

# *Flip the Book – Flip the Memories: a Case Study of Multimodal Interaction for the Library Located in Macao World Heritage Site*

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## Abstract

"*Flip the Book – Flip the Memories*" is a multimodal interactive artwork exhibited in Sir Robert Ho Tung Library, which is part of Macao World Heritage site. This artwork integrates smell with audio visual together into reading experience. When the reader turns the page of the physical book, it would trigger different videos projected on the book. Meanwhile, specific scents would be released from the side according to the videos. The video footages are collected from local video photographers, which have preciously captured the images of the old days in Macao. This artwork uses smell as an ambient medium to connect the present with the past. It aims to lead the readers to recall their memories from the past, also to think about the present while being surrounded by the environment of cultural heritage. By combining physical book with multimodal interaction, this artwork brings the cultural heritage visitors tangible and intangible experience altogether. This paper would take "*Flip the Book – Flip the Memories*" as the case study to discuss the opportunities and the challenges behind while bringing new media into cultural heritage, especially the role of olfaction in multimodal interaction.

## Background

In the age of digital media, there is a challenge for cultural heritage to inherit and reinvent the traditional heritage into new media form. Rinehart and Ippolito, new media scholars, stated that new media brings the impacts on cultural heritage, especially on the aspect of social memory. [1] They believed that social memory is the way that society and people remember their own identities, in the form of official archives in libraries and museums or in the form of unofficial folklore among the general public. It is about the social environment of memory interacting with individual pasts.

Macao, former Portuguese colony, preserves twenty-two sites that blends the architectural influences between Portuguese and Chinese culture. These sites, including the historic streets, residential areas and religious buildings, were inscribed as "*The Historic Center of Macao*" on the UNESCO World Heritage List in 2005. [2] In the past ten years, Macao government has been making attempts on the cultural heritage conservation and revitalization by holding events such as exhibitions, performances and parades. Yet along with the economic growth caused by tourism and gambling industry, many other old buildings were influenced and the relevant social memories were fading away accordingly.

"*Flip the Book – Flip the Memories*" is an artwork developed under this context. It is one of the artworks exhibited in "*Video Creation Exhibition - A Reconstruction of the Fading Memory*" hosted by the local video organization called Audiovisual CUT Association. The organization found that the rapid and dramatic changes in the recent development of Macao have created profound social impact to the city and are leading to the fade-out of the collective memory. They felt obliged to arouse cultural self-consciousness of Macao by reconstructing the city memory. Therefore, they collected the old video footages from Macao video photographers, then invited artists to recreate the content in the formats of new media art. The aim of the exhibition is to recall and anchor the collective memory of Macao among the general public. Hence, instead of showing in the art museum for a particular interest group of visitors, they chose to display the artworks in the public libraries in order to get closer to the general public. This artwork took the form of multimodal interaction by combining smell with audio visual into reading experience in a public library which belongs to Macao cultural heritage site.

## Related Studies

Multimodal technology has been rapidly advanced in recent years, the applications of using speech, touch, vision, and gesture for interaction are on the rise. [3] It bridges the gap between the virtual world and the physical world by engaging users with multimodal experience. Multimodal interaction has been applied widely in different areas such as entertainment and education. [4, 5] In the field of cultural heritage, Damala et al. used visual and acoustic augmentations to provide affective museum visiting experience in both physical and the digital environment for encouraging visitors self-motivated learning. [6] Clarke et al. brought visual, audio and haptic experience together in an interactive museum exhibit about steam-powered locomotive. [7] These applications mainly rely on audio visual and haptic channels. However, the sense of smell which is closely related to memory is seldom used in the form of multimodal interaction in cultural heritage. Here this paper would mainly explore the role of olfactory component in multimodal interaction in cultural heritage.

Smell is an evocative medium. The narrator in Marcel Proust's novel *"Remembrance of Things Past"* recalled his long-forgotten childhood memory through the aroma of madeleine dipped into a cup of tea. [8] This phenomenon is also described in the sociology study conducted by Waskul et al. that one participant described how a particular smell reminded her of the memories and feelings about her father even in her age of forty-nine. [9] Smell is also a subliminal medium. The aromas of a place could affect how the tourists perceive a city. [10] The ambient scent emitted in a department store influence the customers about the impression and behaviors. [11] Social anthropologist Uri Almagor once indicated that smells make the past has existence in the present. [12] It is about being *"here and there at the same time."* The other senses, like sight, have limitations on dealing with the past, the future and the invisible. Yet the smells can recall almost the same feeling with its contextual association in the past. Smell connects *"then and now"* together. Could this powerful medium bring the new possibility of the multimodal interaction in cultural heritage?

