MOBILE AUGMENTED REALITY INTERACTION: an approach to the phenomenon

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ABSTRACT Augmented Reality (AR) and Geolocation are new attractive phenomenon, with great potential in the field of communication and knowledge construction. This paper is the result of an interinstitutional effort which aims at contributing to a better understanding of the use of Augmented Reality for mobile learning. Our research focuses, in the first place, on the types of mobile devices used by the younger generations and the way they are being used, with an emphasis on Geolocation and AR. We then turn to describing the potential of AR –a technology that combines a display of digital information and a view of the real world as captured by a mobile device– to create engaging learning experiences in field activities. But, prior to launching our students into this new learning scenario, which stretches far beyond the traditional classroom, it is necessary for us to locate AR resources by geoposition or tagging. Later on, those data will become accessible when within a specified range of distance from the tagged object. Alongside the benefits of its informal-formal activity structure, the possibilities for interaction are countless, including the ability to track the position and movements of all learners at any given time. On the downside, however interesting mobile Augmented Reality may result, when it comes to designing an educational activity, we need to cater for all types of mobile devices, not just the ones with a specific operating system and GPS (Global Positioning System) capabilities.

Keywords: Augmented Reality. Geolocation. Knowledge management. Mobile devices. Ubiquitous communication.

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1 INTRODUCTION

The interests and goals of the IT industry often run counter the aims and principles of our educational environment. Not so long ago, social media capitalised the audio-visual potential of television and cinema by increasing the number of TV channels and disseminating messages based on powerful images, at present that power has shifted to video on the Internet (VINCENTINI, 2012), whereas at schools audio-visual resources were not being fully exploited, partly because of educators' lack of expertise, partly due to the intrinsic complexity of the communication strategies of audio-visual information (FOMBONA, 1997). Therefore, the iconic potential of a media-based instructional model has been widely underused to the detriment of more traditional instructional models (FOMBONA; MAMPASO, 2010).

Internet is a global phenomenon –not always a positive one (CALDEVILLA, 2010)– which goes beyond our academic and educational environment and creates new learning and social scenarios where virtual reputation is built. Anyway, we are referring mainly to developed countries, where the Internet –besides being accessible– can be consistently used to develop a wide range of competences (VAZQUEZ; SEVILLANO; MENDEZ, 2011). We cannot forget that in many countries and not so remote places access to a wireless or wired connection able to transmit a large amount of bytes is almost unthinkable.

Nowadays, it is pretty obvious that mobile devices are the ultimate technology of convenience, and not just because of their power to communicate. All over the world mobile phones are being used for multiple purposes anywhere at any time, as those devices are for the most part state-of-the-art smartphones able to connect to the Internet and replicate much of a PC's functionality.

As noted by Collis and Moonen (2002, p. 219), an individual's likelihood of voluntarily making use of a particular type of technology for a learning-related purpose is a function of four "E"s: the Environmental context, the individual's perception of educational Effectiveness and of Ease of use; and the individual's sense of personal Engagement with the technology. Hence, the widespread use of mobile phones represents a significant opportunity in education, for mobile technology can be utilized to enhance teaching and learning in innovative ways; not just for data recording, one way transmission of information (such as podcasting), or communication.

The informal-formal activity structure of this kind of human-machine interaction has been widely accounted for by the Psychology of Simultaneity. It is also argued that mobile devices provide intrinsic motivation for the user –i.e. text-messaging just about anything is highly motivating– and encourage empowerment and action, which is the key to understanding appropriation of mobile technologies by young people.

Some researchers have inquired into the pedagogical potential of mobile devices as a learning tool (NUSSBAUM, 2007; XIAOYAN; RUIMIN; MINJUAN, 2007; RAMIREZ; MUNOZ; DELGADO, 2008; GIL; ANDERSSON; MILRAD, 2010), potential uses in higher education (CABIRIA, 2012), whereas Sharples (2007) also notes many examples of applications that situate learning in museums.

We can capitalise our students' emotional attachment to their mobile phones by implementing new mobile-learning methodologies alongside cutting-edge software, thus creating a very powerful learning tool. We are referring specifically to making use of apps supporting location-aware technologies for detecting contextual objects and implementing activities based on Augmented Reality (FOMBONA; PASCUAL; AMADOR; 2012). AR technique relies on the analysis of the image features and their combination through a software application that overlaps stored data over real images.

