

Museo Multiverso: Bridging the Gap between Museums and Mobile Platforms

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Abstract—As mobile devices have pervasively become virtually available to all, cultural institutions have been increasingly investing resources in the creation of apps that can be enjoyed on the phone. Typically such apps are built custom for specific events or exhibitions, resulting in increased IT costs that well exceed the typical costs due to the maintenance of institutional websites and the carry on of traditional marketing strategies. In this paper we describe *Museo Multiverso* (MuMu), a mobile publishing platform that provides a standard interface with the mobile world to museum curators and experts. Using MuMu a museum curator can populate a mobile client with any multimedia information related to an exhibition or to a network of exhibitions and easily publish such information and make it available to mobile users. MuMu is composed of two main components: a platform that museum curators can use to organize and insert the information they want to share with the public and a mobile client where users can originally enjoy all of such information. In fact, the contribution of this work is twofold: (a) from an architectural point of view, we designed and implemented a platform that can be put to good use to support virtually any number of museums and events, and, (b) from a human-computer interaction point of view we leverage on advanced interaction techniques in order to provide an easy to use interface that excites curiosity and interest.

Index Terms—Museums; Mobile Platforms; Human-Computer Interaction; Publishing

I. INTRODUCTION

An interesting aspect of computer technologies is that, as they evolve, they tend to disappear. Gigantic '60s mainframes have been substituted in the '80s by personal computers, which in turn have been replaced in the '90s and '00 by laptops and notebooks. In this “the smaller, the better” process, tablets and smartphones are today’s main characters, capable of entering every home, pervasively becoming fundamental for most human beings [1]. In this race, as computer literacy advances, smartphones and tablets have become one of the main interfaces through which information is explored and retrieved. It is then easy to understand why cultural institutions, among many others, are increasing the budgets they spend to reach their

customers with the use of mobile platforms. Such trend has been known for long now and may be considered established at this time [2]. This has opened a new stream of opportunities for the design and implementation of new software platforms in all cultural fields, with no exception for museum contexts.

Conscious of such evolution, the *Istituto per i Beni Artistici, Culturali e Naturali dell'Emilia Romagna (IBC)* the public institution that manages most of the museums of the Italian Emilia Romagna region, together with a team at the Computer Science Department of the University of Bologna, started working at finding new ways of communication that could facilitate the flow of cultural information from museums to mobile platforms users. Now, after a preliminary analysis made by museum experts and computer scientists, two requirements immediately emerged. The first one amounted to an urgent need for flexible and reusable platforms. In fact, it became clear that tens, if not hundreds, were the events, shows and exhibitions that every year were being held in the public museums of the Emilia Romagna region. This also meant that providing novel custom mobile apps for each of these events would result unfeasible, both financially and in terms of required manpower effort. Hence, reaching mobile users clearly entailed designing a mobile publishing platform that could support the sharing of cultural information, as any digital media became available. The second requirement, instead, amounted to providing a mobile platform that could be smoothly used and whose user experience resulted enjoyable, both from the perspective of museum professionals and from the perspective of mobile users. In fact, a key factor for any running mobile platform is its usability, as this amounts to a fundamental prerequisite to make the platform successful and popular. This said, we here describe the design and implementation of *Museo Multiverso* (MuMu), a software platform that facilitates the publishing of cultural content on mobile platforms. The driving idea is that of providing a tool that can be used by a non-computer expert to publish any type of cultural information through a mobile app. MuMu, hence, is first of all a mobile information broker, a reference point that provides museum curators the interface

and the tools necessary to organize and publish, independently, the content that they prefer. In addition, MuMu implements a mobile interface, based on augmented reality paradigms, easy to use, whose scope is that of providing a pleasant browsing of cultural content. To this aim, MuMu also implements an emotional browsing paradigm: the MuMu mobile client is capable of inferring the mood of its user (i.e., smiling/not smiling) from his/her picture and of selecting the content that is shown depending on the given mood. Finally, MuMu also automatically links the information that it proposes (e.g., the Verdi Museum is connected to the Rossini Museum), in order to provide semantic paths of exploration of cultural content and encourage its users to visit multiple cultural institutions and sites. This paper is organized as follows. The most notable mobile apps developed for the presentation of exhibitions and museums are presented in Section II. In Section III we provide an overview of the architecture of MuMu walking through its typical use case scenario. We finally conclude with Section IV.

