# ARCHEOSTORIE®
# JOURNAL of PUBLIC ARCHAEOLOGY

VOLUME 3 / 2019

*Topic of the Year: Museum Archaeology*

ISSN: 2532-3512

## How to cite this volume:

Please use AJPA as abbreviation and 'Archeostorie. Journal of Public Archaeology' as full title.

## Published by:

Center for Public Archaeology Studies 'Archeostorie' - cultural association
via Enrico Toti 14, 57128 Livorno (ITALY) / *archeostorie@gmail.com*

First published 2020.
*Archeostorie. Journal of Public Archaeology* is registered with the Court of Livorno no. 2/2017 of January 24, 2017.

# ARCHEOSTORIE™
# JOURNAL of PUBLIC ARCHAEOLOGY

VOLUME 3 / 2019
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www.archeostoriejpa.eu

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# Augmented reality in Brescia: Evaluation questionnaires in San Salvatore basilica. A joint process between managers, public, and university

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## Abstract

*This work aims to present the impact of augmented reality technologies on the enhancement of archaeological heritage. In particular, the paper will focus on the data obtained through questionnaires filled out by the public regarding the augmented reality visit of San Salvatore basilica, Brescia. The new project is the first AR/VR experience in Italy on an Early Middle Age site, and it confirms Brescia's remarkable role in the use of AR technologies in Italy. The questionnaires were provided to 775 visitors of different ages, academic background and provenance. The results report an almost universal appreciation of the experience such as the conviction that augmented reality can enrich the historical sites visit; a clear interest in using this technology in other places; an equal preference regarding the presence or absence of human figures in 3D reconstructions, with differences based on origins and ages; the central role of* storytelling.

**Open Access** **Peer Reviewed** **Keywords:** augmented reality, questionnaires, virtual archaeology, Brescia, Longobards

## Augmented reality in Brescia: Archaeological area, *Domus* dell'Ortaglia, San Salvatore

The use of augmented or virtual reality technologies to enhance archaeological heritage sites has significantly increased in the last few years. Just in Italy in 2018 and in 2019 at least twelve new AR/VR permanent experiences were introduced, according to the research that has been carried out for this project (*Caracalla 4D*, *Diocleziano IIID*, *Domus Transitoria and Circo Maximo Experience* in Rome, *RetroFutur* in Pompei, *Nora Virtual Tour* in Pula, *Roman Wreck of Marausa* in Marsala, *Limen Lab* in Siracusa, *Beyond the Castle* in Milano, *Domus del Ninfeo* in Cremona, *Domus dell'Ortaglia and San Salvatore Basilica* in Brescia). However, a study by the NOVA University Lisbon reported the existence of a limited number of studies that involved the general public (8), with a maximum of 201 people. The goal of this work is to present the AR visits developed in Brescia in the last five years, with a particular focus on the results obtained by the analysis of 755 questionnaires filled out by the public regarding the augmented reality experience within San Salvatore basilica.

The civic cultural heritage of Brescia, managed by Fondazione Brescia Musei, includes the *Capitolium* archaeological area and the monastic complex of San Salvatore-Santa Giulia. The sites present well-preserved ancient buildings from the Roman period and the Early Middle Age, which create a continuous stratigraphy sequence. This peculiarity makes the two sites very significant for the rich palimpsest they represent. At the same time, this aspect made it necessary to find a simple and effective way to promote and present such a heritage, so extended both in time and space.

In 2015, a new visit itinerary was introduced in the Capitolium archaeological area through the use of wearable technologies, which integrated an audio guide with augmented reality contents (Morandini 2017). This opportunity was ensured by a Lombardy regional call dedicated to the enhancement of archaeological areas and



**How to cite** Delbarba, N. & Morandini, F. 2019. Augmented reality in Brescia: Evaluation questionnaires in San Salvatore basilica. A joint process between managers, public, and university. *Archeostorie. Journal of Public Archaeology*. 3: pp. 71-84. DOI: https://doi.org/10.23821/2019_4a/

UNESCO sites.

Thanks to the most recent study campaign conducted in the archaeological area, 3D reconstructions were available. Therefore, an immersive visit, which showed the original aspect of the site without altering the ancient monuments, was considered to be the best. Augmented reality seemed more suitable than virtual reality for various reasons:

- visitors can move freely in the archaeological area, since AR devices, as opposed to VR ones, don't prevent the view of the surrounding environment;
- the overlaying of virtual and real architectural structures prevents the substitution of the archaeological findings, therefore, visitors can fully experience the real site, while VR devices offer only the virtual reconstruction;
- the relationship between the ruins and the intact monuments can be immediately understood: the visual juxtaposition provided by the technique helps users in cognitively understanding (and seeing) how the site was in its original aspect.

In the last two years, two new augmented reality visits were introduced in the city museum - Museum of Santa Giulia: one in July 2018 of two roman houses, the so-called *Domus dell'Ortaglia* (a part of a patrician residential quarter of the ancient *Brixia*); one in august 2019, in San Salvatore.

The augmented reality projects were designed by the writer, curator of the archaeological heritage of Brescia Municipality and Fondazione Brescia Musei, and realized with the collaboration of Regione Lombardia, the Soprintendenza Archeologia, Belle Arti e Paesaggio delle provincie di Bergamo e Brescia and with the partnership of ArtGlass s.r.l., a leader company in the emerging sector of wearable video-guides for cultural heritage and edutainment.

The technology used during the visit consists of a pair of smartglasses, which enable to georeference the visitors' position and their movement in the environment; the visualization of information on what the users are looking at, all enriched by audio, video, texts and 3D reconstructions.