2 AN APPROACH TO THE STATE OF THE MATTER REGARDING THESE ISSUES IN SCIENTIFIC LITERATURE

Mobile AR has gained popularity in recent years due to the technological advances of smartphones and other mobile portable devices. Augmented Reality creates real world and virtual reality displays at the same time. It relies on the images taken by the camera; then, the real world can be simulated in a system of coordinates, orientation sensors, magnetometers, inclinometers, inertial sensors and other recent technologies with certain limitations that still need to be solved (BIMBER; RASKAR, 2005; CAWOOD; FIALA, 2008; BASOGAIN et al., 2009). These features are related to the corresponding metadata (SVENSSON; KURTI; MILRAD, 2010) and are analyzed by specific Augmented Reality software. These scientific advances are being put forward into many industrial and work sectors where an immediate implementation of technology is needed. (METZ, 2014) and they are particularly helpful when it comes to developing technologies for the fixing of expensive and sophisticated pieces of machinery. Fiorentino et al. (2014) have evaluated the effectiveness of technical maintenance assisted with interactive AR instructions. They have used commercially available solutions in two modalities: paper manuals and augmented instructions. Statistical analyses proved that augmented instructions reduced significantly participants' overall execution time and error rate.

Augmented Reality is reaching teenagers by means of videogames and it comes along an international cooperative dimension. As new mobile and gaming technologies become increasingly ubiquitous, they encourage new modes of storytelling and engagement. AR can combine with geomedia to create a robust and complex digital narrative (CHESS, 2014). Through narrative analysis of a transmedia game world and community, this author considers ways that information and communications technologies are able to use storytelling to negotiate complex relationships between the regional and the global.

Caldera-Serrano (2014) examines how AR can contribute to the dissemination and uptake of content from audiovisual and television companies. Applications that are emerging to apply RA to television media and the changes should be implemented in the management of visual, audio and text (or hypertext) to maximize the transfer of information and empower its conversion into knowledge. AR would operate as a communications medium on par with film and television, it must evolve a set of conventions that will allow for meaningful communication between its users (BARBA, 2014).

But the blending of virtual data and real world is scarcely reaching the cultural domain (ENGBERG; BOLTER, 2014). AR allows for the efficient and effective implementation of a subset of the design principles defined in the cognitive theory of multimedia learning. There is an increasingly wider use of these techniques in cultural locations such as museums. In those places visitors perform significantly better on knowledge acquisition and retention tests related to augmented exhibits when compared to non-augmented exhibits. Furthermore, they perceive AR as a valuable and desirable add-on to these exhibitions (SOMMERAUER; MUELLER, 2014).

In recent years, there has been an increasing interest in applying AR to create unique educational settings. Bacca et al. (2014) reports a systematic review of literature on this technique -32 studies published between 2003 and 2013- in educational settings considering the uses, advantages, limitations, effectiveness, challenges and features of AR in educational settings.

Regarding the use of mobile phones with AR, we still need to explore the possible relevance it may have in educative contexts (HAINICH, 2009). AR is a medium increasingly accessible to young users such as elementary school and high school students. These systems have the potential to improve student learning, and the educational community remains unclear regarding the educational usefulness of AR in contexts where this technology is more effective than other educational mediums (RADU, 2014). Along the same lines, personalization for promoting an inclusive learning using AR is also a growing area of interest. As a sample thereof, AR can use a body motion interactive game to enhance the body strength of children with disabilities (CHIEN-YU; YU-MING, 2014).

There is an increasing number of studies describing such type of activities in different educational areas, for example, quite recently, Chiang, Yang y Hwang (2014) have put forward proposals for conducting inquiry-based learning activities. Their experimental results showed that the proposed approach is able to improve the students' learning achievements. Moreover, it was found that the students who learned with the Augmented Reality-based mobile learning approach showed significantly higher motivations in the attention, confidence, and relevance dimensions than those who learned with the conventional inquiry-based mobile learning approach.

