3D Digital Heritage and Historical Storytelling: Outcomes from the Interreg EMR Terra Mosana Project

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Abstract.
This paper will explain how the activities undertaken in the Terra Mosana project have combined the writing of new heritage narratives with the creation of digital 3D virtual experiences. The main objective of the project was to strengthen the sense of belonging to the same community for the citizens of the Euregio Meuse-Rhine by recreating their common history and heritage in 3D. This was achieved through virtual and augmented reality experiences based on cross-border and renewed historical storylines

Keywords: 3D digital experiences, Digital heritage, Digital narratives

1 Introduction

Most often understood as "the use of 3D data of heritage sites or monuments"[1], the domain of 3D digital heritage remains, until today, mainly a scientific topic for archaeologists, architects, geomaticians and computer scientists. Indeed, some scientific papers have pointed out that the current use of 3D digital heritage is reserved for a scientific elite and does not really benefit the general public. Moreover, a recent study demonstrated that these data were not sustainable [2]. For this reason, these researchers recommend that 3D digital heritage data should also be thought of in terms of sustainable educational resources

Historical storytelling plays "a fundamental role both as a discipline in itself and as a connective tissue of other disciplines, a way of anchoring cultural experiences in their own time and at the same time of considering them in a diachronic dimension, to understand the past and our complicated present" [3]. But, as two recent studies have shown, the historical narrative, whether urban, regional, national or international, is never neutral. It carries political, cultural or even cognitive biases [4, 5]. The emergence of the use of 3D for cultural heritage has an undeniable impact on the way historical facts are presented and therefore, and it is not surprising, the concept of historical storytelling is sometimes understood as the power to model several phases of the evolution of an object in the form of sequences [6, 7]. The reflection about the historical narratives developed around digital data also focuses on the audience interested in this type of

new media. The public often appreciates being involved, such as by being consulted in advance and having their opinions considered [8–10].

Based on the implementation and exploitation of 3D Digital Heritage experiments, the main objective of the Interreg Euregio Meuse-Rhine (EMR) Terra Mosana project was to strengthen the sense of belonging to the same region by the citizens of the Euregio. In order to strengthen this sense of belonging, several authors had shown that it was necessary to radically transform the way history and heritage are usually transmitted [11]. History taught in schools is presented in a predominantly national framework. Events do not cross borders, neither does heritage. However, "the constitution of the transnational as a central object of analysis shifts things significantly. It shifts the focus from simply 'international' issues to the flows themselves, to the circulations, the intermediaries, the interconnected and crossed histories" [12].

The different partners of the Terra Mosana project were therefore given a triple mission. Firstly, they had to work on the cross-border presentation of historical facts and heritage data. Secondly, they had to exploit the new stories with digital 3D products and finally, they had to involve the public in order to find out their preferences and, if possible, take their recommendations into account. At first sight, these three constraints seemed heavy and difficult to combine. However, it appeared that each aspect could represent a potential enrichment for the other two as the following paper will show.

2   Background on the Terra Mosana Project

The expression "Terra Mosana" refers to a territory, bathed by the river Meuse, which crosses it from south to north. This area is currently shared between three countries, the Netherlands, Germany and Belgium, and covers four provinces: the province of Liège, the province of Belgian Limburg, the Land of North Rhine-Westphalia, and the province of Dutch Limburg (see Fig.1). This area is completely included in the slightly larger EMR area. It should be pointed out that all the activities undertaken within the funded project, also titled Terra Mosana, were aimed at the public of the EMR territory and even, in general, at tourists and cultural public.

Launched on 1 June 2018 and closed on 30 November 2021, Terra Mosana brought together twelve funded partners as well as some non-funded institutions. The funded partners consisted of five cities (Maastricht, Aachen-Liège, Tongeren and Leopoldsburg), four universities (ULiège, Maastricht University, RWTH and the KU-Leuven) and three museum institutions (the citadel of Jülich, the Archéoforum of Liège (AWAP) and the Be-Mine project of Beringen. The project partners had different backgrounds varying from historians, archaeologists, and heritage professionals to developers, computer scientists, economists, and communication specialists. Each partner joined the project with different skills and the activities they carried out were related to their resources and the means at their disposal.

