

**Applications of Augmented Reality in cultural tourism:
The case of Bibliotheca Alexandrina**

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Abstract:

This is an exploratory study about the applications of augmented reality in cultural tourism. The application was 3D Video Mapping Show on Ancient Alexandria as a pilot project. Seeking to verify the study objectives, differentiated between virtual and augmented reality, also reviewed a number of examples, which demonstrate the diversity of applications of this new technology in cultural tourism. The study also used participant observation and focus group on investigating the effectiveness of the show in enhancing the cultural tourism in the city. The results indicated that current application of augmented reality lack the ability to attract visitors to the destination or cultural attraction and It needs to be reconsidered. The conclusion and recommendations were presented giving experts the opportunity to the development of augmented reality technology in a larger scale in the particular circumstances of the case.

Keywords: Augmented Reality (AR), Virtual Reality (VR), Information and Communication Technology (ICT), Visitor experience, International Augmented Med Project (I AM).

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Introduction:

Information and communication technology (ICT) has become the most important tool for information access and distribution. Augmented Reality (AR) is a new technology, which integrates physical world with a virtual computer generated data. The potential of AR has not yet fully exploited but it is expected to grow rapidly in the future. The Bibliotheca Alexandrina organized on 21-22 May 2014 a 2-day video mapping show (3D projection combined with sound and lighting effects) on Ancient Alexandria. Participant observation and Focus group used to investigate the effectiveness of the augmented reality application in enhancing the cultural tourism in the city of Alexandria. The objectives of the study are as follows:

- 1- Presenting an innovative concept for promoting cultural inheritance.
- 2- Developing determinants of success of augmented reality applications in cultural tourism in the circumstances of the case. The study is trying to answer the following questions:

- What is the difference between virtual reality and augmented reality?
- What are the challenges, which face the success of augmented reality applications in enhancing the visitor experience in cultural tourism?

This study provides a broad foundation for understanding how augmented reality shape experience in cultural tourism through presenting cultural heritage in a way that appeals to the interests of visitors worldwide.

Literature Review

Cultural tourism and Information and communication technology

There is an interrelationship between the two concepts of Culture and tourism. Cultural tourism has the opportunity of expanding the tourist market. It may be defined as "the movement of individuals towards Cultural-type attractions".¹ Richards, stated that cultural tourism includes both "heritage tourism" that consists of historical artifacts, and "art tourism" which represents the contemporary cultural production.² Information and Communication Technologies (ICTs) are one of the outstanding Important information tools in the recent years which have an impact on the way of learning and enable tourists and visitors to familiarize themselves with the cultures of tourist destinations.³ (ICTs) are also influential in presenting of an area in a new model looking for enhancing local cultural assets, emphasizing the unique character of the place and creating new opportunities; so that good presentation of cultural sites and attractions can help in achieving financial and educational goals.⁴ Augmented Reality (AR) is a new technology, if it is used correctly, it can change the way visitors see and experience the destination. It is a great way of sharing knowledge and data in a fresh new, interactive and exciting way.⁵

Augmented Reality (AR) and virtual reality (VR)

Until recently, Virtual Reality (VR) was a familiar widespread technology that enables users to obtain the information in an interactive environment.⁶ Virtual Reality (VR) is on of prominent technologies,⁷ aiming at reshaping the interface between people and information and communication technology by providing a creative expression for information.⁸ It refers to the total immersion of the user in a computer - generated contents.⁹ The term is for computer

generated 3D environments, allowing the user to enter and interact an alternate reality.¹⁰ Some consider (VR) to be anything that alters a person's current point of view, transferring them to an alternate reality for a short time. This alternate reality is sometimes referred to as virtual environment (VE), "where the user is completely immersed to the point that any way they look or turn, they are still immersed".¹¹ According to USC, it is also defined as "a computer-generated, interactive, three-dimensional environment in which a person is immersed".¹² However, for augmented reality blur the line between what is real and what's computer-generated.¹³

According to Kounavis, C.D, Kazimati, A.E. and Zamani, E.D (2012) Augmented Reality (AR) is " a visualization technique that superimposes computer-generated data, such as texts, videos, graphics, GPS data and other multimedia formats, on top of the real-world view, as captured from the camera of a computer, a mobile phone or other devices".¹⁴ Augmented reality has three strategies as follows:

- **For the user:** in order to obtain certain information about any physical object such as a historical building or a famous street, the user carries a device such as smartphone.
- **For the physical object:** the computer-generated data is combined with the physical object and changes the user perception of the reality.
- **For the surrounded environment:** there is an interactive relationship between the device and the surrounded environment of the user in order to display the information on the physical object.¹⁵

