ANGLICA

An International Journal of English Studies

Navigating New Frontiers: New Paradigms in Audiovisual Translation and Media Accessibility

34/2 2025

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UNIVERSITY OF WARSAW | INSTITUTE OF ENGLISH STUDIES UNIVERSITY OF WARSAW

Anglica. An International Journal of English Studies 34/2
ISSN: 0860-5734, e-ISSN: 2957-0905

https://doi.org/10.7311/0860-5734.34.2.06

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Sound, Touch, and Place: An Exploratory Study of the Potential for Emotive Cognitive Mapping through the Use of Audio Description and Tactile Objects at a National Memorial

Abstract: Audio description, tactile objects, and memorial sites are often studied separately for their communicative and emotive potential without consideration of potential multimodal connections existing among people, technologies, and solemn public places. This study's novel mixed-methods approach uses site tours, surveys, think-aloud protocol, semi-structured interviews, and observations to develop rich and holistic understandings of such complex multimodal site visits at Pearl Harbor National Memorial in Hawai'i by people who are DeafBlind, blind, or with low vision. Several themes emerged in the grounded empirical data gathered during the tour, afterward, and during an interview one month later, including findings that bridged emotions, inclusion, and place-based narratives.

Keywords: audio description, memorial, orientation and mobility, tactile map, wayfinding tools

1. Introduction

Audiovisual translation (AVT) researchers spend much of their time studying audience-reception issues, in one form or another, but they rarely include in these investigations concerns about the physical listening contexts, especially when focused upon media accessibility and audio description (Perego 2023; Taylor and Perego 2022). Such a filtered viewpoint implies that, outside of these research scopes, a wide array of unaccounted variables may exist in any listening environment. These elements within the physical context may impact comprehension, motivation, engagement, emotive responses, and memory-building, as well as the overall experience of the audiovisual translation itself.

This paper – in response to the journal's call for new frontiers and new paradigms in AVT and media accessibility – aims to establish pathways into such fertile and complex territories toward transdisciplinary exploration of locative audio description (AD). In our definitions, AD is the remediation of visual media into audible media, primarily for the benefit of people who cannot see or cannot see well. Locative AD, as an extension, investigates realities in-situ, documenting messy intersections of people, place, technologies, and AD, at which experiential factors tilt the holistic user experience in the directions of where attention is paid and given. With an overlay of Orientation and Mobility (O&M) that supports an individual's sense of physical space and place during navigational tasks, our research team interrogated the ways that accessibility tools effectively supplemented traveler experiences in the real world. Within this investigation, these experiences are brought to the surface for analysis through interviews, observations and think-aloud protocols, and focus groups.

Much academic study in AD focuses on questions about what the descriptions should say, in what depth, and how the words should be performed, by humans or machines, in placeless settings. Adjacent interests in O&M lead researchers to support the same target audience: People who are DeafBlind, blind, or who have low vision. Instead of content qualities, though, O&M researchers regularly test and establish best practices for successfully navigating public places, via what landmarks are nearby, and understanding a person's in-situ choices, affordances, and constraints (Wiener et al. 2010). While AD generally disregards matters of place, O&M research generally emphasizes site-specific place matters as well as function over form, creating an ideal tension between the partners. Both approaches have distinct strengths and weaknesses in developing a holistic understanding of the user experience, but neither captures the full breadth of the emplaced experience. We therefore intend to illustrate a collaborative approach, across disciplines, which can help to bridge such disciplinary gaps by tossing a wider net for data and metrics for measuring environmental literacy. In that vein, a researcher trained in O&M and a researcher trained in Technical Communication, with a specialty in AD, supported by a group of four O&M-focused graduate students and one working

O&M practitioner, conducted an IRB-approved, mixed-methods, and multimodal experiment about medium effects with a dozen DeafBlind, blind, or low-vision participants at Pearl Harbor National Memorial in Honolulu, HI. This study was intended to illustrate opportunities to more richly gather data about this holistic type of public intervention than either of the two disciplinary standards normally would be able to do on their own. The inquiry was guided by these research questions:

RQ1: In what ways does content delivered through different mediums (tactile maps, AD, or both) affect individuals who are blind or have low vision during a walking tour of a sacred national place?

RQ2: In what ways do participants evaluate different mediums in terms of information-sharing efficacy?

2. Literature review

A vast majority of exhibits, wayfinding information, and interactive opportunities are not accessible at historic sites for people who cannot see them. In many areas of the world, people are living longer and often experience gradual vision or hearing loss that impacts access to information as well as mobility (Killeen et al. 2023). Perceiving, exploring, and processing sensory information during visits to historical sites is inextricably intertwined with both the physical acts of exploration and a contextual understanding of the environment (Fazzi and Barlow 2017). Orientation aids and wayfinding support systems, such as tactile maps and AD, are crucial for facilitating such spatial understanding and cognitive mapping (Griffin et al. 2020). However, such support systems rarely are available, and their effectiveness in improving accessibility and optimizing participatory experiences in public places, such as museums and national parks, needs further investigation.

Historically, people with disabilities have been physically, legally, and socially segregated from public community spaces (Schweik 2009). While it is no longer a widely held belief that people with disabilities should be denied access to public places, there are more nuanced negative attitudes about location-based information, particularly among those who promote visual media and make assumptions about people who cannot see or see well (Li et al. 2023). This uninformed view can be summarized in this question: "Why would a blind person need, or even use, a map?" (Conway et al. 2016, 69). Such a question ignores the universal human need for information, a sense of place, connection to the environment, and agency.

2.1. Tactile maps and digital wayfinding

People who cannot see historically have been forced to seek accommodations in order to access cultural centers and parks (Conway et al. 2016; Kendrick 2014).

Tactile maps, for example, have been provided for decades to offer some levels of geospatial data and information through raised symbols and distinct textures (Brittell et al. 2018). Papadopoulos et al. (2018) investigated the usefulness of tactile maps to convey complex spatial information about the environment. Other scholars have evaluated tactile maps as a tool to reduce the memory load on users, enabling them to feel more competent when traveling on an unguided route (Ungar et al. 1993). Two additional studies that focused on tactile map design aimed to measure usability and effectiveness of those maps. Feucht and Holmgren (2018) generated a list of essential components of effective tactile maps, emphasizing legibility and user preference. Their research established the importance of creating tactile maps that incorporate elements such as a compass rose, a braille key with building abbreviations, and appropriate contrast. Building upon that study, Barvir et al. (2021) added insights about the inclusion of interactive tactile maps using TouchIt3D technology and OpenStreetMap data. Despite challenges associated with map complexity, respondents expressed high satisfaction with the interactivity and usability of those maps, and Barvir's study identified areas for improvement, including implementing interactive symbols for muting auditory descriptions and enhancing map scale detail. By prioritizing legibility, user preference, and interactivity, the study stated, designers could enhance the accessibility and usability of tactile maps across various contexts.

