Values-led digital design for the post-disaster recovery of heritage and sense of place

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Disasters batter places, heritage and sense of place. The application of 3D technologies in rebuilding these elements offers a promising means to support affected communities by strengthening their resilience through a focus on intangible heritage. The paper explores how a human-centred, values-led design approach can guide the ethical development of 3D technological interventions, ensuring respect for the voices of affected communities and leading to more responsible digital heritage practices. The study presents the analysis of the REPLACE (Rebuilding a Sense of Place) project, a research programme aimed at advancing the transformative deployment of 3D technologies in rebuilding heritage and sense of place after disasters, focusing on areas in Italy affected by recurrent earthquakes. This paper illustrates how a values-led design framework was applied to a technological ethnography methodology to create an ethical foundation for the project's digital practices. The discussion addresses the complexities, benefits, and limitations of this framework in navigating ethical tensions, facilitating knowledge exchange, and fostering critical reflections on digital heritage practices in support of places and communities in crisis. By focusing on intangible heritage and post-disaster contexts, this paper offers new insights into ethical practices in the heritage field.

CCS CONCEPTS • **Arts and Humanities** • **Collaborative and social computing**

Additional Keywords and Phrases: Values-led Design, Digital Heritage, 3D technology, Post-Disaster Recovery

1 INTRODUCTION

1.1 This Work

> "How can we remove this panorama of destruction from our soul? 'When I feel low, I go to Google Maps. The images of Amatrice have not been updated, meaning that I can still walk through the old streets and see what was here before the earthquake. Here, that day, we all somewhat died'" [1].

These words from an interview published in OGGI magazine on 24 August 2022, unveil the emotional scars left by the earthquake that devastated Amatrice, Central Italy, in 2016. A resident of Amatrice shared her profound grief and longing for the life that existed before the calamity. The 3D images on Google Maps, capturing Amatrice in a moment pre-earthquake, provide a bittersweet comfort. They enable her to navigate the old streets virtually and reminisce about the town's liveliness before the earthquake. The initial quake struck on the early morning of 24 August 2016 claiming 300 lives, especially in Amatrice, Accumoli, and Pescara del Tronto. These communities were shattered, and the toll of victims amplified by the disaster's timing in

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August, a period when many people returned to their second homes for summer vacations. Drawing from the words shared by the interviewee, it appears that the pre-earthquake 3D images offer a means for mourning and healing after the disaster. Such testimonials remind digital heritage scholars and practitioners of the enduring impact of disasters on communities. They offer calls to action and crucial points of reflection on how digital heritage can support these communities in their journey toward healing, restoration, and renewal. There is a need to expand the horizons of heritage conservation by harnessing 3D technologies to strengthen the resilience of communities through a focus on intangible cultural heritage.

As 3D technologies - e.g., laser scanning, photogrammetry and 3D modelling - and emerging innovations - e.g., Extended Reality and 3D printing - gain prominence in efforts to rebuild heritage affected by disasters [2], it becomes crucial to integrate these advanced tools with principles of human-centred and values-led design. Here we speak of the integration of ethical considerations (e.g., inclusivity, sustainability, respect for community voices) directly into the design and development of 3D technological interventions aimed at rebuilding places lost to disasters. This approach is not merely an ideal: human-centred and values-led design is increasingly being utilised in digital applications within the heritage sector [3; 4; 5; 6]. By embedding ethical considerations within technological advancements, we seek to underscore the importance of an ethical framework that promotes sustainability, cultural sensitivity, and responsible digital rebuilding practices. Such a framework aims to ensure that the deployment of 3D technologies in heritage preservation is not just about the end product but especially about fostering a design process that centres the voices and perspectives of affected individuals, emphasising their unique needs and rights in the context of heritage conservation and disaster management.

This paper presents the outcomes of implementing a values-led design framework within the REPLACE (Rebuilding a Sense of Place) project, hosted at the University of Essex (UK). The core aim of this research initiative is to bolster community resilience in the aftermath of disasters by deepening our understanding of the socio-cultural significance of 3D technologies in recreating a 'sense of place', a term that refers to the emotional and socio-cultural connections people associate with specific locations [7]. This deeper understanding assists communities in preparing for, responding to, recovering from, mitigating the effects of, and adapting to disasters.