Thanks to those projects, today Brescia plays a leading role in the use of AR technologies for the enhancement of archaeological heritage. With three different AR visits, Brescia is the second city in Italy, after Rome, for the number of AR/VR experiences. This third project continues on the path of its predecessors, preferring AR to VR for the previously explained reasons and focusing on the combination of immersiveness and storytelling. Furthermore, the San Salvatore experience is the first case of a virtual reconstruction of an Early Middle Age church permanently available for the general public with such wearable technologies, which brings new light to these "dark centuries".

San Salvatore basilica was founded in 753 AD by the last king of the Longobards, Desiderius, and his wife, queen Ansa, and it constitutes one of the most important surviving examples of Early Middle Age architecture in Italy. The church, alongside the monastery complex in which is located and the adjacent archaeological area, is included in the UNESCO serial site *Longobards in Italy. Places of Power (568-774 AD)*.

Augmented reality technology was preferred once again to prioritize the real remains, given the high level of conservation; to allow visitors to move freely in the environment; to give continuity with the previous experiences.

Fondazione Brescia Musei has collaborated again with ArtGlass s.r.l. for hardware and software support and editing; with Sema s.n.c. for the virtual reconstruction. The smart glasses in use, MOVERIO BT 200, are produced by Epson. Amongst the expertise involved are mentioned Sergio Fontana (general planning), Stefano Focchetti (3D models), Lucia Conversi (fresco paintings' virtual restoration) of Sema s.n.c; Michela Pasqualini (project Management) of Art Glass s.r.l.; Piera Tabaglio (iconographic researches) and Nicola Delbarba (content editing and revisions) for Fondazione Brescia Musei. Reconstructions are based on the studies of G. P. Brogiolo, F. De Rubeis, V. Gheroldi, M. Ibsen, B. Leal, J. Mitchell, G. Panazza, S. Strafella, R. Stradiotti, S. Tonni.

The experts involved in the creative process of this experimental application show the interdisciplinarity of this enhancement method. In this new field, only interactions between different types of knowledge can assure an effective and appropriate result. Archaeologists were needed for making high quality contents, 3D modellers for the virtual reconstructions, video makers for the editing, all continuously interacting with each other. Furthermore, two more actors were involved in the project: the general public and the university. The

*Fig. 1. Virtual reconstruction of the façade of San Salvatore (Fondazione Brescia Musei).*

San Salvatore project has benefitted from a university internship to guarantee a significant training opportunity in a new sector. The archaeology student Nicola Delbarba, from the Università degli studi di Verona – Dipartimento Culture e Civiltà, supervisor prof. Patrizia Basso, and who also has a BA in Engineering that well suited the project's interdisciplinarity, has been actively involved in the making process. Moreover, Delbarba has provided the questionnaires and analysed the data obtained. Lastly, the involvement of the general public has been central, since users have been encouraged to participate first-hand to the improvement of the experience by filling out questionnaires with a trial period, as the ArtGlasses were free of charge.

*FM*

## Coordination of the augmented reality project in San Salvatore within Fondazione Brescia Musei: storyboard, archaeological revision, editing revision, and tests *in situ*

Fondazione Brescia Musei coordinated the project and actively and continuously interacted with both Sema s.n.c and ArtGlass s.r.l.

The storyboard was curated by the project coordinator – Francesca Morandini – and it was infused with an awareness of the importance of high-quality storytelling, which must be at the same time enjoyable and correct from a historical point of view. The language used was targeted on a general adult audience, which means using a correct technical/historical language and scientific contents alongside an explanation of various technical terms. During the storyboarding process it was decided to end the visit with a virtual reconstruction of the basilica at nightfall to prioritise the sacred atmosphere of the place and to emphasise the immersiveness guaranteed by augmented reality.

The 3D reconstruction was entrusted to SEMA s.n.c., as mentioned before. The reconstruction methodology was meant to avoid making new assumptions and to rely on what was already published. Therefore, some parts of the wall decoration of the church remain neutral.

A continuous bibliographic review, here briefly presented, was carried out during the internship of the author to guarantee the accuracy of the 3D model. Depending on the state of conservation, different operations

*Fig. 2. Virtual reconstruction of the iconostasis (Fondazione Brescia Musei).*

of virtual reconstruction were preferred: digital replica, digital restoration, and virtual reconstruction.

For instance, the church façade—demolished by the XIV century modifications of the monastery complex—was reconstructed relying on archaeological evidence (Brogiolo 2014, pp. 45-50) and on comparisons with other Early Middle age religious architectures (Figure 1)

The archaeological evidence proves the existence of an iconostasis and different fragments were identified as part of the structure (Ibsen 2014, pp. 277-281). These elements were the starting point for the reconstruction of the fence, the pillars, and the arches (Figure 2). The same procedure was carried out for the ambon (Ibsen 2014, pp. 281-282), which included the famous marble with peacock.

The stucco decoration in San Salvatore represents one of the best-preserved examples of that kind in Italy (UNESCO 2011, p. 149). Therefore, the virtual reconstruction consists of a reintegration of the missing parts, using the same patterns of the surviving decoration (Figure 3). Archaeologists do not agree on the existence of a polychrome decoration for the stuccoes (Tonni 2014; Leal 2014; Ibsen 2014); as a result, they have been left white.