II. RELATED WORK

An uncountable number of different apps have recently appeared in the mobile world. Interestingly, an important share of these apps is related to cultural institutions and museums. At the beginning the binding trend among these apps has been that of simply transferring generic museum guides on mobile platforms. Visitor guides, in fact, can be easily found on all major mobile app stores for many of the most notable institutions of the world (e.g., Vatican Museums, Louvre, British Museums, etc.). More recently, more complex and sophisticated apps have appeared, apps that do not simply behave as information containers and providers, but as applications capable of presenting content in original and novel ways, often combining artworks with novel presentation means and the use of smartphone sensors. To take a recent example, consider the *Artist's View* iPad application implemented by Netribe for Palazzo Strozzi [3]. This application has been designed to help museum visitors become familiar with the paintings exhibited in the “Americans in Florence – Sargent and the American Impressionists” show. Its designers took advantage of the fact that most paintings portrayed Tuscan landscapes by directing visitors to the locations where the artists found their inspiration. In fact, when a user reaches any of such locations, i.e., the point of view from which the given landscape can be seen, the application provides the possibility of juxtaposing a digital copy of the original painting with the scene the painting represented. Hence, the application leverages geo-location and augmented reality techniques to let users discover the spark, i.e., the landscape, that ignited a given artist. In essence, *Artist's View* provides people with a rich and imaginative context with which to interpret and engage historical artifacts. In particular, it provides access to aesthetic resources and uncanny moments hidden from view on the museum floor.

By extending the practice of visiting, paintings, books, and other historical artifacts may become part of the visitor's broader museum experience.

Marsili's Spirit is a mobile app that has been designed to revitalize the timeless spirit of Count Luigi Ferdinando Marsili, one of the main scientists, politicians and characters of the Bolognese 18th century [4]. This app mixes together geo-location services, artistic comic strips, high quality photos, a museum guide, ancient music and, in general, tangible pieces of the Count's heritage to posterity. Such artistic and technical content has been put to good use to attract visitors and help them walk to and from the institutions that still preserve of Marsili's heritage. In fact, geo-location services are exploited as follows: the artistic content that the app contains becomes available only when one of the involved institutions is reached. The app, hence, relies on an incentive mechanism to tour visitors between different Marsili's heritage sites.

BolognaMusei is a mobile app that has been specifically designed for the network of Bologna Museums [4]. A painted card represents each museum and each card is associated to short poem. Users can browse, turn and discover the cards realistically, just as when dealing with a real deck. The aim, also in this case, is that of playfully presenting the cultural institutions of the city, in order to capture the interest of its users and to portray, in an alternative way, the cultural treasures that are spread out town. While all of these applications have been specifically designed for museums and exhibitions, none of them can be easily updated, as they all have been designed as closed systems. Hence, if a new painting were presented in Palazzo Strozzi, *Artist's View* would need a code update, not being flexible enough to accommodate any new content. The same can be said for *Marsili's Spirit* and *BolognaMusei*. We here present, hence, MuMu, a mobile platform that supports the provisioning and progressive updating of multimedia content. In a context where technology necessarily requires to transition in order to better preserve tradition, MuMu amounts to a first step in such direction [6].

III. MUMU

MuMu is a mobile platform that relies upon two different components. The first component is accessible via web by museum curators and by any information providers, to upload and publish their content. The second component, instead, amounts to a mobile app that can be used to explore any published information and multimedia. With the aid of Figure 1 we can easily understand how the platform works. Museum curators and professionals can utilize the first component, a content management system, to upload multimedia information through an easy-to-use web interface (the UniverseCreator Content Management System in Figure 1). Clearly, a careful design process

should precede such step, as all required media should be previously selected and organized.