2.2. Audio description

Another robust support system for engagement in cultural experiences, across educational and professional communities, is AD (Oppegaard and Rabby 2024). As a distinct mode of AVT, which offers an alternative form of informational access to alt-text, AD involves a process in which a sighted person describes in audible form to a blind person something visual and otherwise inaccessible, creating a connection between the describer and the audience member that, when done well, contributes significantly to feelings of social inclusion (Oppegaard and Miguel 2022). Informal forms of AD likely have been in use in ad-hoc ways for thousands of years, but formal academic study of it only began in the 1970s and did not really pick up significant pace until the 2010s, primarily spurred by AVT researchers in western Europe (Koirala and Oppegaard 2022). Wang et al. (2022) note the importance of AD guides as vital tools for ensuring museum accessibility and in promoting inclusivity. When combined, AD and tactile maps often get used in a broader accessibility strategy that includes touch tours, handling sessions, or other multisensory experiences to provide more-engaging museum visits for people with visual disabilities. But while the Web Content Accessibility Guidelines (WCAG) standards offer important best practices about how to provide image description and plain language for visual content on websites, such standards do not extend to in-situ descriptions that may be provided for physical and real-world objects and

environments, and there is no comprehensive touchstone of equivalence for AD outside of websites.

2.3. Tactile and audio and place

Cavazos et al. (2021) created a formative study with blind participants, art museum staff, and artists to better understand the challenges and needs of stakeholders in accessible art representation. They developed interactive multimodal guides featuring a touch-sensitive 2.5D artwork model and localized description. The study compared the approach to tactile graphics and found that the interactive multimodal guide offered a more accessible and user-friendly experience, increasing confidence and independence when exploring visual artworks. Papadopoulos et al. (2020) expanded on the need for incorporating essential landmarks and environmental information to create useful audio-tactile maps of a college campus for individuals with visual disabilities. Papadopoulos and colleagues (2016) also reported on three separate experimental trials that showed that the use of AD with tactile maps could significantly improve the spatial performance of blind people, as well as their abilities to apply their spatial knowledge from virtual to physical environments. Gardiner and Perkins (2005) explained in their multimodal study the challenges faced by people with visual disabilities who are attempting to navigate in unfamiliar environments and also demonstrated the potential value of tactile maps, especially when accompanied by AD. Brock et al. (2015) examined and discussed the efficiency, effectiveness, and satisfaction of different maps in acquiring mental representations of space and the efforts to make maps accessible to individuals with visual disabilities. The researchers compared the usability of a multimodal tactile map with audio output with a tactile paper map with a braille legend. Despite showing the effectiveness of multimodal wayfinding supports systems, that study used a map representing a fictional city rather than an actual public space, raising questions about its applicability to real-world situations. Griffin et al. (2020) conducted a similar study investigating the use of an interactive audio-tactile map for cognitive mapping and recall by comparing its effectiveness to traditional tactile maps.

3. Theoretical framework

Public spaces, including parks, historic sites, museums, and monuments are important places that provide economic, political, cultural, spatial, recreational, educational, and sociological benefits to members of a community. Well-designed common spaces offer opportunities for visitors to actively engage with people, objects, and media. For architects, archivists, and creators of public historic memorials or cultural sites, a primary design goal includes building spaces that promote

education through access to information in a variety of interactive formats. Park staff members seek to engage visitors in historical narratives by supporting public navigation within the park space, exploration of exhibits, opportunities for inquiry and reflection, and invitations to construct their own memories of the historic site. Universal design theory provides a transdisciplinary framework for understanding the relational nature of individual and environmental factors that promote equitable and flexible use of community assets (Lid 2013). Experts in inclusive design describe the type of intentionality needed in this endeavor as part of a deliberate process for creating spaces that not only reduce physical barriers for participation but which also foster a sense of belonging for all members of a diverse community (Wise 2022). Design that cultivates a sense of belonging has been characterized as one where visitors feel "invited," "a part of something," "alive," as well as "seen and heard" (Wise 2022, 3).

Universal design theory incorporates a multidisciplinary approach to describe the relationship between embodied experiences and complex environments. From a Disability Studies perspective, this framework is often explored with a focus on human rights and full participation in communities. As people age, their experiences of access and mobility also shift, making this a highly practical lens for designing environments that benefit the broadest swath of people. Theorists emphasize the relational nature of the model in exploring human functionality using task-relevant scenarios within constructed spaces. Universal design principles have been distilled into seven domains for exploring the features of an environment; these include: 1) equitable use; 2) flexibility in use; 3) simple and intuitive features; 4) perceptible information; 5) tolerance for human error; 6) low physical effort; and 7) reasonable size and space. In order for public spaces to be accessible to everyone, regardless of their abilities, these dimensions of universal design must be explored through practical use. Universal design theory interrogates the main functions of a space to discover what tasks, activities, or experiences are important for people within the environment. Inclusivity also requires intentional design that accounts for social, cognitive, age, gender, sensory, and physical access (Di Giovanni and Gambier 2018, 8, as cited in Wang et al. 2022). In such respects, we designed our site tour for this study with inclusivity and in ways that integrate and address Universal Design principles.

4. Methodology

This exploratory case study, modeled upon the approach by Guetterman and Fetters (2018), aimed to assess and compare the impacts of AD, tactile maps, and the physical environment as pliable modes of calibrating the experience of DeafBlind, blind, and low-vision visitors to Pearl Harbor National Memorial in Honolulu, Hawai‘i, on the island of O‘ahu. Because existing mixed methods and multimodal studies

about access to public spaces for blind people are rare, our team employed a case study method to develop rich descriptions about shared experiences of the visitors and how accessible tools, such as AD and tactile maps, could impact connections to narratives within the park. The investigation occurred in a real-life context with multiple elements in play, including access to a unique historic site in the world, with other members of the public also serving as unwitting noise in the system. Besides the randomness of the people in the crowd around the participants, the variable weather conditions, environmental sounds, wind, heat, and all sorts of other uncontrollable factors were inextricably connected to the walking tour experience. In that sense, our case study approach was intended to describe both this unreplicable moment in time but also any ordinary day at Pearl Harbor. Copious amounts of qualitative and quantitative data were gathered concurrently and were analyzed using convergent comparisons to respond to the research questions.

4.1. Design

The current research extends the studies conducted by Griffin et al. (2020) by examining how various accessibility factors impact individuals who are DeafBlind, blind, or who have low vision in an open public place. The research methodology used a mixed-methods approach that involved combining descriptive patterns and narratives as well as quantitative and qualitative metrics and data to provide a better understanding of the research topic than either data trends or stories could on their own (Mertler 2021). The research team employed the concurrent triangulation design for this study, in which qualitative and quantitative data collection occurred simultaneously from the same experience, allowing us to validate the findings generated by each method through evidence produced by the other (Kroll and Neli 2009). The reconstruction of a tactile map by the participants, including the sequence of landmarks explored and the salience of the exhibits, was also captured using quantitative and qualitative means. The study's independent variables encompassed the specific route chosen for this study at the national park site, along with the specific audio-tactile mediums assigned to each participant. Dependent variables included the participants' attitudes, perceptions, memories, and overall experiences throughout the study, as well as the insights gathered from the focus group sessions and individual interviews administered during and after the tours. The recall by participants of the features and the location of the landmarks within the park were assessed one month after the live tour.

