Article

Participatory Design Workshops: Interdisciplinary Encounters within a Collaborative Digital Heritage Project

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Abstract: This article aims to investigate how participatory design influences interdisciplinary relationships in digital heritage projects. In particular, the article reflects on opportunities and challenges of interdisciplinary encounters in participatory design, with the cross-border project "Terra Mosana" as a case study, which aims to investigate, digitalize, and communicate the shared heritage of the Meuse–Rhine Euregion (EMR). Terra Mosana is a collaboration between multiple partners from municipalities, museums, cultural heritage sites, and universities in different EMR cities. Partners of the project have different backgrounds that vary from archaeologists, historians, and heritage professionals to computer scientists, developers, and communication specialists. My role in this project focused on designing and organizing several participatory design workshops with citizens of the EMR, aiming to empower and enable them to share their views about their shared history, and what they want from museums and other cultural institutions. Those workshops play a crucial role in the project by creating meaningful connections across the different disciplines involved in the project. In this article, I focus on the negotiation processes between the partners involved: What challenges were they confronted with? How did they arrive at creative solutions, and which issues remained unresolved? My analysis does not draw only on my participatory observation of workshops, but also on a focus group discussion that invited the partners to reflect on and assess the collaborative process.

Keywords: participatory design; digital heritage; interdisciplinary; Terra Mosana

1. Introduction

Interdisciplinary research has been described as the type of research that synthesizes multiple disciplines with non-discipline-specific research approaches [1]. This type of research integrates several perspectives, techniques, concepts, and information from two or more bodies of specialized knowledge or research [2]. It has been suggested that the differences between disciplines—representation of different cultures—provide an opportunity to view research challenges from different perspectives using different focuses, and tools, as well as enabling the different disciplines to learn from and contribute to each other [3,4]. Although there are opportunities, there are also barriers, and the different types of interrelations between disciplines that are embodied in interdisciplinary assemblages, might lead to different approaches to organizing, doing and publishing research, making it challenging to develop a shared understanding and decisions such as between researchers form social and natural sciences [5,6].

In digital heritage research projects, partners from different disciplines collaborate with each other, sharing the main objective of documenting and presenting heritage to ensure that it remains accessible to the public and to prevent it from disappearing. Digital heritage is a field that requires several skills and competences spanning different sectors, such as archaeology, museology, art history, cultural heritage, conservation, computer science, human-computer interaction, communication and project management.

The participatory approach of digital heritage projects is widened to include not only project partners, but also the involvement of local communities in co-creating heritage collections (e.g., [7,8]). Previously, the participation was perceived as only providing a free access to the digital collections, but then the term 'access' has been redefined to include more opportunities for how the public actively participate in co-creation, inclusiveness, and the promotion of cultural diversity [9]. It is argued that this movement toward heritage co-creation might well promote participatory engagement, informal learning, and digital literacy.

Cultural institutions and museums are increasingly open to the concepts of cultural diversity and collective memory. Therefore, social media is adopted as a tool by several institutions for participatory communication and informal learning, empowering the public in a more participatory, multicultural, and engaged society (e.g., [10]). Social media applications (e.g., including blogs and content shares) have been used to facilitate a participative cultural experience. Enabling local communities to create, upload, share, and interact with digital content of cultural heritage demonstrates a proven and growing demand for cultural participation, exploration of identity, and creative expression [11]. In addition, the participative aspect of social media casts a continuous and accumulating memory of the multitude, enabling the public to change the parameters of the who, what, when and why of remembering [12], and diminishing the authority of the 'gatekeepers' of memory [13].

Moreover, digital heritage projects tend to involve local communities in the design activities of the technological solutions (e.g., [14]), and in the development of the digital narrative. These participatory practices correspond to the emerging concept of heritage democratization [15], such as the empowerment of local communities to address local issues about heritage, and to involve them in generating insights about the presentation and accessibility of heritage [16].

As part of the collaborative Euregional project "Terra Mosana"[1], together with our project partners, we planned several participatory design workshops to be held in different cities of the Meuse–Rhine Euregion (EMR)[2], illustrated in the map of Figure 1. With these workshops, we intended to engage and involve local citizens in design activities about the investigation of the EMR shared heritage, and how it can be disseminated through digital storytelling. The main goal was to elicit local knowledge rooted in local residents' lived experiences, as well as to collect feedback on the proposed heritage storylines and interaction designs. We argue that the creative involvement and engagement between different perspectives and stakeholders represents one of the key qualities of Terra Mosana project, in particular the involvement of the EMR residents in the design activities of heritage storylines as well as outputs and exhibitions. This differs from other heritage communication approaches, where technologies are applied to existing cultural heritage assets and museum collections based on predefined heritage knowledge. Rather, we shift the focus to participatory processes of dialogue and transformation, in which emergent forms of cultural heritage can be co-created among professionals, academics, and the EMR residents as well to support new forms of digital engagement.