It is of utmost importance to improve the learning motivation and creativity of students, as well as the teaching efficiency of creative design by introducing AR technology into creative design courses. However, many teachers have only limited knowledge of AR, and software developers are not familiar with general creative design education, which makes it difficult to incorporate AR in such courses (WEI et al., 2015).

One particular area in which mobile AR is being used is library management. However, current mobile AR solutions in this domain are lacking in context-awareness. It has been suggested in the literature that agent programming may be suitable at overcoming this problem, but little research has been conducted using modern mobile AR applications with agents. The results indicate that agent-based mobile AR is a promising tool for context-aware library management (SHATTE; HOLDSWORTH; LEE, 2014).

3 METHOD

This paper describes the findings of a research project funded with support from the University of

Oviedo (Spain) whose design and implementation has been built on samples consisting of over a thousand students from both rural and urban areas in Asturias, a region located in Northern Spain. The collected data may bring some light into the field of mobile learning, as opposed to the situation portrayed by the marketing strategies of mobile operators and makes.

Our research consists of a descriptive study of recent developments and literature regarding the adoption of state-of-the-art mobile devices in education. It aims at quantifying and describing the types of devices owned by our students, and seeks to analyze the affordances by these mobile devices. In order to assess a learning model based on the use of Geolocation and Augmented Reality from a multidisciplinary perspective, this research looks into what mobile AR systems have to offer.

To carry out the survey, we have selected a representative sample of over 1,800 students from 11 Middle and High School centres in Northern Spain, stratified by age and type of school:

- 573 Middle School students (aged 12-16).
- 1037 High School students (aged 16-18).
- 258 Vocational Training students [Note: Vocational Training consists of three stages, namely, initial stage (12-14), intermediate stage (16-18) and occupational training (18-22)].

The survey consisted of an anonymous questionnaire in which students were given a set of multiple-choice questions with a choice of eight items. Those questions were categorized according to the type of device and the use of the most common applications in the Spanish mobile learning scenario (CISCO, 2013).

The test reliability was ensured by a team of expert who made sure the test would produce stable and consistent results. Among other things, such as reformulating questions, they administered a pilot test to a sample group of individuals in order to validate all of the questions. The test was then administered in every school by their own personnel (every teacher in his/her own class). This also made sure that the measure assesses the intended construct under study. This kind of validity is essential when it comes to convince stakeholders that the measure is an accurate assessment of reality.

Alongside the multiple-choice test taken by 1,800 students, an open questionnaire was circulated among teachers who were familiar with Geolocation and Augmented Reality, for them to rate the educational potential of four affordances by mobile devices: GA (Geo-positioning Apps), AR (Augmented Reality), GAR (Geo-located Augmented Reality) and QAR (QR codes and Augmented Reality).

4 THE WIDESPREAD MOBILE DEVICES OWNED BY SPANISH STUDENTS

We started by analysing the type of mobile phones owned by 1868 Spanish teenagers. We aimed at finding out the type of devices they use as well as the way they are being used. The findings about the usage of mobile devices and built-in Global Positioning System GPS receivers among students are shown on Table 1.

Table 1 - Types of mobile devices owned by students aged 12-18 (2013 summary data)

Device	Users	%
Number of students owning a mobile device	1780	95.3%
BlackBerry	480	25.7%
BlackBerry with an integrated GPS receiver	230	12.3%
iPhone	118	6.3%
iPhone with an integrated GPS receiver	116	6.2%
Mobile devices using Android	756	40.5%
Mobile devices using Android with an integrated GPS receiver	595	31.8%
Mobile devices with no operating system	354	18.9%
Tablets or iPads with an integrated GPS receiver	335	17.9%

Source: 2013 summary data

The vast majority of students, over 95% of them, very often use a mobile device, being for the most part a mobile device with an Android operating system. Some 68.2% of teenagers own a mobile device with an integrated GPS receiver and Geolocation capabilities. Besides, another 223 survey respondents questioned, 11.9% of the sample, state that they are considering to buy a mobile device with GPS in the near future. In such a scenario, the proportion of those devices would reach over 80%.

Given that these objective data and facts signal the handiness of mobile technologies and the affordance of mobile devices with Geolocation, as educators, we need to get the most out of those devices so near at hand.

