Perspectives of Visually Impaired Visitors on Museums: Towards an Integrative and Multisensory Framework to Enhance the Museum Experience

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ABSTRACT

Although the growing concern to make museums accessible to individuals with visual impairments, their participation in these institutions is still limited, given the multiple barriers they often experience and the lack of assistive technologies to promote access. This research investigates the perspectives of 72 blind and partially sighted individuals on enhancing their visiting experience in museums. A co-created framework to improve visitors' autonomy is proposed, concluding that sensory, intellectual and physical access must be integrated into the pre, on-site and post phases of visiting museums.

CCS CONCEPTS

• **Human-centered computing** → Accessibility; Interaction Design.

KEYWORDS

Visual impairments, Museums, Access, Visitor experience, Multimodality

1 INTRODUCTION

Billions of people worldwide live with different types of disabilities [26], and museums are, more than ever, aware of the importance of including these individuals and welcoming them in its spaces, exhibitions and programs. Proof of these institutions' actual commitment as agents of change is the International Museum Day theme for 2020 – *Museums for Equality: Diversity and Inclusion* – which highlighted their potential in providing meaningful experiences for all [15]. However, a recent report from the European

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Union [19] stressed the inaccessibility of cultural premises, venues, and content as barriers to the blind and partially sighted citizens' participation in culture.

The World Health Organization estimates that 2.2 billion people globally have a vision impairment, of whom about 36 million are blind, 217 million have moderate to severe vision impairment, 188.5 live with mild visual impairment, and 1.8 billion have near vision impairments [25]. In Portugal, where the present research took place, data from the last Census allowed estimate that among the 17.8% of the population that declared to have any difficulty, 23% (900 thousand) specified the vision as a cause, of which 3.1% (28 thousand) reported blindness [16].

Regarding their attendance to museums, only 5.5% of visually impaired (VI) people visit museums in Europe [8], which exposes a significant potential market for these institutions [18]. Several authors [4, 9, 13] relate barriers to their participation with the fact that museums remain mostly ocular centric oriented, which does not contribute to the engagement with exhibitions through other senses than vision, deprives their access to information and exhibits, and also hinders their independent mobility in the museum space. Despite VI visitors being one of the most difficult to address in museums [20], technology can contribute to a beneficial impact on helping serve these publics by diminishing the barriers to accessibility [12, 24], although being rarely used. Moreover, positive economic effects are expected with the implementation of inclusive digital technologies to promote access to exhibitions [2], since they offer new possibilities to interact with museums and their themes, which can also bring non-disabled visitors closer to museum collections, broadening their sensory experiences [10].

While these facts evidence the need for research in this field, few studies analyze the VI visitors' needs and expectations across the continuum of visits to museums to promote great museum experiences from their viewpoints, and how technology can assist them during the whole museum experience. The present article aims to extend research in the field of accessibility in museums by exploring the perspectives of 72 VI individuals to co-create a framework that could be used to enhance their future visits to museums. The article begins with the discussion of assistive technologies to enhance VI experiences in museums. It proceeds with the presentation of the research methods, followed by the results and the proposal of guidelines for an integrative and multisensory framework linking the various museum visit phases with the access required in each of them. The article ends with some conclusions and implications for the field.

2 ASSISTIVE TECHNOLOGIES AND VISUALLY IMPAIRED VISITORS' EXPERIENCES IN MUSEUMS

VI people's positive museum experiences depend on their reliance on other senses besides vision to access information, physical space, and other facilities [3, 9].

Haptic interfaces allow VI visitors to explore three-dimensional virtual copies of museum collections, like the *Geomagic Touch System* [7], in which visitors are required to pick up a pen of the device to explore the multiple layers of the surface of the artifacts from the National Museum of Transylvanian History of Cluj-Napoca. The *Probos Sensory Console* [2], developed in collaboration with the Manchester Museum, UK, and Gallery Belvedere, in Vienna, Austria, allows visitors to explore virtual objects and hear sounds related to the material properties of the exhibits.

Other museums are using 3D technologies to provide touch replicas digitally augmented, offering tactile and audio multisensory experiences. *Tooteko* [23] was developed for the Correr Museum, in Venice, Italy, requiring visitors to wear a ring sensor during the tactile exploration of the models, which detects and reads Near Field Communication (NFC) tags inserted inside the objects, while a smart device plays the related audio. The *Egyptian Cat Sarcophagus* [22] was produced by scanning an original mummy of the Manchester Museum collection, and includes touch-sensitive sensors to detect the touched areas and trigger contextual audio-explanations, heard through headphones. The gesture-based interactive audio guide for relief interpretation of Gustav Klimt's painting *The Kiss* [21] allows exploration by regions, and different audio files describe the painting and its history. The visitor's interactions are detected by a depth camera placed above the replica and connected to a computer running the software. A similar project allows the exploration of a relief of the painting *Madonna with Child and Angels* [6], in which a Microsoft Kinect is used to track the visitors' hand movement in real-time, while software determines the corresponding verbal description of each area being touched, which can be heard through headphones.

