

Enhancing a museum mobile application through user experience design: a comparative analysis

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Abstract: - Museum mobile applications usually aim at enhancing the visitors' experience, but a poor application design may dissuade people to extensively use the digital tools throughout the visit. In order to make multimedia guides appealing and easy to use, the interaction model, the information architecture and the graphic interfaces need thus to be carefully crafted. This paper presents a comparative analysis of a museum mobile application developed for the exploration of Palazzo Madama-Museo Civico d'Arte Antica (Torino, Italy). The results of an experimental evaluation on the ground from nearly 200 users led to a better understanding of museum visitors' needs and supported a thorough comparison between two different releases of the mobile application, highlighting limits, enhancement of the visitors' experience and improvements in their exploration behaviors. Finally, future research directions are proposed by building on the reported real-world experimental evaluation.

Key-Words: - Interaction Design, Information architecture, Visual Design, Usability, Human Computer Interaction, Cultural Tourism, User Experience, Interface Evaluation.

1 Introduction

The use of mobile applications to facilitate visitors' meaning-making process in museums and cultural heritage sites has become largely widespread in recent years. At present, the most common functionalities featured by handheld guides range from multimedia content provision [14] [15] [17], to indoor navigation [16], digital social sharing and games [18]. If the variety of services offered can indeed satisfy users' needs, the visitors' experience results to be actually enriched if contents are carefully designed to effectively communicate cultural information in a mobile context of use. Moreover, the human-computer interaction process has to be as effortless as possible, in order to reach a high-quality user experience: the pleasantness and effectiveness is strongly influenced by the information architecture and the interaction flow [11] as well as the ergonomics and usability of the application itself. The achievement of these goals is fundamental to facilitate an extensive use of a mobile application throughout a museum visit: whereas a captivating interface and interesting contents may foster curiosity, provide a variety of interpretative stimuli and ultimately encourage

exploration, a poor design and a content presentation, not specifically conceived for a mobile use, may dissuade visitors to adopt the digital tool, leaving the learning potential of the mobile resource untapped. As remarked by the literature, to enable wide usability it is important to develop graphic interfaces that use elements that are immediately appealing to the public [9]. Then, considering that the intuitiveness, learnability and ease of use of the applications - together with other dimensions - contribute to the overall degree of usability [3] [8], it is essential for developers/designers to find the interfaces that best promote an effective use of the interpretative tools in the museum context. Coherently, evaluations, testing either user interfaces at various stages of development or alternative versions of the same application, are becoming a common practice [1] [2] [4].

In this paper we examine how the systematic assessment of "Step by Step", a multimedia guide developed for Palazzo Madama-Museo Civico d'Arte Antica (Torino, Italy), allowed to better identify both users' visiting needs and their difficulties in terms of mobile interaction. Feedbacks collected from nearly 200 users through

observations, interviews and questionnaires were used to support the development of an enhanced version of the application, in order to increase visitors' satisfaction and engagement with cultural contents. After discussing the adjustments that were implemented to support the usability of the application and visitors' meaning-making process, we evaluate to what extent "Step by Step 2.0" - i.e. the second version of the mobile application - improved the user experience and affected visitors' behavior in terms of exploration of the museum. Finally, we point out a set of recommendations to be followed when designing a museum multimedia guide.

2 Step by Step: a mobile museum guide

Palazzo Madama - Museo Civico d'Arte Antica is a UNESCO-listed historical building situated in the city centre of Torino (Italy). Inside the museum it is possible to appreciate beautiful 18th century frescoes and an extensive collection of decorative and fine arts covering a time spanning of almost twenty centuries. The museum is articulated in 4 floors, on a surface of over 4,000 sqm. The considerable amount of cultural artifacts on display and the width of the building make Palazzo Madama an environment suitable for a variety of interpretations, possibly disorienting first time visitors. Moreover, to avoid affecting the aesthetics of the outfitting and overwhelming the visitor, the museum exhibition does not include panels and labels with a detailed explanation of the rooms and the artworks. In order to help visitors meaningfully explore the palace and enhance their experience, "Step by Step" - a mobile location-based multimedia guide - was developed and distributed. "Step by Step" exploits an innovative vision-based system [7], ARRU, to accurately calculate the position and orientation of the visitor and provide contextualized information to the user. In particular, when the visitor frames one of the visual markers deployed in the museum environment, an augmented 360 photo of the actual room is shown (Fig. 1). This photo is augmented with hot-spots that allow the user to access contextual information, provided under the form of texts and pictures [5][6].

