

LEARNING TRADITIONAL HAWAIIAN OPEN-OCEAN NAVIGATION THROUGH IMMERSIVE VIRTUAL REALITY STORYTELLING

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Abstract

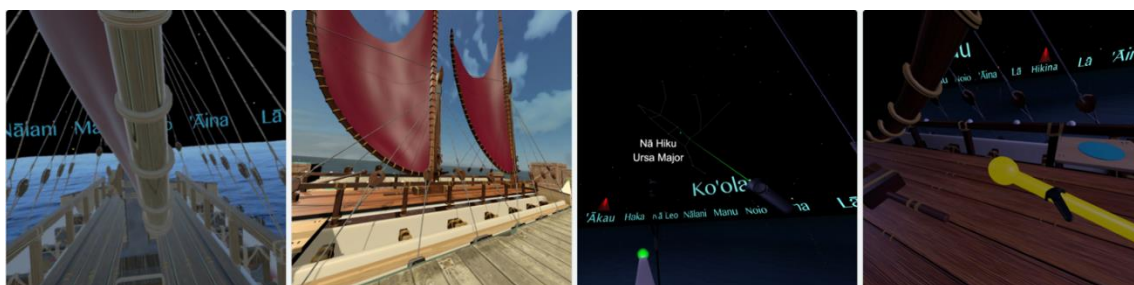
In recent times, there has been a growing interest in Hawaii to acquire knowledge of traditional Hawaiian open-ocean navigation techniques, yet practical canoe experiences remain limited. Our virtual reality simulation, Kilo Hoku VR, aims to address this gap by offering users the opportunity to develop and refine their skills in a simulated environment before embarking on an actual canoe journey. Departing from conventional navigation tools, our simulation utilizes the elements, creatures, and celestial bodies as guiding tools, as outlined by Low (2016). In the pursuit of authenticity, we are currently developing VCs to serve as guides, drawing on the rich tradition of Hawaiian storytelling to impart knowledge. This qualitative pilot study focuses on exploring the values and processes inherent in storytelling, such as eye contact, drawing the listener into the narrative, and the appropriate use of body language. The study aims to evaluate the effectiveness of storytelling as an instructional tool for teaching traditional Hawaiian navigation techniques within a virtual reality environment (VRE). The research methodology involved in-depth interviews with three participants selected from diverse backgrounds: a seasoned storyteller, an individual affiliated with the Polynesian Voyaging Society (PVS), and a native Hawaiian with experience in PVS. Preliminary findings from this pilot study highlight the significance of incorporating storytelling strategies, including sustained eye contact, drawing the listener into the narrative, and judicious use of body language. These elements collectively contribute to engaging learners in active listening and effective learning within the VR storytelling environment, and these conclusions point to the necessity of incorporating artificial intelligence to achieve this immersive experience properly.

Keywords: *Virtual reality, storytelling, virtual characters, cultural heritage.*

1. Introduction

Embark on a celestial odyssey amidst the stars and immerse yourself in the foundational skills of traditional Hawaiian open-ocean navigation through the captivating medium of immersive storytelling. Introducing Kilo Hoku VR, a meticulously crafted virtual reality (VR) simulation that faithfully recreates the experience of navigating a Polynesian double-hulled canoe, specifically the iconic Hokulea, conceived in 1974 with the mission of reviving the ancient Hawaiian art of open-ocean navigation without the use of instruments (Figure 1).

Figure 1. Various scenes from Kilo Hoku VR. kilohokuvr.com



In the traditional Hawaiian context, language was primarily oral, and education revolved around storytelling, a method expertly employed in teaching and learning various skills, as documented by Low (2016) and Karjala et al. (2021). This narrative approach extended to Hawaiian open-ocean navigation,

where the kumu (teacher) shared ancestral stories and life wisdom, allowing practitioners to apply acquired skills on real canoes.

Colonial influences diminished the sharing of Hawaiian arts, including storytelling and non-instrumental, open-ocean navigation. The latter was nearly lost until the Hawaiians sought guidance from Papa Mau of Satawal in Micronesia, whose teachings on Hokulea in 1976 reignited the art (Low, 2016). Despite historical storytelling in the Hawaiian Navigation class at the University of Hawaii at Manoa, limited opportunities exist for students to sail on a double-hulled canoe (waa kaulua) due to logistical constraints. Kilo Hoku VR aims to bridge this gap by providing a platform for learning and applying traditional wayfinding skills before venturing into the real-life ocean.

The incorporation of virtual characters (VCs) within the simulation is envisioned to guide learners and convey the wisdom of traditional wayfinding through storytelling. This pilot study delves into the values and processes integral to storytelling, aiming to inform the development of characters within the simulation who can effectively share wayfinding stories, fostering skill acquisition among participants.

This study assesses the efficacy of storytelling to teach traditional wayfinding, or open-ocean navigation techniques within a VRE, seeking answers to two key questions:

1. How effective is storytelling in transmitting traditional Hawaiian sailing techniques in a VR setting?
2. What role do VCs play in conveying wayfinding knowledge through storytelling?

