Navigating Culture. Enhancing Visitor Museum Experience through Mobile Technologies. From Smartphone to Google Glass.

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Abstract. *This paper focuses on the use of mobile technologies and their ability to engage audiences in a new type of exploration that enriches the museum experience. The rapid expansions of media technology, the universal access to the Internet, the continuous online presence in the social media are fundamentally changing the cultural experience. In the entertainment and the new museum era, the issue is no longer whether new media and technologies should be used by cultural institutions (more precisely, in this article, museums), but how they may be used so that they heighten the visitor experience. Therefore, we will explore the new relationship between technology and museums and the ways in which newly emerging technologies such as augmented reality could be used in order to transform the audience's encounterwith culture.*

Keywords: *mobile technologies, museum experience, Smartphone apps, augmented reality, Google Glass.*

Introduction

The beginning of the third millennium comes with a technological revolution: the digital sphere has been immersed in the everyday life of society. Websites, Ipads, Smartphones are only a small number of new media that have gained control

over our lives. The rapid expansions of media technology, the universal access to the Internet, the continuous online presence in the social media are fundamentally changing the cultural experience. In the entertainment and the new museum era, the issue is no longer whether new media and technologies should be used by museums (the focus of our study) but how they may be used to develop a richer, deeper and more immersive visitor experience. Generally, digital media have been explored in order to strengthen the communication process between the museums and their visitors, to provide new methods of visitor interaction with the collections and the art works.

In this study we investigate some of the forms used by museums to build up a digital experience for the visitor, focusing on the use of Smartphone applications and the characteristics of the museum experience that they share. Through the review of literature and document analysis, we discuss five categories of fundamental topics that subsume different types of applications – *art and ideas, interaction and creativity, curation and interpretation, behind the scenes journey, masterpieces tours and personal trails* – and a series of *character figures,* metaphors for the museum visitor experience: the *Explorer*, the *Analyst*, the *Listener*, the *Creator*, the *Gamer* and the *Socializer*. We also acknowledge the next step in the evolution, by the insertion in the application technologies of augmented reality through which the visitor experience of the museum is highly enriched in terms of learning, entertainment and creativity.

The new museum and the museum experience

The new museology (Vergo, 1989) focuses on the social role of museums and on their interdisciplinary profile, along with new styles of communication. The new museology is promoting an open institution towards the public that focuses on the active participation of the visitor, which functions as a platform that generates social changes. Until the 80's, the museum has been the ivory tower by excellence, without the need of other justification than its own existence. The cultural changes within the mediatized society generated real modifications in the museum's constitution and an essential transition from an institution with an educational purpose towards an institution with a recreational purpose centered on the audience and its needs. More precisely, the museum is nowadays influenced by the consumption society and the entertainment era, aiming to transform art and culture in a spectacular performance. The focus of the new museum has moved from objects / collections on individuals / communities. The public, the audience and the contemporary individual are the concentration point of the new museology. The new museum reflects the dynamics and the multicultural nature of the 21st century, as it is an institution which favors dialogue, interpretation and experience. Museums are, therefore, exciting places for the visitors, free-choice learning environments (Falk & Dierking, 2000) that may shape identities – through access to objects, information and knowledge visitors can see themselves and their culture reflected in ways that encourage new connections,

meaning-making and learning (Hein, 1998; Hooper-Greenhil, 2000; Falk J.D., 1992). Nowadays, museums are involved in a real dialogue with their audience, based rather on interpretation than on absolute truths, sharing views and inviting the public to spend successive, countless experiences, to wonder, encounter and learn. Still, the learning outcome of the museum visit is second after its entertaining quality. Research has found that strong motivations to visit museums are leisure and entertainment (Moore, 1997; Packer & Ballantyne, 2002), as people visit museums for new experiences, worthwhile leisure, learning and entertainment in an exciting and stimulating environment.