4.2. Participants

The recruitment process for this convenience sample involved distributing a flier through community agencies that serve individuals who are DeafBlind, blind, or have low vision. The eligibility criteria were a confirmed diagnosis of visual

impairment or deafblindness, verification of age (14 years or older), adequate functional hearing capability for speech comprehension during the visit to Pearl Harbor National Memorial, and a demonstrated level of functional mobility, showcasing their proficiency in using mobility aids such as white canes, guide dogs, wheelchairs, or similar navigation support systems. These criteria were established to ensure that participants could independently engage with the accessible materials at the memorial. Twelve participants (eight male, four female) with varying visual disabilities participated, with ages ranging from 19 to 66 years (M = 45.2). All participants identified themselves as blind or having low vision, of which four had congenital and eight had adventitious visual disabilities. Three of the participants also identified as having mild to moderate hearing loss. Ten participants had prior experience with tactile maps, and five reported that they had experience with wayfinding technologies. All participants but one reported using either a white cane or a combination of a white cane and human guide for travel. The self-reported confidence levels in independent travel among participants varied from "not at all confident" to "extremely confident." Prior to touring the park, participants completed the UC Santa Barbara Sense of Direction scale, a 15-question self-assessment of one's spatial perception abilities that has been shown to be a reliable indicator of navigational skills (Hegarty et al. 2002).

4.3. Mediated material

To compare the effectiveness of accessibility tools, the research team created a tactile map and recorded AD specifically for this study. We first identified the park area containing salient artifacts (Figure 1). The tactile map creation process included selecting eight artifacts, designing keys for each artifact, and drawing a map highlighting the geographic feature along with the corresponding keys. We then printed the map using a thermoform machine to make it tactile. To indicate the tour route, we utilized the Graph Bendor from the American Printing House (APH) (Figure 2). AD for the preselected eight artifacts was made available through a robust software suite, called UniDescription, which is an open-access, open-source system that includes mobile apps designed for people who are blind or low-vision. It is available on both Android and iOS platforms. That app has been tested and used for nearly a decade, and it offers about 200 audio-described brochures for national parks across the country, among other types of content, including AD for four separate Pearl Harbor brochures.

For the purposes of our research study, we created custom AD to meet the needs of this experiment and then programmed them into the app exclusively to evaluate their effectiveness in aiding comprehension and recall of information among our participants (Figure 3). In addition, the research team included two tactile models in the site visit as a way to ensure participants could access detailed information about the artifacts. One model was a miniature version of the Tree of

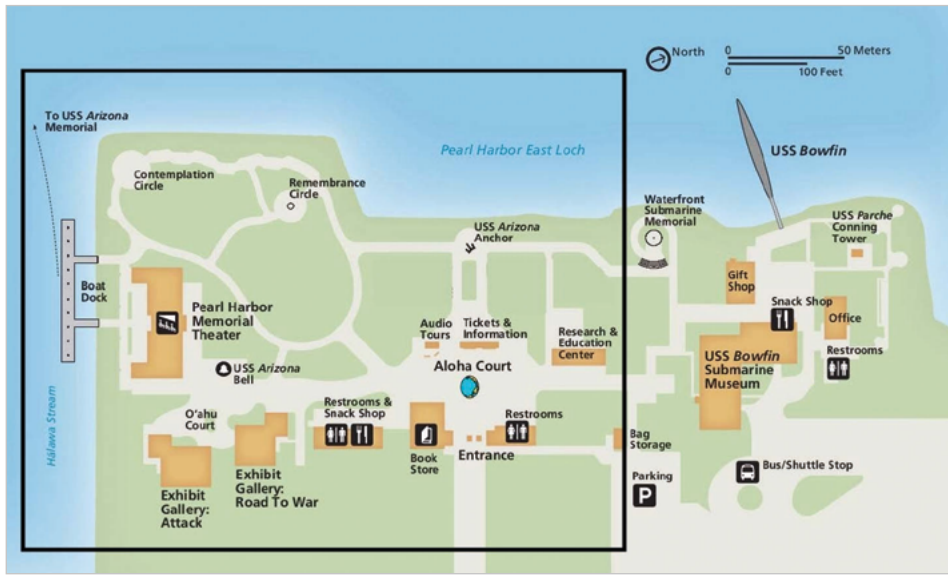

Fig. 1. Map of Pearl Harbor Park

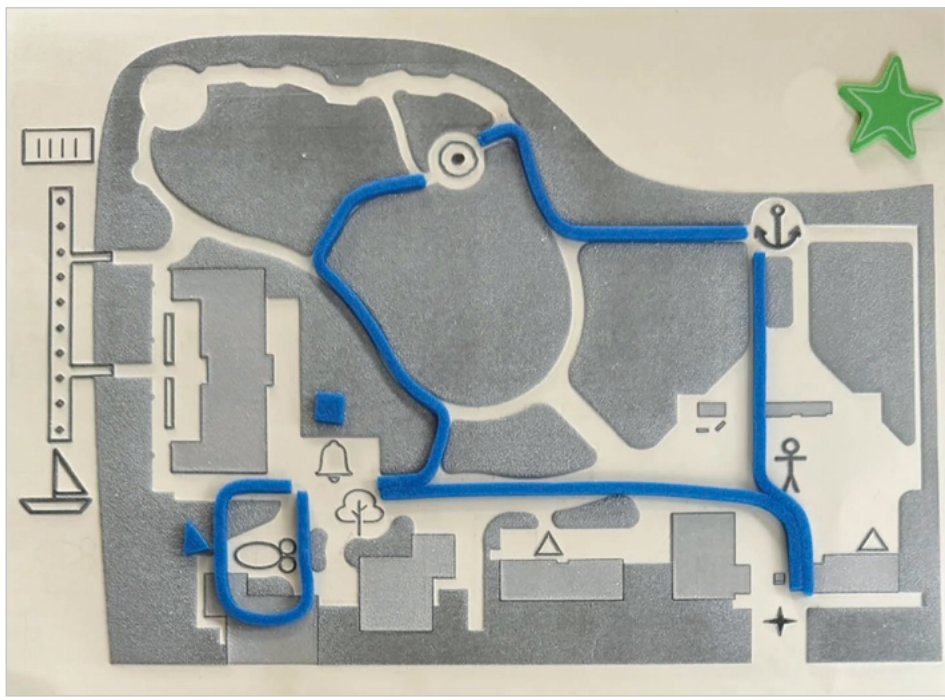

Fig. 2. Tactile map of Pearl Harbour Park with raised path lines
Note. A star shape indicates North.

Fig. 3. Uni description artifacts and site descriptions
Note. The QR code directs to the audio files.