Fig. 1: Terra Mosana Map: Medium grey on the Est corresponds to North Rhine-Westphalia, light grey is Dutch Limburg, medium grey on the West is Belgian Limburg and dark grey is the province of Liège. The hatched areas indicate the German-speaking parts of the Province of Liège.

3   Methodology

To provide a brief overview, multiple methodologies were used in the Terra Mosana project activities, which were organised into five work packages. The activities and results presented below took place within the three work packages titled "project sustainability strategy", "EMR digital storytelling" and "On-site digital experiences."

The work package "project sustainability strategy" covered the issues of intellectual property rights, sustainability of project outputs, but also participatory surveys and workshops to sound out the potential audience for their experiences and stories to be included. The work package "EMR digital storyline" consisted of selecting and telling historical facts and phenomena in a connected and cross-border way. At that point, it should be noted that before the beginning of the 19th century, the notion of border, as we understand it today, did not exist and the inhabitants of the Euregio interacted in a less compartmentalised way than today. The Terra Mosana partners wanted to highlight these interactions [13]. The narratives developed then served as the backbone of the activities undertaken in the work package "On-site digital experiences". These experiences used 3D technologies to reconstruct virtual settings but also to provide access to existing monuments and sites, where access to certain areas is difficult. The augmented reality and VR reconstructions offered to the public allowed people to immerse themselves in the past, in various forms depending on the site visited.

3.1 The Narrative Themes

Before surveying the public about scenarios that might be of interest to them, the partners chose to work on defining important themes to be addressed. By meeting several times for brainstorming, the different participants in the EMR digital storyline working group selected 13 themes to be presented to the different citizen panels. The criteria for choosing these themes were their temporal recurrence, their cross-border aspect and their relevance for the Terra Mosana territory.

The 13 themes examined were as follows: Mobility, Fortifications, Central Places, Religious Infrastructures, Political Infrastructures, Crafts, Urbanism, Natural Resources, War and Peace, Languages, Migration, Innovation and Intangible Heritage.

These themes were researched and interacted with by the partners in order to highlight the different aspects of each topic and how it impacted the multiple areas of the Terra Mosana territory. Then, in order to be easily understood by the workshop participants, the 13 themes were presented in an identical format, in the form of A3 posters.

3.2 Public Participation in the Terra Mosana Project

The involvement of local communities in heritage-related projects commonly generates a larger sense of shared ownership and leads to a greater chance of outcome acceptance and satisfaction among the community, resulting in a larger support base [14]. Thus, the pro-active management of project stakeholders decreases the chances of the failure of a project. Moreover, early involvement of local communities in heritage projects speeds up the process and decreases the chances that costly project revisions having to be made later [15].

The valuable experiences people have with heritage objects or sites is personal and subjective, and cannot only be shaped by relying on the expertise of museum curators and heritage professionals [16]. Therefore, to engage with new and existing audiences, more participative models of interpretation and governance are needed that involve civil society and the private sector.

One of the core qualities of the Terra Mosana project is the aspect of public participation. Throughout the project, several methods were followed in order to achieve meaningful public participation, and to involve and engage the public in the design activities of the project. Our methods included an online survey at the early phase of the project (early 2019) and interviews with stakeholders (i.e. narrative providers and technical developers) that took place in early 2020.

These were followed by a series of six participatory design workshops in late 2020 for involving and engaging the residents of Euregio Meuse-Rhine (EMR) in design activities about the investigation and communication of the shared history of the EMR through digital storytelling. During the COVID-19 crisis, we moved our participatory design workshops online and developed a scenario facilitating both synchronous and asynchronous activities. After the completion of the workshops, a focus group was organized with project partners to evaluate the participatory process of Terra Mosana. In addition, the project followed a community-engagement strategy through social media channels, official website, temporary exhibitions and on-site experiences.

Online Survey. As a preparation for the participatory design workshops, an online survey was developed in the early phase of the project and disseminated with the residents of the EMR to enable them to sort the different themes of the project, such as fortifications, languages, migration, religious infrastructure, immaterial heritage, etc. Participants were also allowed to suggest more themes or a combination of themes. The last part of the survey asked how the themes should be communicated to the public in interactive scenarios. We received a total of 400 completed surveys (190 male; 210 female) from the local community of the EMR in different languages. Our results show enough variation in the background demographics in terms of age ranges, education, place of residence, and frequency of travel. A general tendency was obtained about what themes are the most preferred, and what are the preferred ways of interaction.