Table1. Augmented reality (AR) vs. virtual reality (VR)

Virtual reality (VR)	Augmented reality (AR)
- Everything is still not real. The user cannot sense the real world around him/her. It is used in applications of augmented reality and simulates a real environment.	- It supplements the real world with virtual objects that appear to coexist in the same space as a real world links real and virtual worlds.
- Immersive and interactive (view-hear and touch the created world).	- Enhances the real world instead of replacing it. (Offers natural meaning for people to navigate in the real world).
- For the user, virtual reality is the only computer-generated sensory data such as sounds or images in a video.	- For the user, Augmented Reality enhances the user perception of the real world with a computer-generated sensory data in the real time.

Source: Adapted from USC And Department for Business, Enterprise, Technology and Science, (2013).

Applications of Augmented Reality (AR) in cultural tourism

ICT has played an important role in the development of tourism, especially for cultural tourism.¹⁶ Augmented Reality provides visitors with information of the cultural heritage site in order to enrich their experience.¹⁷ According to Saldana, M. (2013), AR applications for cultural tourism could be classified as follows:

- **Fixed augmented experience**¹⁸ this application is implemented by a 3D or 4D visualization system and other computer data like sounds or graphics.¹⁹ it is called video mapping show that brings building alive such as Darmstadt Unter Strom Panorama Projection in Germany.²⁰ This fixed experience also is related to binoculars,²¹ for example, Canterbury Museum, New Zealand²²
- **Mobile augmented experience or Droid AR by smartphones**, such as the iPhone 3GS and the devices supporting the Android operating system by pointing the camera at the building or attraction reading its name, date of construction, the vicinity of other locations to the site and other information. AR applications allow users to explore the world by adding new layers to their reality, thus resulting in a new interactive and highly dynamic experience²³. (AR) allows re-living historic life and events, an ArcheoGuide AR system was designed for augmented virtual reconstruction of the ancient temple of Olympia, Greece, that was the first case Augmented Reality has been applied in a cultural heritage site. In addition, by using Layer, virtually any visitor directs their smartphones towards the monuments or the historical buildings in order to access valuable information in an interactive way, for example, the 3D model of Berlin Wall.²⁴ This technology provides an alternative approach to discover cities,²⁵ and a tool for sustainable tourism through displaying reality as it was in the past while promoting the cultural heritage, which is a means of preservation of history and cultural traditions. These applications have the potential of replacing the common tourist guide and They also enhance visitors' experiences and make them exceptional;²⁶ using sounds, lights, and graphic techniques in order to provide additional information and create a new perception of the reality and learning more about the cultural heritage sites. Finally, augmented reality is a fantastic tool for tourism planners, in Netherland, there was a free Urban

Augmented Reality (UAR) application as a database designed by Netherland architecture institute, for eight cities enabling tourists to add comments, which help planners in decision making for architecture.²⁷

Case study: Bibliotheca Alexandrina pilot project:

The Bibliotheca Alexandrina is not only a library containing millions of books, It is also a cultural complex, which includes ten academic research centers, four museums, internet archives, permanent exhibitions, a planetarium and a conference center. So that, it is a remarkable tourist destination.

Bibliotheca Alexandrina is one of fourteen partners of seven countries in The International Augmented Med Project (I AM) that was for promoting cultural heritage. The current augmented reality application was a video mapping show and it was organized by Bibliotheca Alexandrina for two days 21- 22 May 2014 and was projected on the wall of the conference center building. the objective of the projection was enriching the visitor's experience in a new appealing way. The projection contains the main attraction sites and historical figures of the city related to the classical period such as the planning of the city and the founder Alexander the Great, establishment and the fire of the Original library and its scientists, The Amphitheatre, and the Underwater Archeology. The projection contained lightings and sounds in a new interactive event using augmented reality technology. It was a pilot project for only one heritage site partner in each participating country in the (I AM) project.²⁸ the show was designed in co-operation between information technology and heritage tourism experts.

For the funding of the program, the partners contribution was only 10% of €3.060.650 and 90% of the fund was under ENPI CBC Med Program* 2007-2013 as € 2.754.583. The program was determined to last to 2015 in order to have a role in the sustainable cultural development in the region of The Mediterranean Sea;²⁹ That is by organizing 3D Video Mapping Show called "Legendary Cleopatra" on the Façade of the Qaitbey Fort on September 2015.

