A Multimedia Tale in which History and Technology Come Together to Create a Fully Immersive and Multi-Sensorial Experience

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"L'Ara Com'Era" (The Ara As It Was) Project, promoted by the City of Rome (Roma Capitale), Department of Cultural Growth – Capitolina Superintendency of Cultural Heritage, was organised by Zètema Progetto Cultura and assigned to ETT S.p.A.[1]

For the first time augmented and virtual realities have been used to scientifically enhance a work of art. The subject is one of Rome's most important monuments, the *Ara Pacis*, built by Augustus between 13 and 9 BC.

The *Ara Pacis* bas-reliefs are brought back to life using Samsung Gear VR viewers, showing visitors their original splendour.

On this project, ETT employed a 3D tracking system, making use of the most advanced computer-vision algorithms. The entire augmented reality (AR) system recognises three-dimensional bas-reliefs and carries out real-time tracking. This recognition system "anchors" the overlay onto the real surface, increasing the effectiveness of this immersive experience. This technology shows visitors the monument in its original colours, as established in studies carried out by the Superintendency. The voices of Luca Ward and Manuela Mandracchia, two major Italian actors, accompany visitors on their walk around the monument, describing the bas-reliefs on the Ara with their characters, gestures and deities relating to the origins of Rome and the lineage of Augustus.

More than 11.000 visitors enjoyed "L'Ara Com'Era" in the first three months following its opening, despite access being limited to Friday and Saturday evenings. This positive response encouraged additional investment, with the addition of a further two virtual reality Points of Interest. We created an immersive film, combining live filming, 3D reconstruction and computer graphics, which takes visitors thousands of years back in time to the northern part of ancient Campus Martius, in Rome. Visitors join the crowd before the *Ara Pacis* to see a Roman sacrifice, re-enacted for the first time in virtual reality (VR).

Feedback is enthusiastic, encouraging us to continue in the use of cutting-edge technologies to enhance our cultural heritage.

This paper illustrates the multimedia solutions designed and developed by ETT S.p.A., analysing them in terms of design, accomplishment and fruition.

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[1] ETT S.p.A. is an International Creative and Digital Industry, specialises in Innovation Technology and Experience Design. Founded in 2000, the company employs over 100 people in Italy — at its Genoa Head Office and branches in Rome, Milan, Naples, Ancona, Pescara and Palermo — and Europe (London and Lugano). ETT combines innovative design, storytelling and cutting-edge technologies to create engaging digital experiences for museums and corporate or public spaces. For more info: https://ettsolutions.com/

INTRODUCTION

The Project Presentation and Technologies

The project was promoted by Roma Capitale, Department for Cultural Development, working through the Capitoline Supervisory Body of the Cultural Heritage Department. The latter department is responsible for the coordination, scientific content, dialogues and performance, while the overall organisation is by Zètema Progetto Cultura. After winning a public tender in 2016, production and fitting-out were assigned to the technological partner ETT S.p.A.

This project is the first systematic use of augmented and virtual realities to enhance the value of one of the most important masterpieces of Roman art, the *Ara Pacis*. The monument, dedicated to Augustus's pacification of Spain and Gallia, was built by the Roman Senate between 13 and 9 BC. Erected along the via Lata (currently via del Corso), the monument is part of the great Augustan urbanisation project of the northern portion of Campus Martius.

Through innovative and avant-garde technologies, the project – opened on October 14, 2016 and still active today – was conceived for evening museum visits. From 8 pm to midnight and by reservation only, groups of 20-25 people may enjoy the experience, which lasts approximately 45 minutes. Visitors can choose one of five different languages (Italian, English, French, Spanish and German). Each visitor receives a Samsung Gear VR viewer fitted with a Samsung S7 smartphone that accesses both virtual reality and augmented reality content.

There are nine Points of Interest (POIs) to see during the visit. POI 1 and POI 2 consist of a combination of film, virtual reality and immersive technologies that merge to create a fascinating experience. Wearing Samsung Gear VR visors, spectators are greeted with a panoramic 360° view of the *Ara Pacis* as it is today. The monument appears in its original colours in the presence of Emperor Augustus, the exclusive guide to this journey of discovery around the Campus Martius (see Fig. 1).

Thanks to the 3D reconstruction of a birds-eye view, visitors can fly over and admire the area while listening to explanations of the various buildings in Campus Martius. During this experience, they fly over the Pantheon, the Saepta Julia (the voting precinct), the Augustus Mausoleum and the aqueduct, all clearly visible in their magnificence.