Interviews with Stakeholders. The second phase of public participation focused on developing an approach to collect data through semi-structured interviews from two groups of stakeholders. First group are content providers, who are involved in writing the narratives of the project storylines (e.g. archaeologists, historians, archive managers of historical sites, etc.). The second group were related to development the outputs and technical development of media technology (e.g. communication team, technicians, technical advisors, policy makers of a cultural service, etc.). The interview questions with content providers revolved around topics such as cultural learning and public participation, while with the development team, the focus was shifted to topics such as visitor engagement and public participation. The results of the interviews were insightful for crafting the guidelines for public participation in digital heritage projects, such as how the public could co-create the content, and how the content should be presented to the public based on their interests.

Participatory Design Workshops. Participatory design is an approach of active user involvement within the field of user-centered design, enabling users to share their insights and feedback in design decisions that influence their lives [17]. Therefore, the Terra Mosana project adopted the approach of participatory design through a series of workshops that were held in different cities of the EMR. With these workshops, we wanted to involve and engage citizens in design activities about the investigation and communication of the shared history of the EMR through digital storytelling. Our main aim was to elicit local knowledge rooted in local residents' lived experiences and concerns, as well as to collect feedback on the proposed storylines and interaction designs.

The workshop dynamics were based on virtual co-creation methods that encouraged participants to tell stories collaboratively and reflect on the shared history of EMR. The insights gained from the workshops inform the writing of the storylines, and the communication of EMR shared history to the public. An average of 15 participants were recruited for each participatory design workshop, which consisted of several activities that were completed in sub-groups. The first group activity was card sorting in order to prioritize the themes of the shared history and to discover what provokes participants in their preferred theme, such as fortifications, languages, migration, religious infrastructure, immaterial heritage, etc.

The second was storyboarding to build a sequential narrative about how the chosen theme could be communicated to the public in an interactive way. This involved developing a persona as a representation of the real target audience, and then visualizing a

scenario by drawing a sequential narrative of the experience and writing captions about some of the persona's actions. To this end, four online participatory design workshops were organized for the cities of Maastricht, Tongeren, Liège and Aachen.

Focus Group with Project Partners. At the end of the project, a focus group with relevant project partners was organized in order to investigate how useful and meaningful the workshops had been for the project, and to what extent the results of the workshops will be considered in developing the different outputs of Terra Mosana (e.g. exhibitions, mobile apps, and onsite experiences). The questions of the focus group revolved around three main themes: (a) the design of participatory design workshops, (b) the move of workshops to online environments, and (c) the impact of workshops on the objectives of Terra Mosana.

3.3 The storylines writing

Within the 13 themes, and considering the preferences and recommendations given by the workshops' participants, 23 storylines were written [18]. The main principle behind the writing of each storyline was that it should tell a fragment of the common history of the Euregio in an innovative way. It was also necessary to go beyond geographical boundaries and the limits of our usual modes of representation. To this end, the storyline writers used the "Historical 3D Matrix - model" method developed in 2016 by Eric Wetzels who was also a Terra Mosana partner in the name of Maastricht municipality [19].

Elaborating these storylines, as with the themes, required a lot of research beforehand. One very important aspect was to ask for a lot of information exchange between the different partners. Since the format of the storylines was deliberately cross-border, each storyline author asked his or her partner(s) to provide any "local" elements of interest for the subject being dealt with. For example, for the storyline "1673" about the siege of Maastricht by the French armies (during which the musketeer d'Artagnan was killed), the Dutch partners asked all the other participants to provide them with a list of archival documents or museum objects (such as weapons) for example [20].

4 The example of Moving Central Places Theme

The moving Central Places theme explains the fact that the territory covered by the Terra Mosana project has known several central places, which can be viewed as "ephemeral capitals" [21, 22]. Contrary to neighboring regions, in the Terra Mosana territory, the seeds of temporal, spiritual or judicial power moved several times.