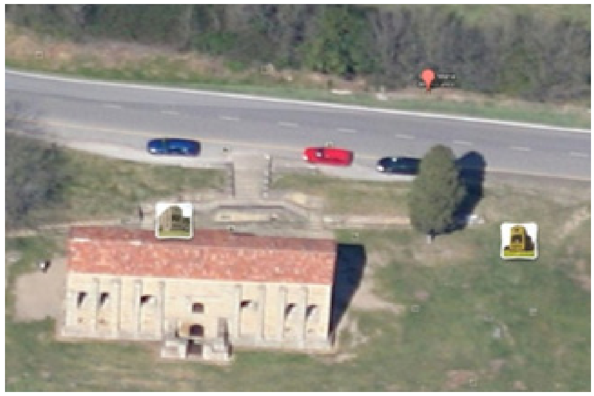
5 AFFORDANCES OF MOBILE GPS TECHNOLOGIES

Although Geolocation for mobile content enables instructors to create learning content by taking into consideration a user's location, the fact of owning a mobile phone with a built-in GPS device does not mean that users may take advantage of GPS functionality at any moment and free of cost. Very often, in order to connect to Google Maps or other mapping systems a data connection is required –for lower-cost GPS chipsets use a mixture of positioning systems including Wi-Fi and cell tower location– and we can use up a large amount of our data allowance in order to get a permanent GPS fix.

If bandwidth and data allowance are not an issue, most mobile devices can pinpoint any person or object's position by interacting with satellites in quite the same way as portable GPS Navigation Systems (*Navsats*) do. The next thing is linking the information provided by mobile phones –let's say, about the nearest museum– to a user's location. As longitude and latitude change, the link will eventually trigger different information (a text, a video, an audio or other embedded media) on mobiles.

In its simplest form, this kind of interactivity through Geolocation consists of tracking the user's location on a conventional map or a satellite view map (Figure 1) and linking it to useful information on nearby locations, which will be eventually displayed on a mobile device.

Figure 1 - Screenshot showing the user's position on a Google Maps satellite view



Source: Own made, based on Google Maps with modifications

The longitude and latitude readings on mobile phones are meaningless on their own, but they become relevant when they are linked to a conventional map where icons are displayed with an option to click to get further information. Instead of that, we can choose to go to Google Maps for a different visualization, an aerial or satellite view of our location. Additionally, mobile devices may provide users with a navigational aid that directs them to a target location. In navigation mode, the longitude and latitude readings are updated automatically at intervals and the system estimates the distance to target and reacts to a user's movements as if using a compass. The feedback provided by the app is typically in the form of directional arrows (Figure 2).

Figure 2 - A combination of directional arrows is used to help users navigate the environment and reach their destination

Source: Own made, based on Vision software

Besides tracking users' location on a map or directing them to a target location, there is a more interesting affordance by mobile phones, for they let us interact with the objects and locations surrounding us by augmenting the scene captured by our mobile's camera with additional information, i.e. through a pop-up window displaying useful information (Figure 3). As a matter of fact, most AR systems are currently integrated into hand-held mobile devices, such as smartphones, which display the see-through augmentation, that is, by showing the real world with an overlay of digital data.

Figure 3 - By gazing at a location or object, a user can instantly recall multimedia information AR

Source: Own made

6 POSSIBILITIES OF AUGMENTED REALITY, DESCRIPTION

Augmented Reality visualize supplementary information geo-referenced in a specific place where can be situated the GPS smartphone user; or embedded with markers in images that, when scanned by an AR device, it may act as a reference for image scaling, or may allow the image and physical object, or multiple independent images, to be correlated (CALDERA-SERRANO, 2014). Prior to use this king of AR, someone (an educator, a tour guide, a journalis) must have mixed the real world with overlays of digital information so that users can get an enhanced perception of a given object or location. Then, an Augmented Reality browser will eventually display that information over the camera-view when users focus on the specific marker or on the Quick Response code QR semacode (Figure 4).