This paper critically examines the process of establishing the values and ethical framework underpinning REPLACE's digital practices and the team's daily work. While a more detailed examination of the impact of these values on digital intervention design falls outside this study's scope, it is being explored in soon-to-be-published research. Ethnographic research played a key role in shaping REPLACE's values-led design framework, ensuring community perspectives were integrated from the outset. Although the values-led design process was conducted internally to align team perspectives, it was informed by ongoing ethnographic interviews and refined through iterative community engagement and feedback on digital prototypes. Establishing a shared ethical framework early in the project was essential, particularly as some team members had not previously worked together. Moreover, since the project was in the early stages of establishing new relationships (and expanding existing ones) with community members and stakeholders, premature involvement of a limited number of local voices risked defining values unrepresentative of the broader community.

Throughout this paper, we discuss how REPLACE's values and ethical principles were crafted and adopted to scaffold discussions, knowledge exchange and decision-making related to the project's digital practice, presenting critical reflections on the benefits and challenges encountered throughout the process. We describe the application of a values-led design toolkit, composed of a set of design cards aimed at embedding ethical considerations into all stages of design [8]. The values were defined through a series of workshops, involving the project's members: the principal investigator (Di Giuseppantonio Di Franco), two senior research officers (including Dolcetti), the project officer and two collaborators from UK technology companies specialised in heritage applications of 3D technologies (six participants in total, three females and three males). The impact of the values-led approach on the project and on each member's individual practice is examined, with a focus on assessing its strengths and limitations in addressing ethical tensions arising from collaboration among diverse stakeholders and the negotiation of varying expertise.

By examining qualitative data collected through the application of this values-led design framework - both during the workshops and in follow-up interviews with REPLACE's team members carried out by an external consultant (Perry) - combined with an assessment of the project's ongoing technological ethnography, this paper seeks to provide valuable insights and lessons for future projects and policies that endeavour to integrate technology in heritage conservation and disaster management contexts. In doing so, it also contributes to computational practice by demonstrating how ethical values can be embedded into the iterative development of 3D digital interventions, informing design decisions and technical adaptations. REPLACE aspires to pave the way for more ethically-conscious and sustainable applications of 3D technologies, ultimately supporting communities in their journey towards recovery, regeneration, and a stronger sense of place.

After presenting the state of the art in the remainder of this section, the paper is organised as follows: Section 2 presents the project and the values-led design toolkit, documenting how it was adopted within REPLACE. Section 3 discusses the results from the values-led design workshops and the subsequent evaluation of the values-led design framework, together with observations from the concurrent ethnographic research. Section 4 examines lessons learned, strengths and limitations of the values-led design approach based on data analysis and our personal reflections. Finally, Section 5 states final conclusions and suggests future research directions.

1.2 Intellectual and Social Context of the Work

Anthropologist Arturo Escobar in his book 'Design for the Pluriverse' [9] highlights how design fundamentally structures our world - in all its political, social, economic and environmental configurations. As he conceives it, through design we can envision new worlds or maintain the status quo. Recent literature in critical design studies raises ethical concerns around the social, political and environmental consequences of design in general and technology in particular [10; 11; 12]. Findings from such research emphasise the significance of design and advocates for it to be driven by values that foreground the well-being of all human beings and the planet more widely.

Indeed, an increasing number of practitioners now speak out on the pitfalls of design, especially the lack of accountability for designers' assumptions and methods, while also voicing their concerns about who is left out of the design process [13; 14]. Similarly, in the heritage sector the adoption of digital technologies, especially in public participation, is not inherently good nor harmless as it can replicate unjust and exclusionary practices if not supported by an ethical framework [15; 16]. Thus, new design processes and approaches centred around impact on communities, accountability and sustainability are needed.

Values-led practices may be summarised as practices in the development of form and content which devote robust, considerable and persistent attention to 'human value', understood here as what people care about and strive to obtain (see also the definition of Fish and Stark [17]). Such practices have a long tradition in the design field, as design research has increasingly evolved toward a human-centred approach putting people at the heart of the design process [18; 19; 20]. In fact, several methodologies have been developed to embed ethics within the design process. Participatory design originated in Scandinavia in the 1970s as a design movement committed to the values of democracy and empowerment of end users in the systems development process, by addressing unequal power relationships within the workplace [21; 22]. During the early 1990s, value sensitive design (VSD) emerged, explicitly integrating human values and social context within the design process [23]. At the same time, inclusive design was being developed as a process committed to including and learning from the full range of human diversity [24]: it was not about making one thing for all people but designing a diversity of ways for everyone to participate in an experience with a sense of belonging. More recently, Costanza-Chock [25] discussed the concept of design justice, which aims at rethinking the design process in a way that centres people who have historically been marginalised to ensure the development of sustainable and community-led outcomes.