Fig. 4a. Tree of Life acrylic miniature

Fig. 4b. USS Arizona Memorial model in paper

Life sculpture, a large artifact that was too tall and large for participants to adequately feel its intricate details. The other was a tactile model of the USS Arizona Memorial, an artifact that requires a boat ride to experience, which we decided not to include for this study, due to time constraints; instead, we provided a model, offering access to the memorial's detailed features (Figure 4a and 4b).

4.4. Procedures

The research team conducted the study in two phases. The first phase involved onsite tours carried out at the Pearl Harbor National Memorial. Participants were divided into three groups and provided with different accessibility conditions: Group 1 received a tactile map only; Group 2 received AD only; and members of Group 3 received both AD and the tactile map (an audio-tactile combination) to compare efficacies. During the first phase of the experiment, all group members engaged in a route familiarization process for up to 10 minutes in a comfortable

conference room, allowing them to acquaint themselves with the names of the artifacts along the tour route, the paths between them, and the general scope of the map. Participants in the tactile map group and audio-tactile group were encouraged to explore the tactile map, which involved reading braille and previewing the keys. Those using only AD were allowed to start the tour whenever they were ready. Subsequently, a researcher guided each participant to the starting point near the park entrance to begin the onsite tour.

While navigating the park, each participant interacted with the eight artifacts using a think-aloud protocol and using the provided accessibility tool as desired. A researcher served as a human guide and was paired with each participant during the tours, providing mobility assistance to ensure their safety. The researcher also captured the experience through audio and video recordings. For this research, we allowed all participants to tactually explore available artifacts along the way, such as models and statues displayed by the Pearl Harbor Memorial Park, in addition to the assigned audio-tactile mediums. The predetermined duration of an onsite tour was approximately 1 to 1.5 hours, depending on the participants' preferred walking pace. After completing the tours, the participants engaged in focus group discussions to share their experiences using the audio-tactile mediums, allowing them to discuss their impressions, challenges, and any insights gained from using the tactile map, AD, or both.

In the second phase of the study, which was conducted a month later, participants took part in individual, in-person interviews. They were asked to create a Pearl Harbor National Memorial map using provided tactile map materials. Additionally, they were asked to recall their pathways and describe the exhibits they encountered along the way. This phase aimed to evaluate the effectiveness of the audio-tactile mediums in aiding memory retention and to explore their additional insights into the overall tour experience. The interviews were conducted in convenient locations for the participants, such as libraries, agencies, or community centers.

4.5. Data collection

The research team collected quantitative and qualitative data through a survey that included short-answer questions, onsite tour and focus group discussions during the first phase of the study, as well as individual interviews during the second phase. Researchers used GoPro cameras during the onsite tour and audio recorders during the focus group discussions that followed. Video cameras with audio capabilities were employed for post-tour individual interviews to document participants' use of tactile maps in recreating their tour experiences and identifying tour features significant to them. All audio recordings were captured to be transcribed into written form for subsequent analysis to evaluate the accuracy of participants' verbal responses about the experiences, and memories regarding the locations of tactile artifacts along the tour route. The summary of the data collection method is presented in

Figure 5. The data collection methods prioritized the security and confidentiality of all information gathered. While the majority of the project's data was non-sensitive, there was a subset of private data encompassing individuals' names, email addresses, and details related to their levels of vision, hearing, or mobility loss. It is important to note that all data collected during this study was handled with measures of care and confidentiality, following IRB protocols. For example, the research team securely stored this survey data within a university-based, password-protected survey system, making those answers exclusively accessible to the research team.

Data	Method	When	Where
Demographic information	Qualtrics survey	Prior to the tour (October 2023)	Participants' convenient location
UCSB Sense of Direction Scale	Google Form	Prior to the tour (October 2023)	Participants' convenient location
Time taken on each tour	Video recording with GoPro cameras	During the tour (November 2023)	Pearl Harbor National Memorial, O'ahu, Hawaii
Focus group discussions	Audio recording	After the tour (November 2023)	Pearl Harbor National Memorial, O'ahu, Hawaii
Individual interviews and map recreation accuracy	Video recording with audio connections	One month after the tour (December 2023)	Participants' convenient location (e.g., local library, agency, community center)

Fig. 5. Data sources and methods

4.6. Data analysis

Some quantitative data collected – such as the self-rating on the UC Santa Barbara Sense of Direction scale, recall percentages, and the time-on-task values – are provided raw in Table 1 as descriptive statistics intended to enrich reader understandings of our processes, participants, and their activities. However, we do not claim statistical significance in those cases, due to the sample size. Qualitative data in this study was drawn from a variety of triangulated sources, including responses to short-answer questions incorporated into the survey, audiovisual recordings of

the onsite tours, in-person focus group discussions, and post-tour interviews. During the discussions and interviews, participants were prompted to recall specific aspects of the tour, including providing insights about their experiences, the routes they took using audio-tactile mediums, and other support systems, as well as salient features associated with the physical environment. To surface, classify, and categorize an "emergent theme" from this mix of data, the seven-member research team used the principles of the constant-comparative method, as outlined by Glaser and Strauss (1999). That means interview transcripts and observation notes were coded by multiple raters using a grounded-theory approach, integrating both deductive and inductive techniques as described by Saldaña (2021), and generating research memos based on initial analyses as described by Marshall and Rossman (2014). This process included researchers transcribing all recorded data from videos and audio into a written format using the caption feature of the Kaltura MediaSpace, a university-based, password-protected media hub designed for storing the media collection. After transcribing, all data went through three coding rounds. First, we conducted an open-coding session, examining all data, line by line, for keywords, phrases, or incidents that could contain significant meaning in this process. Next, an axial-coding round was employed to compare and discover patterns and relationships among the open codes, with reflections on the underlying data of those codes, generating an updated codebook. And in the final step, selective coding was used to connect the categories generated during the axial-coding round, which allowed the team to integrate those codes into a clear and structured framework and to consider connections to our research questions in a process described by Hecker and Kalpokas (2024).

5. Findings

Common ways of studying audio-tactile mediums in terms of enhancing spatial understanding are the following: in theoretical contexts, proposing potential benefits; in highly controlled laboratory-like settings; and with general populations, not including or at least not emphasizing the concerns of people who cannot see or cannot see well. In contrast, our work here focuses entirely on the needs of people who are DeafBlind, blind, or low vision, as they navigate and engage with noisy real-world environments, and we gather empirical data about such built environments to develop deeper understandings about the complexities and concerns of these mediated situations.

