

Interaction with Life-Size Holographic Kiosks for Indigenous Cultural Knowledge Preservation

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Abstract. This paper shares early results from a research project that aims to design interactive experiences using life-size holographic displays to help preserve and share Indigenous cultural knowledge. Working with the First Nation of Na-Cho Nyäk Dun (NND) in Mayo, Yukon, Canada, we adapted the HoloBox, a life-size holographic display originally made for conferences and trade shows. We converted the HoloBox into a cultural knowledge kiosk, allowing community members and visitors to explore oral histories, language lessons, craft demonstrations, and 3D models of cultural belongings. We found that the life-size holographic display offers a sense of presence. This aligns better with the relational and experiential way in which Indigenous oral knowledge is passed down, rather than static archives. The paper describes how we co-designed the system with the NND community. Additionally, we explain the content and interaction design, and highlight key findings from a community evaluation in Mayo. Our findings revealed important issues, including data sovereignty, challenges in designing interactive features for a life-size format, and the role of co-design in building community trust. This research adds to HCI literature on culturally grounded technology, embodied interaction, and digital methods for preserving Indigenous knowledge.

Keywords: Holographic display, Indigenous knowledge preservation, oral tradition.

1 Introduction

Indigenous knowledge is transmitted orally across generations, representing distinctive systems of communication, knowledge, and identity deeply embedded in community and land (Ajani et al., 2024). For the First Nation of Na-Cho Nyäk Dun (FN-NND), whose traditional territory encompasses the upper Stewart River watershed in Yukon, the Northern Tutchone language and its oral traditions are integral to cultural identity, land-based knowledge, and community wellbeing. However, these traditions are under increasing threat due to the loss of fluent elder speakers, the prolonged disruption of intergenerational transmission resulting from colonial policies, and the limitations of conventional preservation methods in capturing the essence of oral knowledge (Godfrey et al., 2016).

Digital archives represent an institutional response to this crisis. While digitized recordings, searchable databases, and static digital archives increase accessibility to language materials, they often capture only the surface form of knowledge, lacking the presence, context, and relational depth inherent in oral transmission. Godfrey et al. (2016) highlight this limitation in the context of Australian Aboriginal language preservation: when elders pass away, their language and associated knowledge are lost. Unlike Western societies, Indigenous communities cannot rely on written materials as substitutes, making the mode of access as critical as the act of archiving itself. Static data cannot engage with a child's curiosity or convey the significance embodied in a storyteller's physical presence.

This paper presents a research project by the First Nation of Na-Cho Nyäk Dun, co-developed by Carleton University, that investigates an alternative approach: employing life-size holographic display technology to develop an interactive cultural knowledge system that animates oral histories and cultural content through an embodied digital presence (<https://kwandekando.ca>). The HoloBox, a commercial display unit initially designed for conference and trade-show telepresence, was adapted and co-designed in collaboration with NND community members. Then, the resulting system was subsequently evaluated by the community in Mayo, Yukon. Our main argument is that holographic display technology provides an experience that static archives cannot: the sensation of being in the presence of a storyteller, at a human scale, directly addressing the audience (Kim & Wohn, 2018).

2 Background and Related Work

The research presented in this paper addresses the need to embrace emerging technologies when approaching Indigenous language and cultural revitalization. This topic is particularly important for youth who live and thrive in a technology-based environment. It is essential to use technology to engage a diverse audience, especially younger ones, while educating them about traditional values. The following sections briefly review the limits of static approaches and possibilities offered by new technologies such as holographic displays.

2.1 The Limitations of Static Archives for Oral Knowledge Preservation

The preservation of Indigenous languages and oral traditions through digital technology represents a critical and emerging focus within HCI and digital heritage. Ajani et al. (2024) contextualize this issue amid rapid technological change. They argue that, although digital tools are effective for documentation and distribution, the primary challenge lies in revitalization rather than mere documentation. While recording an elder's story preserves the words, it does not capture the act of storytelling, the presence of the speaker, the sense of being addressed, or the significance of the moment. Ajani et al. (2024) advocate for digital tools that go beyond static records, enabling interactive and immersive experiences. Such experiences can facilitate deeper engagement among community members, particularly younger generations who frequently learn through digital platforms, thereby fostering genuine ownership of cultural knowledge.