Initially, the territory was a Roman city - state (*civitas*) before being a diocese in the modern sense. This territory has known various forms of unity (political, religious, cultural, economic, ...) for about 15 centuries, from 10 BC (approximate date of the creation of the city of Tongeren) until 1559 AD, the date of the reform of the dioceses of Philip II of Spain, which considerably reduced the size of the medieval diocese. Like other city states and regions of the Gallo-Roman provinces, the *Civitas Tungrorum* was likely the basis for the constitution of the diocese of the Christian Church, which took the name of its new capital Liège around the 8th century. From then on, the medieval

texts refer to *Civitas Leodium*, which is translated as the bishopric or diocese of Liège, whose borders remained until 1559. During the Middle Ages and besides Tongres, Maastricht and Liège, the important cities of this diocese were notably Louvain, Looz, Aachen, Limburg, Namur, Bouillon [23, 24].

Before the achievement of the roman conquest during the 1st century BC, the Eburons were occupying the territory corresponding to the current provinces of Liège, Belgian and Dutch Limburg and the region of Aachen. Although several hypotheses exist on this subject, the location of their capital, *Atuatuca*, is still unknown today. When the Romans had completed their conquest, they created a new municipality, capital of the city – state: *civitas Tungrorum*. They founded and named its capital "*Atuatuca Tungrorum*" (today Tongeren) [21, 25]. In addition to an administrative and economic centre, Tongeren became, at the latest from the 4th century, the see of a bishopric which took its name. From that time also, the bishops exercised judicial power. In the 6th century, the bishop's see was transferred to Maastricht probably by St Monulphe. Since the middle of the 5th century Tongeren has been almost deserted. Maastricht on the contrary was a living and fortified city [22].

At the end of the 7th century, or at the beginning of the 8th century, the Bishop of Tongeren-Maastricht Lambert was killed in Liège. He was first buried in Maastricht but, following the emotion caused by his death, the site of his assassination became a place of pilgrimage. In 718 at the latest, his body was brought back to Liège for a secondary burial. The bishopric see (the bishop's religious jurisdiction that crosses, at that time, political borders) followed and was also transferred to Liège, probably at the end of the 8th century. In 985, the Bishop of Liège also became a temporal lord who ruled over an area directly under the authority of the Emperor of the Holy German Empire [24]. He died in Aachen and was buried in the Palatine Chapel in 814. It was here that, from 936 and for the 600 following years, the Emperors of the Holy Roman Empire were crowned [26, 27].

4.1 The storyline

The written storyline focuses on how the transfer of the episcopal see from Maastricht to Liège is an indirect consequence of the assassination of Saint Lambert in Liège, both a criminal case and a historical fact that has conditioned the whole regional history. Liège's first settlement in historic times was a Roman villa. Lambertus is said to have been killed in "the roman *villa*", but he was probably murdered in part of the *villa*, which was re-used, probably using the existing stone walls and covering it with a new roof. Unlike the sites of Namur, Huy or Maastricht in particular, Liège does not seem to have developed artisanal zones during antiquity or the very early Middle Ages. At that period, Liège was a little off-centre in relation to the main traffic axes: upstream of the ford between Herstal and Jupille, two roman *vici* located along the road that linked Tongeren to Trier. These two *vici* provided housing structures equipped with thermal baths and decorated with mosaic pavements, necropolises for incineration, storage areas and craft areas. A small temple dedicated to Apollo was also discovered in Jupille.

Bishop Lambert. Lambert was an aristocrat, born in Maastricht in the middle of the 7th century in a noble family. Maastricht was already at that time the episcopal see of

Tongeren-Maastricht. Lambert gained importance under the Merovingian king Childeric II, who in 675, was assassinated and then a very unstable period ensued. In 679 or 680 Pépin de Herstal seized power in Austrasia as mayor of the Palace. In the meantime, bishop Lambert had been deposed in favour of Pharamond who ran the church of Tongeren-Maastricht for seven years. In 682 Pharamond was deposed in his turn and Pépin de Herstal restored Lambert on the episcopal throne. One can think from all these events that there was, at that time, a clan hostile to Lambert's clan and that the death of Childeric II strengthened this clan, then that the coming to power of Pépin de Herstal weakened it. At that time, the struggle of family groups for local territorial power was common. It is also likely that this clan and power feud was the cause of the assassination of Saint Lambert. Lambert's murder is thus one episode among others of a clan war, a *vendetta.* [28, 29].

