Technological mediation for Visually Impaired People in exhibition context

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Abstract. Interactive multimedia displays are more and more present in the context of museum exhibition, as playful mediation tool as well as being part of the artistic, cultural or scientific works presented. Vision is mostly involved as the base of most perceptive modalities used to receive information or feedback, and to control interaction with these displays and therefore there is a big risk to exclude visually impaired people. The "OUI" project is the result of a collaboration between cultural bodies and research laboratories. It aims at defining and developing a tangible prototype device allowing to give access to visually impaired people to information and interaction with displays of this kind.

Keywords. Exhibitions and Museums Accessibility, Artistic, Technical and Scientific mediation, Design for all, Communicating objects

Introduction

The **OUI** project has been developed in the context of modern museography and information to museums and exhibitions visitors, where new software and hardware devices are replacing unidirectional audiovisual broadcasting as cultural, artistic or scientific mediation to the works, but also as part of the works themselves : playful artistic and/or scientific stands, installations turning the exhibition space into part of the works itself, giving to the visitor a role in the artistic process.

OUI, in French, stands for *"**O**util **U**niversel d'**I**nterfaçage pour les personnes ayant des difficultés de communication et/ou d'interaction avec les interfaces classiques (écran/pad/souris), personnes aveugles et malvoyantes."*, which could be translated in English as "Universal Interface Tool for people with communication and/or interaction difficulties with classical interfaces (screen/pad/mouse), blind and partially sighted people". This project is the result of a collaboration between two research laboratories : *CHArt/THIM* at University Paris 8, specialised in Human and Artificial Cognition and Assistive Technologies, and *CEDRIC* at the *Conservatoire National des Arts et Métiers* (CNAM) ; and three Parisian cultural bodies : the French National Library (*Bibliothèque Nationale de France* — BNF), *Universcience* and especially the Science Museum at *La Villette* (*Cité des Sciences et de l'Industrie de la Villette* — CSI) and the Quay Branly

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Museum (*Musée du Quai Branly* — MQB), a museum featuring indigenous art, cultures and civilisations.

State of the Art

There are few papers in the topic of accessibility to museums. The use of RFIDs have been explored by several researchers. In [5], a prototype application used in several museums is described, allowing visitors to continue their scientific exploration beyond the museum's walls. [1] reports a location aware tour guide based on RFID localisation and tested during a big flower exhibition in Europe. [4] is using RFIDs to locate and identify art works in the rooms. The paper focuses on orientation of the visitor in the museum. The visitor uses a PDA to listen to the relevant audio guide, which is downloaded on the fly when the user needs it. [3] discusses design principles of mobile guides for museums, from the focus of learning theories and visitor studies. [6] investigates accessibility requirements for electronic guides for museums, while [7] applies them to designing Multimedia Guides for All (MGA).

Access to museum devices

The focus of this project is the interaction by visually impaired users with multimedia devices existing in exhibitions, that is the effective access to information they contain. We have been studying existing exhibitions in Paris, especially at BNF and at CSI, where visitors can interact with so-called *"cartels"*. These devices allow more and more interactive ways of accessing to additional information, explanations, contextualisation, games, where the user is not only here to see but also to participate. These devices are using mainly tactile screens, sometimes very large ones, 3D, cameras catching the face, the gestures or the silhouette of visitors to insert them into their screens or different kind of displays after various kind of processing, *etc.*. The knowledge and reasoning capabilities of the visitor can also be solicited.

The first step has been to identify the concrete obstacles encountered by visually impaired persons to access these devices, focusing on the tasks and interactions. Then we analysed them in order to find out common elements, to classify them and to identify the more general alternative solutions. Then we specified and developed a demonstrator in order to explore feasibility and identify technical difficulties.

The primary barrier comes from the systematic use of tactile screens, where the visual control is essential, both for displaying works, explanations, contextual information, display controls and for choice or decision controls.

A technical study of the multimedia devices used in exhibitions at BNF and at CSI showed that these devices are constituted by basic computers with a tactile screen, containing HTML documents, all related to each other through hyperlinks.

The prototype

The basic idea was to produce a prototype which would, at the same time, be operative and constitute a broad basis for further development. We had to select tasks that are both

useful on their own and as a basis for dealing with more complex interactions in the future (e.g. simulation games).

The tasks chosen were the detection, display and selection of available devices in the surroundings, and the interaction with the device. A prototype has been implemented, including a device and a *'software overlay'* over the cartels. This prototype makes them accessible to visually impaired persons and, in the future, will be the basis of the access to and communication with any kind of exhibition devices. Two services have been implemented. The *detection service* allows the user to be notified of the proximity of available devices, and to select one of them. Then the *browsing service* enables the user to interact with the device through a set of HTML content.

The short duration for this project (9 months) lead us to start from existing devices, and particularly from a smartphone and a joystick. The large availability of smartphones, including as well people with visual disabilities, as well as their computing and storage capabilities makes them good candidates for a mediation tool. The main difficulty for visually impaired users remains the tactile screen of these devices, thus we decided to use together a joystick to interact with the museum device content via the smartphone.

Beyond the usability, using a specific device associated with the exhibition presents some interest in itself, as it gives the visitor a feeling that we could call *"exhibition experience"*. This aspect will be developed in the camera ready paper.

An existing joystick, especially easy to take in hand, was actually chosen for the base and modified according to our needs. It is a well known device called *Nunchuck*. Micro-controllers (Arduino) and a Bluetooth unit have been designed and added to this joystick in order to connect it to the smartphone. Then a specific Android application was developed.

The application tasks are the following :

- detect the museum devices in the close environment and classify them according to their proximity to the user
- show them to the visitor as a list and allow the visitor to select one of them
- download from the museum device its multimedia content, and store it temporarily on the smartphone
- allow the user to interact with this content, start audio presentations, read text contents using speech synthesis, *etc.*

The two first tasks are provided by the *detection service* and the two following by the *browsing service*. The navigation within the content is based on lists. The visitor uses the joystick to navigate in the various lists as well as to control the player giving access to the content. Different synthetic voices are used in order to help the visitor to discriminate between navigation and content reading.

Another important feature of the prototype is that the means of communication and detection are distinct. On the detection side, it is important that a wireless radio frequency signal is used because it allows the detection of cartels by the user's mobile phone according to their proximity (this is coherent with the way a person discovers cartels as he/she walks through an exhibition). As for the communication between the mobile and the museum devices, different options have been tested and implemented : wireless network (wifi), mobile internet access, Bluetooth, *etc.* — which gives the museum different options to choose from.

A demonstration was presented to the museum participants, including visually impaired persons. This demonstration was including content from 2 different exhibitions, one about marines at BNF, and the other about invasive plants at CSI.

Perspectives and recommendations

This feasibility study has strengthened the will of all the participants, and especially the museum staffs, to develop the idea. They could see the potential of the idea and the feasibility of implementation within their museums. More types of interaction must be studied, which could not be undertaken within the short duration of this project. More content must be prepared. The biggest challenge being the real implementation of into the exhibitions.

Through this first contact between scholars and museum participants, all the participants have developed a better understanding of the need for a common work in order to make the museum more accessible to disabled people. The goals that we want to achieve are only reachable if a coordinated work is established. The software overlay that we want to implement is only possible if it is supported by some preliminary works. A first step would be the following of certain specifications — guidelines — within the development of the multimedia content of the cartels.

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