In the central nave, three privileged burials were found during the excavations. They have a significant meaning in the hypothesis that king Desiderius intended San Salvatore to be his dynasty mausoleum (Brogiolo 2014, p. 57). The internal fresco decoration of these burials presents a good state of conservation, but they can hardly be seen by visitors because they are below iron grates. In the virtual reconstruction, they are clearly visible and the central one was left open to allow the observation of the

*Fig. 3. Comparison between the virtual reconstruction of the stucco decoration (Fondazione Brescia Musei) and the preserved parts (Civic Museums of Brescia Archive).*

internal decoration. In particular, a cross – symbol of Christ's victory over evil (Strafella 2014, pp. 257-262) – was impossible to be seen due to the grave cover.

As regards to the archosoleum burial on the southern wall – traditionally attributed to queen Ansa – the reconstructions consisted of a virtual relocation of decorative elements, today parts of the museum collection, which are believed to be originally part of that burial (Morandini 2014; Stradiotti 2014). Additionally, a dedicatory inscription – whose presence was testified until the XVII century (Morandini 2014, p. 345) – was virtually recreated.

Lastly, the surviving parts of the fresco decoration was virtually restored to remove the scratches. No reintegration was done due to the absence of a reconstructive hypothesis.

After the 3D reconstruction, editing – carried out by ArtGlass s.r.l. – was the following step. The aim was to obtain the strongest connection possible between audio and video content, and the real environment. Numerous on-site tests were done to reach this goal. Users must be independent during the visit, knowing where to go and which element they are invited to observe. Therefore, infographics played an important role in making directions as clear as possible. Moreover, some parts of the visit do not include video content. Visitors are encouraged to look at specific elements through the glasses' transparent lenses. This seemed the best choice to maintain the central role of the ancient architecture, in particular regarding the well-preserved stucco decorations. This was also a way to enforce one of the strengths of augmented reality: the constant connection with the real environment. To better the glasses transparency, no darkening lenses were used.

## Evaluation questionnaires

The aim of the evaluation questionnaires was to assess both the appreciation of the new augmented reality visit in San Salvatore and the visitors' opinions regarding the use of augmented or virtual reality technology to enhance archaeological heritage, in general.

Questionnaires were paper based and available in two languages, Italian and English. Every visitor was asked to fill in the questionnaires at the end of the smart glasses experience.

The questionnaire was divided into four sections: visitors' general information; smart glasses' usability and performance; evaluation of the augmented reality experience in San Salvatore; role and relevance of augmented or virtual reality technologies in archaeological contexts.

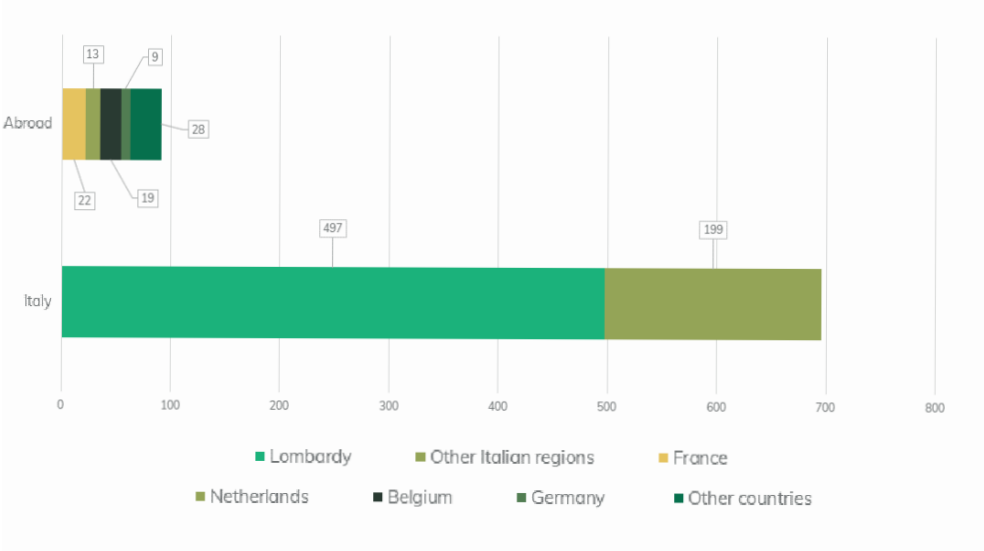
Questions were written by the author with the collaboration of ArtGlass for the ones concerning the technology used and the project coordinator.

The questionnaires were presented to the public in the course of two months, from August to September 2019. The majority of the results were obtained in the central two weeks of August, when the entrance to the civic museums in Brescia is free and the affluence is considerable, especially from the citizens of Brescia itself. Therefore, a collaboration with the community was sought by the project organisers. Local journals and the museum communication channels spread the news that the new augmented reality experience would have been available without additional cost with the purchase of the Domus dell'Ortaglia ArtGlass and—in a sort of quid pro quo—visitors would have been invited to fill out evaluation questionnaires, actively participating in the improvement of the experimental service.

To better understand the data obtained, it is useful to start by presenting the results regarding the first section: provenance, age, academic background and previous experiences with augmented/virtual reality. The visitors involved were 775: 90% from Italy and 10% from abroad (Figure 4a). The majority of Italians were from Brescia and its territory (75%), 12% from the other provinces of Lombardy, 4% from Veneto, 2% from Emilia Romagna, 2% from Lazio, 5% from other regions. Foreign tourists came from France (29%), Netherlands (17%), Belgium (12%), Germany (9%), Austria (8%), USA (6%), and Romania, UK, Switzerland, Australia, Ukraine, China, and Singapore (19%).

Regarding age ranges, 15% of visitors were under 18 years old, 16% between 19 and 30, 13% between 31 and 40, 20% between 41 and 50, 23% between 51 and 60, 13% over 60 years old (Figure 4b).