2. Related Work

2.1. Storytelling-based training

A study conducted by Sarica and Usluel (2016) explored the impact of digital storytelling on visual memory and writing skills in grade school children over a period of fourteen weeks. Their findings indicated a positive correlation between storytelling and increased visual memory retention. Gallets (2005) arrived at a similar conclusion through a comparative study. Their research compared the effectiveness of sharing information through traditional reading methods versus presenting it in an engaging storytelling format. The study revealed that children not only demonstrated better comprehension of the content but also exhibited improved memory recall, attributed to the inherent engagement associated with storytelling.

2.2. Combining storytelling and VR

Doolani et al. (2020) developed a VR vocational training system, acknowledging the proven efficacy of storytelling in knowledge transfer. However, they asserted a lack of comprehensive understanding regarding the effectiveness of combining VR and storytelling. Their system seeks to bridge this gap by creating an immersive virtual workplace environment and employing a creative, non-interactive, fictional narrative. I contend that incorporating interactivity into the system, as suggested by Zhao et al. (2019), could enhance engagement, subsequently leading to increased cognitive benefits.

Wood and Reiners (2015) conducted a comparison between traditional learning methods and a virtual environment enriched with storytelling elements. Their study demonstrated how storytelling contributes to heightened engagement and self-directed learning.

2.3. Virtual characters (VCs)

I find it necessary to provide some clarification on terminology. The term *Virtual Character* denotes a digital entity that may exhibit traits and characteristics of a human but operates autonomously without human control from behind the scenes. The level of engagement and interaction of a VC is determined by its coding. There is a lack of consistency in naming conventions across the papers I have reviewed. Terms like digital agent, digital character, and virtual guides (Carrozzino et al., 2018) have been used. In contrast, the more commonly used term is virtual human or avatar, which implies entities controlled by a human from behind the scenes.

3. Methods

I designed a qualitative study with in-depth interviews to assess the efficacy of storytelling in teaching traditional Hawaiian open-ocean navigation techniques within a VRE.

3.1. Participant selection

A purposive sampling was chosen since it was necessary to identify and recruit participants with diverse backgrounds relevant to traditional Hawaiian open-ocean navigation and storytelling. Individuals with experience in the PVS, seasoned storytellers, and those with a cultural connection to Hawaiian navigation were included.

Three people with varying backgrounds were interviewed; a storyteller that has in-depth knowledge of the Hawaiian culture, someone who is currently working with the PVS to learn Hawaiian navigation, and a native Hawaiian that has worked with PVS in the past, but currently interviews people to better understand cultural heritage. As shown in Table 1, the backgrounds of these three people, offer a holistic view into my study.

Table 1. Unique Perspectives of Participants.

| Participant | Area of expertise | Perspectives |
|-------------|---|--|
| #1 | professional storyteller, has lived in Hawaii all her life | Understands the values and processes of storytelling, and from a Hawaiian perspective |
| #2 | Member of the Polynesian Voyaging Society (PVS), experience with VR | Understands the application of traditional Hawaiian navigation, and the capabilities of VR |
| #3 | Native Hawaiian, Professional interviewer | Can communicate from the viewpoint of a Hawaiian, and as a PVS practitioner |

3.2. Data collection methods

To help answer the research questions, a data collection approach employing semi-structured, in-depth interviews was adopted to gain comprehensive insights into the unique experiences of each participant. This method facilitated an exploration of individual motivations, knowledge, and subjectivity, providing a nuanced understanding of the research questions. The choice of semi-structured interviews allowed for a balance between specific queries guiding the conversation and participants freely sharing their personal narratives.

The effectiveness of this approach was particularly evident during the interview with a professional storyteller participant. The semi-structured format accommodated her storytelling style, allowing her to respond to the questions in her own distinctive manner. While only a few explicit questions were posed, the participant conveyed a wealth of information through her narratives, sharing valuable insights into the world of storytellers.

Similarly, another participant preemptively addressed several questions, prompting a skip in the interview sequence. In such instances, participants were encouraged to provide additional information as needed for clarification, ensuring a comprehensive understanding of their experiences. This flexible and adaptive approach to semi-structured interviews proved instrumental in capturing the richness and depth of participants' perspectives.

3.3. Data analysis methods

I employed diverse coding techniques, encompassing in vivo, descriptive, process, and value coding, to analyze the data. Notably, the coding approach evolved with each research question, displaying variations and, at times, a combination of coding styles within responses. For example, while question one primarily featured in vivo codes, subsequent questions incorporated a blend of in vivo, descriptive, process, and value codes.

To ensure a thorough analysis, I meticulously reviewed each transcript multiple times. In the initial pass, I focused on reading and rectifying any misspellings. Subsequent rounds were dedicated to specific coding lenses—first identifying in vivo codes, then descriptive codes, followed by process codes, and concluding with value codes. This sequential approach allowed for a more focused and manageable coding process.