Methodology and data analysis

The research procedures comprised a review of the relevant literature. Participant observation was used. it is preferably used in descriptive studies related to the elements of the culture of the communities where to contribute to more accurate analysis of the phenomenon because it includes involvement of the researcher in the research community directly and closely, before the 2 days of the show in May 21-22 2014 , there was a preparing meeting in April 15 was attended by the specialists . Focus group was also used in collecting data because it could be well suited to uncovered information; So it is suitable for the current augmented reality (AR) pilot project. In focus group, one or more groups of people are asked about their perceptions, opinions, beliefs, and attitudes towards a new idea with a qualitative analysis and no statistical data. According to McLafferty (2004) and Stewart and Shamdasani (1990), The number of selected focus groups is determined according to the homogeneity of the research population, so that, in some cases, only one focus group might be enough. Smaller groups were more manageable; it was difficult to ensure equal contribution to the discussion in such a large group. For this reason, four to six participants might lessen difficulties in facilitation³⁰ For the current study, there are two selected focus groups each one is comprised of the five homogenous persons with a common background, interest, and they were chosen among individuals who were able to attend the show.

-The first group is comprised of graduates of archeology department (archeology inspectors and Museums curators), and the coordinator of the show with the (I AM) project.

-The second group comprised graduates of the faculty of Tourism and Hotels (staff members of Tourism Guidance departments, tour guides and the Director of hotel reservation at a luxurious hotel). The two groups were selected in this manner; in accordance with the goal of the projection that displayed the history of Alexandria for citizens, and aimed at attracting tourists to the city.

Results and discussion

It was only one session for each group, which took about 70 minutes. Howard et al. (1989) stated that carrying out one focus group interview might be for difficulty in arranging mutually convenient times³¹ Questions should not be more than ten.³² Here, there were open-ended five major and one summarized question. Questions were about some suggested determinants proposed to evaluate the show, these determinants were derived from literature, the researcher observation of the show, and the comments heard from attendants of the show and the preparing meeting. The proposed determinants were about the focus groups perception that personalizes needs and preferences and represents the current situation that depicts the relationship, between the visitor and the (AR) application provider, which in this case is bibliotheca Alexandrina. The questions were about the clarity of the concept, visitor's experience, duration of the show, the content of information, efficiency of technology, then a summarized question. Questions and their analysis were as follows:

How is clarity of augmented reality concept?

Six members of the two groups confirmed that the concept of augmented reality is not clear either for visitors or stakeholders because of the lack of adequate prior publicity for the show, majority of the two focus groups was informed accidentally about the show through the internet or through their friends who are Bibliotheca Alexandrina staff members

(Alex Med). Other three said that there is a difference between augmented reality and virtual reality but they could not exactly differentiate, That was for the novelty of the concept, and it was clear for only one, but he said "it is not important to understand if it is enjoyable". All of them see that prior publicity is very important especially for tourist guides and travel agents.

What is your opinion about the new technology of AR, which was in the video mapping show?

Four members of the second group and all the first one admired AR technology which means a tendency of the majority to accept it in the manner in which it was displayed. Although , all of the members of the two focus groups compared the technology of augmented reality to the technology of the sound and light show which was used in cultural tourism in Egypt; that uses lasers to display some pictures with an audio for one celebrity as a narrator about the history of the place ;while the augmented reality technology, in this case, used a 3D video and a background music to display images telling the history of the place without a narrator. Only one member of the second group criticized the show "the sound was only music, no narrator", she suggested to put a narrator in future shows.

To what extent was the duration efficient in providing an enjoyable experience?

Four members of each group see that duration of the show was short and not sufficient to provide an enjoyable experience for visitors because it takes less than five minutes. The majority of the two focus groups were shocked by the short duration. All of them attended the sound and light show either in Cairo or in Luxor that takes about 45 minutes and all of them made the comparison that it was not positive for the 3D show.

To what extent was the content of information efficient and useful?

Seven members of the two focus groups stated that the content of information of the 3D video was inefficient for the audience, especially who have not knowledge about Alexandria during the Ptolemaic period, the writings, inscriptions, the historical figures and their scientific achievements that were shown in the 3D video. Two members of the first group stated that the video had no clear chronological order of the historical events related to development and establishment of bibliotheca Alexandrina during ages, which had not provided an interactive educational experience for visitors. The quality of information encourages visitors to enjoy the site appropriately.

How do you describe your experience?