Godfrey et al. (2016) illustrate this challenge through the Living Archive of Aboriginal Languages project, which sought to digitize and distribute Indigenous language materials from Australia's Northern Territory. Although the project resulted in an open-access online collection containing thousands of documents, the researchers observed that simply having availability does not animate the materials. Community members required more than access; they needed interactive methods that preserved the content's relational and contextual significance. The project emphasized visual navigation, thumbnail browsing, and community-specific organization of materials. This approach demonstrates that the manner in which individuals access knowledge influences its impact, not solely its accessibility. We propose incorporating embodied holographic presence as a potential solution to this gap.

2.2 Holographic Technology as a Medium for Cultural Knowledge

Holographic displays have become a distinct medium in museum and heritage contexts, providing spatial depth, life-size presence, and three-dimensionality that other digital display formats cannot achieve without specialized equipment. Xu et al. (2025) present a comprehensive review of holographic technology in museum settings, identifying curiosity, wonder, and a sense of the lifelike as the primary emotional responses reported by visitors. These responses are attributed to holography's ability to simulate depth, parallax, and spatial presence in ways that engage both kinaesthetic and visual perception. This quality differentiates holographic displays from flat-screen digital formats. In contrast to augmented reality systems that require headsets, holographic displays enable multiple viewers to share the same exhibit simultaneously, with each individual experiencing slightly different perspectives based on their physical position (Xu et al., 2025).

This spatial quality directly influences the reception of cultural knowledge. Xu et al. (2025) observe that visitors to holographic museum exhibits experience a distinct emotional progression: initial curiosity and fascination develop into sustained cognitive reflection and a deeper connection to the presented content. According to their analysis, holographic displays facilitate layered storytelling through spatial realism and light design, serving as narrative tools that integrate information with experiential immersion in ways that conventional exhibit formats cannot achieve. This narrative affordance is particularly significant for applications focused on oral histories.

Tang and Zhang (2023) conceptualize this affordance in terms of visitor experience. Traditional museum exhibits typically permit only passive visual and auditory reception, whereas interactive holographic systems enable authentic two-way engagement between the audience and the virtual presence, transforming exhibitions from displays into exchanges. Their research on interactive holographic technology for oral heritage demonstrates that holographic projection can animate cultural traditions through touch-based interaction, significantly enriching the visitor experience compared to static displays. This finding aligns with broader evidence that emotional engagement with exhibits enhances learning by anchoring memories more vividly and improving information retention (Xu et al., 2025).

The life-size format is particularly relevant for this application. Kim and Wohn (2018) investigated a holographic presentation system in which a human presenter was spatially integrated within a three-dimensional visualization space. Their findings indicate that this embodied integration significantly enhances audience engagement, attention, curiosity, and intrinsic interest compared to conventional presentation formats. Participants reported feeling more connected to the information conveyed, describing the experience as more like a conversation than observing a display. This social presence effect supports the use of the HoloBox for NND storytelling, as the system presents cultural knowledge holders at a life scale, speaking directly to visitors in a format that preserves the relational quality of a live encounter.

3 System Design

3.1 System Overview

The HoloBox is a life-size holographic display unit manufactured by ARHT Media and originally intended for conference and trade-show telepresence. The system projects a full-height, three-dimensional rendering of pre-recorded content onto a transparent display panel, in front of a hollow box, which produces the visual impression of a person or figure standing in the enclosure at human scale (Fig. 1a). For this application, the hardware was repurposed as a cultural knowledge kiosk. It currently presents oral histories, language lessons, craft demonstrations, and three-dimensional representations of cultural belongings. Retaining the life-size format was a central design decision (Fig. 1b). Xu et al. (2025) document that perceptual realism at the human scale, with depth and spatial immediacy, and the sense of being addressed directly, make this medium distinct from conventional video displays. These features foster the emotional and narrative engagement the system seeks to achieve. The device also offers the possibility of live tele-presence when in-person communication, for example with an Elder, is not possible.