Initially, we planned our participatory design workshops to be held on-site, but as a consequence of the COVID-19 lockdown, we moved the workshops online, developing a scenario that facilitates both synchronous and asynchronous activities. The dynamics of the workshops were based on virtual co-creation methods that encourage participants to collaboratively tell stories and reflect on the EMR shared heritage. Based on the results of the online participatory design workshops, we discussed the lessons learned about how different communication tools and infrastructures influenced individual and collective participation during the pandemic [17]. We concluded that moving the workshops online positively influenced the engagement, participation, and inclusion in the participatory design process, such as (a) benefiting from the vast amount of online tools that can be utilized for different purposes, (b) the potential to expand participation to other people who may not be able to participate in face-to-face sessions due to travel and time-zone differences, (c) the ease of documentation using online tools that support traceability of

actions, (d) the increased level of privacy, and (e) the cost and time efficiency. However, we also faced a number of challenges, such as (a) the need to train participants who were not familiar with online tools, (b) the unexpected technical issues, and (c) the reduced non-verbal communications among participants. Overall, the process and output of the workshops provided insights to our partners responsible regarding narratives (i.e., historians and archaeologists) about the writing of the themes and storylines, as well as inspire our partners responsible for developing the digital outputs (i.e., developers and computer scientists) about how the EMR shared heritage should be communicated to the public in engaging and meaningful manners.

Figure 1. Terra Mosana Map (the Meuse–Rhine Euregion): Medium orange on the East corresponds to North Rhine–Westphalia, light orange is Dutch Limburg, medium orange on the West is Belgian Limburg, and dark orange is the province of Liège. The hatched areas indicate the German-speaking parts of the Province of Liège.

Accordingly, this article aims to investigate how participatory design influences interdisciplinary relationships in digital heritage projects. In particular, the article reflects on the opportunities and challenges of interdisciplinary encounters in participatory design within Terra Mosana project. The results and analysis are based on my observation of the participatory design process, and on a focus group discussion that invited the partners to reflect on and assess the collaborative process.

2. Qualities and Interdisciplinarity of Participatory Design

Within the field of human–computer interaction (HCI), and related disciplines, participatory design is considered as an effective approach for developing solutions, where end users are involved throughout the design process. Participatory design is an approach of active involvement of users in user-centered design, enabling them to share their feedback and insights in design decisions about products and services that influence their lives [18,19]. The primary motivation for participatory design is the democratic ideal that the people who are affected by a decision should be given the opportunity to influence it. Accordingly, participatory design aims to include all relevant stakeholders in each phase of the design process. Such stakeholders include designers, customers, general users, the community at large, and others. When it comes to designing for the public, users are particularly valuable stakeholders [20]. The main purpose of involving users in the design process is to get better insights about future use situations in order to design services or products that align with their needs and requirements [21].

Participatory design is considered a helpful and convenient way of researching and developing new designs because it focuses on how different stakeholders verbally exchange their design ideas, which is particularly important in the early design stages. Participatory design can be implemented in several ways, such as workshops, cooperative prototyping, building mock-ups, card sorting, user design, and even ethnography. In a participatory design workshop, designers and other stakeholders collaborate to create ideas, designs, or even a simple understanding of certain problems to look for a possible solution [20].

In the participatory design process, roles are distributed among participants according to their disciplinary background, their profiles (e.g., initiator, or facilitator), or even the form of design participation (e.g., operational, functional, or conceptual). For instance, the researcher should take on the role of a facilitator, he/she provides tools for ideation and expression; guides and encourages participants at all levels of creativity, and should have experience of working in interdisciplinary and multidisciplinary teams [22]. Previous studies on participatory design in museums and heritage environments argued that professionals of cultural heritage should be only as informants and facilitators, but they need to be actively engaged as designers [14].

There are several digital heritage projects that have adopted the interdisciplinary approaches, combining expertise from various fields such as archaeology, history, art history, computer science, engineering, and more. Here are a few examples:

- *Virtual Pompeii:*[3] This project combines archaeology and computer graphics to create a 3D model of the ancient Roman city of Pompeii as it was before the eruption of Mount Vesuvius in 79 AD. The project combines archaeological data with computer graphics and virtual reality technology to provide a unique interactive experience.
- *CyArk:*[4] This is a non-profit organization that uses laser scanning and 3D modeling technology to create digital archives of cultural heritage sites and monuments. CyArk's projects combine archaeology, engineering, and computer science to create detailed 3D models that can be used for research, preservation, and education.
- *The Digital Dubliners Project*:[5] This project aimed to digitize the works of James Joyce, one of Ireland's most famous writers. The interdisciplinary team involved experts in the fields of literature, history, technology, and heritage who worked together to create a digital platform that would allow scholars and the general public to access and explore Joyce's works in new and innovative ways.
- *The Memory of the Netherlands*:[6] This project is focused on the cultural heritage of the Netherlands and involves a team of historians, archaeologists, and computer scientists who are working together to create a digital archive of the country's cultural heritage. The project includes a database of artifacts, a virtual museum, and a website that provides information and resources for researchers and the general public.
- *Virtual Curation Laboratory:*[7] This project brings together a team of archaeologists, computer scientists, and educators to create digital models of artifacts and other cultural heritage objects. The goal of the project is to use digital technologies to make these objects accessible to a wider audience and to provide educational resources for students and the general public.

These are just some examples of digital heritage projects that have used interdisciplinary approaches, demonstrating the benefits of bringing together experts and professionals from different fields to work on digital heritage projects. However, it seems that little is known about how the approach of participatory design might influence interdisciplinary relationships in the collaborative projects of digital heritage. As a designer, facilitator, and co-organizer of the participatory design workshops among different disciplines, I discuss in this article the possibilities and challenges of the interdisciplinary participatory design in digital heritage project. The challenges are not necessarily characteristics of interdisciplinarity, but some could be ascribed to intercultural differences, managerial aspects, or unexpected situations.