Drawing upon this literature, we understand values as embedded, practice-based commitments that emerge through the social, cultural, and political dynamics of design. Rather than fixed moral obligations, values are framed as contextual, situated ethical principles which transform over time and through engagement between individuals. To further articulate this conceptualisation, we draw on the theoretical framework of the ethics of care [26; 27], which emphasises attentiveness to lived experience, and emotional and cultural sensitivity.

However, adopting a values-led approach is challenging and imperfect in execution. In their scoping review on ethics in Human-Computer Interaction (HCI), Nunes Vilaza et al. [28] highlight that despite a growing discussion on the topic, the question of how to put ethics into practice remains difficult to address. Following JafariNaimi, Nathan and Hargraves's [29] concept of values as hypotheses, values are realised in practice and, as such, design specifications alone cannot account for what will manifest when the design itself is deployed in real-world settings. Rather than pre-established formulas, values should serve as working hypotheses to help designers and non-designers navigate the contextual challenges arising from practice (see for example Perry [30]). Values are also difficult to articulate and actualise in design activities as they are inherently vague, open to multiple - if not conflicting - interpretations, and operate across several professional and personal levels. Ethical tensions between values and actions frequently emerge during the design process and are difficult to address without appropriate strategy and resources [31]. In light of such complexities, on REPLACE we adopted a values-led design toolkit to navigate the challenges of ethical design in practice [32]. Specifically, this toolkit was employed to support ethical consideration and discussion around values in a more concrete and structured fashion, not only to support decision making around specific design outcomes but also to engender wider reflection on how ethics (and ethical tensions) are experienced and manifested across individual and project practice.

2 MATERIALS AND METHODS

2.1 Case Study: The REPLACE Project

REPLACE is a four-year programme of research that aims to enhance the use of new technologies to sustain heritage, communities and culture through disasters. The central focus of the REPLACE project is to explore how 3D technologies can help communities to respond to, recover from, mitigate the effects of, adapt to and prepare for disasters. This research is centred on the recognition of heritage and sense of place as central values for post-disaster community recovery, echoing the values outlined in UN Sustainable Development Goal 11, aimed at resilient and inclusive urban development. In this study, resilience is defined according to the Sendai Framework [33], where the community's ability to 'bounce back better after a disaster' is at the core. However, the deployment of 3D technologies in heritage conservation raises significant ethical considerations. There is a tendency among designers and developers to overlook ethical tensions or address them only reactively [34]. This oversight can lead to the dehumanisation of the cultural heritage they want to preserve. Furthermore, the profound impact of disasters on communities highlights the need for a more ethically-grounded approach to technology deployment in heritage conservation practices, one that moves beyond built heritage towards a more holistic focus on social recovery [35]. To address these challenges, REPLACE adopts a rights-based approach to heritage conservation, stressing the importance of respecting, protecting, and fulfilling the rights of individuals and communities regarding their local heritage. This approach acknowledges that cultural heritage holds much more than tangible objects or sites; it is an integral part of people's identity, self-understanding, and social cohesion [36; 37].

The REPLACE project is informed by ethnographic work in Italy, a country prone to recurrent earthquakes that have profoundly shaped its heritage and approaches to community resilience. These include the earthquake of 1980 at Senerchia and Conza in the Irpinia region in Southern Italy (current population 734 and 1,245 respectively); the earthquake of 2009 at L'Aquila in the Abruzzo region (current population 287,806); and the earthquake of 2016 at Amatrice and Accumoli in the Lazio region in Central Italy (current population 2,250 and 522 respectively) [38]. For each case study, REPLACE's ethnographic approach seeks to involve various stakeholders who are as representative as possible of the whole community. For this reason, when reaching out to community members to collaborate on the project, REPLACE follows a purposive sampling approach [39] that seeks not only to include people willing to share their experiences about the earthquake, but that is also concerned with demographics - e.g., age and gender - the stakeholders' social roles within the community, and whether they are residents, returnees or non-residents who own a second home in the places we are studying. Through these case studies and collaboration with technology companies and a selection of community members, the REPLACE project aims to forge new pathways in disaster management, heritage conservation, and digital practices, ultimately building community resilience and supporting a more sustainable future.