Assassination of Lambert. During the night of 17 September of an unknown year between 696 and 705, Lambert was murdered in the village of Liège. According to the *Vita vetustissima*, an anonymous document written between 727 and 743, two members of Lambert's clan, perhaps even his nephews, Petrus and Autlaecus, would have killed Gallus and Rivaldus, two brothers, relatives or in any case members of Dodon's clan. It would therefore be the one who, in retaliation, would be at the instigation of the bishop's murder. According to the *Vita vetustissima* still, the attackers would have entered the place where Lambert was gathering; one of them would have climbed on the roof, removed the vegetal covering and killed the bishop with a spear.

At first, Lambert had an aristocratic reflex, that of taking up a weapon. Then he renounced it and behaved like a man of God. Given the exemplary nature of his life (and death), Lambert was immediately considered as a martyr and a saint. Dodon and his clan were powerful and even the mayor of the Palace, Pepin de Herstal, was relatively powerless. Perhaps it is to erase this relative impotence, another explanation for the assassination was that the second wife (or concubine) of Pepin de Herstal, Alpaïde, would have asked Dodon (presented in this version as her brother) to eliminate Saint Lambert. The reason given by later authors of this version is that Lambert would have reproached Pepin for his relationship with Alpaïde. Contemporary historians have broken this legend in order to re-establish a narrative closer to the actual course of events [28, 29].

After the murder. Just after Lambert's murder his successor, Bishop Hubert, brought his body by boat to the Saint Peter's church of Maastricht, probably the current Saint Servatius church. In Liège, however, emotions quickly grew up around the place of the murder, where then miracles began to happen. The cult of Saint Lambert developed to the point that a first building (a basilica), placed under the patronage of Notre-Dame, was built.

Several years after the assassination, Bishop Hubert had Lambert's relics returned to Liège to be buried in the newly constructed building. From then on, the site became a place of pilgrimage. The war of the clans that had killed Saint Lambert continued, since in 714 Grimoald II (son and designated successor of the mayor of the palace of Pepin de Herstal, who died the same year) was assassinated while he was praying at the tomb of Saint Lambert in Liège. It can therefore be assumed that Lambert's body had already

been brought back from Maastricht at that time and that therefore the assassination of Saint Lambert is in fact prior to 705 and, it could have been 17 September 705 [30–33].

It is difficult to know exactly when the see of the bishopric was transferred from Maastricht to Liège. It must certainly have been between the middle of the 8th century and the beginning of the following century. All the successors of Pepin II: Charles Martel, then Pepin III and then Charlemagne regularly resided in their palaces in the Liège region, notably Charlemagne who celebrated Easter in Liège in 770 and in Herstal in 784. We also know, thanks to archaeology, that the first building built after Lambert's death was replaced by a larger Carolingian edifice. The latter probably coincides with the double cathedral dedicated to Saint-Lambert and Notre-Dame erected when the seat of the bishopric was transferred. From then on, Liège became the centre of a bishopric, and then of an episcopal principality. For almost a thousand years, the city's physiognomy was marked by the juxtaposed presence of a cathedral and an episcopal palace. This functional duality of the place was broken shortly after the French and Liège revolutions when, in 1794, the revolutionaries began the demolition of the cathedral, which they considered to be the symbol of the power of the prince bishop [34, 35].

Impact of the transfer of the bishopric see. The murder of Saint Lambert and its indirect consequence, the transfer of the episcopal see, had a considerable influence on the history of the city of Liège but also on regional history. Let us note however that three elements contributed to increase the consequences of this various fact: Hubert's choice to bring the body back to Liège, the devotion of the Pippinides family (who later became Carolingian) and finally the setting up, just before the year 1000, of the system of the Imperial Church which made the chief town of the diocese the capital of a territorial state. Once this configuration was in place, Liège acquired a religious, political and economic position of primary importance at the regional (and even international at certain times) level. Its architecture and town planning benefited from this, as did the territory of the former *civitas tungrorum*, which became the Principality of Liège and was therefore entirely reorganised around this new centre.

4.2   From storytelling to 3D experiences

The places chosen to set up the two 3D virtual immersion experiments resulting from the Central Place storyline are located under the current Place Saint Lambert in Liège. They are both situated inside the Archéoforum of the Walloon Agency for Archaeology and Heritage (AWAP). The Archéoforum of Liège is both a museum and an archaeological site. It is located underneath the current Place Saint-Lambert and covers more than 3,725 m². Excavations in the Place Saint Lambert have brought to light remains dating back almost 9,000 years. Mesolithic, Gallo-Roman, Merovingian, Carolingian, Romanesque and Gothic traces are still visible today. With them, the roots of Liège have been carefully preserved. Indeed, it was here in an annex of the Gallo-Roman villa, that Bishop Lambert was murdered at the beginning of the 8th century.