In recent years, digital olfaction has been advanced in different areas like improving the realism of virtual environment, converting information, stimulating the gustatory perception, etc. [13, 14, 15] It opens up the opportunities to include smell as the multimodal interaction for cultural heritage especially for reinventing the social memory. The concept of *"Smell-O-Vision"* which originated from movie industry has strongly influenced the development of digital olfaction. It is the idea which allows the audience smell something related to what they see on the screen. For example, the scent of chocolate was emitted when the scene of chocolate factory was shown in the movie. [16] Many researchers have followed this approach when they developed digital olfaction in multimodal interaction. Smelling Screen is one of the cases. [17] Other attempt was also made to tackle the challenge by providing odours ahead of audiovisual content for a better synchronization effect. [18] However, smell is very subjective experience. By mapping the smell to a certain object, like using the scent of lavender to represent the lavender in the digital content, it may lead to individual expectation gap. Köster et al. indicated that the role of odours in daily life mainly is to link the people to the affective appreciation of surrounding and the episodic memories. [19]

### Flip the Book – Flip the Memories

*"Flip the Book – Flip the Memories"* is an artwork that combines smell with audio visual with the action of flipping into reading experience. Its aim is to bring the evocative role of smell into the multimodal interaction in cultural heritage. By turning the page of a physical book, visitors would trigger different videos with the relevant smells alongside like reading a memory book. Smells are

treated as ambient medium to provide the atmosphere for visitors engagement rather than representing a certain object in the video frames. This memory book is invisibly written by visitor's memories and thoughts. It consists of the videos provided by video photographers, the smells selected by the artist, the scenery at the heritage site and the memories of the visitor altogether. This artwork invited the visitors to rest, to recall and to think. When the visitor put on the headset and turned the page of the book, the videos would be projected accordingly on the papers. Meanwhile, specific scents would be released from the side. A guestbook is placed beside to let the visitors write down their thoughts and memories behind. It provided a chance for the visitors not only to rest at present, but also to recall their past and write about their future. These memories and thoughts could be very personal or collective ones.



Fig 1. *The installation of the artwork, 2015, Mei-Kei Lai, photo, ©Mei-Kei Lai*

This artwork was exhibited at the corner of the semi-outdoor courtyard area in Sir Robert Ho Tung Library as shown in Fig 1. The library itself is located in the heritage site that belongs to *"The Historic Center of Macao."* It provides a special atmosphere where tourists and local readers meet. As its identity of cultural heritage, Sir Robert Ho Tung Library paid more concerns on culture promotion and the maintenance compared with other public libraries in Macao. For example, they would invite artists to redesign the reading corner in the library, scholars to share the cultural history of Macao, and musicians for outdoor performance. Besides, they also employ full-time architect as the consultant for regular maintenance in the library. If there is any construction of the exhibition, they would consult the architect to discuss if the artwork installation affects the appearance of the heritage. For example, it is not allowed to mount the projector on the wall of the library. Since this artwork includes olfactory component in the multimodal interaction, it may affect the library readers due to allergic issues. The indoor reading area was not considered as the scents would spread out to the whole floor through the ventilation system.

## System and Interaction

The system of "Flip the Book – Flip the Memories" includes the projector, flex sensors and smell diffusers connecting through Arduino and Processing as shown in Fig 2. When the visitor turns the page of the book, it would trigger different videos projected accordingly on the papers. Three flex sensors were embedded respectively at the right bottom corner of three different pages. Once the system detects the action of flipping, it would trigger a random video to play. The original video footages were collected from the local video photographers. The artist re-edited the sources into four video clips. It includes a video captured the local Macanese community dancing and singing in Portuguese, a video captured the construction of the casinos, a video captured the night view and light pollution of Macao, also a home video captured how a Chinese girl celebrated Christmas with her family back in 1995.