3. Participatory Design of the Interdisciplinary Project 'Terra Mosana'

Terra Mosana is a collaborative cross-border EU project, bringing together archaeologists, historians, cultural heritage specialists, developers, technical specialists, and policy makers working in municipalities, museums, heritage sites, and universities. The main aim of the Terra Mosana project is to investigate, digitalize and communicate the shared heritage of EMR. Partners from various EMR cities collaborate together in order to develop digital narratives through 3D modelling, augmented reality, and on-site digital experiences connecting cultural heritage sites in Belgium (i.e., Liège, Leopoldsburg and Tongeren), Germany (i.e., Aachen and Jülich), and Netherlands (i.e., Maastricht). Five work packages form the backbone of Terra Mosana; each work package (WP) requires collaboration between the different partners to realize certain tasks, deliverables, and milestones.

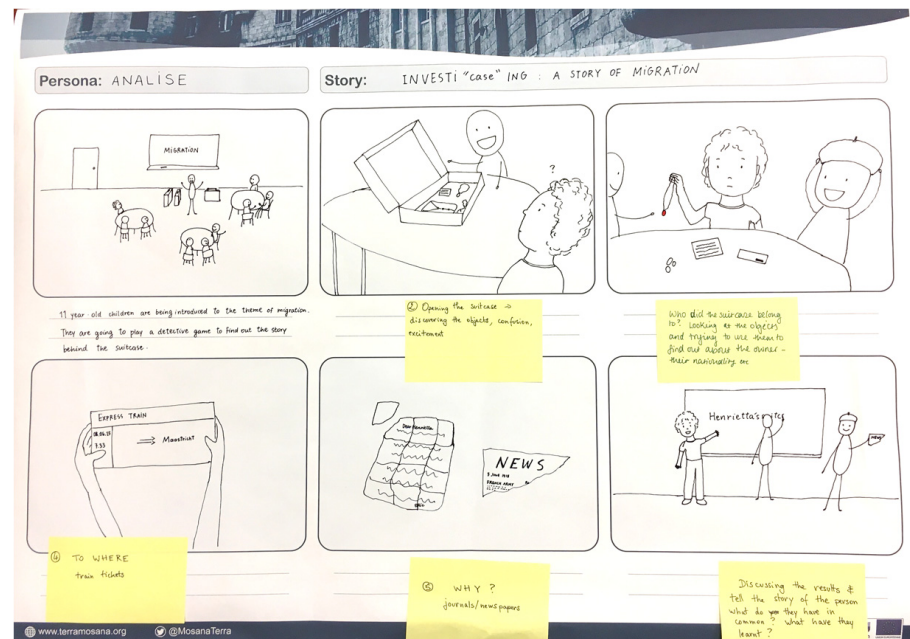*3.1. Design of Terra Mosana Participatory Design Workshops*

As part of the project, several participatory design workshops were organized for engaging and involving local residents of the EMR in the design activities of Terra Mosana's digital storytelling. The participatory design workshops were part of WP1 of the project, which focuses on project sustainability and is coordinated by Maastricht University. The results of the participatory design workshops were expected to be considered in re-writing the storylines (WP2) and in developing the digital outputs (WP3), and also to better prepare for the future of the project.

The main aim of the participatory design workshops was to gain insights in shared interests and thematic preferences by enabling residents of the EMR to collaborate with stakeholders by providing input and sharing their views on the shared history. The organizers of participatory design workshops collaborated with other project partners, who were responsible for the narrative and provided thirteen themes[8] of the shared heritage in the EMR, such as religious infrastructure, migration, fortifications, languages, intangible heritage, etc. The criteria for choosing those specific themes were their cross-border aspect, their temporal recurrence, and their relevance for the territory of Terra Mosana [23]. Those themes have been chosen, developed, and intensively investigated by archaeologists and historians to highlight the shared heritage of the Euregion with the aim of achieving a shared identity feeling through the digital exploitation of their cultural heritage, highlighting the different aspects of each theme and how it influenced the multiple regions of the Terra Mosana territory. Regarding the participatory design workshops, we standardized how the project themes/storylines would be presented in the workshops. Archaeologists and historians were motivated to participate in the workshops to collect feedback and gain insights about how the writing process of the storylines would benefit from the input of workshops' participants.

Initially, we had planned the workshops to be held on-site in several cities of the Euregion by designing group activities that encourage participants to provide feedback and share their knowledge on the shared heritage of the EMR. We planned to recruit around fifteen participants for each participatory design workshop that consisted of multiple activities done in smaller groups. The first activity was *card sorting* that aimed to prioritize the thirteen themes of the shared heritage and to discover what intrigues participants in their preferred theme, such as religious infrastructure, migration, fortifications, languages, intangible heritage, etc. The second activity was *storyboarding*, which aimed to construct a sequential narrative about how the information of their preferred theme could be disseminated to the public in an interactive manner. That activity involved first developing a fictional persona as a representation of the real target audience (i.e., tourists), and then visualizing a scenario by sketching a sequential narrative of the experience with concise captions added about some of the persona's actions. By the end of the workshop, all groups were invited to present how they prioritize the themes, and which scenario they developed of their expected experience.

Before conducting the actual workshops with residents of the EMR, we managed only to organize a pilot workshop, based on the original plan (i.e., before COVID), with

22 students from the international Master's Arts and Heritage, and the Dutch program *Kunst, Cultuur en Erfgoed* (Faculty of Arts and Social Sciences, Maastricht University)—see Figure 2a. The pilot workshop aimed to (a) reveal any obvious usability issues, such as whether participants could intuitively understand the workshop activities and properly manage to conduct them, and (b) to set up a standard base of the following workshops in the other cities. In addition, 18 project partners (from Maastricht, Liege, Aachen, Tongeren, Leopoldsburg and Jülich) were also present at the pilot workshop either observing, mentoring the students, or participating in the activities of the workshop.