"Step by Step" allows the visitor to choose between two different ways to visit the museum: freely wandering through the location or selecting a thematic guided tour. With the first option, a user is able to build her own visiting path and select the rooms and works of art she wants to explore. On the

other hand, each guided tour suggests a list of destinations to be reached: framing a marker and activating the navigation option, the visitor is provided with navigation information to reach her target.

In order to test the validity of the proposed approach [12], "Step by Step" was thoroughly evaluated on the field [6], through questionnaires and interviews involving around 200 museum visitors overall. This process led to the realization of a new version of the application, "Step by Step 2.0", which is described in the following section.

3 Enhancing the visitors' experience

"Step by Step 2.0" aims at improving visitors' museum experience, by providing an easy to use digital tool that can go along the user throughout her visit, with a set of functionalities meant to support her meaning-making process. With this goal, the application was redesigned from different points of view: the interface was freshened and the number of functionalities reduced; the information on the artworks was completely restructured; and the navigation functionality was simplified.

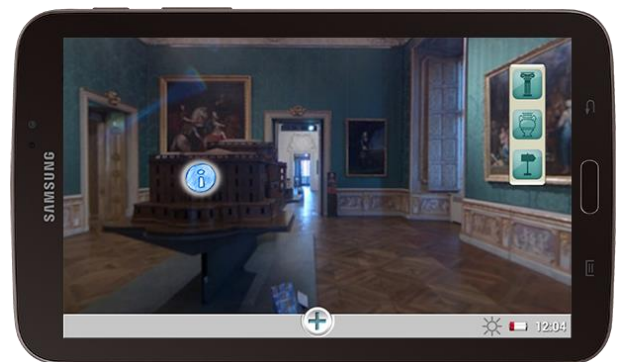


Fig. 1 – "Step by Step": augmented 360° photo and menu

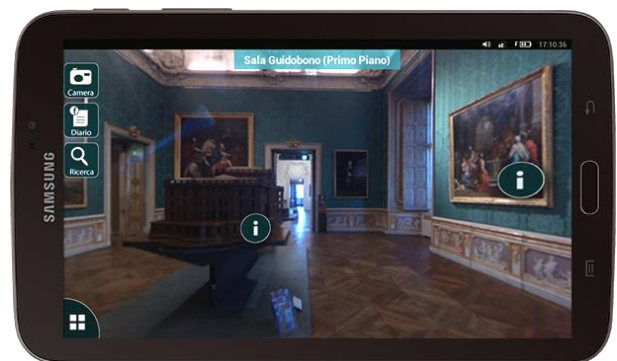


Fig. 2 – "Step by Step 2.0": augmented 360° photo and menu

First of all, we simplified the interaction model, in order to make the user complete her task without being overwhelmed by the interface. As pointed out by the Hick's law [13] (i.e. the time it takes to make a decision increases proportionally to the number and complexity of choices), the user's decisional process was facilitated firstly acting on the menu. The menu of the previous version of the application was considered hard to find as it was not always visible (Fig.1): some functionalities were directly accessible with the controls on the right, while others were shown when tapping on the "+" icon placed on the bottom of the display. In "Step by Step 2.0", the main menu functionalities were made always visible on the left side of the augmented 360° photo (Fig. 2), while minor functionalities were made accessible through a toggle menu with collapsible items located on the bottom left side of the screen. Icons were moved from the right side to the left to increase accessibility, as stated in [19].



Fig. 3 – "Step by Step": content presentation



Fig. 4 – "Step by Step 2.0": content presentation

One of the major functionality of a multimedia mobile guide is to provide visitors information on the artworks that surround her or on the room she is in. In the first version of the application, when tapping on a hotspot, the description of the artwork was shown to the user in form of text and photo-

galleries (Fig. 3). The evaluation pointed out that the textual descriptions were considered reliable and well written, but definitely too long. Moreover, photo galleries with details and contextual images were not easily noticed by users and consequently not commonly browsed. These considerations drove us to completely rethink the contents to be provided to the user, moving from a mere replication of texts elaborated for a printed guidebook to a presentation of the cultural material specifically thought for a mobile context of use. Long texts were reformulated, simplified, and subdivided into small paragraphs that were shown in combination with explanatory images (Fig. 4). This process was undergone also in consideration of the intended target of the application, i.e. common people lacking a deep and specialistic background in art history.

The re-writing of the texts allowed to insert anecdotes that could foster visitors' empathy and emotional engagement; the extensive use of images and the subdivision of the contents into "slides" aimed at driving users' attention and make the information easy to scan.