With the development of digital technologies and the rapid expansion of new media, museums have been undergoing a fundamental shift to a site for experiences. Emerging technologies (the wireless Web, virtual worlds, augmented realities overlaid on physical ones, advanced simulations and networked knowledge) have transformed everything that constitutes our notion of "reality"– our ability to sense our surroundings, our capacity to reason, our perception of the world (Burnette Stogner, 2009). The museums are re-evaluating their position in relationship with their audiences, while the new media technologies are changing the very concept of the museum. The issue is no longer whether to use this technology to recreate the museum experience, but how to use it for a maximum impact on the audience.

The use of technologies and the digital experience of the museum

Contemporary museum exhibitions are adopting a range of new media technology, from high definition videos, animation, music, sound effects, sets and lighting, to 3-D movies, 3-D interactive, 4-D sensoramas, holographic imagery, simulations, gaming and a lot of other new, emergent forms as means of ensuring the *entertaining* of the visitors. The traditional audio guides are replaced by multimedia tours, Smartphone apps, PDA's, GPS locators, augmented reality to provide more complex information with *instant access* or on-demand. Through the use of the cyberspace, most museums are extending the visitor experience *beyond their borders*: websites provide supplementary on-line information, exhibitions or educational programs, creating connections and direct access to a global audience, while the Newseum and others offer virtual experiences on Second Life, where one's avatar might join a docent avatar on a tour of a digitized exhibition. Different devices are used to *personalize* the museum experience, visitors calling for immediate personal relevance experience that results in clearly identified knowledge gain. The museum presence in social media (Facebook, Twitter, Myspace) generates *direct feedback* and new forms of *participatory user experience, personal and shared*. The use of new technologies demands a new type of literacy on behalf of the visitor, but, in the same time, they enable a high level of *creative output* and *creative consumption*. Two distinct new forms of museum experience are emerging (Burnette Stogner, 2009). The first is the *media-enhanced on-site experience*: richly multi-sensory, contextualized, experiential

and immersive. It is narrative-driven. It draws a diversity of people together and provides a collective experience. The second is *the media-driven off-site experience* that is personalized, on-demand, global and enables a vast sharing of information and personal experience. These types of experience reflect the new vision of museums that are now visitor centered, focused on reaching out multiple audiences, expanding their role of on-site and on-line cultural trend-setters.

As Stephen Weil (Weil, 2007) observes, museums have shifted the balance from being about something to being for somebody. Challenging the unique authority of the curator, they invite visitors to actively create their own meaning from the collections, encouraging existing audiences to interact in new ways with the objects, as well as reaching out to new audiences. In this process, museums have been experimenting with different strategies and practices, exploring, among others, the use of new technologies which were developing very fast, permeating every aspect of social life.

Introducing Smartphones

The convergence of communication technologies and mobile consumer computing devices is on the way to bring interoperability and change the way people interact and communicate with the world. The Smartphone is the main device that is at the moment on the leading edge of this convergence process and it is playing the role of universal mobile terminal. The Smartphone term was introduced to refer to a new class of mobile devices that provide integrated capabilities including communication, computing and mobile services like voice communication, messaging, personal information management applications and wireless communication. In fact, the Smartphone is a mobile phone with more advanced computing capability and connectivity than basic feature phones. Smartphones typically combine the features of a phone with those of a computer and other popular consumer devices, such as a personal digital assistant, a media player, a digital camera, and/or a GPS navigation unit. Smartphones came to include all of those features, adding a touchscreen for easy user interaction, web browsing, Wi-Fi connectivity, 3rd-party apps, motion sensor and mobile payment. The adoption of Smartphones has been tremendous in mainstream consumer markets all over the world. Surveys show that around 42% of mobile subscribers in US use Smartphones, along with 44% of mobile users in 5 major countries of European Union (France, Germany, Italy, Spain, and UK) (Nurfit, 2012). Media usage on mobile – including browsing the mobile web, accessing application and downloading content saw a major increase and surpassed 50% in many markets. This introduced the high-speed networks and increased public WiFi availability in those areas. With the ability to connect on-the-go and use internet and mobile services, mobile users have not only adopted real-time social networking on their Smartphone at a growing rate but frequency of access has been also increasing day by day. A UK telecommunica-

tions regulator, Ofcom, released the following statistics as part of their study on Smartphone usage in the United Kingdom only: 37% of adults and 60% of teens admit they are highly addicted to their Smartphone; 51% of adults and 65% of teens say they have used their Smartphone while socializing with others; 23% of adults and 34% of teens have used their Smartphone during mealtimes; 22% of adult and 47% of teens admitted using or answering their Smartphone while in the bathroom (ComScoreInc, 2012).

