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"Augmented Interaction": bringing geography, history and art to life

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Abstract. Augmented Reality (AR) is a technology that uses interactive and digital components to alter a person's perception of their surroundings using simple devices such as a smartphone or a tablet. Elements come to life to produce new interactions, and insight into specific points of interest, to provide experiences to increase engagement, also adapted to a specific context and personalized. This technology can also offer gamification possibilities which can be activated during the exploration of a site, a museum or even a city, which can make the tour and the cultural or scientific attractions more interesting. New technologies changed our way of telling history, art, and even geography. This article aims to present two applications based on augmented reality to improve the learning process with digital technologies by "augmenting" the live view of the real world of the users: the app Shadow of Norge, developed by Università Europea di Roma, and the multimedia project for the volume "Palermo. Second star to the right" designed by INAF in collaboration with Bas Bleu Illustration.

Key words. Augmented reality, geography, art, cultural heritage, history, virtual reality

1. Introduction

The joint use of simulation and virtual/augmented reality technologies (VR/AR) represents a promising scenario for applications in place and story-telling (Leonardi (2015)). It becomes possible, in principle, to describe material and immaterial features of sites, landmarks, travels and situations far beyond the concrete "spatial" and "temporal" reach of the users of the simulated or virtual experience (Minucciani (2017); Kruse (2019); Kurnia Putra (2022)) and far beyond the capabilities of traditional means (Stojšić et al. (2016); Bujdosó et al. (2019)). In the first part of the article, we will present the application Shadow of Norge, an international historical communication project that aims to commemorate the Amundsen-Ellsworth-Nobile expedition on its 95 anniversary (1926-2021) and the first flight crossing of the Arctic region in the history of humanity. The second part will show an example of an "augmented" book (Zanazzi, et al. (2021)), with an interactive map full of augmented reality elements to discover the beauty of

the Sicilian capital from a new and unusual point of view, across science, history and art: "Palermo. Second star to the right" (original title "Palermo. Seconda stella a destra").

2. Stop-over in Vadsø. Re-living a journey to the North Pole through Augmented Reality

Starting in 2021, the Geographic Research and Application Laboratory of the European University of Rome is focusing its attention on some aspects of simulation and AR/VR applications both for research and for cultural dissemination. A crucial advantage of these tools seems to be their ability to expand users' perception range of places and environments up to remote locations and inaccessible situations. Aspects such as accuracy, immersive and emotional rendering of virtual representations are, in this sense, key factors; factors that could remarkably expand individuals' "access" to seeing, feeling and, in the end, knowing (at least to some degree) places and facts otherwise beyond the boundaries of their lives (Mikropoulos & Natsis (2011)).

The Geographic Research and Application Laboratory has recently set up a series of research activities in the field of technologies for didactics. Applications involve pupils and students from the university and also different school types and grades. The ongoing scientific work is particularly focused on virtual and augmented reality applications in education environments, as demonstrated in scientific studies as well as by attention in the media (Andreoli (2018); Longo (2015); Gaudiosi (2016))). Gamification strategies relying on new and affordable technologies, whose effectiveness as teaching tools has been proven, allow to go far beyond mere entertainment and can be used to boost knowledge development through innovative and effective means (Maestri (2015); Andreoli (2018)). The first augmented reality project, developed at GREAL in 2021, was called Shadow of Norge[1]. It was meant to be a celebration of the 95th anniversary of the first transarctic flight, conducted by airship Norge in 1926. Shadow of Norge was multidisciplinary and included different kinds of activities such as webinars and Web/social media communication. As part of the project, an augmented reality (AR) application was developed, that enabled users to "witness" and share the fly-by of a reconstructed full-scale 3D digital model of the airship in some iconic locations of the 1926 expedition. After the end of the official commemoration (May 14th, 2021), the Varanger Museum in Vadsø[2], one of the international partner institutions in the project's network, included a series of experimental teaching-related activities by the use of the AR App. The small Vadsøya island, now in the town's municipality, was selected in 1926 to host a mooring mast for the original airship. The facility is no longer in use, but the mast is preserved as a historical landmark. Today, over 95 years after the mission, Vadsøya can be reached through a bridge that links it to the mainland, and the mooring facility can be visited. Using the App it is possible to see the 3D model of the airship approaching the existing infrastructure (see fig.1) and virtually stopping in the correct position. Another routine shows the airship's departure for the continuation of the journey.