As for qualification, the majority had high school diplomas (41%), followed by BA (31%), Ph.D. (13%), grade 12 (13%) and elementary education (1%) (Figure 4c). This result does not take into consideration underaged participants.

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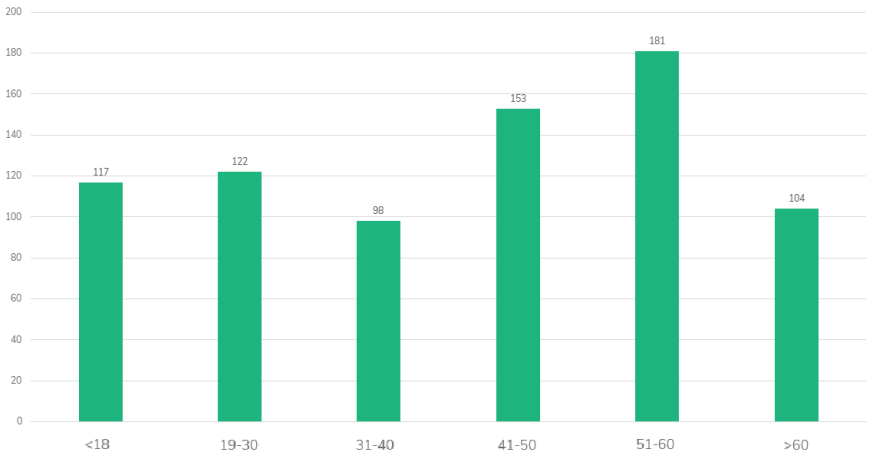


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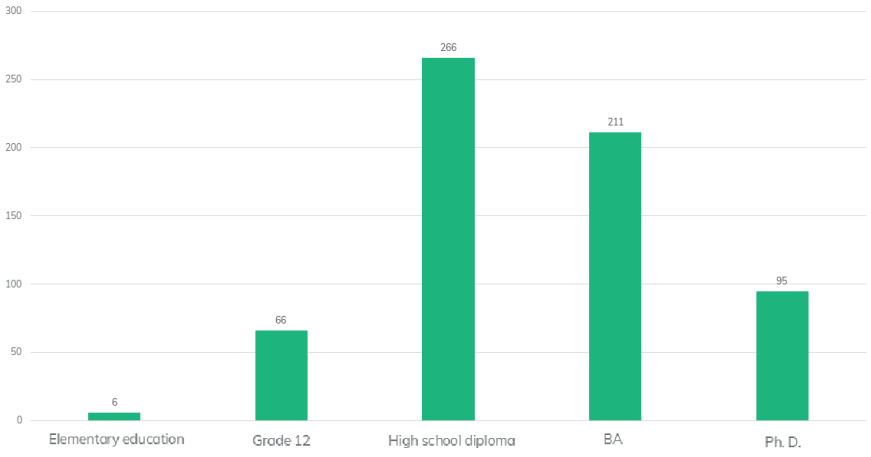


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*Fig. 4. a) Country of origins; (b) Age; (c) Academic background*

Almost 80% of the visitors used augmented or virtual reality technology for the first time in an archaeological context on this occasion. The ones who had already experienced it indicated Brescia (37%) and Rome (25%) as the place where they had. 38% of them had tried it elsewhere.

## Usability and performance

Results obtained regarding the technology's usability were positive enough: 94% of visitors did not find wearing the glasses difficult. 40% of the visitors did not report inconveniences in using the glasses, while the others indicated the weight of the glasses (27%) and the presence of prescription glasses (18%) to be the major faults.

Regarding the clarity of the audio and the image, 97% found the audio to be "good" or "very good", 93% found the image to be clear or very clear.

## Storytelling and immersiveness into the Past

Visitors were asked to point out the most and least interesting parts of the visit. Before proceeding, a brief description of the visit is needed. It is articulated in eight stops: (1) an introductory video about the foundation of the monastery and its transformation through centuries and the UNESCO site *Longobards in Italy. Places of power (568-774 A.D.)*; (2) a 360-degrees video that shows the original aspect of the church façade; (3) a video with the description of the interior of the present church; (4) a 360-degrees video with the virtual reconstruction of the interior of the church in the VIII century; (5) a video about the stucco decoration of the arches and the virtual reconstruction of queen Ansa burial; (6) a video that shows the original aspect of the ambon; (7) a video dedicated to the fresco decoration; (8) a 360-degrees video about the interior of the church in the VIII century, viewed from the apse at the sunset.

The data that have emerged, reported in Figure 5, were unexpected. Five stops (1, 2, 3, 5, 6) received homogenous opinions, with an average of 353 positive opinions (minimum 333, maximum 373) and an average of 74 negative responses (minimum 59, maximum 101). The other three are less aligned with these results. Stop number 4 – the 3D reconstruction of the original aspect of the interior of the church – received 490 positive opinions and 18 negative ones; stop number 7 – about the fresco decoration – received 444 positive opinions and 74 negative ones; stop number 8 – the last one, with the 3D reconstruction of the original aspect of the church at sunset – received 257 positive opinions and 204 negative ones.