Smartphone Apps for museums

There is considerable information and research on the use of multimedia technologies in the fields of cultural organizations and tourism for the provision of cultural interpretational information, but mostly connected to their technical aspects. Currently, the tools used to develop multimedia applications for mobile devices and their development process comprises of tasks for: multimedia content creation or optimization, interface design, interaction design and service development or provision, all tailored to adequately satisfy user, designer and mobile device applications requirements.

A survey conducted by the Museum Association (Atkinson, 2013) on the use of mobile devices in UK museums in 2013 points out that 50% of 175 respondent institutions have a mobile offer, in which QR codes are the most popular mobile technology employed in museums (63% of the museums that provide a mobile offer), followed by museum-provided audio-tours (46%), mobile optimized websites (45%), Smartphone apps for Apple (39%) and Smartphone apps for Android (36 %). The main objectives in offering mobile technologies are to provide additional content to visitors (68%) and to create a more engaging visitor experience (67%), to attract new visitors (33%), to keep up with visitor demand (28%), to widen access for people with special needs (27%). These devices were dedicated and targeted for all visitors, rather than for specific groups. The limited use of mobile technologies in museums is a consequence of the lack of human resources and insufficient staff time, of the limited knowledge, of the lack of a dedicated budget and the high costs of these devices, as well as of the structural barriers in venues. QR codes is at the moment the most widely used mobile technology (especially in mid-size museums), certainly because of their affordability and easy to use character. Still, with the development of technology, these QR codes (Quick response codes) seem to be overstepped by MPV codes (Mobile Visual Search codes) used through mobile apps such as Google Goggles. Therefore, the expanding of museum mobile apps is mostly popular with large-size institutions that can financially afford this technology while their use increases each year.

Worldwide museums have started introducing mobile apps in their range of interpretative media and visitor services in 2009. With the continuous development of mobile technology, the capabilities of Smartphones in creased, while they became

more accessible and popular. The use of mobile apps opened up, for museums, new channels of communication with their visitor, which extent to his or her personal space and go beyond the boundaries of the museum's walls. It was in the 1990's when the popular audio tours started to develop in digital mobile guides (the Minneapolis Institute of Art in 1994, The HIPS/HIPPIE project in Europe in 1997) allowing visitors a more interactive experience: they received related information as they wandered around in the galleries independently and to their own will, they gained access to information related to the particular context and the surrounding space, while enjoying the use of these devices that were offering an increasing number of options for color presentation, incorporation of sound and video, memory capacity, wireless communication or the ability to get a personalized presentation of the content according to the users' needs (Tallon, 2008). From 2002 the existing and possible applications of mobile computing in museums have been studied, with different possible scenarios, for the use role of mobile applications as: virtual guides, electronic maps, guides to the museum's website, communication channels, ways of accessing the museum shop, and personal diaries for recording visitors' impressions (Gay, Spinazze & Stefanone, 2002). Since 2009 the museum-related applications for mobilephones, known as mobile / Smartphone apps, the large majority of which were designed for Apple's iPhone, were widely used. The creation of mobile apps with museum content has been a rapidly expanding area with several institutions around the world experimenting with their potential, particularly their advanced computing abilities and connectivity.

For museums which are continuously exploring new strategies for communicating with current and potential audiences, one of its most attractive features is that it opens the possibility for reaching new audiences through a personal device they have chosen and are familiar with, not only during thei rmuseum visit, but also before and after the visit, wherever the user chooses to be. This ability to reach users in conditions and in an environment of their choice opens up new possibilities for the communication of cultural content for life-long learning and edutainment, apart from the potential for cultural marketing. Additionally, the fact that these users are connected in a wide network opens up possibilities not only for one-to-one communication between the cultural organization and the user, but also for social networking and creating communities of users interested in cultural content, incorporating Web 2.0 capabilities (Economou & Meintani, 2011).