After this emotional fly-past, Augustus takes visitors to the original coloured version of the *Ara Pacis* to see a sacrificial rite, reconstructed in 3D and computer graphics and performed by real actors. Once the sacrifice is over, spectators come back to reality and move on to the next part of the visit, to see details of the *Ara Pacis* in POIs 3-9.

Fig. 1. Detail of the frieze of Ara Pacis with the ″Goddess Roma″ in augmented reality.

At the end of the visit, the final bas-relief shows Augustus in a procession, followed by his family who is surrounded and protected by augurs (a type of priest), lictors (civil servants acting as bodyguards) and priests who accompany him as he performs a sacred ceremony. This is not merely the simple representation of a state ritual, but the image of Rome's institutions at that time and in the future. For the first time ever, Augustus and his family, children included, were immortalised on a public monument.

ETT adopted a very special 3D tracking solution that relies on the most advanced computer vision algorithms. This AR application traces the detail of the bas-reliefs and sculptures in 3D, tracking them in real time. The virtual elements appear to visitors to be "anchored" to real objects, adding to the overall effect and sense of being part of the scenario and the completely magical experience. Indeed, by wearing the Samsung Gear visor, visitors see both the real object (the altar) and the virtual element (the augmented reality reconstruction) merged into one image (see Fig. 2).

This added-value augmented reality technology carefully respects academic findings from archaeological studies carried out on the marble of the monument during restoration by the Capitoline Superintendency of Cultural Heritage, more than a decade ago.

ETT implemented these augmented and virtual reality solutions in order to give users a new kind of visit experience. It is a new way of presenting in-depth knowledge of the history and importance of the monument. Visitors become aware of its original condition, with the narration emphasising the celebration of Emperor Augustus and underlining his predestination as a commander during the return to a mythical golden age.

Technology also helps the museum to meet the needs of Italian and foreign visitors. With content available in five languages on the same device, it is easier for reception staff to manage 150 Samsung Gear VR viewers.

Several factors had to be taken into account when choosing technologies. The multimedia exhibit had to be in architectural harmony with the museum layout and the storytelling content and texts needed to be adapted by skilled professionals (museologists, graphic designers, video-makers etc.). These activities were also based on a careful target analysis in order to identify potential audience profiles and create content in line with user expectations [Ioannides et al. 2016].

Fig. 2. Detail of the ＂Goddess Roma＂ in Augmented Reality from L´Ara Com´Era (The Ara As It Was).

Concept, contents and theoretical background

The first project consideration was the strong connection between content and narrative, which needed to include emotional yet balanced storytelling that would enable visitors to experience the splendour of ancient Rome.

Accordingly, various virtual reality content was created which, together with the narrative voices of Luca Ward and Manuela Mandracchia, two Italian actors, was extremely useful in creating emotional impact. Starting from the depiction of the sacrifice of Aeneas and the birth of Romulus and Remus, characters, gestures, deities and animals illustrate the origins of Rome and the family of Augustus.

Whilst observing the figures in procession, on the side of the monument, parts of the renovation are highlighted

during the narration of the complex history of the Ara in modern times, from its discovery in the 1500s, its transfer to Florence and the reconstruction of all the fragments just before the Second World War. Continuing the tour, the goddess Tellus, bearer of prosperity, and the goddess Roma, seated on the weapons of the vanquished, reflect on a world transformed by the Augustan peace. The vibrant narrative, highlighting the functions and meanings of the characters and objects shown, eloquently describes the setting. The colours of the panel beneath the goddess of Rome, as well as the tidy and luxuriant nature of the beautiful plant frieze, inhabited by animals and insects, are shown between racemes and hidden symbols. The beliefs of the ancient Romans, invited to forget the horrors of war in this lush garden, are vividly brought to life.

The goal of the creators of "The Ara As It Was" was to find the right way to give new life to the monument, restore its image in the collective consciousness and to communicate its importance so that visitors would acquire insight through familiarity with it [Cataldo 2011]. It is undeniable that studies conducted on the basis of Milgram's theories on the relationship of the continuum between the real and the virtual world – and therefore on mixed reality – have helped. Various considerations were done on how a monument like the *Ara Pacis* could be effectively enjoyed in an innovative and immersive way by using new technologies.

The main aim was to enhance the monument, working on the technical and technological side and intersecting the results with those achieved in other sectors. Diagnostics and restoration were approached with more sensitivity to the material data of the monument via the virtual reality experience, showing that which today is no longer visible (the chromatic data).