(**a**)
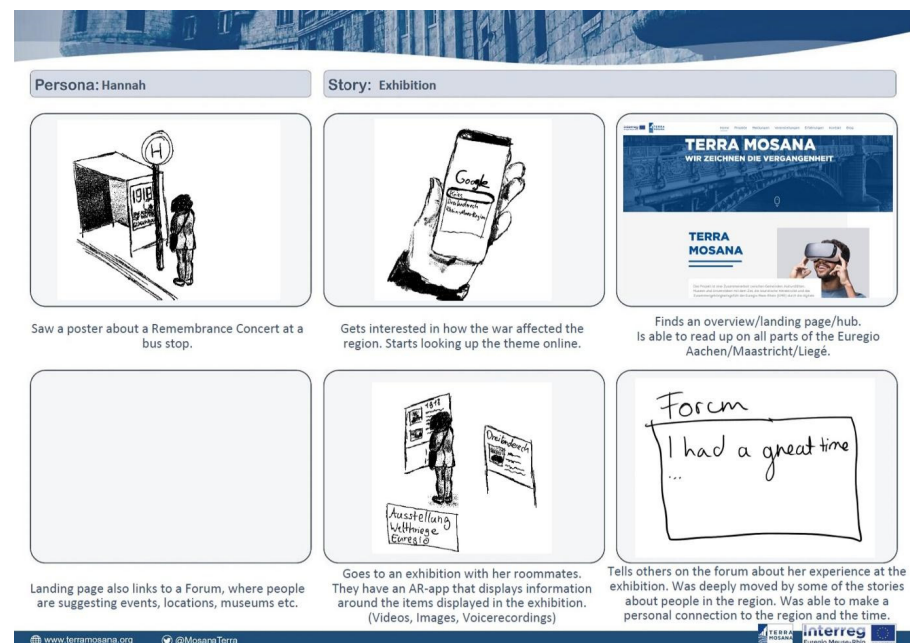
(**b**)

Figure 2. Samples from the storyboarding activity during the participatory design workshops of Terra Mosana project: (**a**) on-site workshop 'pilot', and (**b**) online workshops 'Aachen'.

However, the restrictions of the COVID-19 pandemic forced us to come up with an alternative plan for organizing the workshops. Thus, we developed an 'online' scenario that facilitates both asynchronous and synchronous activities. The dynamics of the workshop are based on virtual co-creation methods [24] that encourage participants to collaboratively tell stories and reflect on the shared heritage of EMR. Each online workshop encompassed two online sessions: (a) an introductory session, in which we explained the project, its different themes, the workshop expectations, and the setup of the second session; and (b) the activity session, which usually took place a few days later, in which participants were invited to sort the Terra Mosana themes, and to develop the storyboards in smaller groups (Figure 2b). As an asynchronous activity, during the few days between the two sessions, participants were encouraged to familiarize themselves with the themes of the shared heritage by going through the posters on the website of the project. For this purpose, four online participatory design workshops were organized for the cities of Maastricht, Liege, Aachen, and Tongeren.

The recruitment of participants of the workshops was the responsibility of the project partner who organized the workshop (i.e., RWTH Aachen, and the municipalities of Maastricht, Tongeren, and Liege). In order to achieve a diverse representation of the EMR residents in the workshops, we aimed to recruit participants of different genders, backgrounds, and age ranges. We used different communication channels to recruit participants; however, most participants were recruited via personal contacts, and only a limited response was obtained through social media channels.

As illustrated in Table 1, the goal of having 12 to 15 participants was not always reached; sometimes we had fewer participants than originally planned. There was enough variation in the background demographics of the workshops held in Maastricht, Tongeren, and Liege, including participants with different age ranges and backgrounds. However, the Aachen workshop consisted of university students. Not all participants who attended the first session could make it for the second session due to different reasons (e.g., illness, or other appointments).

Table 1. Demographics of recruited participants of online workshops of Terra Mosana.

	Maastricht	Tongeren	Liege	Aachen
No. of invited participants	20	NA	60	15
No. of participants (1st session)	13	12	11	10
No. of participants (2nd session)	10	12	11	8
Gender	4M, 6F	7M, 5F	3M, 8F	3M, 5F
Age range	28–64	27–73	25–67	20–25
	$M = 44$	$M = 54$	$M = 45$	$M = 22$
	$SD = 12.52$	$SD = 16.95$	$SD = 15.62$	$SD = 1.94$

Before each of the workshops, much preparation had to be carried out according to the role of each of the organizers, such as creating a shared online folder with all the necessary documents (e.g., the posters and the templates needed for the different activities of the workshops). If needed, these documents were translated by the partners of the project. A standard email was sent out to the organizers of the different workshops, which contained links of Zoom sessions, a link to the consent form, and a link to the shared folder with all required documents during the workshop. A few days before each workshop, a meeting with the partners was organized for discussing the practical aspects and the course of the two sessions.

3.2. Focus Group with Project Partners

After all the participatory design workshops of Terra Mosana (both on-site and online) had taken place, we decided to organize a focus group with relevant project partners to examine how meaningful and useful the workshops for the project, and to what extent the workshops' results will be taken into consideration in developing and designing the

different outcomes of Terra Mosana (e.g., mobile apps, exhibitions, and onsite experiences). Moreover, the focus group was meant as an opportunity to communicate the results of the workshops to all project partners and to our academic peers who are interested in both the process of online workshops and the results. We also reflected on the challenges and concerns we encountered.