There is limited empirical research investigating the existing Smartphone apps in international museums (let alone in Romania, where the apps have been rarely introduced since 2012). This is partly because of the rapid evolution of these mobile devices and the relatively slow rate of integration of these devices in the museum work, partly because of the issues that emerge with their use: selection of distribution platforms of mobile apps, the rather traditional content of the information integrated

within the apps, the overshadowing of the exhibits and the museum itself, the nature of the interaction between the museum and its visitor etc.

Different types of classifications for museum Smartphone apps have been pointed out in a series of studies, focusing either on the information content of the application (Economou & Meintani, 2011), on their effects on the visitor experience and the user interaction (Rung & Laursen, 2012), or on the technical approaches and development tools used for building up the application.

From the content information point of view, six categories have been investigated: presentations – guided tours of permanent exhibitions and the museum in general, presentations – guided tours of temporary exhibitions and practical information about the museum visit, combination of the two above, apps devoted to a single object or artwork from the collection, content creation or manipulation from the user, inspired by artists' work, games based on the exhibits (Economou & Meintani, 2011). Taking in consideration the development tools used for museum apps, two categories have been generally described: mobile apps with interactive and multimedia features (incorporate text, audio, video, location systems) and mobile apps with augmented reality features (Economou & Meintani, 2011). Several functions have been discussed for the building of a museum app: to arouse curiosity and inspire people to visit the exhibition, to function as an experience in itself away from the exhibition, before, during and after the exhibition, to function as an audio guide that introduces a 'slowness' of pace to the way people walk through the exhibition, thereby inspiring people to look at the artworks in more detail, to present different perspectives on the artworks, to provide a contemplative dimension (the music, which is not connected to specific art works), to function as a memory of a good and meaningful visit to the museum – a memory that can be shared with others and that is stored on the phone (Rung & Laursen, 2012). In the same time, three categories of users have been illustrated: the guide-orientated user (very loyal to the guide, following it from the beginning to the end), the spontaneous user (led by instinct and interest, drawn spontaneously on works that attract him / her), and the all-consuming user (following both the app and the written exhibition guide on the wall). The research found that visitors choose to use the app for four major reasons: to receive various and new type of information, just to try it, to be in control of the visit, or to have a nicer experience (Rung & Laursen, 2012).

Smartphone apps and the visitor experience

As we mentioned above, museums are nowadays visitor-centered and a high quality museum experience is set as a major goal for each of these institutions. We have made a short analysis of the Smartphone apps offer provided by some of the most important art museums in the world (placed in top 5 of the most visited institutions in the last two years) (Visitor Figures 2012, 2013) (Pes & Sharp, 2014)

in order to observe what museums promise through their applications and what kind of experience they value. This off-site analysis is based on the information found on the internet pages of the following institutions: The Louvre Museum (no. 1 in attendance in 2012 and 2013), Metropolitan Museum of Art New York (no. 2 in attendance in 2012 and no. 3 in 2013), The British Museum (no. 3 in attendance in 2012 and no. 2 in 2013), Tate Modern (no. 4 in attendance in 2012, no. 6 in 2013), National Gallery (no. 5 in attendance in 2012, no. 4 in 2013).

The Louvre Museum provides 4 apps: one general app. *Musée du Louvre official* app, *The Louvre Audio Guide App* and two exhibitions apps: *Louvre Abu Dhabi* and *Late Raphael* Exhibition Apps. The Met provides 22 apps and games of which one official app *The Met App,* one video collection, *82nd & Fifth from the Met*a nd 20 quizzes, online games and exhibition complements. The British Museum offers one general app made by an external provider *Vusiem The British Museum*, a recently launched official application based on augmented reality – *Gift for Athena* and one exhibition app *Life and death Pompeii and Herculaneum.* The National Gallery is the first of these institutions that had launched a Smartphone app in 2009 – *Love Art* and it has only been joined by a second app dedicated to Leonardo's studio. Tate Modern provides 22 apps dedicated either to the whole museum (*Tate Guide to Modern Art Times* or *Tate etc.*) to different series (*The Unilever series at Tate Modern App*) or different exhibitions (*Gerhard Richter Panorama app, Damien Hirst app*) generating the most diverse offer for the visitor.