The Archéoforum offers visitors a museum trail through the still preserved remains: from the Gallo-Roman villa to the foundations of the Gothic cathedral, each period is physically represented by fragments of walls, architectural elements or objects from daily life. The scenography is structured around a timeline, evoking the urban landscape

over the centuries. A series of showcases containing numerous previously unseen pieces from the collections and reserves of the Grand Curtius and the Walloon Region's Provincial Archaeology Service punctuate the tour and explore the various themes addressed. The Archéoforum also provides its visitors with interactive digital tablets. Quadrilingual, they offer, with flexibility and simplicity, an exceptional set of documents. They cover topics as varied as excavation techniques, conservation measures, daily life in a Gallo-Roman villa and the construction of cathedrals. Therefore, the two 3D experiments had to fit into a pre-existing museographic project that had to be complemented in a relevant way. They also had to fit into a symbolically charged environment.

Archéoforum 3D experience 1: The first crypt was built by Prince Bishop Notger as a shrine to house the relics of St. Lambert and to allow pilgrims to worship. The crypt was likely built on the site of the martyrium, i.e., the place where Lambert was murdered around the year 700. At the moment, it is difficult for the visitor to imagine that this sort of cellar was originally a wooden hut, which stood against the Roman villa. It is also difficult to imagine the interior of the Notgerian crypt, which was so popular in the 11th century.

The virtual reality (VR) experience manages to re-implant a 3D digital Merovingian hut in the place where it was originally located. The assassination of Lambert is evoked through a filmed scene embedded in the virtual hut. In a second step, this hut is then transformed into the 3D modelled interior of the 11th century crypt. The shrine containing the relics of St. Lambert is shown and pilgrims walk around the shrine.

Fig.2: Positioning of two screens – doors to the past into the current crypt remains

The reproduction of these two scenes is carried out through two immersive devices positioned in the ruins of the Crypt. The exact positioning of these devices is described in Fig.2. These devices are made up of a vertical television, a computer and a camera sensitive to the movements of the viewer. The camera is placed on the top edge of the television. It follows the movement of the head of the viewer watching the television, and when the viewer moves his or her head, the image is adapted to give the effect that the viewer is looking through a window and not a television.

Archéoforum 3D experience 2: The hemi-dome allows visitors to observe the current tangle of western walls of the various buildings that succeeded the Gallo-Roman villa following Lambert's assassination. These buildings are: the Merovingian church, the Carolingian cathedral, the Notgerian - Romanesque cathedral, and the Gothic cathedral.

The position of the visitor's area is outside these ancient buildings. In the current state of the room, it is rather difficult to make non-specialists aware of two important things, such as where they are in relation to St. Lambert's Square or the actual elevation of the ancient buildings. The VR experience helps to answer these two questions. Visitors can witness the successive reconstruction of each of these walls, from the most recent to the oldest, using virtual glasses. The viewer - manipulator of the virtual helmet - can explore these old gables by deciding where to point his binoculars. Then the walls disappear to make way for the Gallo-Roman villa. The visitor steps back and gradually rises into the air. They discover the Roman landscape and begin a slow aerial rotation around the site and witness its evolution over time.

Softwares and other technical questions: The two experiences of the Archéoforum were designed following the same creative protocol. First of all, the computer graphics designers used the point clouds of the archaeological sites obtained by laser scan. To reconstruct the buildings in elevation, they used the excavation plans and established a dialogue with the archaeologists for the details of the elevations (superstructures, textures etc...). The 3D models were designed using Unity software.

5   Discussion

Archéoforum onsite experiences 1 and 2 are intended to complement the existing museographic arsenal. It aims to offer visitors an experience that enriches their understanding of the site and the remains that are still visible. It helps them, in an interactive and stimulating way, to understand several elements such as where they are, or how the ruins are located comparing with the current urban infrastructures.

In comparison with other scientific teams working on similar projects [36], we also used a laser scan and a point cloud for our two experiments. However, we used this field data to set the virtual scene. We then detached ourselves from modelling reality in favour of a modelled historical reconstruction. An important choice was made here to let storytelling drive development and technical decisions, not the other way around.