Figure 4 - Text and video "triggered" by QR on the camera

Source: Own made

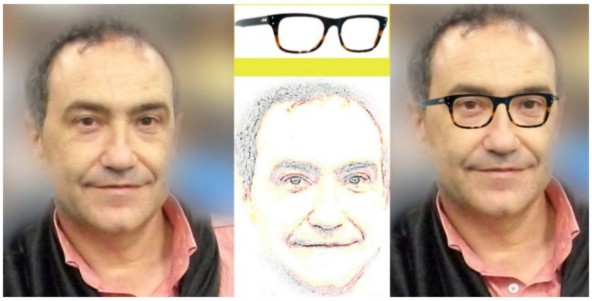
But AR requires the process of tracking real-world objects so that virtual contents can be embedded into a real environment. In order to do so, we may use a PC equipped with an AR software to create a computer-generated graphic overlay which will add –or else, hide– parts of the real environment for/from a user.

To start with, we need to get hold of, let's say, a digital image from a webcam source or the Internet. Next, a layer of digital information needs to be superimposed on top of it, therefore augmenting the image with synthesized virtual data and multimedia by means of AR software. This software will allow us to add files to that digital layer from our own database or from the Internet. A screen will, then, display the synthesis of real and virtual data, which may be customised depending on the kind of expected interaction between users and objects.

A key aspect is, therefore, that of synchronising a virtual world with a real world, where users may keep moving around. Augmented Reality software accounts for that by taking the point of view of the observer and tracking the user's position; consequently, the overlaid information is aligned with his view of the world.

In many sectors (i.e. furnishings and garments), this functionality is being used to create a real-time friendlier interface which allows customers to virtually try on new clothes or to place virtual pieces of furniture in their real homes by means of webcams or smartphones. As a sample thereof, in Figure 5, we can see an AR system alike to the *Virtual Mirror* app developed by Ray-Ban which leverages face recognition techniques and augmentation therefore allowing customers to try on a virtual pair of glasses. The user can select from various models of glasses and the system will fit the selected pair of glasses onto his/her face.

Figure 5 - Photo capture (leftmost) used for the detection of reference points based on face recognition and AR markers (centre) and to superimpose a pair of glasses over the face (rightmost)



Source: Own made

"*Virtual mirror*" and "*Virtual fitting-room*" apps capture the user's movements and output the mirrored images onto a large display which augments reality with 3D computer graphics. The three-dimensional motion is tracked thanks to sophisticated tracking algorithms, so that the user seems to be interacting with the manipulated objects. The occlusion problem is also handled in such a way that only those parts that are not occluded by the user are displayed.

The fact that the display replicates the effect of a mirror rather than that a webcam makes it feel more realistic and, it opens a window of opportunity for educational use and training in an increasingly experiential learning environment, where supplementing the real world with virtual information has become so important. That's why augmentation is being used to train students in hazardous situations or to manipulate an object which otherwise would be difficult to view or locate, as in surgery.

Beyond offering enhanced multimedia information, augmentation apps (*iTacitus*, *Experenti, Zappar*) can make any object –including a book– to the environment, hence triggering on our mobile a wide array of features for learning through multimedia: offering video explanations and audio-guided tours; presenting the evolution of architecture, history or science through 3-D charts of artifacts or buildings; rendering statues and works of art to their original condition… It would be possible, for instance, to superimpose Roman emperors onto scenes of the *Colosseum*, overlay images of battles fought by gladiators on the arena, or have a 3D virtual architect explaining all the details about Roman construction techniques (Figure 6).

Figure 6 - We can experience Rome's *Colosseum* as if we were in Ancient Rome with ARmedia Augmented Reality 3D Tracker