The mast is today an important monument in local history and a tourist attraction (Roura, 2009, p. 37); therefore, the Museum organizes didactical visits with local schools. In the summer of 2021, five classes with students between the age of 11 and 15 were taken to the mast for outdoor lessons and the AR app was used as a support for storytelling NORGE's expedition (see fig. 2, 3, 4). The application proved rather effective, especially with younger students, who appeared enthusiastic about managing to see the airship through the smartphone and following its landing sequence. Overall, Shadow of Norge demonstrates the capability of virtual and augmented reality (VR/AR) technologies for knowledge sharing and, in this line, the importance of interaction between real and virtual worlds (Sahin (2020)) as well as the effectiveness of the BYOD (Bring Your Own Device) formula for conveying contents.

[1] www.shadowofnorge.eu

[2] https://www.varangermuseum.no/en/

Fig. 1. Photo by Lisbeth Dragnes (Varanger Museum of Vadsø) through the Shadow of Norge App.

Fig. 2. Photo by Federico Cianella through the Shadow of Norge.

Fig. 3. Photo by Giulia Vinci through the Shadow of Norge.

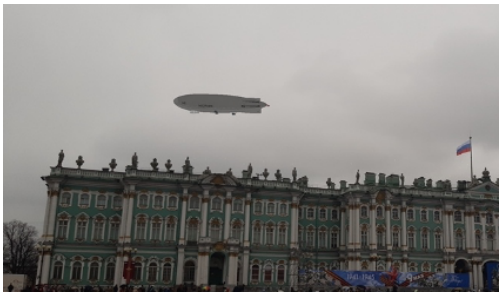

Fig. 4. Photo by Adelina Terekhova through the Shadow of Norge.

Fig. 5. In-depth section showing objects about the Prince Giulio Fabrizio Tomasi di Lampedusa.

Fig. 6. The interactive map of the second itinerary.

3. The "augmented" city: innovative strategies in augmented reality for "Palermo. Second star to the right"

Among the experimental activities related to the enhancement of scientific cultural heritage (Leonardi (2019)), INAF Palermo Astronomical Observatory, in the field of Astro tourism (Daricello et al. (2021)), worked on the implementation of Augmented Reality for the astronomical guide "Palermo. Second star to the right"[3] (Tuscano (2021)), a tourist guide viewed with a keen eye on astronomy and science, published after those of Padua and Florence by INAF - National Institute of Astrophysics with Bas Bleu Illustration.

By "augmenting" the guide, users can get new and additional information (Leonardi (2014)), preview some sites and locations, rare documents, 3D models of scientific instruments get videos, and visualizations of images in detail, explore virtual tours, and much more. To promote direct participation, the user can learn astronomical concepts by solving games and is guided to identify astronomical aspects on his/her own, walking around the city. Moreover, thanks to the use of augmented reality it will be possible to keep updating the contents and some basic information, such as timetables, contacts and ticket costs. The interactions are powered by Zapworks[4], a web-based Content Management System (CMS). The program needs no code and empowers designers and developers to produce immer-

[3] https://www.studiobleu.it

[4] https://zap.works/

Fig. 7. In-depth part showing one of the four "canto" of the center with the statue representing summer, one of the four seasons.

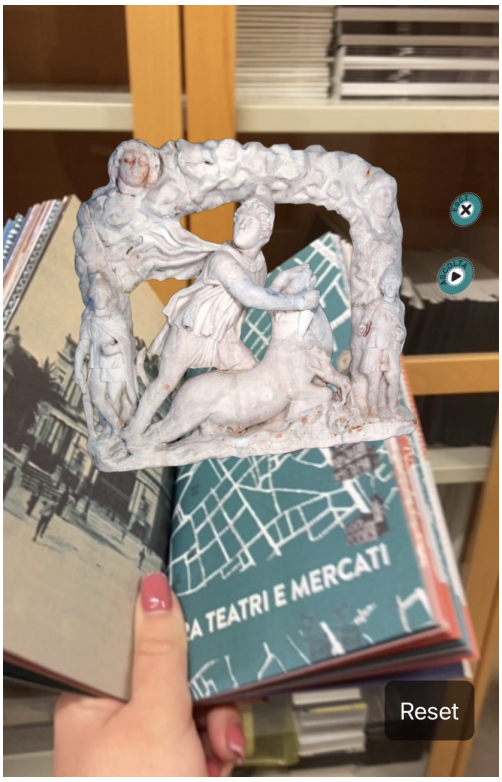

Fig. 8. Augmented picture of a rare marble find (III century d.C.) with Mitra, solar deity.

