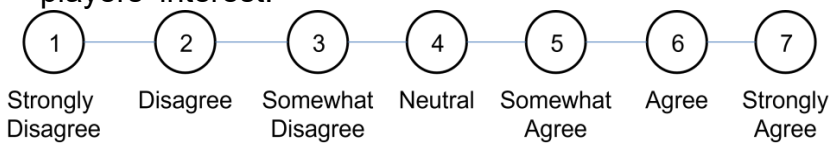


Heuristics:

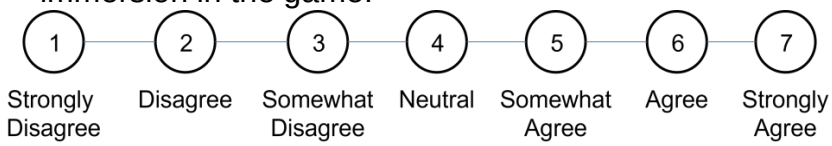
Instructions

We would like to learn more about the user experience. Use the 7 -Point Likert Scale for the following statements:

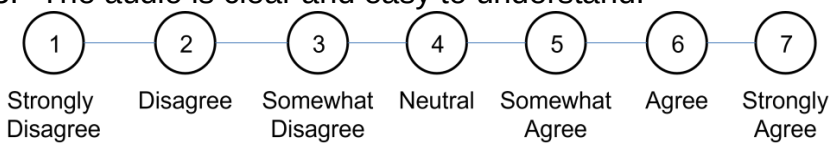
1. The narrative offers something different in terms of attracting and retaining the players' interest.



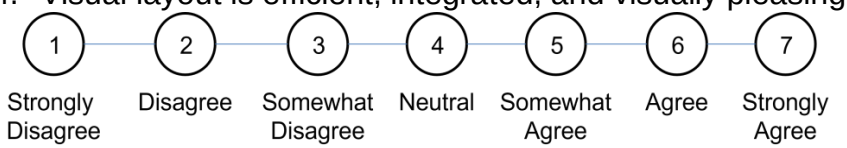
2. The game utilizes instinctive audio and visual content to further the players' immersion in the game.



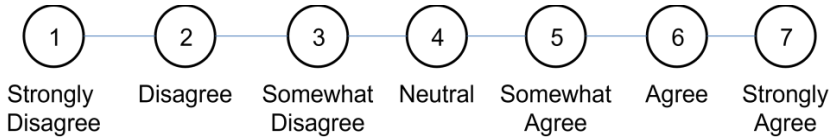
3. The audio is clear and easy to understand.



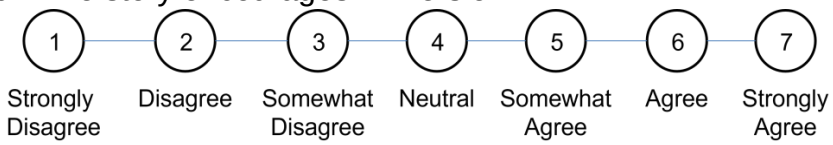
4. Visual layout is efficient, integrated, and visually pleasing.



5. Art is consistent, professional, and compelling to the themes.



6. The story encourages immersion.



Perceived Learning:
Do you believe you learned using this virtual reality experience? Y / N

ID#_____ Date:_____ Time:_____

Pre-test & Post-test (multiple choice):
Choose the correct translation of these Romanian words:

1) How do you say girl in Romanian?
a. Săritură
b. Băiat
c. Fată
d. Iarbă

2) How do you say tree in Romanian?
a. Copac
b. Alerga
c. Floare
d. Porcel

Answer the following questions about the cultural aspects of the narrative:

3) What real-life castle is the one in the story based on?
   a. Kornis Castle
   b. Poenari Castle
   c. Vajdahunyad Castle
   d. Bran Castle

4) Who is Ion Creangă?
   a. Ion Creangă was the one to publish the folktale this story was based on in Romania.
   b. Ion Creangă is the artist of this virtual reality experience.
   c. Ion Creangă was a famous Romanian who was well known for his music.
   d. Ion Creangă was the father of the character in the folktale experience.

5) What is the name of the folktale that this prototype is primarily based off of?
   a. Like Salt in a Meal
   b. The Old Man's Daughter and the Old Woman's Daughter

c. Youth without Age and Life without Death
d. The Enchanted Pig

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