The interaction layer uses touch-based navigation. Visitors use a touchscreen interface to select content categories and navigate within them. Content categories were chosen collaboratively with NND community members during co-design sessions. These categories include oral histories told by community elders, traditional language lessons with NND vocabulary and phrases, craft demonstrations of traditional practices, and three-dimensional representations of cultural objects. Rather than applying an external research framework, content categories were shaped entirely through community decision-making. The life-size format introduced specific design challenges related to physical interaction. The display is approximately the height of a standing adult. This affects visitor positioning, space requirements around the kiosk, and how the touchscreen interface relates spatially to the holographic figure above it. These constraints required careful planning of the interactive and display elements.



Fig. 1. HoloBox for (a) tele-presence and (b) community storytelling

3.2 Design Process

The initial phase focused on defining the system's content requirements. Rather than having the research team independently determine content categories for later community review, these categories were collaboratively developed from the outset. Co-design sessions identified four primary areas: oral histories shared by community elders, traditional language lessons featuring NND vocabulary and phrases, demonstrations of traditional craft practices, and three-dimensional representations of cultural belongings.

After establishing the content structure, participating elders recorded stories, language lessons, and demonstrations specifically tailored for the HoloBox format. The life-size projection necessitated production considerations distinct from conventional video, including framing recordings for a full-height display and ensuring the elder's address appeared direct, as if speaking to a person standing before them. Elders determined the knowledge to share, the mode of presentation, and the appropriate level of detail. The recording process served as an act of cultural transmission rather than data collection, with knowledge holders maintaining full agency throughout. After the content was decided on, the user flow was created and can be seen in Fig. 2.

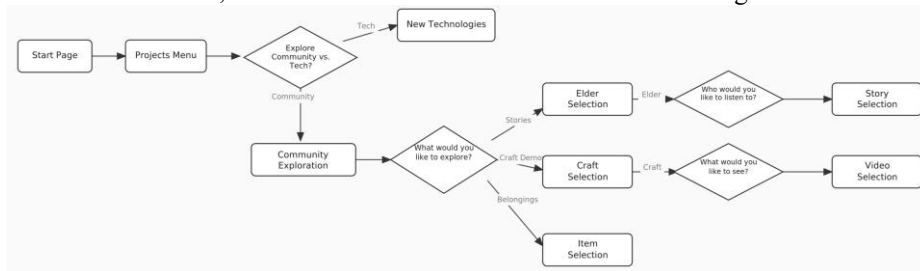


Fig. 2. User flow diagram for the HoloBox cultural knowledge kiosk, illustrating the navigation structure from entry point through content selection.

Following content preparation and overall stylistic design choices, such as logo and colour palette, by an NND graphic designer, the design process progressed to interface development. The initial iteration was functionally coherent but lacked cultural specificity. The use of white backgrounds, green buttons, and rectangular portrait frames for elders resulted in an application that was legible but indistinguishable from standard interfaces. Elder portraits appeared in cropped frames similar to profile pictures, and craft categories were organized in a manner reminiscent of a product catalogue. The visual language and the interface were operational but reflected the designer's perspective rather than the community's. Although the interface was operational, it did not align with the project's cultural objectives. This can be seen in Fig. 3.

Community feedback highlighted the shortcomings of the initial design, prompting the second iteration to address the question of what characterizes this community's visual environment. The color palette shifted to burgundy and amber, reflecting the warmth of materials present in the community. Elder portraits were placed in circular frames with decorative borders inspired by NND beadwork traditions, intentionally referencing cultural craft practices rather than standard user interface conventions. Warm gradients replaced the clinical white backgrounds, resulting in an interface that felt contextually grounded. Fig. 4 shows the revised design, where the visual language now communicates the system's cultural ownership.