2.2 Ethnographic Approach: Values and Challenges in Post-Disaster Research

The REPLACE Methodological Framework is informed by studies in techno-ethnography (i.e., technography or techno-anthropology [40; 41; 42]) and designed as an iterative process to support community resilience and cultural heritage preservation through technology. This framework is structured around four interconnected pillars: Ethnography, Digital Data Collection, Digital Experience, Data Analysis and Processing (Figure 1). Each component, as described below, plays a crucial role in guiding the project's technological interventions and ensuring alignment with the community's values and sense of place.

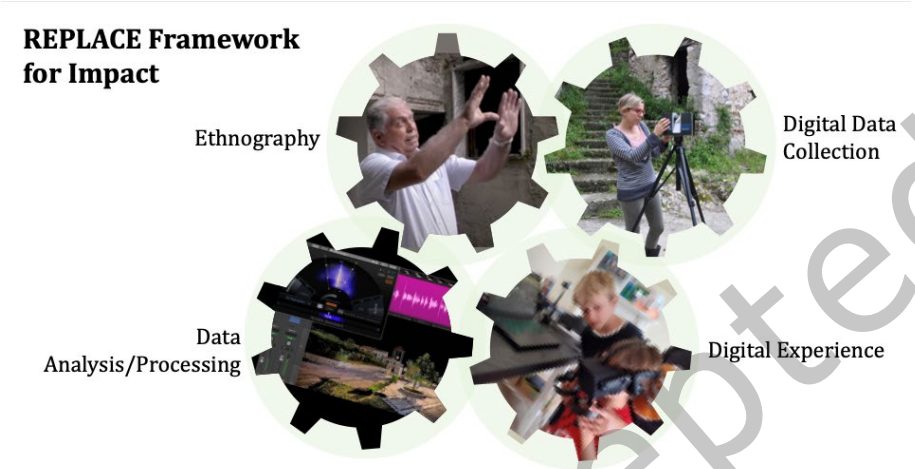

Figure 1: REPLACE Framework for Impact: An iterative methodology integrating ethnography, digital data collection, data analysis/processing, and digital experience to strengthen community resilience and restore Sense of Place in post-disaster settings.

1 Ethnography: This foundational element emphasises engaging with community members to understand their experiences, values, and connections to heritage. Ethnography in REPLACE involves both indirect observations of people and their interaction with the place under analysis, and direct interaction, such as video-interviews, focus groups, and community workshops, to capture the ways in which communities conceptualise heritage and sense of place. These insights are essential for shaping technology development and ensuring that interventions resonate with the community's cultural, social, and emotional needs.
2 Digital Data Collection: Building on ethnographic insights, the REPLACE team employs advanced 3D digital tools, including photogrammetry, 3D scanning, and 360 videos, for creating VR digital interventions that can aid people to reconnect with their damaged or lost place.
3 Digital Experience: This phase enables communities to assess and provide feedback to the 3D interventions, so that they can be edited, and improved.
4 Data Analysis and Processing: This step involves analysing community assessment data and editing the digital interventions.

The framework's iterative nature allows each stage to inform and refine the others. For example, insights from the Digital Experience phase can lead to new ethnographic inquiries, which in turn inform data collection and processing strategies. This dynamic process ensures that the REPLACE project remains responsive to the evolving needs, values, and perspectives of the community, fostering a participatory approach to heritage conservation and disaster resilience.

The ethnographic component of REPLACE began informally in April 2017, shortly after the last major earthquake in Central Italy on 17 January 2017. This marked the beginning of a pilot study aimed at understanding how digital replicas could help individuals reconnect with their lost heritage. The only clear ethical value guiding this early work was a deep respect for the vulnerability of those involved. This respect

shaped the ethnographic approach as well as the concept of the final output of the project: a co-created immersive documentary titled *Italia Terremotata* [4]. The pilot set the foundation for conceptualising REPLACE's research question and selecting the case studies. It was also crucial for establishing key community contacts that facilitated recruitment for the ethnographic study [39].