From the point of view of the information content and its conceptual structure, we mention five categories of fundamental topics that subsume different types of applications: *art and ideas, interaction and creativity, curation and interpretation, behind the scenes journey, masterpieces tours and personal trails.* The first category – *art and ideas* – integrates multiple perspective approaches, videos, photographs, essays, texts and comments by curators, critics and artists. They investigate a complex areal of artistic approaches and styles or current trends in art theory and practice, define specific terminology or share new concepts. The second category – *interaction and creativity* – includes those apps that focus on visitor interaction, offering the possibility for the visitor to explore and play with the content information provided, to answer questions and solve quizzes, to create and recreate stories, puzzles or images, as well as to combine surprising and playful interactions with articles, multimedia and do-it-yourself experiments. Personal engagement and sharing are the specific features of this type of applications, as the visitors are invited to be active participants in the development of the app and most generally to upload their answers and results or creations on social media networks. The third category – *curation and interpretation* – enables the visitors to virtually construct their own galleries, to curate their own digital exhibitions based on the existing works, to comment and interpret on the art collections and exhibits, to draw, video or photograph (on) the exhibits and to browse and select information while immersing within different levels of the ap-

plications. The fourth category – *behind the scenes journey* – supplies the visitor with interesting insights and central concerns about artists' lives and works, presenting detailed aspects of particular works of art or carefully selected attributes that either describe, analyze or build them up. The last category – *masterpieces tours and personal trails* – invites the visitor either to follow up guided tours based on thematic selections or masterpieces descriptions, or to personalize his/her own voyage on the basis of their own interests, knowledge and disposition.

As a direct consequence, these types of apps promise different types of museum experience by conveying, what we call a series of *character figures,* metaphoric for the museum visitor: the *Explorer*, the *Analyst*, the *Listener*, the *Creator*, the *Gamer* and the *Socializer*. Most people who go to museums do not usually have a predetermined idea of just what they are going to do or learn, unless they already know a lot about the works; thus, they willingly allow the museum to structure their visit. These apps offer the museum the possibility to target different audiences who use museum content in varied forms. Tourists, for example, tend to try to see the entire museum; schools, on the other hand, tend to target visits to a particular gallery or a subject. The self-directed visitor may have a specific goal related to long-term personal interests and may be building o nlong-term knowledge. In most of the cases, visits to museums are brief and leisure or learning oriented. But besides these two main goals of the museum (to provide learning and entertainment), the focus on specific museum experiences by recognizing the active role of their visitors could raise the attendance and enhance the quality of the visit. Therefore, within our analysis we have ventured to construct these museum visitor experience typologies, by conceptualizing the actions that the visitor should involve into and by their outcomes at the personal level.

The *Explorer* is the visitor who is ready to focus on, and integrate multiple perspectives, who takes varied tracks and investigates different tour guides and options. These *Explorer* types of apps transform the Smartphone in interactive virtual worlds, masterpieces tours and unforgettable journeys with varied stops and choices on the way. They are the largest apps, usually the general apps of the museums.

The *Analyst* is the professional visitor who holds a large expertise in the field and focuses mainly on details, insights and critical approaches that concern specific objects or works of art. These type of apps provide clearly defined pieces, additional videos, comments or photographs, biographical or historical information, putting themes, concepts, movements, works of art, various media at the visitor's ease. These are the apps that focus on specific exhibitions or art works, specific artist movements or theoretical or practical trends.

The *Listener* is the visitor who takes a guided journey, step by step, immersing in the story provided by the app. Storytelling emerges as a major paradigm, whereby the story is narrated by one or more virtual characters, as the visitor moves within the museum site. The narration sequence may be linear or it might adapt dynami-

cally to the trajectories followed by the visitor. These types of apps create various narratives, bringing exhibits to life or sharing interesting visions and fantasy worlds.