The strong preference expressed towards the reconstruction of the interior of San Salvatore in the Longobard period was easily predictable – since it is the core part of the experience –

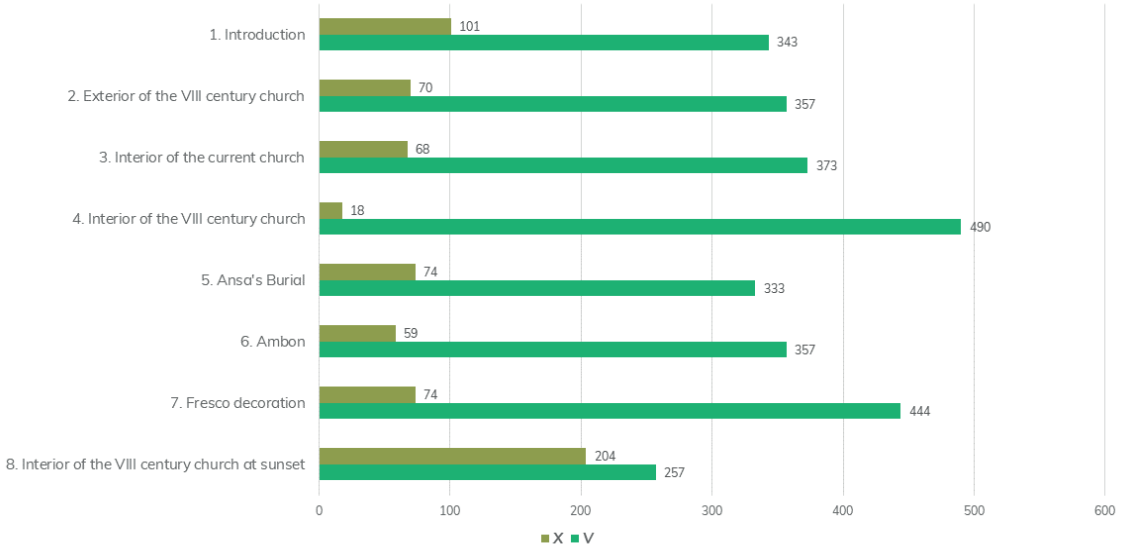



*Fig. 5. Answers to the question: "Tick the part that you found the be the most interesting (V), mark with an X the one you found the least interesting".*

*Fig. 6. Virtual restoration of the fresco decoration representing the martyrdom of Pistis or Elpis (Fondazione Brescia Musei) and the drawing made by Gaetano Panazza (Panazza 1962, p. 215).*

shown in an immersive 360-degrees video. Not only it has the highest number of positive opinions, but also the lowest number of negative ones.

On the other side, the reviews received for the fresco decoration description and the interior of the VIII century church at sunset were more unexpected and the considerations on the two stops are connected.

A few details must be considered before proceeding. During the project's implementation, the fresco decoration part of the visit was the one that received modifications. This was due to several reasons which made it particularly complicated. Firstly, the conservation status of the frescos: the preserved parts are for the most fragmented and with numerous scratches, caused by the modern age whitewash; in some cases, only the sinopia survived. Besides, the iconography of the best-preserved parts is not widely known: the martyrdom of Elpis, Pistis and Agape; their mother Sophia visiting their burials; the siege on Carthago by the Vandals. Also, the position of the fresco decorations – high on the walls of the central nave – made them hardly visible for the visitors.

Moreover, a virtual reconstruction of the missing scenes was not possible – as aforementioned – therefore, only a virtual restoration on the surviving parts was possible.

For these reasons, a lot of attention was placed on the writing process of the *storyboard* regarding the depicted scenes and in the choice of the best infographics to use. The virtual restoration only removed the scratches and the scenes continued to be hardly readable. Drawings by Gaetano Panazza – director of the archaeological excavations conducted in San Salvatore in the 1960s – were used to solve the problem (Figure 6). Those simple-lines-drawings significantly simplified the comprehension and, at the same time, added historical value to the explanation. In addition, the storytelling was as descriptive as possible, guiding the visitors in the observation of the details mentioned to improve the understanding of the painted scene. Those two aspects were the key elements of the final result. Despite the efforts, the aforementioned reasons, the considerable length of the video – almost five minutes, making it the longest one – and the static nature of a bidimensional video suggested that this part of the visit would have been less appreciated than the more immersive 360-degrees video. Surprisingly, with 444 positive opinions, this was the second most appreciated part of the visit – second only to the 360-degrees video of the basilica in the Longobard period – overcoming the third one with over 70 preferences. In the comments, many visitors expressed appreciation for the opportunity to learn in a clear and captivating way about an aspect of the church that they would have hardly been able to see with the naked eye, especially regarding the martyrs' life. On the other hand, the 360-degrees video of the original church at sunset was imagined as a way create a suggestion of the original atmosphere of that sacred place at the end of the experience, rather than give new historical content. Despite that, this is the part of the visit that received the less appreciations – 257 – and the highest number of negative opinions – 204, over a hundred more than the second one. It is possible to suppose – also thanks to the comments left by visitors in the questionnaires – that this part was considered redundant,

showing a facet they had already seen and did not provide any further explanation.

An additional evidence – more tenuous than the previous one – is the result obtained by the 360-degrees video of the original façade of the church, a perfectly on average number of 357. The external reconstruction of the church can legitimately be considered the most surprising one because it shows the now demolished façade of the church and the wide courtyard, surrounded by trees. While now the church is inserted in a complicated architectural structure and visitors arrive inside the basilica directly from the museum rooms. As there are not many facts about the façade – which emerged from the archaeological excavations – this part is extremely short with less content than usual to share.

In the end, two out of three 360-degrees video received negative and average reviews, although they represented the most visually immersive parts of the visit. The reason for these reviews can be found in the storytelling: the description is extremely brief during the 360-degrees video of the church façade and it does not give any new particular contents in the 360-degrees video of the church at sunset.