Milgram's study shows how a mixed reality environment is the combination of real and virtual environments. If the real world is on the left of the continuum, the virtual world is at the other end (see Fig. 3). Through special virtual reality viewers, such as Samsung Gear VR, it is possible to superimpose augmented elements onto the real world (augmented reality) or directly replace a real world with a virtual vision (virtual reality) in a continuum [Milgram and Fumio 1994].

Fig. 3. Mixed reality (MR) continuum.

The world of technology is constantly changing. This calls for constant monitoring and testing of the latest technological solutions available on the market, so that their strengths and weaknesses may be identified correctly. The same can be said for communication trends in digital design and culture when creating robust and cutting-edge products.

In the field of immersion and interactive design, the use of augmented and virtual reality technologies is increasingly taking an active role in the cultural heritage sector. In fact, real data can now be integrated with additional visual information and this is perceived as being close to reality, verisimilar, and therefore easier to memorise [Walker et al. 1999].

RESEARCH AND RESULTS

Protection of Cultural Heritage represents part of the fundamental mission to safeguard our collective identity. In this respect, the aim was not to transform an encounter with a treasure from the past, such as the *Ara Pacis*, into a mere technological experience. On the contrary, the goal was the creation of a transformational experience, driven

by educational motives, which would engage with visitors on varying levels: from the multisensorial to academic; and from observational to emotional.

The use of virtual reality viewers gives a visit-experience to the monument a hybrid approach. Immersion in virtual or augmented reality takes place only in certain areas or points of interest and visitors are free to choose whether to deepen their experience, using the virtual reality viewer, or not. In fact, the Ara may be observed without visors at any moment, enabling comparison with the media format.

The project enjoyed very convincing visitor flows and customer satisfaction. During the first three months after opening, more than 11.000 visitors were recorded. The updated figure from December 31, 2017 reports over 35.300 visitors since the start of the project, considering Friday and Saturday evenings only.

This intense reaction made it essential to conduct a customer satisfaction survey. Questionnaires, face-to-face interviews and social media channel feedback analysis have given excellent results, with satisfied users equalling 95%.

The profile of interviewed visitors was mainly of local residents (56%), with a further 32% coming from other Italian cities (including 19% from Northern Italy) and 12% from abroad (2% from the USA, 2% from Germany and 2% from Spain, with the remaining 6% from other countries).

In detail, 34% of the sample consisted of employees, 18% students and 16% freelancers; 67% of the interviewees have a degree or post-graduate specialisation. The female gender prevails, with 59% of total respondents. Furthermore, 41% were aged between 19-39% and 33% were aged between 45-64 (see Fig. 4).
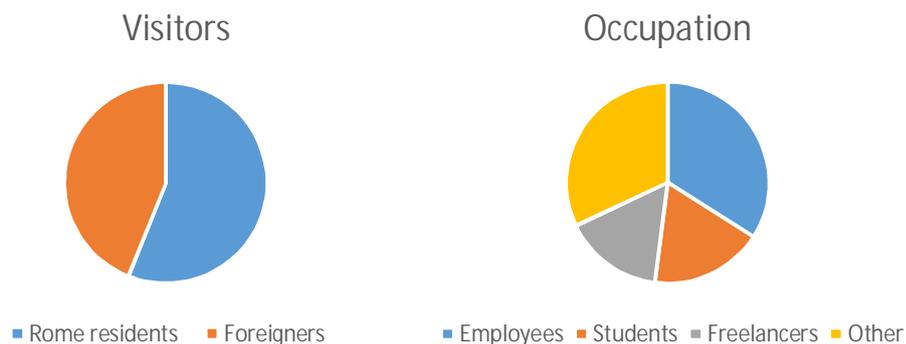

Fig. 4. a) visitors; b) occupation.

We a used a scale from "Very satisfied" = 3 to "Not at all satisfied" = 0 to understand the average level of satisfaction. The overall satisfaction level of surveyed visitors is good, with an average of 2,51 and 95% of the people interviewed were very or quite satisfied visitors.

All analysed aspects have a standard average satisfaction value of 2.20 (which is very good). The reception staff (2.83) and general organisation (2.64) are among the most welcome aspects. The created content is the most important and satisfying aspect, together with the overall experience in augmented and virtual realities.

Finally, the survey analysed how people learned about the "L'Ara Com'Era" initiative. Word-of-mouth prevailed (35% of the total). The Web reached a total of 24% of interviewees, the press followed with 11% and then advertising with 10% (of which 8% on billboards).