The *Creator* – is the visitor who creates his/her own story, drawings, photographs or digital works of art or curates his/her own exhibition by accepting the incitement of the museum apps and generating new art and content. These apps focus on entertainment and dare to provoke the users to enrich the experience with their own creativity. Most of these apps are directly targeted, providing specific content for certain group ages or allowing various forms of do-it-yourself projects.

The *Gamer*–is the visitor who responds to particular requests of performing situated tasks, thus contributing to the achievement of some plot, devised by the apps, often inspired by well known educational museum games like role-playing, treasure hunt, observation or mystery games. These apps are highly interactive, focused on entertainment and therefore offering leisure oriented content. These apps complement various exhibitions or illustrate different artistic and practical trends.

The *Socializer*– is the visitor who shares his/her views on social networks, generally following up his/her experience within the museum. This category is related to the sharing of museum content, commenting, evaluating and tagging material as 'favorite'. Sharing is related to content of either the app itself (video, images etc.) or that has been created by the users (photographs, comments, evaluations, lists of favorite material, messages etc.), or both use as sharing platform the online social network websites (Facebook, Twitter, Flickr) video sites (YouTube, Vimeo) and email. Most of the apps integrate this profile and include this type as a general target.

Smartphone apps have the potential to promote the museum, to support the visitors' meaning-making by framing and focusing their activities and interactions, as well as to build up the visitors' active participation and follow up beyond the museum. And, especially with the insertion in the application technologies of augmented reality, the visitor experience of the museum is highly enriched in terms of learning, entertainment and creativity.

Augmented reality and the museums

Some of the newest Smartphone applications used by museums, which attract also a great number of users and a lot of publicity are those based on augmented reality like The British Museum App "The Gift for Athena" or the Tate Modern "Pocket Art Gallery". Among the first museums which inserted this technology were the Stedelijk Museum in Amsterdam which used AR to install artworks in a local park (ARTours), and the San Francisco Exploratorium which turned an evening event into a surreal AR playground (Get Surreal).

Augmented reality is a concept that can be traced for already a hundred years. It was first mentioned in the 1900 as an idea of an electronic display/spectacles that overlays data onto real life. It has always been a goal for inventors to try to create a workable implementation of the idea by applying the newest technologies of the day.

It went through a long development process, from a cinema style implementation in the 50's, though a variety of cumbersome head mounted displays until the 90's. Serious development on augmented reality began in the 1960s through inventors like Ivan Sutherland, Myron Krueger and Howard Rheingold. Considered by some as an evolution of VR, augmented reality always implies a mix of real world and virtual experience. Azuma first defined augmented reality in 1997 (Azuma, 1997) as a medium 'combining the real and virtual, interactive in real time, registered in 3D: Augmented Reality (AR) is a variation of Virtual Environments (VE), or Virtual Reality as it is more commonly called. VE technologies completely immerse a user inside a generated synthetic environment. While immersed, the user cannot see the real world around him. In contrast, AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Therefore, AR supplements reality, rather than completely replacing it. Ideally, it would appear to the user that the virtual and real objects coexisted in the same space. Augmented reality is a live direct or indirect view of a physical, real-world environment whose elements are *augmented* (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. As a result, the technology functions by enhancing one's current perception of reality.

With the introduction of the Smartphone, the idea has seen a new boost in interest as the relatively high computational power coupled with the camera and display of the phones presented a new base for the creation of augmented realities. As the phones became more and more powerful and cameras and displays became better suited for the requirements of the new technology, the resulting augmented reality applications became more realistic and started to generate more interest in a variety of fields. Also the wide scale penetration of Smartphones means that the base for augmented reality has increased considerably. New fields have come to benefit from the application of AR. Art, architecture, commerce, culture, education, navigation, entertainment are just some of the new fields that have incorporated AR.