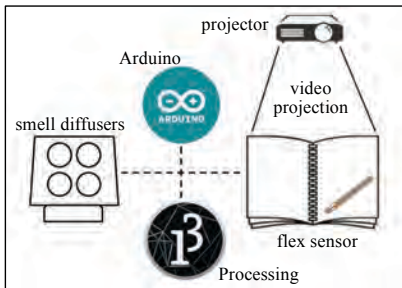


Fig 2. The system of the artwork, 2015, Mei-Kei Lai, illustration, ©Mei-Kei Lai

Instead of using the scent to match the specific object in the video, this artwork emitted the smells during the video transition. A black screen with subtitle was inserted in the middle of the video. It lets the reader focus on the present experience with smell without the interference from the video image. It also avoids the expectation gap and synchronization issue between visual and smell. The smell diffusers were placed beside the reading table. When the black screen was shown, it would trigger a preset smell released from the diffuser, as shown in Fig 3. The duration of the black screen with scent emission is about twenty seconds. It allows the scent spreading near the reader's position. Different types of scents were chosen according to the context of the videos. For example, in the video about a girl celebrating Christmas with family in her childhood, a sweet smell like fruit would be released. In the video about the construction sites, a smell similar to tobacco was chosen. In the video of Macanese singing in Portuguese, a smell of perfume like white musk was used. In the video of the night view of Macao, a smell like whiskey was chosen.



Fig 3. The video projection on the book and the smell diffusers on the side, 2015, Mei-Kei Lai, photo, ©Mei-Kei Lai

## Observations and Discussions

Observations were conducted in a distance without interrupting the readers. Some passersby, at their first glance, would say, "Oh, there is an e-Book.", "Isn't it a new facility of the library?". Other passersby simply gave it a glance and walked away without putting on the headset. Some readers simply enjoyed watching the videos without flipping the book. Once the readers found out that they could turn the page to change the video clips, they would feel curious and tried to find out the secret behind by picking up the book or waving hands on top of the page. Yet in most of the cases, the readers were not aware of the smells emitted from the side until they noticed the diffusers nearby or read the description of the artwork. Besides, interviews were conducted during the guided tour of the exhibition. Most of the visitors found the idea interesting as they could turn the page to watch different videos. It let them watching the old video footages on a physical book like reading the social memory book of Macao. When some visitors found that the smells coming from the side, they walked close to the smell diffusers. One of them responded, "how come I smelled the odour of cigarette?" while actually the smell of fruit was emitted just a few minutes ago. This may be caused by the scented mist stuck on the surface of the surrounding. Despite of this, most of the visitors found the combination of smell with audio visual is interesting though many technical issues needed to be solved. While watching the old footages of the city and experiencing the smells with it, the visitors started to talk about the old days of Macao and the change of the society in recent years.

Throughout this artwork, there are opportunities and challenges found behind. Due to the historic and architectural values, there are many limitations on the infrastructure of cultural heritages. Multimodal technology could enrich visiting experience without changing the architectural structure and heritage essence. Smell is an intangible media that exists in the air. The olfactory component of the multimodal interaction can

be changed from time to time according to the themes of the cultural heritage seasonal events. Its evocative and affective characteristics provide visitors engaging experience that transcends time and space. It could be applied in various ways such as telling the story of the cultural heritage and evoking the memories of visitors. In this artwork, the combination of smells with audio visual in physical reading evoked the visitors about the social memory of the city and prompted them interact with each other to share the old stories of Macao.

However, there are also some challenges behind. One is the context of olfactory interaction. Each cultural heritage has to find out its unique visiting pattern to match with the odour emission in multimodal interaction. Instead of using click-to-sniff, this artwork adopted the action of flipping as the trigger of the odour emission to fit in the multimodal reading experience in the library context. Another challenge is the selection of smell. In this artwork, the scents were chosen based on the artist's perspective on the social memory of each video clips. As olfactory perception is very subjective, the artists and heritages need to find out the smells which shared commonly among the target visitors while creating the desired multimodal experience. Last but not least, it is the technical issues of digital olfaction system. Each cultural heritage needs to find out its suitable olfactory output system for multimodal interaction. It can be based on the essence of the cultural heritage, the location of multimodal interaction, the duration of the events, the ventilation system, etc.

## Conclusion

On one hand, the institutions of cultural heritage need to pass on the historic values to the era of new media. On the other hand, they face the limitations of construction and expansion in the current environment. Here new media technology provides new possibilities to reinvent the content by delivering multimodal experience. In this case, "*Flip the book – Flip the Memories*" integrated the tangible and intangible experience together by combining smell and audio visual with the action of turning page of a physical book. It brings the new perspective to the social memory and enrich the visitors' multimodal experience in the cultural heritage.

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