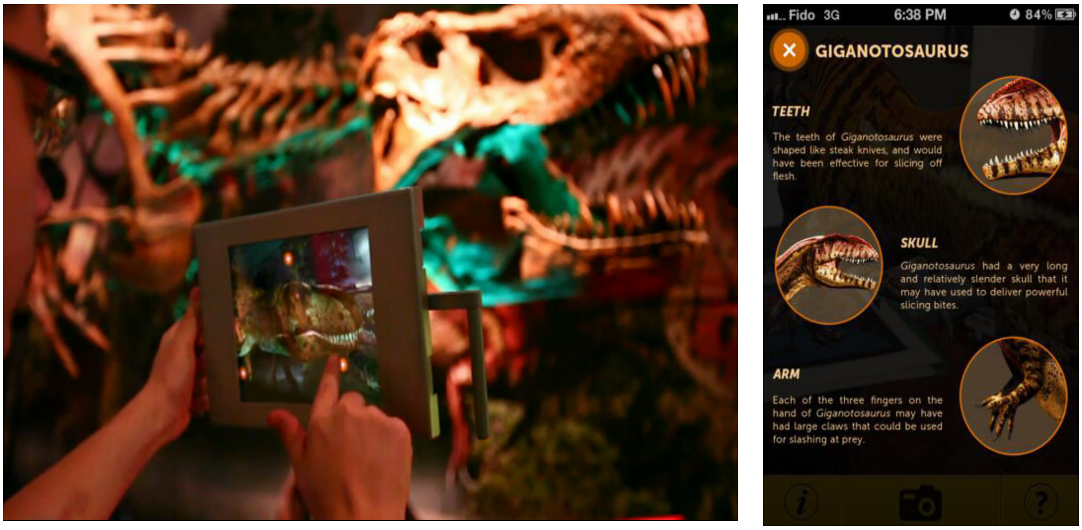
Source: http://www.armedia.it/

Science, art and history can be shown in a manner that "brings things to life" and students can manipulate or interact with objects and people in an innovative and motivating way.

Augmentation can also be used to enhance teaching and enrich learning content, i.e. markers could be embedded in textbooks and other educational material, so that when scanned by mobile device multimedia information could be displayed and students could interact with 3D objects and people.

As a sample of AR indoor possibilities, many anthropological museums enable visitors to virtually flesh out the fossil dinosaurs on display by using augmentation, as in the Royal Ontario Museum, where QR codes have been placed strategically on the floor in front of the fossils (Figure 7). By focusing their mobile device cameras on the markers, visitors see what those dinosaurs may have looked like with their skin on.

Figure 7: Augmented Dinosaur at theRoyal Ontario Museum, Toronto



Source: Reuters (http://www.reuters.com/uk) and ROM Ultimate Dinosaur (https://itunes.apple.com/)

There is a more sophisticated way to handle augmentation, i.e. through AR wearable –some of them not much larger than a pair of glasses (Figure 8)– which will enhance the users' field of view by displaying multimedia and taking into account their movements. As noted by Hwang and Peli (2014), the Google Glass provides a platform that can be easily extended to include a vision enhancement tool. This augmented vision system overlays enhanced edge information over the wearer's real-world view. The enhanced central vision can be naturally integrated with scanning. The impacts of the contrast enhancements were measured for three normal-vision subjects, with and without a diffuser film to simulate vision loss. Improvements were measured with simulated visual impairments.

Figure 8 - Google Glass Shades. N.B. Although this device was not intended originally for augmentation, multiple AR applications by companies such as Layar, Blippar, are available for download on Google Glass

Source: http://www.ebay.com/

This wearable originated from specific AR equipment, such as the head-mounted display systems which were used for advanced tracking and sensing in contexts such as maintenance of very expensive equipment or surgery, where a high level of accuracy was needed in order to manipulate a rendered object in a convenient way.

As the reader can easily figure out, this type of AR equipment –besides being unaffordable– is not well-suited for most classroom use. Anyway, in most cases no hand interaction between the user and the object is needed and no such a level of accuracy as in surgery is required. Aligning virtual objects with real ones should be good enough.

7 CONJUNCTION AR AND GEOLOCATION

Besides, mobile AR applications can be used alongside Geolocation to enrich field-trip activities by providing students with a personalised, paperless, more interactive experience. On this learning scenario, which stretches far beyond the classroom, the possibilities for interaction are countless, including the ability to track the position and movements of all learners at any given time.

Quite often, for object detection, AR relies on mobile GPS location and matches an image against a database of location-tagged images in the same area. Once identified the location or found a marker, the database unlocks certain content and provides the user with information and graphics overlaid onto the camera-view of the screen. Those data are provided by an AR browser application, such as *Layar, Junaio*, *Panoramio* or *Vision*, which has been previously downloaded to the user's mobile. The information typically displayed by those apps has to do with other services (hotels and restaurants), information from the social media (*Twitter*, *Facebook*), entries from the *Wikipedia* or comments and photographs made by previous users of the app.