Workshop organizers, work-package leaders, and the management team of Terra Mosana were invited to an online session via Zoom video conferencing tool. Nine partners from five cities representing different disciplines (i.e., historians, archeologists, computer scientists, communication team, and coordinators of the project) participated in the two-hour session that was video recorded. The session started with a short introduction and all participants were asked to sign an online consent form. The questions of the focus group focused on three main themes: (a) how the workshops were designed, (b) how the approach of participatory design was influenced by moving the workshops to online environments, and (c) to what extent the results of the workshops might impact the objectives of Terra Mosana.
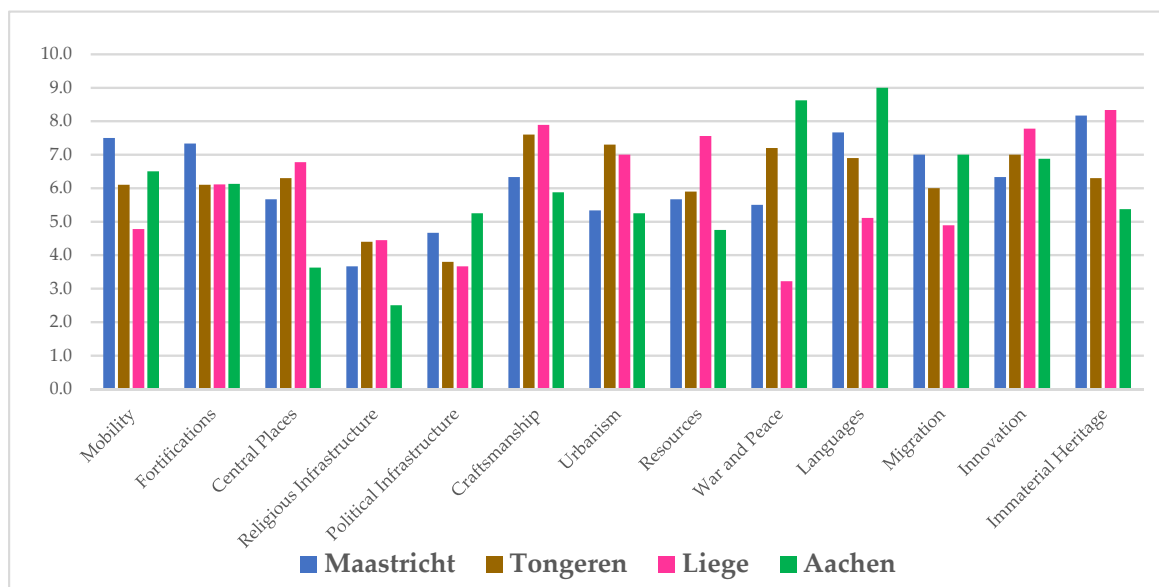
4. Results

In this section, only the results that relate to the interdisciplinary encounters in participatory design are presented based on the observation of the participatory design process, and also based on the focus group with project partners. The analysis is influenced by the author's role in the project as a designer, facilitator, and co-organizer of the participatory design workshops. Previous research on participatory design draws an analogy between the example of a person holding a gun and the analysis of participatory design, as it is neither the person nor the gun that is responsible for shooting, but the configuration that emerges in combining the two as an alliance [25]. Similarly, it is argued that participatory design research should not be analyzed based on the method itself nor the designer, but the designer using the method [26,27].

In general, the results obtained from the different activities of the participatory design workshops influence how partners of Terra Mosana could improve their plans and intentions for digital storytelling. During the focus group, the first set of questions asked participants to identify one positive and one negative aspect of the workshops. Some project partners reflected on the qualities of participatory design such as listening to other perspectives, involving all kinds of people, and even enjoying the group activities of the workshops themselves. Others related the workshops to their role in the project, such as how people sorted the themes and realizing that the themes are in need of revision as they were abstractly formulated (WP on narrative of storylines). Likewise, the storyboards helped in identifying how people would prefer to interact with the different themes of the shared heritage (WP on digital outputs).

Several types of results about the participatory design workshops were communicated to the partners during the focus group, such as the demographics of workshop participants, and how participants prioritized the themes of the shared history. With regard to the results about the feedback of participants, partners were positively surprised by the high rating of participants in terms of relevance, as it shows how the workshops really matter.

Results about sorting the themes (Figure 3) did not surprise project partners, as they admitted that the way posters had been written influenced the sorting. They realized that several themes are in need of revision as they were formulated too abstractly. For instance, the theme of 'religious infrastructure' was the least preferred theme by the workshops' participants, but if certain examples had been included (e.g., Murder of Lambertus)[9], the ranking might have been different. Archaeologists and historians do not expect to dramatically change the content of each of the themes, but instead aim to adjust how storylines are presented, making them more accessible and engaging to the lay visitors. For instance, the Tongeren municipality worked on revieing and re-writing the texts of their onsite exhibition with the help of an external editor.

Figure 3. Results of rating the different themes of Terra Mosana (on a scale from 0 'least preferred' to 10 'most preferred') based on preferences of participants of each of the online participatory design workshops. Themes such as languages, innovation, craftsmanship and immaterial heritage turned out to be the most preferred, while themes such as religious and political infrastructures were the least preferred.

In addition, the activity of storyboarding helped project partners to understand how people would interact with the themes of heritage and what makes them interested. From the results of the focus group, our partners were positive about the activity of creating a persona, as they found that developing a fictional character guided participants to step outside of their own perspective. The communication team of Terra Mosana mentioned that the use of fictional persona in developing the storylines helped them to gain more awareness of audiences.