The life-size format introduced physical design challenges not typically encountered in conventional screen-based interfaces. Each interactive element required careful positioning relative to a projection matching the height of a standing adult.

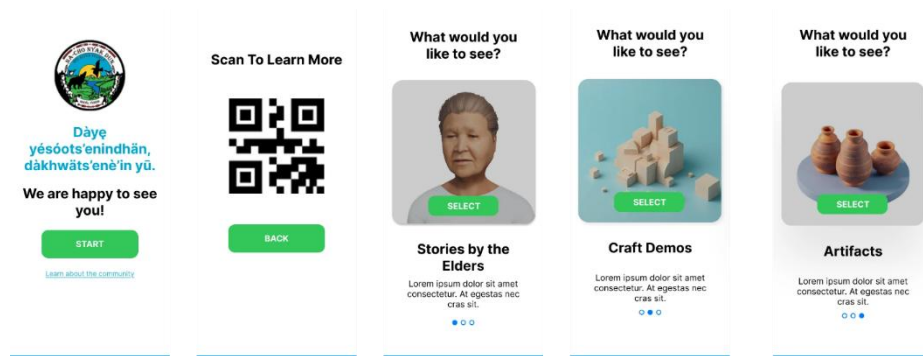


Fig. 3. First design iteration of the HoloBox kiosk interface. The layout and visual language were later revised through community feedback. Photographs shown are placeholders used during the design process, not final community content.

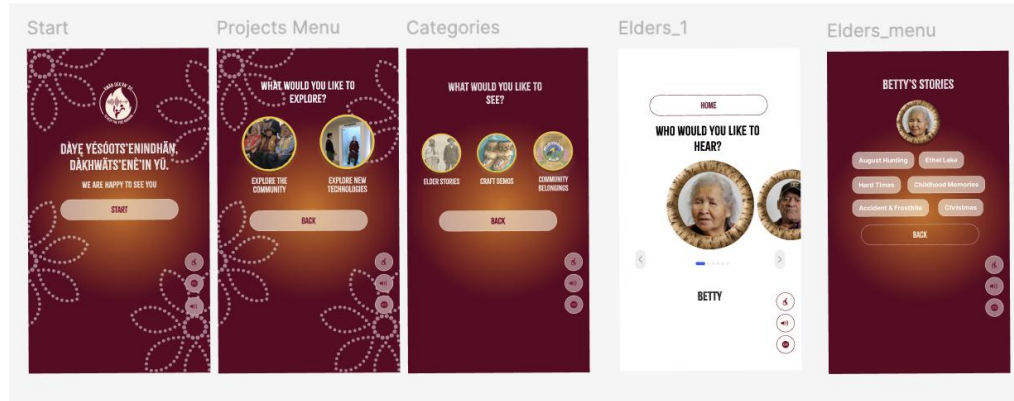


Fig. 4. Final design iteration of the HoloBox kiosk interface, revised following community feedback. The burgundy and amber palette, circular Elder portrait frames with beadwork-inspired borders, and warm gradients reflect the community's visual world rather than generic UI conventions.

4 Community-Driven Co-Design Process

Our design process followed a community-based co-design model in which NND community members were participants in decision-making rather than subjects of evaluation. This approach is grounded in Kapuire et al. 's (2016) community-based co-design (CBCD) framework, which identifies engagement, reciprocity, and ongoing collaborative doing as the core conditions for ethical technology development with Indigenous communities. These conditions distinguish genuine co-design from consultation conducted after the key decisions have already been made.

Initial sessions focused on understanding how the NND community currently shares knowledge: in what social contexts, between whom, and with what protocols around sensitivity and access. These conversations were not about capturing specifications but about establishing trust. Subsequent sessions moved into content selection and interface design, with community members making explicit choices about which stories and demonstrations to include, how they should be introduced and contextually framed, and which navigational metaphors felt appropriate. Icon designs were revised when they did not resonate with community members.