5.1. Quantitative analysis

Table 1 shows the performances of participants across three types of accessible support systems: Tactile only; audio only; and tactile and audio combined. It also describes their demographic contexts, including a UCSB Sense of Direction self-rating, the duration of the guided tour for them (in hours, minutes, and seconds), and their

Table1. Summary of accessbile interventions and results

Tool Used	Participant Number/Age	Visual Disability	UCSB Self-Rating	Timeon Task	Recall (%)
Tactile only	Tl/42	LV	2.9	00:27:54	50.00
	T2/21	B	4.6	00:22:34	12.50
	T3/19	B	3.3	00:20:50	50.00
	T4/66	B	2.6	01:06:14	12.50
MEAN Age:	37	MEAN:	3.4	00:34:23	31.25
Audio only	Al/25	LV	4.5	00:24:01	81.25
	A2/50	B	4.7	00:26:41	31.25
	A3/44	B	2.5	00:40:16	37.50
	A4/63	LV	4.5	00:40:55	6.25
MEANAge:	45	MEAN:	4.1	00:32:58	39.06
Audio-Tactile	AD1/53	B	5.9	00:25:35	43.75
	AD2/33	LV	4.5	00:40:56	37.50
	AD3/65	B	3.9	00:40:43	18.75
	AD4*/62	B	3.5	00:16:56 *	12.50*
MEAN Age:	53	MEAN:	4.5	00:35:44	33.33

Note. This table demonstrates the quantitative data for each intervention group, detailing the time spent on the tour and the accuracy of map recreation among participants. The accuracy of the map recreation was assessed by assigning half a point for each correct location of an artifact and half a point for the correct order, totaling one point per artifact. If a participant recalled the correct order for four artifacts (2 points) and the correct locations for two artifacts (1point), the total point for this participant would be 3 points, demonstrating 37.50% accuracy.

*Participant AD4's data point was excluded when calculating the mean for audio-tactile group, as this participant did not complete the onsite tour.

recall accuracy (as a percentage). One participant from the audio-tactile group did not complete the tour; therefore, the research team excluded this participant's data point when calculating the mean for that group. In terms of the time spent on the tour, the audio-tactile group had the longest mean duration (00:35:44) for the intervention, while the audio-only group had the shortest mean duration (00:32:58). On the flip side, for recall accuracy, the audio-only group displayed the highest average recall accuracy (39.06%), followed by the audio-tactile group with a moderate average recall accuracy (33.33%), and the tactile only group with the lowest average recall accuracy (31.25%). The data suggests that participants in the audio-only group exhibited superior performance in terms of recall accuracy compared

to the other two groups; however, no significant correlation was observed between the duration of engagement with audio-tactile mediums and memory recall, and the sample sizes were too small to argue for statistical significance.

5.2. Qualitative analysis

Theme 1: Medium effects on feelings of inclusion

In the evaluation documented in Table 2, participants assessed their perspectives on the efficacy of the audio-tactile mediums and expressed ideas about the effects the mediums had on their visit to Pearl Harbor. The availability of AD, tactile maps, and tactile models prompted expressions of engagement with the historic site in ways that participants have not normally experienced before at such public places. The participants reported that these audio-tactile media not only facilitated access but also enhanced their overall comprehension and enjoyment of the visit.

Table 2. Medium effecton inclusion

Accessibility Group	Example Quote
Tactile only	"Having the map and walking around really helped because it gaveme a bettersense of where Iwas." "The fact that I had the map, it made me stop and you know, I was feeling the bomber plane. I was taking more time than I normally did feeling things because I could see." "I enjoyed having the map with me so that I could already know where we were going next, by the tactile map. SoI really enjoyed that part because it made me focus more instead of just listening to the tour guide." "What surprised me the most is that having the map and, you know, like I said the way you guys laid it out with the way that these figures were, that helped me so much, and I have a different outlook on maps now you know, tactile maps. I really, really do."
Audio only	"Iwas able to not only feel the, for example, the Arizona, and got to explore with my hands and at the same time, listen to the story behind the sculpture, listen to the story behind the Arizona, and just get a more global perspective of rather than just okay, here's the artifact, but itallows for myself to engage." "I really liked the lone sailor because of the description. I really liked that description because it really went into detail about it wasn't just like sailor clothes, right. I twas like the type of collar that he had on and what the shoes looked like the type of collar that he had on and what the shoes looked like in the texture of the coat and all of that."

Table 2. Cont.

Accessibility Group	Example Quote
	"I think most memorable part was I really like how the descriptions gave the orientation step by step. Like if you start with your finger here and then go down the back. I think it was one of the Arizona, if you start here, then you could feel like the holes and how it signified the different bombs. I think that was the most memorable for me like hearing the description as I'm feeling it rather than having to read and feel at the same time, kind of eliminated one of those aspects."
Audio-Tactile	"I'm listening to the description, you can feel the model at the same time, you kind of get a draw picture in your mind of, you know, where everything is, et cetera. That's pretty cool."
	"I think tactile description is good, but, I think for me, combined with the audio description. It really works well." "I really like all the tactual cues. I like the map and how the map is used in conjunction to our walking. That's pretty cool... And I also like the audio. Some of the audio descriptions are pretty good." "I think the cues, the more stimulus, the more description, the better, you know, it makes our experience more immersive and enjoyable, memorable. And you know, especially when you connect history with the present. You know, I think it makes it more meaningful, memorable."

Note. This table demonstrates participants' feedback on the effectiveness of accessibility audio-tactile mediums provided for the study, which was discussed during the focus group sessions held on the day of the tour and individual post-tour interviews held one month after the tour.

AD delivered helpful information about eight landmarks at the site: the Tree of Life, the USS Arizona Bell, the Torpedo Bomber (in the Attack Museum), the USS Arizona Model (in the Attack Museum), the USS Arizona Memorial, the Remembrance Circle, the USS Arizona Anchor, and the Lone Sailor statue. Participants noted feelings of connection, moments of intellectual discovery, and opportunities for visualization of each landmark. Additionally, participants reported value in the option to touch landmarks while listening to descriptions, particularly when the description offered information about where to position one's hands to locate the features of an object.

The tactile map proved to be a mechanism that prompted feelings of a greater sense of independence and agency in terms of the participant better understanding their physical context at the site as well as building feelings of anticipation for what was coming next on the tour. The map helped participants to better comprehend and explore the layout of the national park and its eight landmarks, increasing active participation and engagement with the surroundings. The capacity to physically

trace the park's layout and location of landmarks led to multiple comments about the navigational agency of the medium and its impacts on the experience.

Additionally, the tactile models provided immersive and interactive elements to the site, empowering participants to interact with tangible representations of the landmarks.

Theme 2: Emotional impacts of discovering perceptible information

At times, participants drew connections between the research-study tour and previous Pearl Harbor tours, throughout their lifetimes, sparking childhood memories and fostering emotional bonds with the site (see Table 3). This dynamic mix of past and present resulted in a reported sense of enrichment, according to participant comments, on the available methods of accessing information when comparing this tour with earlier ones.