Recalling the comments on the fresco decoration video, it emerges that a high quality and captivating storytelling, able to stimulate the interest of visitors, is essential for the appreciation of the experience. Even a suggestive and immersive view of the basilica at nightfall was not enough to attract the preferences of the visitors, who prefer the visual content to be accompanied by an appealing storytelling.

## Presence of human figures in 3D reconstructions

The AR experience in San Salvatore does not include the presence of human figures in the virtual reconstruction, as well as the two previous experiences in Brescia. The high level of conservation of the buildings seemed not require this type of animation. Besides, this addition – apparently simple – implies a much more demanding and expensive work of planning and rendering.

Nevertheless, during meetings, conferences, round tables with representatives of museums or archaeological sites about the first experiences in Brescia, it was pointed out that the absence of human figures made the virtual reconstructions aseptic. It was argued that the presence of figures carrying out activities connected to the function of the place would have made the virtual reconstruction more effective. In addition, the presence of local people filling these ancient buildings could improve the perception of the dimensional scale.

For those reasons, the public was taken into consideration and asked if they thought the visit could have been improved by the presence of virtual people going on about their daily activities. 51% answered this question affirmatively. Therefore, the public does not seem to have a clear preference for this topic. It is interesting to analyse the data obtained for each category.

As for the provenance (Figure 7a), a strong preference for an affirmative answer (79%) emerges for the foreign visitors. On the other hand, Italian users show a slight tendency to prefer the absence of virtual humans (52%).

By dividing the answers by age ranges, we can see that the percentage of affirmative answers increases as the age decreases: 37% of visitors who are 60 years old and older would enjoy the presence of human figures, 39% in the 51-60 range, 50% in the 41-50 range, 50% in the 31-40 range, 55% in the 19-30 range, 83% for the under 18 (Figure 7b). The results are extremely homogenous between 19 and 50 years-olds, while the youngest and oldest users show stronger views.

Answers divided by qualifications are homogenous (from 39% to 55% of affirmative answers), apart from who has elementary education, that express a strong preference (83%) for the absence of virtual human figures.

In conclusion, it is not possible to reach a definitive conclusion through data analysis because a clear opinion from the public does not exist. Nevertheless, some considerations regarding the technology use can be made. Human figures seem to be more suitable for virtual reality: visitors are completely isolated from the surrounding environment and the sense of immersion in a virtual space could be improved in that way. It seems legitimate to think that the presence of human figures could play a relevant role to "humanize" of the place.

On the other hand, in an augmented reality experience, as the one tested in San Salvatore, the main focus is on the continuous dialogue between the real architecture and the virtual reconstruction in overlay. The risk, as some

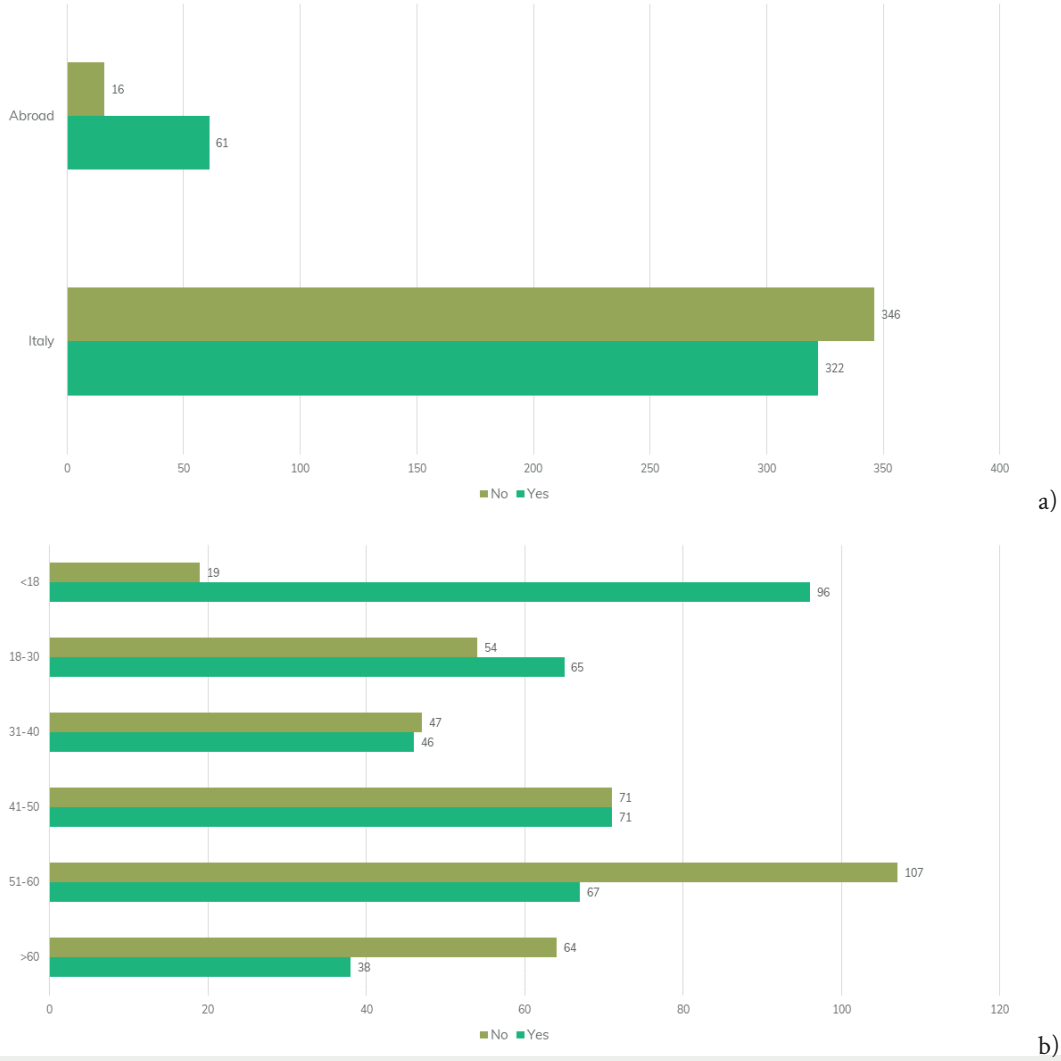



*Fig. 7. Answers to the question "Do you think that the visit would have been improved by the presence of virtual people going on their daily activities?" divided by (a) provenance and (b) age range.*

participants expressly underlined in the questionnaires, is that human figures could be more of a complication – or a distraction – that an advantage.