When REPLACE officially began in 2022, its ethnographic approach had to adapt to new team dynamics and challenges. Fieldwork began with two campaigns in July and September, led by the PI and digital industry collaborators, while Senior Project Officers joined later due to University of Essex grant delays. The first full-team fieldwork in March 2023 proved challenging, with internal tensions and language barriers further complicating collaboration (some collaborators did not speak Italian, making it difficult to establish common ground with community members). Disagreements arose over the role of technology companies in co-creation, balancing community-driven decision-making with technical feasibility, and the purpose of the digital heritage interventions. To maintain ethical coherence, we paused ethnographic data collection, prioritising internal value alignment before re-engaging with communities, as we recognised that inconsistencies could undermine trust. While the values-led workshops were internal, the values were shaped by existing ethnographic data, including video-recorded walking interviews and informal conversations. Community insights on post-disaster heritage, sense of place, loss, and 3D digital interventions informed the framework we aimed to formalise within the workshops.

However, tensions were not limited to internal stakeholders. The ethnographic work also faced cultural complexities inherent in working with diverse community groups - i.e., residents, returnees, or local associations - each bringing their own priorities. To navigate these complexities, REPLACE prioritised inclusivity by employing purposive and snowball sampling methods, ensuring a wide range of voices were heard. This approach balanced demographic diversity with attention to social roles within the community, fostering a holistic understanding of post-disaster dynamics (Tables 1 and 2)

Table 1: Diverse stakeholder groups involved in REPLACE, highlighting the interdisciplinary and community-based foundation of the project's design process.

Communities	Academics	3D content creators
Senerchia: individual community members. 8 people aged 25 to 63 (3 females and 5 males). L'Aquila: individual community members and the Case Matte/Collective 3.32. 11 people aged 24 to 65 (4 females and 7 males). Accumoli: individual community members and the Radici Accumolesi Association. 11 people aged 12 to 80 (4 females and 7 males). Amatrice: individual community members and the Casa delle Donne Association. 15 people aged 7 to 75 (10 females and 5 males).	REPLACE research team members. 4 people, 3 females and 1 male (3 Italian-native speakers and 1 English-native speaker). Roles: project lead and management, administration, ethnographic data collection and analysis. Disciplines: Digital Heritage and Humanities, History and Comparative Literature.	REPLACE principal collaborators. 2 people, both males and English-native speakers. UK-based 3D digital heritage companies focused on 3D scanning and modelling, 3D prints, VR experiences and WebGL applications.

Table 2: Timeline of stakeholder engagement activities, showing the iterative and participatory structure of REPLACE's methodology.

Who has been involved	How	When and Where
Residents and non-residents (owners of second homes). People who experienced the earthquake or returned immediately afterward. Generations born a few years before and after the earthquake.	Ethnographic data collection: video-recorded walking interviews. 3D data collection. Community events: presentation of 3D prototypes; video-recorded sessions of testing and evaluation.	March 2023: ethnographic and 3D data collection fieldwork campaign in Accumoli, Amatrice, L'Aquila and Senerchia. May 2023: ethnographic fieldwork campaign in L'Aquila. August 2023: exhibition "Roots&Wings" in Senerchia. September 2023: ethnographic fieldwork campaign in Accumoli. April 2024: International Alliance for Disasters Risk Reduction event in Accumoli, Amatrice and L'Aquila.

REPLACE team: 3 academics and 2 content creators.		May 2024: 3D content Evaluation in Accumoli. June 2024: ethnographic fieldwork campaign in Senerchia. September 2024: 3D content Evaluation in Accumoli and Amatrice. October 2024: 3D content Presentation in Accumoli.

2.3 The Values-led Design Toolkit

The values-led design toolkit adopted for the project consists of a set of design cards which adapt methods commonly used in human-centred and participatory design for archaeology and heritage. Design cards are a long-established tool in design, used since at least the 1970s. They have proven valuable in promoting equal participation, while encouraging critical thinking and innovation [43; 44]. There are also examples of design cards within the heritage sector [45]. However, it seems that there are still only a few card-based approaches developed with the specific purpose of encouraging designers to incorporate ethics into their design process [46; 47]. The Ethics for Designers toolkit, for example, was developed by designer Jet Gispen [46] to address the lack of ethical knowledge of most designers and design students, helping them to focus on ethical considerations and designers' accountability, and to develop skills of moral sensitivity, creativity and advocacy. Recently, Dolcetti et al. [29] developed a values-led design toolkit to further fill the gap, which has since been adapted and used in a variety of contexts within the archaeological and heritage sectors [3; 32]. Their toolkit provides a resource composed of five decks of design cards - Values, Vision, Concept, Design and Challenge - and a methodology to support and guide archaeologists and heritage professionals in foregrounding ethical considerations and embedding values in the design process of a diverse array of projects and resources.. Given the emphasis of this method on incorporating ethical considerations and values into the design process from the beginning, REPLACE provided a highly suitable, as well as challenging, context for further testing and evaluation. Herein the toolkit's benefits and shortcomings could be studied in the context of long-term ethnography and collaboration among different stakeholders. We therefore decided to implement the toolkit through a series of workshops held over the course of nine months to support sustained engagement with ethics: from collective reflections as team members on the core values underpinning REPLACE to decision making processes embedding these values into our design outcomes. Furthermore, these workshops aimed to facilitate knowledge exchange between academics and 3D content creators, so that REPLACE's researchers conducting ethnography and its collaborators from the technology companies could share their insights and expertise in designing technological interventions, aligned with the project's values and guided by communities' priorities emerging from the ethnography (Figure 2).