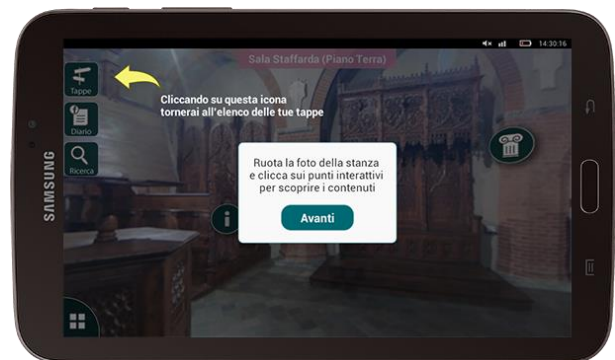


Fig. 5 – "Step by Step 2.0": tutorial with pop-ups

Another major improvement consisted in improving the direct interaction with the multimedia guide. In the first version of "Step by Step", the main features of the guide were shown by a video tutorial, that was played as the application started. Interviews pointed out that this was confusing: in fact, some people did not notice it was a video and tried to interact with the interface in vain during the video playback. Moreover, users frequently did not remember how to interact with the guide once the video was ended. To address this issue and make the tutorial more useful and effective, we divided the help guide into chunks of explanations: in "Step by Step 2.0" information is provided when users need them. This change was meant also to take into consideration the fact that people tend to easily forget instructions when they do not immediately

put them into practice [10]. In this perspective, a pop up is shown near the control the user has to interact with for the first time (Fig. 5).



Fig. 6 – “Step by Step”: 3D navigation system

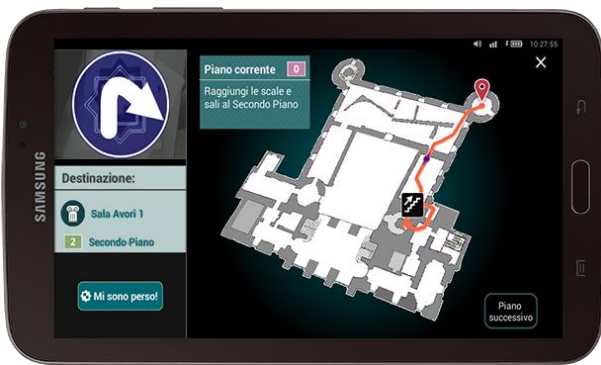


Fig. 7 – “Step by Step 2.0”: 2D navigation system

Hints aiming at better assisting visitors' behaviours were added in the navigation system, too. In the first version of “Step by Step”, 3D maps were used to show the user the path she has to follow to reach a given destination (Fig. 6). Even if this approach was found intuitive by people accustomed to play with video games, most museum visitors found it difficult to follow, as its interpretation requires a too hard abstraction process for the users. In this perspective, 3D models were replaced by 2D maps (Fig. 7), where the actual position and the destination are made explicit by a pin and the visitor can look at a glance the total path on the map. The path to the next destination is shown both by a fixed red line and an animation that further explains the steps to be followed. Brief textual indications explicit the floor in which the user is (e.g. “you are at the ground floor”) and the basic actions she has to take in order to reach the destination (e.g. “Reach the stairs and go to the second floor”).

4 Evaluation of the new release and comparative results

An in-depth testing of “Step by Step 2.0” was conducted in a real context of use, involving 21 museum visitors: users were observed when using the application and then interviewed. Results pointed out that the main functions of the new menu were generally easily found by users: in fact, when asked to perform an activity, people mostly succeeded in selecting the right button at the first attempt. This confirmed that the reduction of the number and type of functionalities made available, together with their presentation through better conceived icons, facilitated the usability of the application. Overall, just a minority of users reported difficulties in performing the tasks, and they suggested to avoid splitting the functionalities into two menus, in order to make all the functionalities always visible. Concerning the tutorial, users clearly understood that pop-ups appearing when performing an activity for the first time were hints and deemed useful to get explanations about functionalities progressively. The graphic layout of the whole application was rated positively too, and some users stated that the pleasantness of the visual design encouraged them to use the application, thus reinforcing the principle that visual appeal can support an extensive use of digital tools.

Overall, the combination of images with short texts highlighting not only the meaning of the artworks but also unusual anecdotes was highly appreciated by visitors: with few exceptions, it was found effective in communicating cultural information, fostering curiosity and providing context to the artworks. One visitor considered the information per artwork excessive, whereas three visitors would have preferred to have even more information: this underlines that a certain degree of personalization in the contents is valued by visitors, since their personal interests may vary consistently.