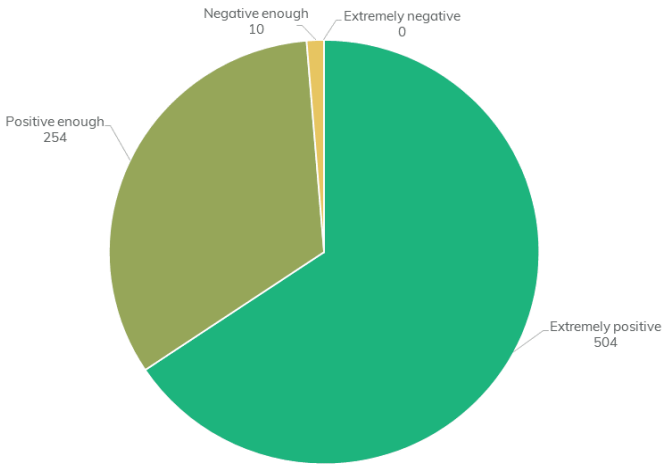
The presence of human figures in a 3D reconstruction must certainly be considered carefully, depending on the context and the reference users, in particular if the project involves schools.

## Overall opinion on the experience

The opinions received on the experience are extremely positive. When asked what their overall opinion was, 66% of the visitors reported it to be "extremely positive", 33% said it was "positive enough", 1% "negative enough", while no one answered it was "extremely negative" (Figure 8a). The results obtained are very encouraging, well beyond expectations, with 99% of visitors satisfied with the experience.

There are no substantial variations linked to qualification, while it seems interesting to report the results divided by age range (Figure 8b). Being the opinions overall positive, it is better to focus on the "extremely positive" and "positive enough" answers. The "extremely positive" highest percentage values are found in the under 18-years olds (77%) and the 51-60-years-old range (74%), while the lowest ones in the 19-30-years-old range (52%).

Firstly, it is interesting to notice that visitors

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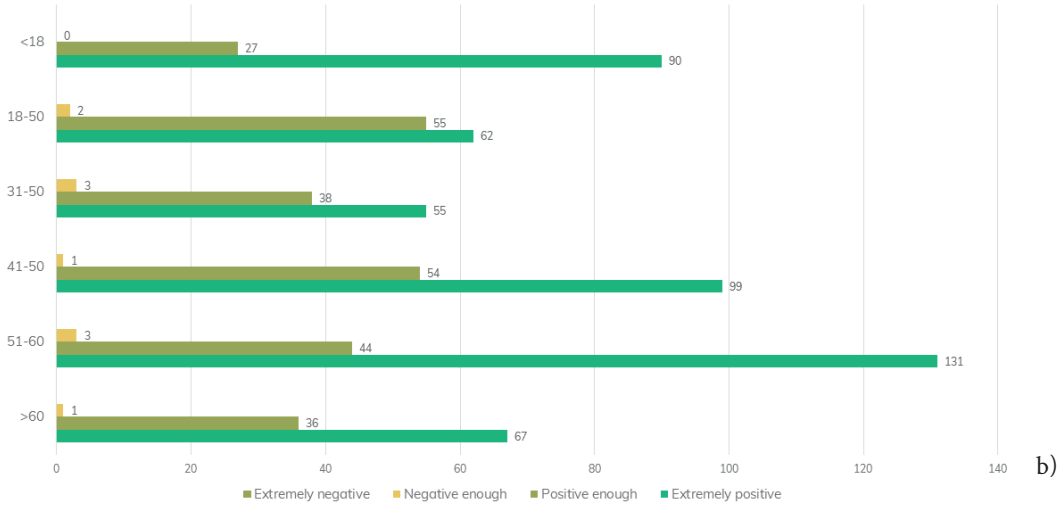


b)

*Fig. 8. (a) Answers to the question: "Is your overall opinion of this experience"; (b) answers to the question: "Is your overall opinion of this experience" divided by age ranges.*

under 18 are the ones that have appreciated the experience the most, even though the visit was designed for an adult audience. Actually, 63% visitors under 18 reported having found some parts of the explanation hard to understand, while only 6% of adults reported similar difficulties. If it were addressed specifically to a younger audience, this technology could be an extraordinary educational tool.

Secondly, another aspect to be underlined is the comparison between the answers given by the age groups 19-30-years-old and 51-60-years-old. It might have been expected that a younger audience – usually assumed to be more used to modern technologies – would have responded with greater enthusiasm to this innovative offer, while the feedback from an audience less used to virtual worlds would have been more lukewarm. Instead, data show the opposite result, with a higher appreciation within a more adult public.