Although most apps are based on the assumption of continuous localization of the user, truth is there are always issues with localization accuracy. Anyway, when users are indoors and there is not a suitable GPS signal, there is still a chance to use an indoor positioning system (IPS), mostly based on Wireless Local Area Networks (WLAN), IP and/ or Bluetooth. "Instead of using satellites, an IPS relies on nearby anchors (nodes with a known position), which either actively locate tags or provide environmental context for devices to sense" (NAMIOT; SCHNEPS-SCHNEPPE, 2011, p. 48). With regards to this, "[…] recent developments also include chips that use broadcast television signals to locate phones even indoors" (MCGARRIGLE, 2012, p. 16).

8 OPTIONS FOR LESS ADVANCED DEVICES

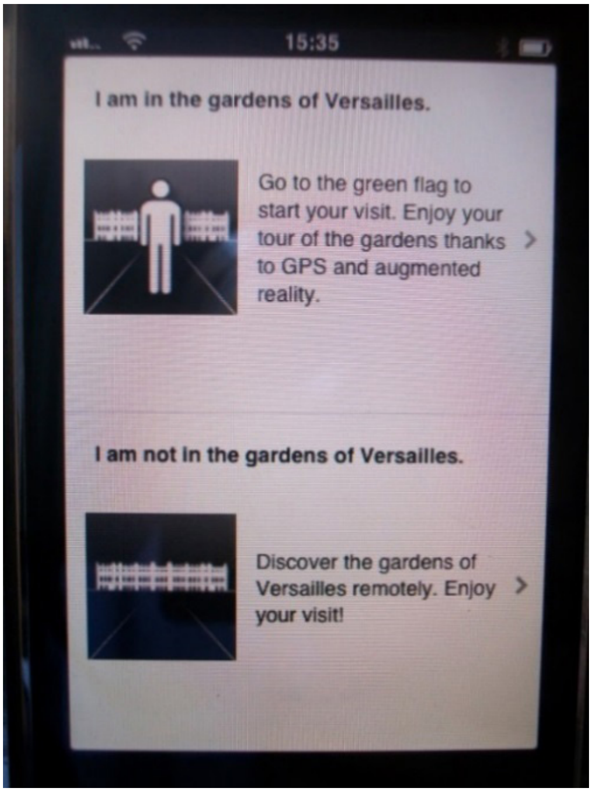
Most AR apps are available for Android and iOS and can be downloaded for free –or else for an inexpensive price– from sites such as Google Play Store or iTunes. Once those apps are installed into our mobiles, we may need any of the following circumstances to concur:

- Availability of an Internet/data connection. Or into a wireless network.
- A reliable GPS coverage.

But, however interesting mobile AR may result, when it comes to designing an educational activity, we need to cater for all types of mobile devices, not just the advanced ones with a specific operating system, or GPS capabilities, like smartphones. We should, therefore, eliminate the need for continuous location by providing students with simple devices with a suitable alternative.

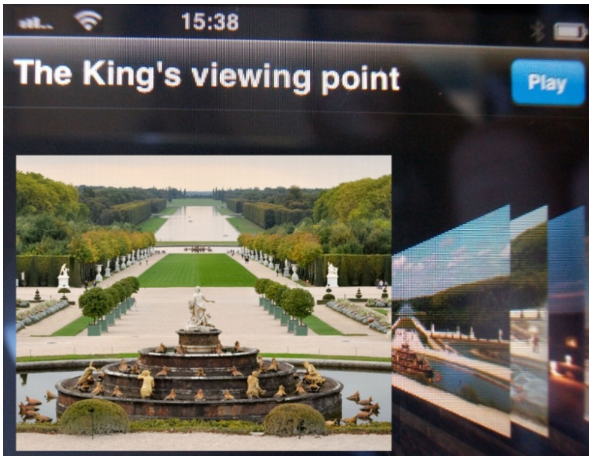
In this regard, a number of AR apps make use of different approaches to location-awareness resulting in different affordances for the use of augmentation in field activities (Figure 9): one location-based feature displays different content according to the user's position and movements, or another feature allows users to access content –which has been previously downloaded– off-line at anytime, anywhere, even when away from a set point-of-interest, or device has no choice Geolocation and just plays video (Figure 10).