Table 3. Participants' emotional connection within Pearl Harbor National Park quote

Accessibility Group	Example Quote
Tactile only	"Everywhere, it reminds me, like the... back in the day when I was like elementary I felt that, you know, like this, this, this remembrance, this remembrance circle remind me of like the day I came on tour when I was younger."
	"It kind of brought back the... that memory of, you know, coming here and getting to tour the entire place. Like even after the visitors left and being able to actually experience that and it kind of just brought back that memory for me."
	"The anchor, it lets us know of our unity. Okay. And that without one another, our nation is somewhat disabled, you know, but we should no longer look down on one another, but we be an encouragement to one another...So if we're anchored one to another nobody goes astray."
	"I've been to the memorial several times, but if, if you were to ask me that date, do you remember seeing, you know, feeling this from in your previous trips? I would have said absolutely not... What surprised me the most is that having the map and you know the like I said the way you guys. Laid it out with the way that these figures were. That, that helped me so much, and I have a different outlook on maps now you know, tactile maps, I really do. I really, really do."
Audio only	"I felt like a little kid wanting to go fmd the backpack of that, the naval sailor and it's like: where's his backpack? Where is his backpack? I want to go see his backpack. I really did say that...it made me want to go dig into the history books and uncover stories."

Table 3. Cont.

Accessibility Group	Example Quote
	"One thing that I appreciated about the tour was there was a kind of like a chain area, but then they said that for this tour, they're letting us, you know, go stretch our hands beyond the, the chain, which was really nice. I mean, it just added, you know, just that sense of, like, a kid... I can feel things like the anchor and feel how the chain kind of goes up in the air and you kind of draw a bigger picture." "It's kind of sad because I actually had relatives that were at Pearl Harbor, they passed away already when the bombing occurred...But, you know, it's nice that people go you know, not only not only just to remember what was, but to understand the past. So that we don't do that no more."
Audio-Tactile	"I think it's really nice with all- I think the cues, the more stimulus, the more description, the better, you know, it makes our experience more immersive and enjoyable, memorable. And you know, especially when you connect history with the present. You know, I think it makes it.. makes it more meaningful, memorable. Yeah, overall, it was fun for me."
	"Well, it was a good experience because I never have that kind of experience." "Anything that surprised me? I think it was just the fact that I had reflected that this is a different experience since I was a young kid. When I was a young kid. I just know I'm going on a boat ride. That's all I know. I'm glad to see the memorial. But to that.. I'm older, and then to understand that is a very important event and everything. Then it's way more meaning than just The boat ride and the memorial ship. Like just listening to the audio that I remember you guys provided. I didn't even know, like. certain things on the memorial."

Multiple participants stated that the additional information available during the research tour awakened their curiosities about the site, tying together in their minds accessibility issues and personal experiences. One participant, a 63-year-old whose blindness occurred due to macular degeneration and a pituitary tumor, shared that a family member had a direct connection to the site's history that created an emotional response in them. That person emphasized the significance of comprehending historical events on a personal level.

> It's kind of sad because I actually had relatives that were at Pearl Harbor. They passed away already when the bombing occurred. … But, you know, it's nice that people go, you know, not only just to remember what was, but to understand the past. So that we don't do that no more.

When questioned a month later and asked about any surprising aspects of their experiences at Pearl Harbor during the research study, most participants mentioned the emotional impacts of the tour.

Multiple participants also said that the research study had addressed gaps in their understanding of the site, created during previous visits, including one 33-year-old participant with Usher Syndrome who uses a white cane said, now that she is older, she better grasps the full significance of the site and its global implications. She reported that those reflections also enriched her childhood recollections and added layers of complexity to her earlier site visit, as illustrated by the following excerpt:

> [t]his is a different experience, since I was a young kid. When I was a young kid … I just know I'm going on a boat ride. That's all I know. I'm glad to see the memorial. But to that. I'm older, and then to understand, that is a very important event and everything. Then it's way more meaning than just the boat ride and the memorial ship. Like just listening to the audio that I remember you guys provided. I didn't even know, like, certain things on the memorial.

Theme 3: Emotional impacts related to inclusivity

Inclusiveness is a concept that aligns with Siu's (2013) emphasis on parks as crucial spaces that encourage physical, social, cultural, and sometimes spiritual interactions for people with diverse backgrounds and capabilities, advocating for the inclusion of all groups in these opportunities. We identified a clustering of comments around the feeling of inclusiveness, as an emotional state, such as when several participants expressed profound appreciation for the research study's opportunity to connect with others who are blind or who have low vision during the tour in a place that normally does not attract groups of people who do not see well. One participant, for example, expressed a sense of privilege at the chance to touch exhibit items that are typically off-limits. Another participant shared an emotional reflection, highlighting the significance of providing access that leads to self-determination:

> [t]oday was perfect. … This walk-through was like a perfect template of what could make it easier and more normal and self-independent without having to, you know, deal with the struggle of being disabled and then reaching out and asking because even as someone who, you know, coaches himself to get over that hard-headed barrier every day. Every day I have to work on that. Every day I have to, you know, push that barrier. So, it's, you know, that was nice. … I felt like it humanized and made it a completely normal experience, than more of a disability experience.

This participant stated that, by embodying the potential of inclusiveness, the research study tour connected individuals who would greatly benefit from AD and tactile objects and maps. The participant also emphasized that accessibility could

be normalized through design approaches that are inherently inclusive, serving a broader range of visitors rather than relying on special accommodations.

As another piece of evidence of emotional impacts of inclusivity, one of the study's participants felt inspired after the study and, unprompted, wrote and recorded a song about the experience, which he called "Pearl Harbor Park."

This song described the transformative experience of the tour, including the emotional impact on the songwriter, which, he sang, deepened his connections with the historical site. The lyrics presented memorable and enjoyable aspects of the experience, emphasizing the social significance and positive impact of accessible interventions within inclusive design.

Title: Pearl Harbor Park (January 20, 2024)

[intro] "This song is dedicated to the people at Pearl Harbor who made it all possible for those of us who are blind, and hearing impaired to enjoy fully a multisensory experience. This song is for you."

[chorus] Pearl Harbor, Pearl Harbor Park
What a wonderful place
Where great people left their mark.

[chorus] Pearl Harbor, Pearl Harbor Park
What a wonderful place
Where great people left their mark.

[verse 1] My brother and I came to visit
Pearl Harbor Park
We came there with eyes that couldn't see
But we saw with our hearts.
The sun was shining so brightly and the breezes kept us cool
To those of you who made this memorable
I want to thank you.

[chorus] Pearl Harbor, Pearl Harbor Park
What a wonderful place
Where great people left their mark.

I'll say it again.

[chorus] Pearl Harbor, Pearl Harbor Park
What a wonderful place
Where great people left their mark.

[verse 2] One of the many highlights during my visit at this place
was the tree of life standing with grace.
The Arizona Memorial ship and the lone sailor too
The audio descriptions and the tactual things made for me and you.

I'll say again.

[chorus] Pearl Harbor, Pearl Harbor Park
What a wonderful place
Where great people left their mark.

[rap] "In the heart of the ocean, where stories lie deep.
We walked through Pearl Harbor, where memories seep.
The sun kissed the waters, the sky vast and clear,
In a park where history whispers for all to hear."

[chorus] Pearl Harbor, Pearl Harbor Park, Pearl Harbor
Where great people left their mark.
Pearl Harbor, Pearl Harbor Park, Pearl Harbor
Where great people left their mark.

[outro] Pearl Harbor.