## Opinions on the use of augmenter reality technology in the enhancement of archaeological heritage

After their experience, visitors were asked if they thought that augmented reality could in general enrich an archaeological site. 76% of them answered that it "definitely" did, 23% "kind of", 1% "not that much" and no one

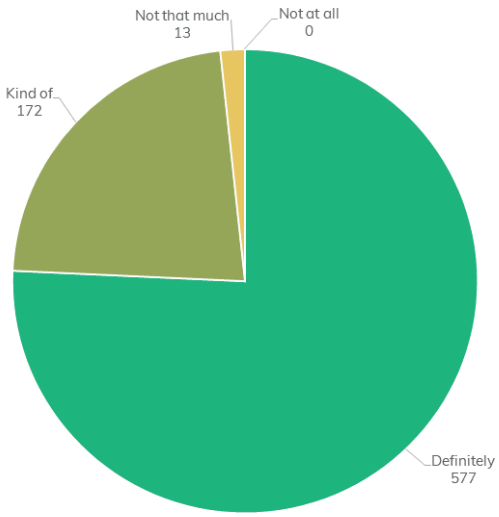


*Fig. 9. Answers to the question: "After your experience, do you think that augmented reality can enrich the visit to an archaeological site?".*

answered "not at all" (Figure 9). Data show a strong interest in those technologies and their use in archaeological context.

As for the answers regarding the experience in San Salvatore, there are no considerable differences between qualifications or age groups: the "definitely" answer highest percentage value (85%) is found between in the under 18 group, the lowest one (66%) in the over 60 one. Overall, the interest shown is intergenerational.

When asked what was the strongest suit of augmented reality – even though answers were various and subjective – it clearly emerges the possibility of seeing with their own eyes the original aspect of a historical place, which would be difficult to imagine otherwise and enables the immediate perception of the ancient place. In addition, it is highly appreciated the possibility to see the real environment and to have an immediate comparison with what is preserved on site. Its weakest spot reported in the comments is linked to the specific technology used, considered a little complicated and uncomfortable.

Furthermore, 89% of the visitors expressed interest in using this technology in other archaeological sites, especially regarding the area of Brescia.

## Prices

In conclusion, it seems useful to mention that visitors were also invited to express their opinion about the appropriate price for an augmented reality visit experience (Figure 10). The average value obtained is € 4.94.

This result has been taken in consideration by the Fondazione for the final ticket price, although it is yet to be decided at the time of writing. The previous ticket prices were decided relying on the results obtained by questionnaires provided before.

## Conclusions

At the end of this study, some aspects emerge clearly, and they deserved to be highlighted.

First of all, the role of Brescia in the Italian context is a remarkable aspect: it is the second

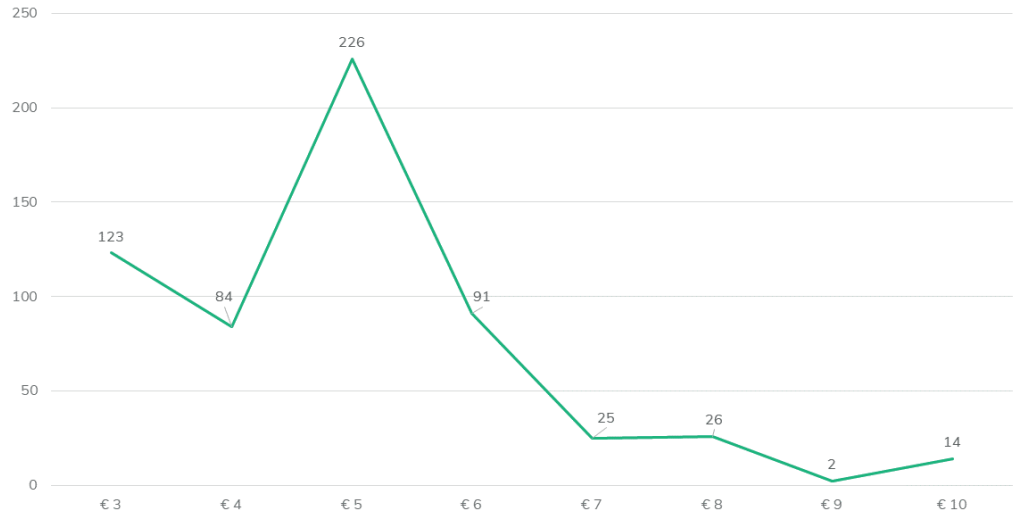


*Fig. 10. Answers to the question: "Which price do you believe to be adequate to experience one augmented reality visit?".*

city in Italy for number of augmented or virtual reality visits available and the first city in Italy to use this kind of technology permanently in an Early Middle Age church.

What emerged is that this enhancement method requests the interaction of various actors from different fields, showing the interdisciplinarity of contemporary archaeology and a virtuous example of fruitful collaboration. The engagement with a university, thanks to the author's internship, guaranteed a precious formative experience in a new field, the results of which have been presented in this work.

Furthermore, the virtuous commitment to search for the engagement of the community deserves to be underlined. Visitors were exhorted to participate first-hand in the improvement of the project without any additional cost. They responded to the invitation to express their opinions during the test period in large numbers, well beyond expectations.

In conclusion, the consistent number of visitors involved in the providing of the questionnaire, the variety of age groups, qualifications, and origins, gives a relevant reliability to the results obtained. Visitors have shown an almost universal appreciation of the experience and a strong interest in the use of augmented reality technologies in archaeological contexts.

Useful guidelines regarding the way to communicate contents can be derived from the experience: a high quality and captivating storytelling, even of trickier information, is preferred over generic or meagre content even if accompanied by a visually immersive environment. The opinion regarding the presence of human figures in 3D reconstruction is not definite, but the differences between the various categories invite an attentive consideration of the intended audience.

*NDB*

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