Other projects also use technology to provide better physical access, indoor navigation and wayfinding in museums. *Blind MuseumTourer* [17] was designed for the Tactual Museum of the Lighthouse for the Blind of Greece, the National Archeological Museum and the Acropolis Museum. The application runs on an Android smartphone and presents vocal routes, emergency, and back options, and also describes the exhibits approached by the visitor along the tour route. It uses Bluetooth low energy (BLE) beacons as proximity sensors at the exhibits to update users' current location and provide audio presentations. Another project [14] proposes a voice guidance system for VI visitors that uses a hyper-directional speaker to radiate guiding audio instructions only to a target visitor who needs guidance, and a Kinect image sensor to detect user position.

Different from the explored solutions, a research project [1] at the Museum of Cycladic Art, Athens, Greece, allows VI visitors using a smartphone with a mobile app to choose thematic areas and exhibits, providing navigation instructions by taking advantage of sensors embedded in the room. When arriving in front of an exhibit, the user can tactually explore its form while listening to the piece's audio description.

Most of the research found in literature explores technology to enhance the on-site visiting experience, supporting mainly sensory and intellectual access to exhibits, and physical access, in some cases. Extensive research is still needed to identify the blind and partially sighted visitors' expectations and necessities across the continuum of visits to museums, which extends beyond the in-museum experience [11]. It is also essential to grant a central role to these people and include their perspectives during the research process [9, 24], to ensure more fruitful results for all [3]. The understanding of those dimensions can contribute to help museums develop unified inclusive solutions, which effectively enhance accessible exhibition designs and improve the museum experience of VI patrons.

3 RESEARCH METHODS

The present research was circumscribed to three of the five regions of continental Portugal: North, Center, and Lisbon and Vale do Tejo. It was undertaken for seven months in six cities: Porto, Braga, Viana do Castelo, Vila Real, Viseu and Lisbon. For the data gathering, it followed a methodology based on qualitative research.

3.1 Sampling technique

To randomly sample participants for the study, the leading official institutions for the VI of the mentioned regions of Portugal were identified. A total of 19 institutions were contacted and asked for collaboration with this research. The institutions then notified the members about the research, and 72 people, from 10 institutions, expressed their interest in voluntarily collaborating in the study.

3.2 Research instrument and procedure

Semi-structured interviews were used as the instrument for data-gathering, and the interview guide included mainly open-ended questions. The closed questions were about the participants' demographic information. The set of questions was conditioned by the research's general objectives, addressing the following topics: profile of the participants, habits regarding visits to museums, and suggestions on solutions to enhance their future museum experience.

The study was conducted between January and July of 2019, mainly at the institutions where interviewees were members. In eight of the cases, the interviews were conducted in participants' homes, and five persons asked to meet them at their workplaces. All interviews were individual and performed face-to-face, except for nine cases (12.5%) in which it was necessary to do the interviews by telephone. A document with the initial protocol was read aloud at the beginning of each interview and asked for permission to audio record the data-gathering session. Each individual gave their consent to participate in the study by signing the document. The exceptions to this were the cases of telephone interviews, in which participants gave their oral consent, and the minor-age cases, for which their parents previously signed the document when arranging the interviews.

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3.3 Tools for data analysis

The average duration of each interview was 29 minutes and 17 seconds, excluding the initial protocol. The NVivo 12 software 'transcribe mode' tools were used to transcribe the audio files manually. The same software was used to conduct the qualitative data analysis, following the thematic analysis method [5]. The coded themes derived inductively from the collected data and their identification was performed through a semantic approach, in which the explicit level of meanings of the data was considered in order to identify the different patterns.

Regarding the answers related to the profile of the VI participants, as well as their habits concerning visits to museums, it was possible to convert the qualitative data into quantitative data, and the IBM SPSS 26 software was used to carry out descriptive and exploratory statistical analysis of these research topics.