Overall, the participatory design workshops were an interesting and insightful experience for Terra Mosana. Yet, the point in time at which they were conducted remains questionable. Since most products and deliverables are in the final stages of being implemented, it is challenging to pivot ideas around the new insights and focus of interests for the onsite experiences at this stage of the project.

Based on the abovementioned results and insights of the Terra Mosana participatory process, I argue that participatory design workshops enabled us to involve all relevant disciplines in the project, and to bridge the gaps between the different objectives of the project, as shown in Figure 4. For instance, the first objective 'investigate' was linked to the second objective 'digitize' by informing us which themes/stories of the shared history that we already investigated should be digitized. Likewise, the workshops created a meaningful link between the second objective 'digitize' to the third objective 'communicate' by proposing scenarios about how the digitized heritage/shared history could be disseminated and communicated to the public in interactive, engaging, and meaningful manners.
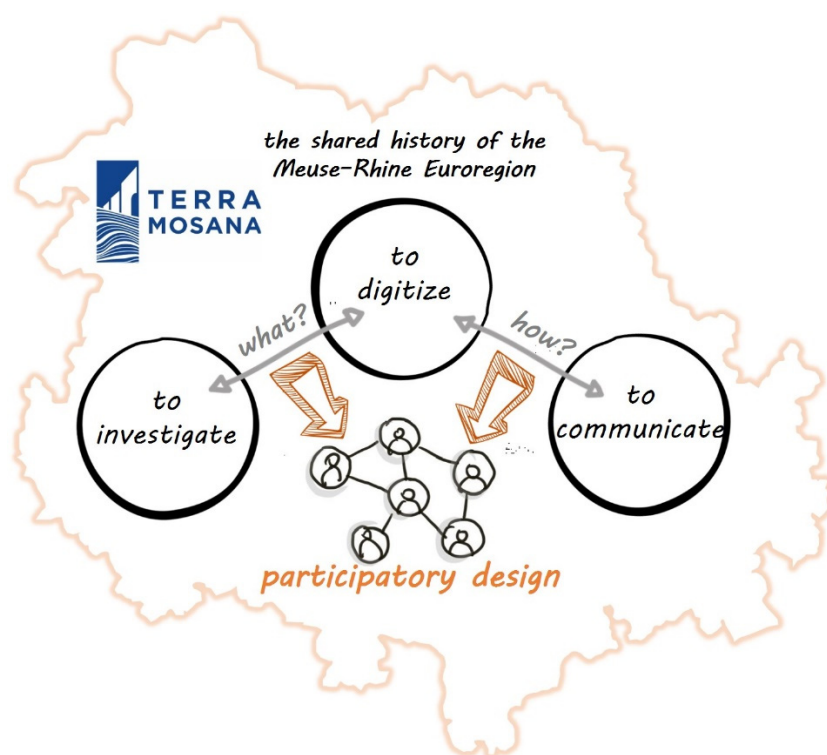
Figure 4. Mapping the importance of the participatory design workshops to the main objectives and work-packages of Terra Mosana project about the shared history in the EMR.

5. Discussion

The results of the participatory process that we followed in the Terra Mosana project show that it is beneficial for digital heritage projects to leverage interdisciplinary relationships to allow for collective productivity and unique perspectives by partners from different disciplines. These qualities are due to the high fluidity and critical review of ideas during our discussions, which led to innovative improvements in the process of investigating heritage and deciding on the way of heritage communication. Related work argues that museums and cultural institutions need to move from being only suppliers of information to providing tools and knowledge for visitors (i.e., the public) to explore their own ideas and to reach their own conclusions about heritage [11]. Within the Terra Mosana project, thirteen general themes about the EMR shared heritage were written and developed by historians and archaeologists to highlight the shared and common history of the EMR, and to strengthen the shared identity feeling, while local partners were asked to write storylines that refer to the overarching set of themes. The approach of participatory design acted as an exceptional vehicle for spreading values and information about the shared heritage of the EMR. Our participatory design workshops activated the process of converting the themes into storylines based on the ideas and feedback of participants. In turn, the storylines are used to shape the on-site experiences of Terra Mosana that were developed by engineers and computer scientists. Museums and cultural institutions of the EMR are encouraged to make use of the results of the Terra Mosana workshops in their exhibition plans by focusing on what themes of the shared history the target audience would like to know more about, and what type of interactive features should be adopted to achieve engaging and memorable experiences.

Participatory design influences interdisciplinary relationships in digital heritage projects by promoting collaboration and co-creation among different stakeholders, including heritage professionals, designers, developers, and users. By adopting the participatory design approach in a digital heritage project, the interdisciplinary teams work hand-in-hand to better understand the needs and requirements of the end-users and to accordingly

design solutions that are innovative, sustainable, and inclusive. In addition, problems of knowledge fragmentation in heritage projects can be avoided, since teams composed by different interdisciplinary backgrounds should develop greater cohesiveness and connectedness among relevant disciplines in such projects. Moreover, participatory design can help by bridging the gap between technology and heritage, as partners from different disciplines can learn from each other and find common ground.

The approach of involving residents (i.e., users) in the design process, narrative providers, and designers and developers was carried out with the intention of gaining a deeper understanding of their needs, which can help them to create more effective and meaningful digital heritage projects [28]. This can result in digital heritage projects that are more informed and grounded in the cultural context.