Two members of the two focus groups could not decide and said "not bad" and only one enjoyed and said, "It's unique". Other seven members indicated that the show is not efficient in enriching visitor's experience. Three members of the first group stated that dues to the absence of more financing; another one said " in the Lebanese experience which was performed in the (I AM) project, it was accompanied with a concert for world famous musical band". A member of the second group confirmed that the show lacks to display the cultural image of the destination and revive the historical events of the place again. Another member of the second group pointed out that the show might have been more interesting if it is about the folkloric side or the modern Alexandria, which is as important as the old Alexandria. One another claimed that the absence of the seats was a disadvantage but the rest of them confirmed that was consistent with the short duration of the show. The majority of the two groups compared the current show to the sound and light show and the comparison favor of the latter in its ability to make the audience amused. The previous analysis means a general tendency of the focus groups to consider that the show did not achieve the desired success

In summary, what are the most important success determinants of the applications of augmented reality in enriching the visitor experience?

Duration of the show, the efficiency of the AR technology, the content of information of the 3D video and efficiency of financing, were the effective factors anticipated from the sessions of discussion. This result strongly suggests a significant relationship between these determinants and the extent of the success of augmented reality applications in cultural tourism. These factors, if it will be reconsidered, Alexandria, as a destination will have a competitive advantage in cultural tourism and ensure a successful nightlife for the city. So that, the designation of the applications of augmented reality in cultural tourism should be conformed to the objective of them, in order to achieve visitor satisfaction and profitability.

Conclusion

Cultural tourism is a promising application domain for augmented reality that offers a significant potential for improving the benefits for the destination and its' tourists, citizens and businesses as well as sustaining cultural identity. It is a means to achieve a competitive advantage that enrich the visitor experience and improve promotion and management. According to the evaluation of the two focus groups, the augmented reality application under the given conditions has not achieved the desired success, it is necessary to transform the current application into an intuitive tool that helps the visitor to fulfill his information demand in an enjoyable and easy way. It is about facing two main challenges; First, The cost of designing, implementing and maintaining technology because it is a pilot project, and second is information management, reconsidering the technology in sound, and language in the video in order to extend the tourism experience and rebuild local pride, understanding, and confidence about Alexandria history and culture. It is also suggested that providing the

same application in different languages on specific dates during the week. Although not ideal, this pilot study has succeeded to provide an overview about the concept of the study.

Recommendations

In order to take the chance of the cultural tourism in Alexandria and attract more visitors in a new and unusual horizon, it is possible to re-implement the 3D video mapping show in other cultural locations in the city especially in Greco- Roman amphitheater; Egyptian Company for sound and light could implement the application. Collaborative networking will be between all stakeholders, the policy makers, and the entrepreneurs. They should work together to strengthen intercultural dialog based on historical common heritage and promote cultural routes between partners in the (I AM). Future research might be about other tourist services providers need to know how to work with augmented reality technology and build new efficient applications for their purposes using smartphones applications. Achieving this, requires further research not only from a technical point of view but also with regard to the users' preferences.

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تطبيقات الواقع المعزز بالخيال في السياحة الثقافية

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موجز

تعد الدراسة الحالية دراسة إستطلاعية حول تطبيقات الواقع المعزز بالخيال في مجال السياحة الثقافية. تمثل التطبيق في عرض فيديو ثلاثي الابعاد حول الإسكندرية القديمة كمشروع تجريبي. ومن أجل تحقيق أهداف الدراسة، تم التفرقة بين الواقع الافتراضي و الواقع المعزز بالخيال. كما تم استعراض عدد من الأمثلة التي تعرض تنوع تطبيقات هذه التكنولوجيا الجديدة في مجال السياحة الثقافية. وقد تم إستخدام الملاحظة بالمشاركة و مجموعة التركيز في الدراسة وذلك من أجل التحقق من فعالية العرض في إثراء السياحة الثقافية بالمدينة. أشارت النتائج إلي أن التطبيق الحالي للواقع المعزز بالخيال يفقد القدرة علي جذب الزائر للمقصد او لعنصر الجذب الثقافي ويحتاج لإعادة النظر فيه من أجل إثراء تجربة الزائر بالمدينة. وقد تم عرض الإستنتاجات والتوصيات من أجل إعطاء الخبراء فرصا لتنمية التجربة علي نطاق أوسع بالمدينة في اطار الحالة المشار اليها.

الكلمات الدالة: الواقع المعزز بالخيال-الواقع الافتراضي-تكنولوجيا المعلومات والاتصالات- تجربة الزائر- مشروع الواقع المدعم بالخيال في

البحر المتوسط (IAM)