Fig. 6. Pearl Harbor Park song lyrics

Theme 4: Recommendations for site improvements

Another benefit of an embodied study with real people performing real scenarios in real settings is that the participants could choose to comment on usability concerns at the site as well, which were not necessarily intended to be a part of the study (Table 4). For example, multiple participants recommended during the study that the site should include color-coded and tactile pathways to assist visitors using

Table 4. Participant voices: recommendations for improvement

Category	Recommendations
Provision of tactile and audio tool	Make tactile artifacts as realistic as possible. Offer audio descriptions of the exhibits. Incorporate braille descriptions of artifacts and areas within Pearl Harbor, including historical facts. Provide braille handouts that include descriptions, histories, and meanings of artifacts and exhibits. reate color-coded or tactile pathways on the ground for visitors to follow with mobility devices or feet to access all exhibits. Install a call button that provides voice assistance with information and visual cues. Ensure braille is correct and written in Unified English Braille (UEB). Provide audio description during the boat ride to the USS Arizona Memorial. Ensure that everything is more audible and tactically hands-on.
Universal design	Train staff to give tours to those who are visually impaired. Reach out to Teachers of the Visually Impaired and Orientation and Mobility Instructors to bring their students/clients Encourage family days at Pearl Harbor where volunteers engage with people with disabilities, providing opportunities for meaningful learning, exploration, and interaction. Provide a disability guide tailored to individual needs to facilitate optimal access to Pearl Harbor.
Integration of technology	Utilize QR codes to scan and produce audio descriptions. Utilize barcode scanners to produce audio descriptions. Implement audio descriptions and install a loop system to assist people with hearing aids.

a variety of mobility devices. The participants asked for call buttons that provided voice assistance at various places on the tour. They also noticed typos, inconsistencies, and other errors in the provided braille materials. Choosing one braille code, such as Unified English Braille (UEB), and sticking with it throughout the site was recommended.

The tactile artifacts provided were helpful, multiple participants said, but they also should be more realistic than stylistic, allowing more information to be conveyed through them. AD should be provided for all of the exhibits, multiple participants said, not just for some, and not just for parts of the exhibits. Braille

handouts also should be made available, multiple participants said, especially those with detailed descriptions and histories of exhibits.
Even though the boat ride to the USS Arizona Memorial was not a part of this study or its scope, participants who had been to the site before recalled a lack of AD on the boat ride and on the memorial itself that had left them wanting more information. So, they brought up the potential for AD in the exhibit halls, in the boat, and on the memorial as ways to improve inclusion beyond the landmarks visited on this research study tour.

Lastly, integrating more assistive technologies throughout the site, even beyond the scope of what mediums and points of interest were studied here – such as ubiquitous QR codes, NFC tags, and telecoils for those with hearing aids – were just some of the suggestions participants made during their tours. In other words, this embodied and active approach to studying site mediums and media gathered much more information about ways to improve site accessibility and inclusiveness than even researchers expected, or aimed for, with ancillary comments adding much unexpected value, including generating ideas about additional aspects of the holistic site environment that could be addressed and studied further in future research projects.

6. Discussion

This study has created an opening for further exploration of the potential of collaborative, cross-disciplinary research that integrates AD tactile maps and objects, and a physical environment of public interest. Pearl Harbor National Memorial is a built environment created atop many other built environments, including the Native Hawaiian's "pearl water" bay, called Wai Momi, which was converted by the U.S. military into a naval base during the early 1900s, which later was converted into a sacred National Park Service place to pay tribute to the soldiers killed during a major attack there in World War II. These built environments, including the present-day one, could have been designed and created in ways to make Pearl Harbor universally accessible for people, regardless of sensory abilities. But, like most public places in the world, since Pearl Harbor National Memorial was not built in such an accessible manner, it is mostly inaccessible in story and in spirit to people who cannot see or cannot see well. Staff at the site have been trying to remediate those issues for decades, including building tactile maps, tactile objects, and, as a part of the collaboration for this and an earlier study, creating AD for the park brochure and other landmarks of the site.

If this same basic research had been conducted only about AD, or only about tactile maps, we could have learned more about those audio-tactile mediums on their own and how they might impact participants in a vacuum. However, that is not the way visitors experience them in real tourism situations. They experience

the place holistically, with other people, variable weather, media of all types in all sorts of places, and in a nonlinear fashion. The Department of the Interior and National Park Service staff, with the best intentions, have invested an enormous amount of time, energy, and taxpayer money to build this environment for visitors, but certain American citizens, because of exclusionary production practices, are left out of many of those plans, and as a result, they only can access a small amount of these public resources. By pushing open this built environment a little further, in providing our additional audio-tactile media, the place became more inclusive, the research participants noticed and responded. In short, per their comments, they felt like fuller members of the club, able to go beyond the front window.

Across two phases, a month apart, the study investigated how audio-tactile mediums impacted user-experience objectives, such as with comprehension, also aiming to identify potential strategies for creating accessible and memorable experiences. During our onsite intervention, followed by focus group discussions and individual interviews, each audio-tactile group expressed ways that the mediums they used considerably enhanced their experiences, making the tour more enjoyable and engaging. Importantly, no participant expressed discomfort or reluctance in using these audio-tactile mediums, indicating their overall acceptability.

6.1. Equity in use

Universal design theory challenges interdisciplinary planners to consider people with disabilities as active participants within communities. AD, tactile models and objects, and tactile maps are audio-tactile mediums that enable action and participation. With them, blind or low-vision visitors at national parks are invited to learn, to explore, to create meaning from their tours, and to make memories during their visit. Without them, those same people feel unwanted. In other words, accessible audio-tactile mediums promote equity in use of the park, so that people who are DeafBlind, blind, or who have low vision have opportunities to engage in essential visitor roles. Just as other nearby visitors were visibly moved by the complex and somber nature of the memorial site, participants in this study reflected on their own histories, interconnectedness, and sorrow regarding the nature of conflict. That sort of emotive connection, they reflected, was made possible primarily because of equitable access to information.

6.2. Perceptible information

The collected responses highlighted how memorable the tour was for participants and how the audio-tactile mediums helped them to conceptualize and understand specific artifacts, as they could access information meaningfully from multiple senses. Although participants were divided into three groups, overlapping themes emerged regarding how different audio-tactile media provided additional opportunities for

action and participation. Our discoveries emphasize the crucial role of accessible formats, particularly with the combination of AD and tactile information, in bridging the gap between minimum access and meaningful engagement. Notably, participants in the audio-only group also had access to tactile models. The audio-only group as well as all participants in the audio-tactile group, using tactile maps, expressed the effectiveness of combining these audio-tactile media. For example, one participant shared that prior to participating in our study, he was aware that artifacts were on display but lacked the opportunity to truly understand their appearances or the history behind them. Through our intervention, he gained access to meaningful information that filled this gap, allowing him to engage deeply with the artifacts and enhancing his overall experience, he said, making it more meaningful and memorable. AD thereby holds promise as a medium for enhancing and extending the implementation of WCAG standards for websites into real-world physical environments.