4 RESULTS

4.1 Participant's profile

Of the 44 (61.1%) individuals who reported to be blind, 18 were early-blind (EB) and 26 late-blind (LB). The remaining 28 (38.9%) participants had low vision: 16 severe (SVI), 9 moderate (MoVI), and 3 had mild visual impairment (MiVI). It is mentioned that 75% of the interviewees in this research had visual references (LB and partially sighted), and that the average age of vision loss of the LB participants is approximately 30 years old (M=29.6; SD=17.5). The group was relatively homogeneous in terms of gender, i.e., 51.4% were female, and 48.6% were male. Interviewees' age ranged from 14 to 87 years old (M=48.7; SD=17.1). The predominant age group was 42-57 (33.3%), followed by 58-73 (32%), 26-41 (18%), 14-25 (13.9%) and 74-87 (2.8%) years old. Regarding their education level, basic school represents the highest education level completed by 38.9% of the individuals, and the secondary school was the second level of education achieved by most of the participants (37.5%). Seventeen participants (23.6%) completed higher education: 12.5% holds a bachelor's degree, and 11.1% holds a master's degree. Concerning their area of living, 52.7% live in a metropolitan area (Porto, Lisbon and Setúbal), whereas the rest of the participants live in less populated Districts: Braga (12.5%), Viana do Castelo (11.1%), Viseu (9.7%), Vila Real (6.9%), Aveiro (2.8%), and Évora, Guarda and Santarém (4.2%).

4.2 Habits regarding visits to museums

More than half of the participants (56.9%) reported they visit museums less than once every two years, and 22.2% informed that they go one to two times a year. Five participants (6.9%) use to visit museums three or four times in a year, and seven (9.7%) reported they visit more than four times in a year. Three participants (4.2%) have never visited any museum at the time of their interviews.

Of the total answers given by the 69 people who frequent museums to the question about whom they visit museums with, 34.1% referred to the associations where they are members, 31.7% stated visits with close family members, 20.3% with friends, and 13% visits in school contexts. One person (0.8%) affirmed had visited a museum alone. Regarding the question about if they enjoy going to museums, 46.4% of the participants responded "yes", 34.8% said

"more or less", and 18.8% revealed they do not enjoy visiting those places.

4.3 Improvement suggestions to enhance the visiting experience in museums

All the 72 interviewees shared suggestions about the aspects they considered that must be improved and provided solutions to enable more enjoyable visits and enhance future museum experiences. The answers provided by the three participants who stated had never visited museums were also considered, given its relevance. A total of 479 commentaries were coded during the performed qualitative analysis, which allowed to co-design the guidelines towards a framework that will be discussed in the next section.

5 AN INTEGRATIVE FRAMEWORK CO-CREATED TO ENHANCE THE MUSEUM EXPERIENCE

Based on the qualitative analysis, it was concluded that a framework must support integrating the different phases identified as relating to the experience of visiting cultural institutions: pre-visit, on-site visit, and post-visit. Furthermore, the data analysis performed revealed that it is imperative to ensure that the framework also articulates the strategies to promote sensory, intellectual, and physical access, so individuals are more likely to feel a sense of autonomy during the various phases of a visit, despite their diverse degrees of visual impairments.

5.1 Pre-visit planning

5.1.1 Museum Website: Accessible, Informative and with Inclusive Language [Intellectual Access]. Should follow the Web Content Accessibility Guidelines (WCAG) to guarantee users the intellectual access to information. Besides the introductory presentation of the museum and its collection, museum websites should use inclusive language to welcome potential visitors with disabilities, and also provide useful information to VI individuals planning a visit: if anything can be touched during the on-site visit and what; the availability of audio guides and guided tours; if there are audio descriptions or supports in Braille; accessible events and services provided; if guided dogs are allowed inside; entrance fees and costs of these services.

5.1.2 Proper Dissemination of Information about the Museum [Intellectual Access]. In order to reach VI audiences, museums should disseminate information through e-mail and user-friendly social media channels (taking into account the WCAG). Since not every participant stated feeling comfortable using digital devices and accessing websites, the information must also be directly disseminated to schools, associations, and other institutions where people are part or attend, so it can be delivered to them.

5.2 On-site visit

5.2.1 Presentation of the Museum Space and Exhibitions [Intellectual Access]. Participants suggested that museums must provide them with complementary ways of accessing information about the exhibitions' spaces and their organization through audio at the

beginning of a visit. According to the vast majority of the interviewees, resorting to sound would be more useful in the context of a spontaneous visit than having to read this information in Braille or printed media, since the awareness of the contents would be faster, more enjoyable and more convenient if listening. They also informed that Braille cannot be considered an inclusive reading medium because not every person developed adequate literacy to read it, and texts with large-sized fonts and adequate contrast ratios do not serve all persons with low vision.