Means of communication

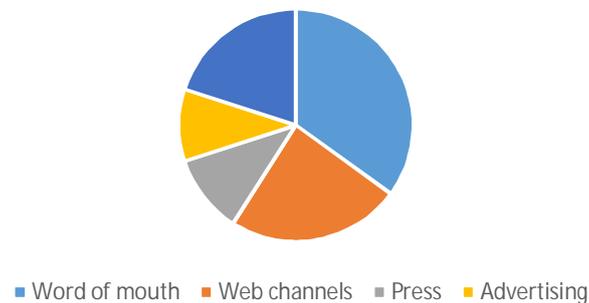■ Word of mouth ■ Web channels ■ Press ■ Advertising

Fig. 5. Means of communication.

It is significant that word-of-mouth is the predominant means (although some people discovered it "by chance"). Roman or foreign visitors who came to the *Ara Pacis* Museum for the first time were generally very satisfied when they left. Looking at communications media, the Web prevails for Italian tourists, especially the MiC (Musei in Comune) portal for adults over 45 years, some of whom have already been to the museum, whilst social networks reach young people under 35 years. Press and advertising are the most effective means for Romans, but mainly for adults over 55 years, who are mainly very satisfied with their experience. Billboards, however, impacted well on the age-range between 35 and 54 years (see Fig. 5).

Therefore, in "L'Ara Com'Era", the most commonly judged aspects are those related to the augmented and virtual reality experience and the visit content. None of the investigated aspects had a negative impact on overall satisfaction.

Indeed, the results show high satisfaction levels and identify two main visitor clusters with varying behaviour patterns in the acceptance, use and experience of virtual reality and augmented reality.

The survey results permitted the scope of the project to expand and, from April 21 to October 31 varying the "L'Ara Com'Era" visit was open not only on weekends but, with prior booking, every evening from 8 pm to midnight (latest admission at 11 pm). Moreover, due to the high level of satisfaction, the second release of the project included new Points of Interest and an introductory 360° video.

CONCLUSION

Our ICT Company has gained experience in looking at museums in a new way, creating immersive visitor experiences, and using innovative technologies to increase visitor engagement and interaction. ETT has achieved this by developing an engaging gamification model using tools such as high-resolution monitors, interactive touch-screen interfaces, 3D reconstructions, proximity sensors, gaming simulations, augmented and virtual reality, and interactive projections with on-screen actors.

The "L'Ara Com'Era" project experimented a new way of appreciating Cultural Heritage, thanks to the use of augmented reality and virtual reality. This visual system shows great potential both for science and for tourism, and represents a first step towards understanding possible innovative future applications in information management.

Before the "L'Ara Com'Era" project augmented reality was usually employed using special two-dimensional markers or for special applications, using photographic images of the real object. It is clear that using these techniques meant that AR could not be employed on rounded irregular objects such as statues or monuments. However, with "L'Ara Com'Era" we have developed 3D tracking implementation, making AR work even on three-dimensional objects.

The enthusiastic visitor feedback, by both Italians and foreigners, encourages the continuation of cutting-edge technology use, creating improved engagement with the cultural heritage sector both at local and international levels.

This fascinating experience certainly marks a very important step in reassessing the role that new multimedia technologies play within enhancement processes and valorisation of both content and research.

On the basis of progress so far, every virtual and augmented reality environment developed in the cultural field can certainly offer rewarding aesthetic and learning experiences, which otherwise would be difficult to attain. But this is not enough.

The starting point for the conception and development of new projects is the awareness that the past and the present can both be presented simultaneously, through new media, while contributing to research into cultural patrimony from which any country can benefit. It is about enhancing the audience experience with an engaging interpretation while guaranteeing protection and conservation of the work of art.

In the long run, a project like "L'Ara Com'Era" is just a first step towards considering how a new methodology can be applied to the Cultural Heritage sector, making it accessible to the wider audience. Cultural Heritage is a powerful gathering of tangible and intangible assets that can talk to people, even from the remote past. In order to make this possible, restoration, art history and technology must work together, interweaving their expertise towards the shared goal of promoting, protecting and valorising Cultural Heritage. The interaction of such diverse professions led to the success of this project.

By constantly adopting new technologies and carefully using the most suitable and sustainable media for each project, ETT has increased visitor involvement; making museums fascinating. All age groups are catered for, as are experts in specific fields, and the story told by the museum reaches everyone. Results are visitor appreciation, visitor number growth and international awards.

The intellectual property rights of the "L'Ara Com'Era" project, which will last until 2019, are owned by Zètema Progetto Cultura and are not interoperable or available on any other market.

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