While interdisciplinary approaches in digital heritage projects offer substantial benefits, several challenges must be addressed to ensure that collaborations are successful and suitable for all partners involved. Our study identified a few barriers that hindered effective management and communication among partners. The practical challenges of organizing meetings and coordinating with partners of different response rates were significant. Additionally, a summary of the challenges that should be considered in future digital heritage projects is presented. These challenges include the ambiguity of a centralized objective among project partners, conflicting expectations among different disciplines, and the need to balance disciplinary autonomy with the overarching project goals. These issues can arise from the diverse expertise and perspectives of partners, which can create different expectations for project outcomes. As a result, managing these complexities requires significant effort and coordination, and failure to do so can lead to communication breakdowns, conflicts, and even project failure. Therefore, addressing these challenges is critical to ensuring the success of interdisciplinary digital heritage projects.

5.1. Different Expectations among the Different Disciplines

Before conducting the participatory design workshops, project management and several project partners were enthusiastic about them, while others (presumably historians) were skeptical about the value of such method. We believe that the results of the workshops were useful to sort out the themes that people are interested in, but also to change some partners' attitudes toward participatory workshops in general.

For instance, the historians tried to deliver what they thought was interesting and important to the people. They thought that the content of the storyline should be more general so the people will be more interested in that. However, it was ironic that the results of the workshops show that the favorite themes of the historians were the less preferred by the participants (i.e., public). Moreover, the results of the workshops also informed developers and computer scientists about what themes interest citizens the most, and accordingly, what themes should be digitized and how they should be communicated to the public in interactive and meaningful scenarios.

On the other hand, some more challenges could be ascribed to intercultural differences, such as the lack of a common language and knowledge. During the focus group with the project partners, most of them expressed their appreciation about the activity of creating a persona or a fictional character. They found it a good method to guide participants to step outside of their own perspective, creating a new neutral perspective. They agreed that it positively influenced the group dynamics, as in some cases participants did not know each other, but the persona activity was a productive and pleasant method to get them involved and to generate new and creative ideas.

5.2. Lack of a Common Language and Knowledge

Previous work shows that the interdisciplinary relationships sometimes fail to share knowledge in a comprehensive way among the different disciplines in a certain project due to multiple reasons (e.g., cultural, human, and social) [29]. Within Terra Mosana, the communication team admitted that it was difficult to understand the content and the

description of the themes/storylines, as well as how that might fit in the bigger picture of the project. They care more about the onsite experiences, and they thought the writing of the storylines might be interesting from only an academic point of view; in practice, however, it was a bit blurry to them. Likewise, the local specialization of partners who were responsible for writing the storylines led to a feeling of a lack of expertise required to talk about the euregional narrative instead of just focusing on their area of expertise. The interdisciplinary relationships might cause a lack of understanding in digital heritage projects [29], as partners form different disciplines might not fully understand the significance and relevance of each other's work, leading to misunderstandings and a lack of appreciation for the contributions of others. Therefore, project partners should be aware that different disciplines have their own jargon, ways of thinking, and approaches to problem-solving, which can make communication and sharing of knowledge challenging.

While potentially beneficial in the long-term participation, project partners should have been aware that the participative outcomes might not align with each of their objectives. Partners can often resist change, in particular when they feel that their own discipline or area of expertise is being challenged. This might lead to resistance to new ideas and approaches, and a lack of willingness to learn from other disciplines. Accordingly, project partners should have prepared for unexpected and challenging objectives and ambitions from interdisciplinary relationships and critically review the suitability of resulting outcomes within their contexts. To ensure a comprehensive knowledge sharing in interdisciplinary digital heritage projects, we recommend that participatory practices should establish clear communication channels, foster a culture of collaboration and mutual respect, invest in training and professional development opportunities, as well as highlight the connection between the different work-packages.

5.3. Inappropriate Timing of Participatory Design

Digital heritage projects can be time-sensitive and deadline-driven, and project partners from different disciplines may have conflicting schedules, making it difficult to coordinate and share knowledge. That means other challenges can be considered as a result of managerial aspects, such as the inappropriate timing of participatory design, or a result of unexpected crisis [17], such as the recent outbreak of the COVID-19 pandemic in 2020. Although most of project partners were impressed and inspired by the process of the participatory design during the project, the point of the time at which they were conducted remains questionable. They believed the workshops should have been organized earlier in the project to maximize the benefit. Organizing the participatory design workshops has been delayed due to several managerial reasons and of course due to the consequences of the COVID-19 pandemic.

Since most products and deliverables were in the final stages of being implemented, it was challenging to pivot ideas around the new insights and focus of interests for the onsite experiences at a later stage of the project. This shows how important it is to conduct participatory design workshops at a very early stage of such collaborative project.

5.4. The Impact of COVID-19 Pandemic on Interdisciplinary Participatory Design

The outbreak of COVID-19 in 2020 made it difficult to organize face-to-face project activities. Thus, we organized with an alternative scenario to move the workshops online, developing both asynchronous and synchronous activities. The online setup of the workshops enabled us to learn about how different online communication tools influenced individual and collective participation during the crisis (i.e., the pandemic) [17]. For instance, online participatory design benefits from the extensive amount of online tools that can be utilized for multiple purposes, such as communication, expressing ideas, audience participation, and document sharing. In addition, online participatory design proved to be more time-efficient and cheaper, and the diversity of target users can easily be maintained due to the absence of travel restrictions.