The Tree of Life sculpture, for example, emerged as a significant feature for many participants in our study, primarily because their combined access to AD and a handheld tactile Tree of Life model allowed them to understand what they could not see. Without these audio-tactile media, the Tree of Life base – meaning the touchable part that people can reach – could appear meaningless, feeling like a blank concrete wall. However, having AD and a tactile model of the sculpture enabled participants to access information about it, relate to the exhibit, and form emotive connections. The affordance to touch other artifacts on the tour, such as the Lone Sailor and the Anchor sculptures, were mentioned multiple times as being crucial to the understanding of the place. Participants questioned whether these artifacts were accessible to touch outside of guided tours, which they are not, emphasizing the meaningfulness of tactile engagement with exhibits and how preventing touch limits the experience. This aspect of the study underscored the importance of tactile accessibility for participants in connecting with and comprehending the historical significance of artifacts.

6.3. Simple and intuitive

Wayfinding information, in the form of signage as well as digital and paper maps, is ubiquitously available at national parks to sighted patrons. Once created, tactile maps can be easily produced for visitors to receive upon entry or to request in advance via mail. While learning to read maps is a skill for all people, regardless of visual ability, being able to determine one's location in a new environment is a vital task for visitors to use spaces effectively. Although many of our participants indicated that they had rarely used a tactile map, they each expressed the value of the map in terms of their own agency within and awareness of the environment. One participant reflected that the map helped him to slow down and appreciate each artifact. Notably, there was no significant improvement in recall for those who used a tactile map for their tour to recreate the sequence of artifacts one month after their

visit. Rather than the technical aspect of using the map for independent navigation or recreation of a tour, participants said that the gestalt of the map allowed them to appreciate the layout of the park and their own position within an active travel space. Participants also used AD via an open-access smartphone application, called UniDescription. The ubiquity of smartphones and the ease with which descriptions were created supports the use of more AD, reflecting the universal design principle of simple and intuitive use. Such use of accessible AD in a web format may be used by parks and museums to promote virtual tours or enhanced web-based experiences that align with WCAG standards outside of the Internet. A key consideration for the park is that many of the artifacts in the park were bronze sculptures, which are resilient to touch-based exploration. By explicitly allowing blind visitors to access these sculptures through touch, the park staff also were supporting the principle of simple and intuitive universal design.

6.4. Participant recommendations and desire for greater flexibility in use

With think-aloud protocols and multiple opportunities to discuss their experiences with researchers, participants richly provided recommendations to enhance accessibility and visitor experiences at Pearl Harbor National Memorial. Those comments mostly focused on the pragmatics of the audio-tactile media, the alignment with universal design, and the integration of multiple technologies. Suggestions included making tactile objects more realistic, offering ADs and Braille throughout the park, and liberally providing braille handouts that detail exhibit histories. Additionally, proposals for color-coded or tactile pathways, call buttons for assistance, and ADs during boat rides to the USS Arizona Memorial were made. Training staff for tailored tours, collaborating with educators for engaging programs, and implementing technologies, such as QR codes, for finding and hearing AD were suggested. In terms of universal design, multiple participants said, training staff to give tours specifically tailored to those with visual impairments and reaching out to educators specializing in working with visually impaired individuals can help to facilitate meaningful engagement. Furthermore, encouraging family days where volunteers interact with people with visual disabilities can create a welcome environment for all visitors.

7. Conclusions

Audio-tactile media require greater attention from researchers, particularly for advancing our understanding of media-accessibility issues. This field will also benefit from cross-disciplinary collaboration and approaches that welcome a broader range of scholars. AD, for example, has a relatively small core of researchers focused on it worldwide, as it is mostly clustered in AVT. But many other

disciplines – including Technical Communication, Rhetoric, Urban Planning and Development, Architecture, Public Lands Management, Disability Studies, etc. – could contribute much as well. The relatively small group of currently engaged academics also represents various subspecialities, with some studying media-production methods that include both dynamic and static media, some studying theory or history or law, and some studying audience reception. Within each of those topics there are many subdomains, creating a splintering of the already limited resources engaged in this type of study.

Orientation-and-Mobility scholars are in a similar situation with tactile maps and objects that not only press them into relatively narrow and separated research paths but also limit the scope and reach of their work because of disciplinary constraints. In other words, O&M research rarely includes AD qualities as a consideration, and AD research rarely includes physical environments and the mobilization and guidance of people around a place through accessible information. Even within the borders of audience-reception studies, the imaginary settings typical for AD research typically frames the audiovisual-translation listeners as frozen in position, focused on nothing else, in silent surroundings, with no distractions, and without mention of any site-based particularities that might interfere or add to the experience.

Rather than conducting research within such a narrow bubble, this study highlighted numerous factors that might be overlooked from such a highly filtered perspective. It examined the interplay of AD, tactile maps, and a public place in the messy ways that happen in the wild, with real people in real situations, in an effort to bring to the surface unknown, understudied, or unappreciated aspects of user experiences, when visiting such a place with limited or no vision. We also hope that this study provides a model for an open and inclusive approach to research into audio-tactile media for accessibility purposes, which could inspire further exploration.

Pearl Harbor National Memorial is a site rich with place-based narratives encompassing international conflict, loss, cultural differences, racism, the courage of ordinary people, and reconciliation. The events described at the historic memorial had a profound impact on the world, on America, and on Hawai‘i. One may argue that the purpose of the site is to provoke reflection and to encourage an understanding of history and the importance of peace. As a national park, Pearl Harbor belongs to everyone as a place of remembrance.

People with disabilities, particularly those who are DeafBlind, blind, or who have low vision have often not been included as full members of communities with access to such cultural and historical information in usable formats and with opportunities to participate in public spaces. Methodologically, we sought to investigate the ways in which audio-tactile media, such as tactile maps, models, and AD, may enable greater participation within a dynamic public site. In this way, we were blending approaches from two disciplines, Orientation and Mobility, a field

that prepares people to use wayfinding and mobility tools for safe and efficient navigation, and AD, an academic area that investigates the translation of visual information into audible formats.

Themes from this investigation not only highlight the technical value of audio-tactile media that increase access to information and self-determination, they call attention to the benefit of membership within a community. Both maps and AD provided enhanced access to the narratives of space, place, and history with the national park. The dozen participants who joined this study each expressed a connection to the artifacts and landmarks at Pearl Harbor as well as solemnity about the loss of human life. It is significant that all participants are residents of Oʻahu, and while some had visited the park before, many expressed that they were not aware of the spatial details, such as features of the bomber plane, the shape of the USS Arizona Memorial structure, or the size of a ship's anchor. Participants expressed appreciation for being invited to understand the story, to share their own voices, and to suggest improvements to make the site more available for other people with disabilities. One participant, a DeafBlind musician, even created a song about the visit as a way to express his feelings about it but also his appreciation for the opportunity to be included in a place he had visited once as a kid but never thought thereafter was a place for him and people like him.

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