Once the coding phase concluded, I undertook the task of categorizing the codes to create cohesive groups. This categorization facilitated a higher-level organization of the data. Finally, I delved into identifying overarching themes within the established categories and codes, thereby providing a comprehensive understanding of the patterns and insights encapsulated in the dataset.

4. Results

During the coding of my transcripts, several prominent themes emerged from the interviews, with one noteworthy insight standing out: for genuine learning to occur, participants must actively engage in the learning process. This involves not only participating in the activity being taught but also applying it to their own lives, a concept aligned with place-based learning (Doolani et al., 2020). This realization led me to believe that a simulation involving participant interaction with VCs could foster active learning. Strategies such as eye contact, drawing the listener into the story, and the effective use of body language could be employed to enhance engagement and encourage active participation. The VC could pose questions, and vice versa, with the option for participants to select from a list of questions, each with pre-set responses.

The emerging themes from the pilot study further elucidated the characteristics of effective storytelling within the context of traditional Hawaiian narratives. These themes include:

- **Significance of Eye Contact** - The storyteller emphasized the importance of eye contact, describing it as making a connection with the audience, akin to "making love to the camera."
- **Engagement and Interaction** - An effective storyteller must actively engage, understand, react to, and interact with the listener. Drawing the audience into the story and making them feel a part of it is crucial.
- **Adaptability to Audience** - The storyteller should have the ability to adapt engagement and the story itself to meet the audience's needs. This includes reinforcing key points as needed and adjusting the narrative based on audience response.
- **Immersive Storytelling** - Successful storytelling involves making listeners feel like they are part of the story, actively engaged rather than passively listening. A skilled storyteller uses body language effectively to convey the narrative.
- **Passion for the Story** - The storyteller must genuinely care about the story being told and have a desire to share it with others. In the context of traditional Hawaiian storytelling, this act becomes a means of sharing history and passing down ancestral knowledge.
- **Cultural Sensitivity** - A storyteller should be sensitive to the culture and place they are in, creating a connection with the audience by respecting their background and incorporating elements that resonate with their sense of place.
- **Listening Skills** - A proficient storyteller knows when and how to listen. They function as mentors, recognizing the importance of listening as an integral aspect of effective storytelling leadership.

These themes collectively underscore the multidimensional nature of effective storytelling, emphasizing the dynamic interaction between the storyteller, the audience, and the cultural context, all of which can be considered valuable insights for the development of storytelling strategies within a VRE. A VC will not have these innate abilities without the incorporation of artificial intelligence (AI).

5. Discussion

A crucial distinction must be made between avatars and VCs in the context of my research. While an avatar serves as a representation controlled by a human, a VC operates independently. A professional storyteller shared with me that a VC within VR may not achieve the same level of engagement and connection with the audience as a live storyteller. I propose that a well-designed VR system, integrating VCs with artificial intelligence (AI), could assess each learner individually using tools such as eye-tracking software, haptic feedback, and cerebral measurements. This personalized approach would enable the system to dynamically adjust and update content for each learner, addressing the limitations identified by Doolani et al. (2020) regarding immersion and engagement in VR storytelling.

Zhao et al. (2019) highlighted the need for further exploration of non-verbal communication in VR, a sentiment echoed by my research participants. The advantages of exposure to non-verbal communication were consistently emphasized during interviews, aligning with Doolani et al.'s (2020) assertion that body language plays a pivotal role in human communication.

Insights from Zhang and Bowman (2021) on immersive digital storytelling in VR align with my research findings. They observed that incorporating rich characters enhances learner engagement and immersion. My participants echoed this sentiment, emphasizing the value of rich interactivity in VR for a more engaging experience.

Previous research consistently suggests benefits of incorporating storytelling by VCs in a virtual reality environment, including increased engagement, a heightened sense of presence, and a more immersive learning environment. My research aligns with and complements these findings.

Zhang and Bowman's exploration of multi-character storytelling experiences having instructional advantages raises an intriguing point that I have not investigated. They propose that dialogue between characters is more interesting than monologues. This aspect merits further exploration in future research to enrich our understanding of the instructional dynamics within immersive digital storytelling in VR.

6. Conclusions

In the long term, I aspire for this research to evolve into a comparative study, contrasting the acquisition of traditional wayfinding skills in a VRE against the conventional classroom approach. This envisioned study would adopt a more quantitative methodology, with the evaluation criterion focused on students applying their acquired knowledge in practical scenarios aboard a waa kaulua. The primary objective of subsequent research endeavors is to unearth the underlying values and cues within storytelling that effectively facilitate the learning and application of traditional wayfinding skills.

Furthermore, the anticipated outcomes hold the potential to unveil best practices for engagement and online learning within a VRE educational system, transcending the specific context of traditional wayfinding. These findings could be generalized and applied to diverse subjects, enhancing the overall effectiveness of virtual learning environments. To bridge existing gaps, a subsequent study integrating AI into the VCs may prove instrumental. This advancement aims not only to enhance engagement but also to contribute to the ongoing improvement of online learning experiences within a VR setting. If ACs are to play a role in conveying knowledge through storytelling, the data points to incorporating AI for best results.

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