However, moving the workshops to online environments raised a number of technical challenges; thus, it seemed that participants of online participatory design may need training on how to use technology to avoid any frustrations. In addition, the online setup made it challenging to read non-verbal clues, such as body language and facial expressions. In such situations, it was challenging for the workshop organizer/facilitator to create a sense of a shared space, in which creativity, inclusion, and openness were welcomed.

Moving the workshops of the Terra Mosana project to online environments provided us with an opportunity to investigate how participatory design in heritage-related projects can be effectively organized in times of crisis when all stakeholders (i.e., the project partners from the different disciplines as well as the citizens of the EMR) cannot simply meet in person (similar to the situation during the COVID-19 pandemic). Moreover, instead of perceiving the online of the workshops as only an emergency response to the consequences of the pandemic, we considered the opportunities and challenges the online medium offers and how some of the activities we developed could be used in the future [17].

6. Conclusions

Reflecting on my role within the cross-border collaborative project on digital heritage, Terra Mosana, this article investigated how participatory design influences interdisciplinary relationships in digital heritage projects. The article discussed and reflected on the opportunities and challenges of interdisciplinary encounters in participatory design. It was observed that participatory design is beneficial for digital heritage projects to leverage interdisciplinary relationships to allow for collective productivity and unique perspectives by partners from different disciplines. Interdisciplinarity expands to activate the involvement of heritage visitors within the field of visitor-centered design, empowering them to share their feedback and insights in design decisions [18,19].

Yet, our results raise several challenges that should be considered in the future to ensure that interdisciplinary relationships in digital heritage projects remain productive and are suitable for all project partners based on their disciplinary backgrounds.

According to the feedback we received on the participatory practices of Terra Mosana project, we can conclude that the participants from the local community enjoyed the experience; they learned about the history of the area in which they live, obtaining insight into the cultural, social, and political developments that have shaped the community over time. This knowledge can also deepen one's sense of connection to their community and increase appreciation for its unique history and heritage. Additionally, our participants from the local community managed to create links about the shared heritage in the Euregion.

For the project partners, who are from different disciplinary backgrounds, have several missions to achieve, and use different modes of operation, the participatory design workshops were an interesting and insightful experience for achieving the objectives of the Terra Mosana project. Some storylines have been adjusted according to the results of the workshop, but because of the timing issue, we cannot generalize that the results directly facilitated the writing of the heritage themes and storylines by archeologists and historians. Differently, the results of the participatory design workshops provided our technical partners (i.e., computer scientists and developers) with tendencies about what themes interest citizens the most, and accordingly, what themes could be digitized and how the themes of the shared heritage could be communicated to the public in meaningful and interactive scenarios. During the focus group, project partners clearly appreciated the input that resulted from the participatory design workshops; however, how far that input could be incorporated remains a bit open.

As a designer, facilitator, and co-organizer of the participatory design workshops, I reflected on the possibilities and challenges of the interdisciplinary participatory design in a digital heritage project. Not all the challenges addressed in this chapter are characteristics of interdisciplinarity, but some could be ascribed to intercultural differences, managerial aspects, or unexpected crisis, such as the outbreak of COVID-19 pandemic. The project coordinators believe that the results we gained from the participatory design workshops

of the project could envision creating even better experiences in a second phase of the project where the insights of this project phase are integrated. In general, the approach of participatory design in the Terra Mosana project proved to be more than satisfactory not only for participants, but also for project partners and local organizers.

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Notes

1. The project of Terra Mosana (2018–2021) is coordinated by University of Liège (Belgium), and is conducted within the context of Interreg V-A Euregion Meuse-Rhine, and is funded by the European Regional Development Fund (Interreg), the Walloon Region, the Provinces of Limburg (Netherlands and Belgium) and the Land of North Rhine-Westphalia. The website of the project: https://www.terramosana.org/ (accessed on 2 February 2023).

2. The Euregio Meuse-Rhine territory has a population of 3.9 million people and covers an area of 11,000 km^2 (between Belgium, Germany, and The Netherlands). The cities of Liège and Hasselt (Belgium), the city of Aachen (Germany), and the cities of Maastricht and Heerlen (The Netherlands) are the main centres of the EMR. In the past, the cross-border region formed a coherent cultural area between the Meuse and Rhine rivers, but now it is considered to be one of the most complex Euregions with its three languages and five partner regions. https://www.terramosana.org/blogs/5-things-you-dont-know-about-the-meuse-rhine-euregio/ (accessed on 2 February 2023).

3. The project of Virtual Pompeii: http://tesseract.uark.edu/virtual-pompeii/ (accessed on 2 February 2023).

4. CyArc non-profit organization of digital heritage: https://www.cyark.org/ (accessed on 2 February 2023).

5. The Digital Dubliners project: https://digitaldubliners.com/ (accessed on 2 February 2023).

6. The Memory of The Netherlands: https://geheugenvannederland.nl/ (accessed on 2 February 2023).

7. The project of Virtual Curation Laboratory: https://vcuarchaeology3d.wordpress.com/ (accessed on 2 February 2023).

8. A brief about the thirteen themes of Terra Mosana can be found here: https://www.terramosana.org/news/discover-the-history-of-the-euregio/ (accessed on 2 February 2023).

9. Saint Lambert (c. 636–c. 705) was the bishop of the region Maastricht-Liege-Tongeren since 670 until his death. Lambert condemned Pepin's liaison with his mistress Alpaida, the mother of Charles Martel. Lambert was murdered during the political disorder that developed when various families fought for influence as the dynasty of Merovingian gave way to the Carolingians. Lambert is considered a martyr for his defense of marriage.

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