5.2.2   Exhibits' Information Presentation [Intellectual Access]. It should be prioritized the use of audio instead of Braille or printed media to convey the exhibits' information, for the same reasons previously discussed. It is also necessary to use appropriate descriptive language, so the detail of information and used terms to present the exhibits' contents are adapter to the reality of someone who cannot entirely rely on her/his vision to sense the world. The museological information must be as concise as possible to convey the crucial aspects, to avoid the excess of information and visitors' fatigue and loss of interest.

5.2.3   Physical Objects: Replicas, Models and Reliefs [Sensory Access]. Sensory access to physical objects was identified as essential to an enhanced and meaningful museum visit, serving different purposes. 3D models of museum spaces can enable the creation of mental representations of its organization, while 3D models of the museum building allow them to create accurate mental images of the architecture and other relevant details that are hard to express by language. On the other hand, 3D replicas of exhibits (at least of the most relevant) were pointed out as vital to effectively make sense of the objects, which are, generally, the purpose of museum exhibitions. It should be used reliefs for accessing bi-dimensional artworks like paintings, photos, or others only perceived through vision. The sensory access to physical objects must combine both touch and hearing, at least, to be effective, and the access to these objects should be available while visiting the entire museum, with the aim to promote inclusion.

5.2.4   Magnified Images to Amplify Visual Capacities and Adjusted Lighting of the Exhibits [Sensory Access]. Participants with low vision highlighted that they still have some vision and wish to use it to perceive the museum objects and artworks. Tablets and screens with zoomable high-resolution images of the exhibits can be provided to visualize better the pieces' details, preferentially close to the originals. Brighter lighting of the exhibits, on the other hand, could also improve their visiting experiences by helping them using their remaining visual capacity.

5.2.5   Exhibition Space Design and Assistive Guide for Museum Navigation [Physical Access]. Exhibitions must be designed to afford a circulation route within the spaces free of physical obstacles and to promote a sense of safety and autonomy on the VI visitors. The use of an assistive guide that automatically provides contextual information was suggested to enhance their sense of autonomy and control while moving in exhibitions. It is recommended to be used as complementary ways to offer accurate feedback when approaching points of interest, provide route assistance indications while moving, and alert visitors.

5.3   Post-visit phase

5.3.1   Museum Website: with Additional Contents for Promoting Further Engagement [Intellectual Access]. Interviewees recommended that websites included audio described videos and allows listening to the audio-clips from the audio guides. The possibility of exploring those materials, and additional ones not featured in the exhibitions, would benefit new discoveries and promote their interest and engagement, motivating further visits.

5.3.2   Social Media Platforms to Strengthen Connections [Intellectual Access]. Social media platforms can be used as a strategy to strengthen connections with the VI community and make museums more relevant after the on-site visit. In order to captivate their attention and foster engagement, it is essential to transmit them a feeling of welcoming and that their interaction with the museum through this media will add value and generate positive outcomes, besides implementing the WCGA.

5.3.3   Souvenirs: Recalling the Visit Experience [Sensory Access]. Participants expressed the interest of taking souvenirs home and commented about the role that those objects can assume in recalling personal memories of their visits to museums. To this end, some exemplars of souvenirs can include miniature replicas of museum objects, reliefs, or materials that were available to touch on the on-site visit; fragrances related to exhibitions; objects that produce music, voices, or sounds heard when visiting the museum; among others. Those souvenirs can also be digitally augmented and point to the museum website or other relevant web content related to the exhibition, for instance.

6   CONCLUSIONS

The present research proposes guidelines towards a framework to enhance the museum experience of blind and partially sighted visitors, linking the pre, during, and post-visit phases with the access required to provide in each of them. It was co-created based on the perspectives of 72 VI study participants, collected through semi-structured interviews. The framework has some limitations and reveals new research opportunities. It was grounded on the opinions and suggestions of a reduced number of Portuguese individuals, of whom 75% had visual references. It also did not include the diverse museum professionals' perspectives to obtain a more in-deep perception of the aspects proposed on the framework. Although during the design of the framework was made an effort to cover its applicability in the diverse museum types, it implies direct challenges to museums, namely concerning their practices for exhibitions, curatorship, and management, to name a few. As a last consideration, the proposed framework does not intend to replace accessible guided tours nor other inclusive activities in museums, but rather to use technology to complement them and also allow VI people to have access to museum-related content whenever they wish to make spontaneous visits.

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