For these models and reconstructions, we also adopted a resolutely didactic and non-spectacular position. Our aim was not to make visitors feel like they were in a cinema, but to make them exercise their critical thinking and curiosity, because they were in a museum. From a more general point of view, the three missions that Terra Mosana's partners had to fulfil influenced each other to the point of increasing their respective benefits. Since the projects have been recently launched, we cannot yet present feedback from visitors. These opinions will obviously be taken into account in the near future.

Public participation influenced the storylines by showing a greater interest in topics related to contemporary issues. It also influenced the choice of the implementation of the onsite experiences by favouring experiences delivered in a mixed form (mixing virtual and real). The writing of storylines has had an obvious impact on 3D experiences since it has provided them with a subject and the framework for the scenarios implemented. The storytelling, resolutely turned towards a cross-border point of view, had an impact on the audience because they were presented with an international perspective, which is not common in these types of digitally reconstructed historical experiences to date.
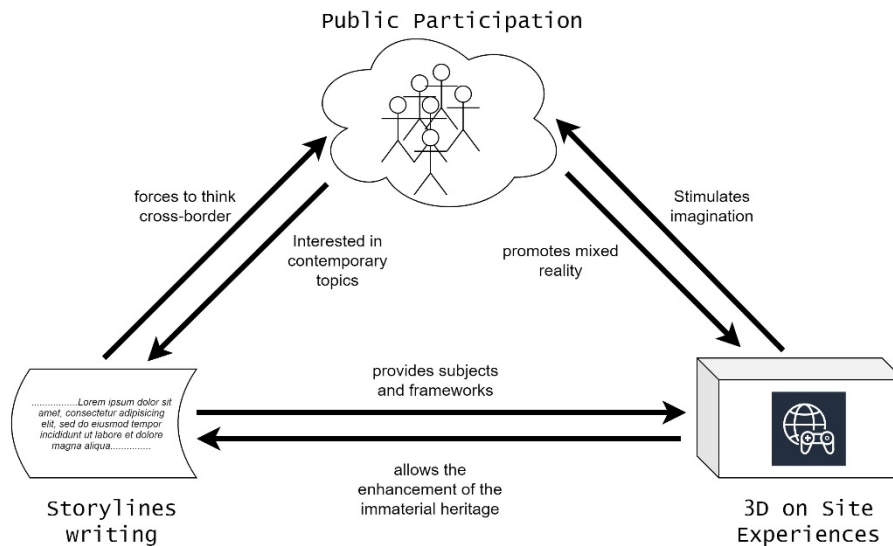
Fig. 3: Schema of interactions between public participation, 3D on site experiences and storylines writing

Finally, the onsite 3D experiments influenced the user panels involved in participatory workshops by stimulating their imagination, but we can speak here of an impact 'in absentia'. At the time of the participatory workshops, the experiments did not yet exist, so the participants were therefore free to imagine any type of digital restitution such as an augmented reality application following the visitors of an exhibition to provide them with the explanations of the documents exposed in real time. Finally, these

experiments also influenced storytelling by allowing authors to tackle historical or heritage issues that were detached from the "only possible" (that is the tangible locations visible today) to tackle intangible events or places.

Besides these undeniable gains however, one limitation was that we did not manage to express the transregional aspect of the subject matter to the level we desired to implement within the experiences. Moreover, the deadlines for the realization of the 3D models and the pre-established choice of their locations placed some constraints on the participatory workshops and the writing. Therefore, some recommendations from the participatory workshops, which came after the choice of the storyline, could not be included. This led to a learning for future project planning that we should organize the order of the methodology differently for the story construction process.

6   Conclusion

In conclusion, it can be recalled that the actors of the Terra Mosana project had to overcome several challenges. These included, establishing an efficient collaboration between 12 partners coming from different disciplines, using different modes of operation, and they had several tasks to fulfil. They needed to obtain public participation, write cross-border storylines and base the onsite 3D experiments on the pre-established 13 story themes. We demonstrated that the Terra Mosana project largely overcame the difficulties along the way and succeeded in producing 3D onsite experiences based on original scenarios that were themselves partly inspired by suggestions from the public. However, there is still work to be done to connect all these achievements across the project partners' outputs into a global framework and to further increase the visibility and marketing efforts. Here too, public and citizen participation will prove to be a very important asset.

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