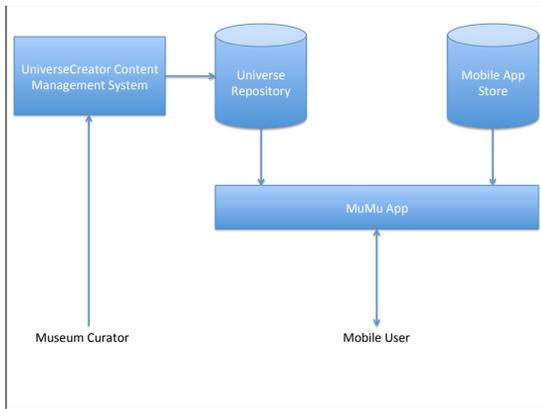


Figure 1. The MuMu mobile platform architecture

Once this step is completed, all the data that has been inserted is available to the MuMu mobile app, in the form of a Universe (how we leverage on a Universe metaphor to organize information is explained in the next paragraph). In practice, the mobile app that a user downloads from an app store (iOS or Android) contacts the Universe repository at each run. If any new Universes, i.e., organized collections of cultural media, are present, such information appears in the app. It is then up to the user to decide whether downloading, or not, a given new Universe. We have hence here engineered a mobile publishing platform, where content and presentation are separately dealt with, and where content providers can easily create and upload new cultural information without needing to create a new mobile app every time a new event, museum or show opens.

Before proceeding with a step-by-step explanation of how MuMu works, however, we should here spend a few words on the design spirit that led to the creation of this platform. Groups of information (e.g., paintings in an exhibition, museums in a network of specialized institutions, etc.) are here metaphorically reinterpreted as universes of information, where each single element is represented as a planet. Hence, for example, if a museum curator desires to create an app instance specifically dedicated to the major Italian opera composers, a possible way of utilizing MuMu could be that of creating a universe (e.g., the Opera Universe) where each single planet is assigned to a different composer (e.g., Verdi, Rossini, etc.). This organization also justifies why the platform has been named Museo Multiverso: in fact, as the platform grows, it can potentially accommodate an indefinite number of universes, i.e., sources of cultural heritage information. Now, as aforementioned, MuMu is composed of two components: (a) a web-based content management system that can be easily used to create and publish universes, and, (b) a mobile app, an initially empty app, that can download

and present to its user any of the content that has been previously published through the content management system. In the following we will proceed walking through the details of the features made available by these two components.

A. UniverseCreator: The MuMu Content Management System

MuMu, on the publisher's side, presents itself as a simple web-based content management system. In fact, in order to appear familiar and easy to use, some of its visual elements largely recall mainstream social platforms (e.g., Twitter). In Figure 2 we show how MuMu appears the first time a potential publisher accesses its web portal. The classic web portal provides two possibilities, the user can either register if this is a first access, or login if not. Now, once the user has entered the MuMu web-portal, s/he is entering the "Universe Creator" site (topleft label in Figure 3). In fact, with this tool, the user can either access and edit a Universe (e.g., VersoVerdi, the Universe dedicated to the compose Giuseppe Verdi, in the left part of Figure 3) or create a new Universe (plus sign icon in the right part of Figure 3).

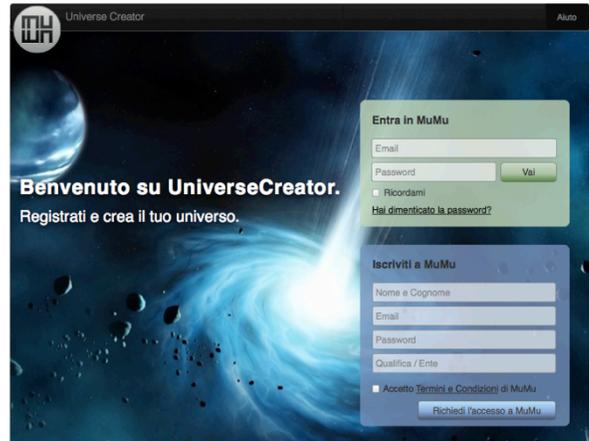


Figure 2. Opening page of UniverseCreator, a new user can register while a returning one can access his/her content.