sive WebAR experiences, without specific skill sets or objectives. The astronomical guide aims to communicate astronomy, in a new way, through art and history, in connection with the society of our time which is surrounded by multimedia and information. The guide is suitable for people of different ages and cultural backgrounds and points to bring together an audience that is not normally attracted by scientific subjects. The guide proposes five itineraries in the city center of Palermo that are divided from a logistical point of view. Each itinerary is highlighted by the color of the layout of the pages and they can be walked in half a day: the representations of the sky, stars, and zodiac signs are in blue, the "places of time" - such as clocks and sundials – follow the color pink, while the itineraries where you can admire scientific instruments and objects are highlighted by the color orange. The tour follows the ancients principal roots of the city that design a big cross-cutting the city center into four parts. The trip officially begins from the sea, to symbolize the connection between the origins of the city and the outsider dominations over the centuries that changed its artistical style and history (Piano della Marina) (see fig. 5); People then encountered the most scientific itinerary of the guide, to find out university museums founded in at the beginning of the XIX century, rare scientific collections and the INAF OAPa laboratories particularly active in the field of space astrophysics (Dalla Natura alla Scienza) (see fig. 6); The earliest center, the heart of the city, presented in the third itinerary, is a symbolic place where all happened, from celebratory parades to public

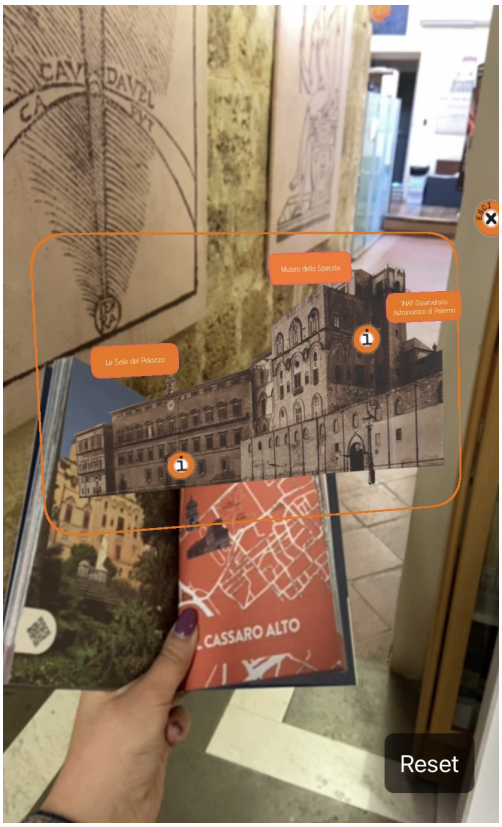

Fig. 9. Exploring the Royal Palace and the Astronomical Observatory.

hangings, through astronomical analogies (Il Cuore della città) (see fig. 7); At this point, there is a crossroad, where one could chose to follow the path to the discovery of theatres and historical markets (Tra teatri e mercati) (see fig. 8) or to pursue the route to the Cathedral and the Royal Palace where it awaits the Astronomical Observatory (Il Cassaro alto) (see fig. 9).

As mentioned, the city of Palermo has very ancient origins and astronomy has been all around, since ancient times, in frescoes, statues, paintings, and decorations. All these elements reveal the central role the firmament has always played in human life and the role of astronomy in the daily life of the citizens. Viewing objects from different angles, by using innovative tools like augmented reality, makes it easier to appreciate discoveries, and historical facts, and to emphasize the key role of astronomy to shape the city. This guide invites tourists as well as residents to uncover new details even inside famous and well-known places when looking at them, as it was the first time.

4. Conclusions

Augmented reality supports both engagement and motivation, especially for the young generation who sometimes view subjects such as art, history and geography uninteresting. The use of interactive multimedia, videos, sounds and images that accompany the storytelling could make the difference to deepen knowledge and higher users' satisfaction (Majeed (2020)). Shadow of Norge was an experimental application, developed in just a few months within a wider commemoration project. It was a prototype to test challenges and opportunities towards new methods in public geo-history and the history of exploration. The AR enhancements in the guide "Palermo. Seconda stella a destra" were finalized in November 2022 and the volume hasn't been already presented to public. In the next months, we are organizing the official presentation of the guide, together with some astronomical tours around the city, thus starting the experimentation of the AR tool.

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