The new design of the navigation system allowed visitors to easily understand their position on the map and the location of their destination; however, since the system does not automatically track users' movements inside the building, people had some difficulties in orienting themselves when moving towards the destination, finding hard to relate their physical position with the path displayed on the map.

In order to understand whether the new release enabled a better user experience, 8 visitors (aged 13-45) were also asked to evaluate the new release against the first version of the application. Given

that, an extensive and enjoyable access to cultural contents represents the main goal of the multimedia guide, visitors were particularly invited to express their opinions about the different models of content presentation used in the two versions of the application. Overall, the new version was frequently defined as more fluid and intuitive, and it was preferred by the totality of users: *“The direct connection of the texts with the images helped me easily understand the identity of the characters portrayed in the painting. I also liked seeing pictures providing context to the artwork”* (male, 30 years old, visiting in couple); *“I found the new version more intuitive and easier to use. It also explains contents more deeply; the pictures help you focus your attention, they suggest where to look at”* (female, 20 years old, visiting in couple).

As to collect empirical evidence for these results and understand whether the new user interface actually affected visitors' behaviors, the data-log automatically recorded by the application were analyzed and compared against the data available for the first version of “Step by Step”.

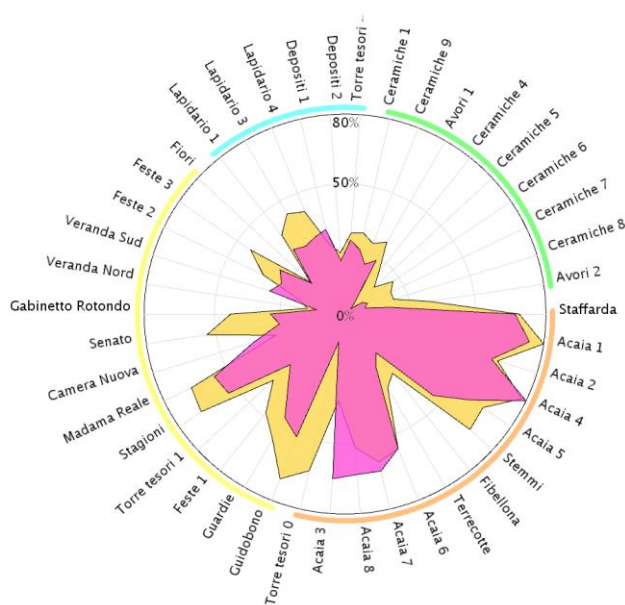


Fig. 8 – Room visits percentages: comparison between Step by Step (pink area) and Step by Step 2.0 (yellow area)

Fig. 8 shows that the new release fostered a higher exploration of the venue: on average, visitors using the new release scanned 39% of the 45 visual markers deployed in the environment (calculated on about 200 visitors), against a mean of 34% registered for the old version (calculated on about 80 visitors). This means a small increase of 5% in absolute terms, but a 15% improvement in relative

terms. Interestingly, the markers located on the ground floor (see Fig. 8, orange sector) - i.e. at the beginning of the visiting path - were scanned with similar rates both by users of the old version and of the new one, whereas the markers placed in other areas of the palace were framed mainly by visitors who experienced “Step by Step 2.0”. This means that the new release was effective in encouraging a scattered exploration and in keeping visitors' interest, showing how a more pleasant and easy to use interface improved visitors' will to explore the cultural venue with the support of the mobile guide.

5 Conclusion and future research

This paper provides evidence that enhancements regarding the information architecture, interaction model and visual design of a museum mobile application can lead to a higher degree of use of the digital tool, supporting visitors' curiosity and exposing them to a larger number of learning stimuli. The results of the comparison analysis are useful to identify recommendations for designing an effective museum mobile guide. Firstly, the interface needs to present a limited number of essential functions, to simplify users' decisional process. Secondly, contents must be specifically conceived for a mobile consumption: this means not only that they must be appealing and well readable on a small digital screen, but also that they must be easily accessible in a context where time resources are limited and the user is free to move. Finally, the cultural contents need to be structured to allow the user to access information according to her interest: with this regard, adaptive and recommendation systems could represent a valuable solution. Then, the progressive disclosure principle needs to be followed when designing the tutorial tools, not to overwhelm visitors with information, and the navigation system should either take advantage of technologies that automatically track visitors' movements inside the building or adopt a layout that does not require an excessive abstract process to be interpreted.

In order to further improve the user experience and better understand visitors' opinions and behaviors, future steps of research are represented by the conduction of a more structured questionnaire among a wider number of users (i.e. integrating Likert-scale questions), as to have quantitative and comparable data that could better inform effective human-computer interaction solutions.

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