Let us now assume that a generic event manager decides to create a new Universe (i.e., the user is a museum curator that wants to share a given set of content with the mobile public, as a preview of a forthcoming exhibition). This process can be completed walking through three phases. The first phase amounts to assigning a name and a description to the brand new Universe (Figure 4). The second phase, instead, amounts to defining and instantiating the planets that compose the Universe (Figure 5). This is, perhaps, that most creative part of the design process, as the designer is here completely free of interpreting what a planet could signify and represent in the given context. For example, in a network of museums that participate to a given event, each

planet could clearly represent a Museum. However, if the Universe concerned only a single museum, each planet could instead be devoted to selected items that are exhibited at that museum, following some type of logical path.



Figure 3. Creator's first step: change existing universe or create a new one.

Hence, once the Universe designer assigns a name to each planet, the next step within this phase is that of uploading the desired multimedia information related to that planet (Figure 6 and 7). This step includes also the assignment of a specific description to that planet, as well as tags that may well describe it in short. This is an important step: in fact, the MuMu platform will later be able to create new connections between planets of different Universes depending on this information. However, connections between planets that live within the same Universe are not left to an automatic algorithm to create. In fact, a Universe designer can here decide which connections are relevant for the given Universe and easily create and tag them. This third phase amounts to the final one that needs to be completed (Figure 8).



Figure 4. First phase: insert universe name, create planets and initial connections.

B. The MuMu Mobile App

The MuMu mobile app can be easily represented by the following metaphor: the app amounts to an empty shell that can be filled with any available Universe that becomes available online. This app, hence, represents the entry point for any MuMu final user and provides an interface to, virtually, any number of different Universes (resources).



Figure 5. Second phase: store information inside planets.

Just as in an app store, hence, the MuMu mobile client offers an interface where a user can select and download the Universes of interest. How this part works is clearly visible in Figure 9a. In particular, once a user selects a maximum of three Universes, a multiverse can be created. Let us now take one step back and explain, more in detail, what a multiverse is. As mentioned in the previous Subsection, a Universe Creator is required to input the tags that best describe each planet s/he creates.



Figure 6. Second phase: planets are named and tagged.

When previously describing this process, we also mentioned that this information is used to automatically relate a planet to other planets of other Universes. This

mechanism exactly amounts to the one involved in the creation of a multiverse: a multiverse is an ecosystem of Universes where planets are automatically connected based on the information that describes them. This means, for example, that if a user at some point visited a planet dedicated to Enzo Ferrari, i.e., the Ferrari motor team founding father, in a Universe dedicated to the history of sports cars, MuMu would also suggest the user to visit a planet dedicated to Francesco Baracca, i.e., Italy's top fighter ace of World War I, in a Universe dedicated to aviation. While we here leave to the interested reader the discovery of why these two planets (i.e., characters) could be connected, we here want to underline that the MuMu mechanism favors the creation of networks of knowledge as different Universes are downloaded and explored.

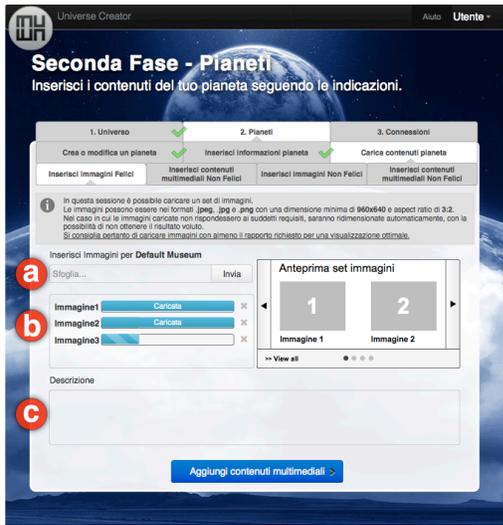


Figure 7. Second phase: how multimedia information is stored in planets.

This said, the MuMu mobile app interface has been greatly influenced by those apps that are commonly used to explore the sky and its constellations. With an important difference, here planets represent pieces of knowledge. It is hence possible to use the interface to aim at a planet (Figure 9b) and see what that planet represents. In Section I we mentioned that the MuMu mobile app integrates an important feature, a mood detector [7]. The mood detector is easily accessible at all times while browsing, navigating, a universe by simply clicking the orange icon placed at the bottom left corner of the interface (Figure 9b).