Museums have also started to use AR in order to bring the ultimate immersive experience to the museum visitor.Augmented reality applications can enhance a user's experience when traveling by providing real time informational displays regarding a location and its features, including comments made by previous visitors of the site. AR applications allow tourists to experience simulations of historical events, places and objects by rendering them into their current view of a landscape. AR applications can also present location information by audio, announcing features of interest at a particular site as they become visible to the user. A study of the British Museum (Mannion, 2014) points out four categories of interactions AR could be used for: outdoor guides and explorers, interpretive mediation, new media art and sculpture, virtual exhibitions. Still, as AR is a technology that uses all of the functions available on a mobile device, the potential interaction is incredibly varied. AR could be generally used in different manners to present the museum

collection. Virtual reconstruction is one of the most used techniques to generate content. AR has the potential to show things at scale, such as buildings, interiors or massive objects. Using 3D models, it is possible to reconstruct these large scale contexts around objects which respond to users' movements. As they rotate their device, for example, new elements of the models are exposed and can be explored by zooming or tapping the screen for more information. Another way AR is used in museums apps is the "multiple views"of the same gallery space or narrative. Museum interpretation is becoming increasingly sensitive to the needs of different audiences. It is impractical to cater to a variety of needs with printed panels and labels because of space limitations. AR allows invisible content suited to different users to be embedded in galleries and accessed by users on demand. A third category is connected to bringing creatures back to life. Using animated 3D models to show what an extinct animal or plant would have looked like is another ideal use of AR. Holding your device over a skeleton or fossil to reveal an animated model answers an age-old interpretive challenge. These types of applications are increasingly easier and cheaper to construct.

The next big thing in museum apps: Google Glass

The next step in AR is wearable technologies. Devices like Google Glass and a few others are on the way to completely changing our day to day life. The new devices will have as the main function bringing augmented reality to the user in a way no other devices were able to do so before, and most importantly at a price that many will be able to afford. Google Glass is a mobile wearable technology created by Google that enables users to capture images and video, to receive email, SMS messages, and social media updates, and to find directions or browse the Internet. Although it's arguably the most famous, it's only one of many new mobile devices that have emerged in a field of wearable cameras, smart watches, and wristbands. As these devices are intended to enrich the experiences of the user, the adaptation of these devices for entertainment and more in line with our line of research, the museum experience will be straight forward.

Museums could provide the visitors the needed devices, or visitors who own Google Glass could use / rent / buy an app from the museum store. The app would use image recognition to automatically identify works of art and other exhibits, quickly surfacing relevant information about what the wearer is looking at. The app could also offer narrated audio guidance and indoor and outdoor navigation to help guide visitors around the museum's grounds. In January 2014, the Creative Augmented Realities Hub at Manchester Metropolitan University (MMU) started the first Google Glass project in cooperation with Manchester Art Gallery and 33 Labs from California, aimed at testing the technology in an Art Gallery Environment (Jung, 2014). Visitors were able to explore the art gallery in a completely different light, receiving augmented information to create a unique experience of cultural

heritage. The pilot project (testing some very simple prototypes based on a painting – in April and June 2014) received a general positive feedback, where users were excited by the opportunities of this new and innovative technology, appreciated the following: more convenient hands free experience, personalized experience, enhanced interaction, better understanding of connections between paintings, increased dwelling time, sharing functions. Still, as it is a new technology the producers were confronted with issues with heating up of device, problems with loading times of videos or battery life.

It is only a matter of time, costs and involvement until these new technologies will be mass produced and used. Still, at the moment, we can only assume (based on the rapid evolvement of information technologies and media in the third millennium) that the future for museum visits is highly connected to these devices that personalize and multiply the experience of the visitors, providing enhanced interaction and sharing.

Conclusions

Mobile technologies have started to be widely used in museums nowadays, facilitating the visits and providing additional information and generating different types of museum experience. This article investigates the use of new technologies, from Smartphone apps to Google Glass and their effects on the users, conceptualizing five categories of fundamental topics that subsume different types of applications and different types of envisaged museum experiences (and their protagonist's characters). The large extent to which Smartphone apps have spread in museums (the top 5 most visited museums in 2012 and 2013 have provided since 2009 around 50 applications that we have considered in our analysis) proves that this tendency has already been appropriated by museums and constitutes the future of the connection between the museum and its audience. Smartphone apps have the potential to promote the museum, to support the visitors' meaning making by framing and focusing their activities and interactions, as well as to build up the visitors' active participation and follow up beyond the museum. And, especially with the insertion in the application technologies of augmented reality, the visitor experience of the museum is highly enriched in terms of learning, entertainment and creativity. Augmented reality and wearable technologies seem to be the next step in the above mentioned connection, Google Glass opening up series of infinite ways of sharing the museum experience.