Figure 9 - Geolocation guides visitors automatically through the Gardens of Versailles, or view of a slideshow based on a Map, independent of the user position



Source: Versailles Gardens F. Telecom

Figure 10 - Caption from a video designed for both remote use or for "in situ" use at the Gardens of Versailles



Source: Gardens Software

Although access to a wireless or wired Internet connection cannot be made compulsory in field trips, its use would be an interesting asset in order for learners to engage in collaborative activities and to get immediate feedback from their teachers and peers, for instance: when learners complete a task and submit their answers, teachers get the results right away, which allows them to react accordingly by reformulating a question, increasing/decreasing the level of difficulty or tracking students' location in order to clarify any aspect of the activity.

9 CONCLUSIONS

Mobile Augmented Reality (AR) has attracted much research attention and become increasingly important over the last few years, as mobile technology advances and the processing power of our state of the art mobile devices has grown exponentially. As a result thereof, AR is being increasingly used in educational contexts.

Whether we like it or not, mobile phones are becoming ubiquitous among teenagers and the ultimate companion for our students. As a matter of fact, our data show that over 95% of the teenagers surveyed have a mobile phone.

The cutting edge capacities of those mobile devices can potentially be used for educational purposes, for instance, as well as allowing for voice communication and texting, most smartphones include features such as GPS (Global Positioning System) and cameras and allow users to search the Internet. Yet, they are seen by schools as disruptive devices rather than as an educational tool and few teachers attempt at using mobiles in an innovative way. As a matter of fact, most schools' policies still forbid their use within the classroom, but this is rapidly changing as mobile devices (cell phones, tablets…) are becoming do-it-all indispensable mobile computers.

At a time when Geolocation and Reality Augmented are enabled through the use of extensive networks of GPS and advanced mobile devices, it is worth understanding the role of AR when it comes to creating engaging field activities. Position and orientation tracking via GPS or Wireless Local Area Networks –in the case of indoor environments– ranks among the most innovative developments within this field, as it allows us to customise interaction with objects and places (i.e. triggering a download or a mobile transaction of information about a specific location or picture) and provide communication users with a very intuitive interface and quick feedback.

Thanks to AR and Geolocation we are able to merge reality and virtuality, thus creating an innovative learning experience. On the other hand, the mode of delivery contributes to creating an engaging activity, given that for the transmission of knowledge, especially in young people, the wrapping tends to be just as important as the gift.

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INTERAÇÃO DISPOSITIVOS MÓVEIS E REALIDADE AUMENTADA: uma aproximação ao fenômeno

RESUMO *Realidade Aumentada (AR) e Geolocation é um novo campo, atraente e com grande potencial na área da comunicação e construção dos eventos de culinária. Este artigo é o resultado de um trabalho apoiado por diversas instituições sobre as possibilidades de Realidade Aumentada. Nossa pesquisa se concentra principalmente em descrever os tipos de dispositivos móveis que têm a juventude e especificamente usa Geolocation e RA. Uma aproximação do potencial desta tecnologia de AR, o que é capaz de exibir a informação digital combinada com as imagens captadas pelo dispositivo móvel, gerando uma experiência de utilizador novos e atraente, especialmente na área da educação é realizada. Esta actividade tem lugar em novos cenários, diferentes dos espaços tradicionais de treinamento. Mas primeiro você precisa projetar fontes RA relacionados com localizações geo-posicionadas ou marcas específicas. Em seguida, estes dados são acessíveis para o utilizador posicionado a uma distância a partir do local específico ou etiqueta. Além dos benefícios da actividade educativa formal e informal, existem muitas possibilidades relacionadas com o acompanhamento da situação dos alunos em todos os momentos. No entanto, no projeto de atividades educacionais, devemos considerar todos os tipos de dispositivos de usuários móveis, e não apenas aqueles que têm estas escolhas do sistema operacional e posicionamento GPS (hardware para Sistema de Posicionamento Global).*

Palavras-chave: *Comunicação ubíqua. Dispositivos móveis. Geolocation. Gestão do conhecimento. Realidade aumentada.*

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