For simplicity, our mood detector can only distinguish two different states: smiling vs. not smiling. Figure 9c depicts the result that is presented when a non-smiling (i.e., sad) user is detected: the background color changes slightly, becoming reddish. In the opposite case, i.e., a user is

smiling, the background keeps a light blue coloring (Figure 9d).



Figure 8. Third phase: creating connections between planets.

At the end of the mood detection process, a user can explore the content that has been published within the given planet. Hence, two buttons (a green one and a blue one, as shown in Figure 9e) appear and can be clicked. Depending on the information that has been uploaded with the Universe Creator, the user will be able to access a slideshow, a video or an audio track (Figure 9f). Now, we finally find out when connections appear. Figure 9g shows how after visiting a planet a user is encouraged to visit other planets by the connections that suddenly appear.

IV. CONCLUSION

In this paper we present MuMu, a mobile publishing platform specifically engineered for cultural applications. To the best of our knowledge, unlike any other previous experience, MuMu is the first platform that embodies the flexibility required to accommodate the continuous stream of information and events typically created by the world of museums and cultural events [8]-[12].

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REFERENCES

- [1] V. Cerf, "Where is the Science in Computer Science?" Communications of the ACM, ACM, vol. 55, n. 10, pp. 5.
- [2] Available [online], accessed on the 31st of August 2013: http://www.nytimes.com/2011/03/17/arts/design/apps-give-museum-visitors-multimedia-access.html?_r=0
- [3] Available [online], accessed on the 31st of August 2013: <https://itunes.apple.com/mg/app/artists-view/id504132267?mt=8>
- [4] M. Rocchetti, G. Marfia, A. Varni, M. Zanichelli, "How to Outreach the External World from a Museum: The Case of the Marsili's Spirit App", Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering, LNICST Volume 116, 2013, pp. 25-32, 3rd International Conference on Arts and Technology, ArtsIT 2013, Milan, 2013
- [5] Available [online], accessed on the 31st of August 2013: <https://itunes.apple.com/it/app/bolognamusei/id645867491?mt=8>
- [6] D. Rosner, M. Rocchetti, G. Marfia, "Transitioning Tradition: Examining the Digitization of Cultural Practices," accepted for publication, Communications of the ACM, ACM, August 2013.
- [7] M. Rocchetti, G. Marfia, C. Bertuccioli, A. Marcomini, M. Zanichelli, A. Varni, "Supporting Cultural Emotional Browsing for Museums: The VersoVerdi App," Proc. of the IEEE International Conference on Multimedia and Expo (ICME 2013), IEEE, San Jose, July 2013.
- [8] G. Marfia, M. Rocchetti, "TCP at last: Reconsidering TCP's role for wireless entertainment centers at home," IEEE Transactions on Consumer Electronics, 56 (4), art. no. 5681095, pp. 2233-2240.
- [9] M. Rocchetti, G. Marfia, A. Semeraro, "Playing into the Wild: A Gesture-based Interfaced for Gaming in Public Spaces," Journal of Visual Communication and Image Representation, Elsevier, 23 (3), pp. 426-440.
- [10] C.E. Palazzi, M. Rocchetti, G. Marfia, "Realizing the Unexploited Potential of Games on Serious Challenges," Computers in Entertainment, ACM, 8 (4), art. no. 23.
- [11] M. Rocchetti, G. Marfia, "Recognizing Intuitive Pre-Defined Gestures for Cultural Specific Interactions: An Image-based Approach," 2011 IEEE Consumer Communications and Networking Conference, CCNC'2011, pp. 172-17
- [12] M. Gerla, D. Maggiorini, C. E. Palazzi, A. Bujari, "A Survey on Interactive Games over mobile Networks", Wiley Wireless Communications and Mobile Computing, vol. 13, no. 3, Feb 2013



Figure 9. Mobile app (from top to bottom: a, b, c, d, e, f, g): (a) choosing the universes, (b) pointing at a planet, (c) the user is unhappy, (d) the user is happy, (e) discovering the planet, (f) browsing the content of a planet, (g) suggesting new connections and paths of exploration.