Refereces

1. Atkinson, R. (2013, October 14), *How Are Museums Using Mobile?*. Retrieved from Museum Association: http://www.museumsassociation.org/museum-practice/mobile-in-museums-2013/15102013-mobile-survey-2013-results.

2. Azuma, R.T. (1997), *A Survey of Augmented Reality. Presence: Teleoperators and Virtual Environments*, 355-385.
3. Burnette Stogner, M. (2009), *The Media Enhanced Museum Experience: Debating the Use of Media technology in Cultural Exhibitions. Media in Transition 6 (MiT6).*
4. ComScoreInc. (2012), *ComScore releases the 2012 Mobile Future in Focus Report*. Retrieved from http://www.comscore.com/2012MobileFutureinFocus.
5. Economou, M., & Meintani, E. (2011), *Promising beginnings? Evaluating museum mobile phone apps. Rethinking Technology in Museums 2011. Emerging experiences*, (pp. 26-27), Limerick.
6. Falk, J.D. (1992), *The Museum Experience,* Whalesback Books, Washington.
7. Falk, J., & Dierking, L. (2000), *Learning from Museums: Visitor experiences and the Making of Meaning*, AltaMira Press, Walnut Creek.
8. Gay, G., Spinazze, A., & Stefanone, M. (2002), *Handscape: exploring potential use scenarios for mobile computing in museums. Cultivate Interactive*, 8:15.
9. Hein, G. (1998), *Learning in the Museum,* Routledge, London.
10. Hooper-Greenhil, E. (2000), *Museums and the Interpretation of Visual Culture,* Routledge, London.
11. Jung, T. (2014), *Google Glass Augmented Reality*. Retrieved from Creative Augmented Realities Hub: http://www.creativear.org/wp-content/uploads/2014/08/Google-Glass-Project-Summary.pdf.
12. Mannion, S. (2014), *British Museum – Augmented Reality: Beyond the Hype*. Retrieved from Museum ID: http://www.museum-id.com/idea-detail.asp?id=336.
13. Moore, K. (1997), *Museums and Popular Culture,* Cassell, London.
14. Nurfit. (2012), *Smartphone Addiction and Impact on Society*. Retrieved from http://nurfitriah.wordpress.com/2012/03/25/smarphone-addiction/.
15. Packer, J., & Ballantyne, R. (2002), Motivational Factors and the Visitor Experience: A Comparison of Three Sites. *Curator, 45*(2), 183-198.
16. Pes, J.,& Sharp, E. (2014, March 24), *Visitor Fugures 2013: Taipei takes top spot with loans from China*. Retrieved from The Art Newspaper: http://www.theartnewspaper.com/articles/Visitor-figures--Taipei-takes-top-spot-with-loans-from-China/32105.
17. Rung, M.H., & Laursen, D. (2012), *Adding to the experience: use of Smartphone Applications by Museum Visitors. The Transformative Museum,* Roskilde.
18. Tallon, L. (2008), Introduction: Mobile, Digital and personal. In L. & Walker Tallon, *Digital technologies and Museum Experience, Handheld Guides and Other Media,* (pp. XIII-XXV). UK: AltaMira Press.
19. Vergo, P. (1989), *The New Museology,* Reaktion Books, London.
20. *Visitor Figures 2012*. (2013, April). Retrieved from The Art Newspaper: http://www.theartnewspaper.com/attfig/attfig12.pdf.
21. Weil, S. (2007), *From Being about Something to Being for Somebody. The ongoing transformation of the American musuem*, in R.S. Janes, *Museum Management and Marketing* (pp. 30-48), Routledge, London.