Trust was not a precondition of the co-design process but an outcome of it. Kapuire et al. (2016) describe a similar dynamic in their work with the Ovahimba community in Namibia: community members became more engaged and invested in the technology as they saw their own decisions reflected in the system, and as the research team demonstrated that their authority over the design would be respected. The iterative structure of our co-design sessions served the same function. Each revision made in response to community feedback communicated that the collaboration was genuine and built the conditions for more genuine conversations about data sovereignty and cultural protocol.

5 Early Findings & Design Insights

During the field evaluation in Mayo, community members interacted with the HoloBox prototype and gave feedback through discussion. The life-size format drew the most consistent and notable response. Several participants said the experience resembled being told a story, not just watching a screen. This distinction is important in a cultural context where oral storytelling is inherently relational, embodied, and dependent on presence. This qualitative feedback aligns with the findings of Xu et al. (2025), who identify unique emotional affordances in holography. These include curiosity, wonder, and a sense of lifelikeness evoked by three-dimensional spatial presence. Other display formats do not replicate these effects.

The life-size format, while enhancing storytelling, introduced design challenges that became evident only once the system was in a community setting. The scale of the holographic figure, about the height of a standing adult, created spatial requirements around the kiosk and influenced visitor engagement. The touchscreen interface at the base of the unit required visitors to divide their attention between the interactive surface below and the holographic figure above, at times disrupting the intended sense of presence. Tang and Zhang (2023) argue that holographic systems need interaction design to support the narrative, not just visual quality, for authentic cultural communication. The physical connection between interaction and display is integral to this narrative.

These constraints reveal design opportunities unique to life-size holographic systems. Such opportunities are not present in conventional kiosk or screen-based exhibit design. The spatial zone around the kiosk, visitor approach patterns, standing positions, and group dynamics all contribute to the interaction design, even without intentional planning. Future iterations will focus more on the physical layout of the interaction zone. The spatial relationship among the visitor, the touchscreen, and the holographic figure will be assessed to reinforce, rather than disrupt, the sense of embodied presence.

6 Conclusions and Future Work

This paper presents the design and early evaluation of a life-size holographic cultural knowledge system adapted from commercial telepresence hardware. It is part of a language and cultural revitalization project by FN-NND, co-developed by Carleton University. The system demonstrates that holographic displays, as a medium, can shift the experience of engaging with digital cultural knowledge toward something meaningfully different from static archival formats. This was immediately recognized by the community, which reported feeling that the life-size format was like being told a story rather than watching a screen. This experiential quality is not incidental but central to the system's contribution. Oral knowledge is not just content; it is a relational act. If digital preservation is to serve revitalization rather than mere documentation, the medium must carry some of that relational quality forward.

The co-design process with the First Nation of Na-Cho Nyäk Dun extended beyond the creation of a culturally appropriate interface. This deliberate collaboration determined the system's content, boundaries, and exclusions. Community authority over

these decisions, grounded in data sovereignty and enacted through co-design sessions, distinguishes this work from institutional archiving and establishes the system as a community resource rather than a research artifact. Trust developed through this process constitutes a significant finding, demonstrating that authentic co-design transforms not only design outcomes but also the scope of discussion and decision-making.

Future research will proceed along three primary directions. The first involves integrating conversational artificial intelligence into the system to facilitate more responsive and dynamic exchanges between visitors and holographic cultural knowledge holders. This integration will require rigorous community oversight regarding AI training, permissible outputs, and representation of the community's voice, and will be developed through the established co-design process. The second direction focuses on enhancing the interaction design to embody cultural protocols beyond content access restrictions. Future iterations will address what the Mayo evaluation revealed: visitors arrived as groups, but the system was built for one. The interaction model will be redesigned to meet people the way they actually come. The third direction responds to the community's own momentum: following the Mayo evaluation, NND members expressed interest in expanding the system's content, with more elders wanting to record their stories and additional cultural material proposed for inclusion. This suggests the system has earned the community's investment, and that future development will be as much about keeping pace with community enthusiasm as it is about solving a technical problem.

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