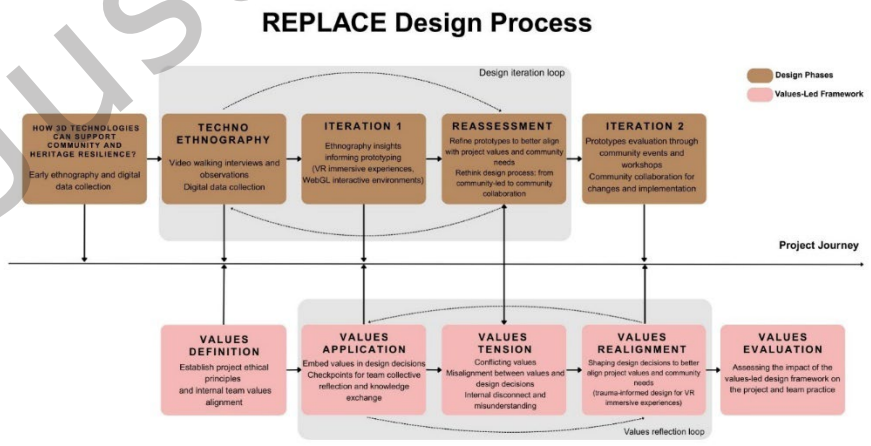

Figure 2: Diagram mapping REPLACE design journey from initial ethnographic engagement and problem framing, through iterative design and testing of digital interventions, highlighting how the values-led framework was embedded throughout each stage.

2.4 Authors' positionality, data collection and analysis

The data collection and analysis were conducted by the authors, all of whom have academic backgrounds in digital heritage and currently hold research positions at UK universities. Co-author Perry has also worked in leadership and consultancy roles for charitable and commercial organisations internationally, where she has overseen, assessed or informed values-based work pursued both internally and externally by her employers. Together, we bring practice-based experience in the application of 3D technologies within the heritage sector, and in the co-design and evaluation of immersive and emotive digital experiences for diverse audiences across Europe, the UK, Africa and the Middle East, usually working in multiple languages. Our approach to values-led design is shaped by our experiences in interdisciplinary teams - including educators, artists, designers and 3D content creators - both within and beyond heritage institutions, and through collaboration with creative industries partners. These experiences have made us more attentive to the distinct responsibilities attached to different professional roles, to the plurality of ethical approaches in collaborative practice, and to the presence of sometimes competing ethical agendas. Throughout this study, we therefore engaged in continual reflexive dialogue to surface and negotiate such influences.

Qualitative data were gathered during the values definition and implementation workshops in the form of personal notes by the first author, alongside a total of nine hours of video recordings. All workshops were conducted in English and quotes were extrapolated from the original recordings' transcriptions. Observations and video recordings were analysed using Thematic Analysis, where we coded data using a combined deductive (researcher driven) and inductive (data driven) approach to identify and interpret themes across data [48]. This process followed several phases, including familiarisation with the data, generation of initial codes, searching for and reviewing themes, defining and naming themes, and producing the final analysis. Themes were developed through sustained analytical engagement and iterative returns to the full dataset. For instance, the theme "tensions between declared values and design decisions" was developed by clustering related codes such as "internal team tensions", "values misalignments", "design negotiation" and "community participation". This overarching theme captures the discrepancies between the project's stated ethical commitments and the challenges encountered in their practical implementation.

Following reflection by the REPLACE research team on the efficacy of the values-led design framework, one of the authors was engaged to conduct individual semi-structured online interviews in English with academic team members and 3D content creators (six in total). The distance offered by the author as an external party to REPLACE was seen as important for enabling candid, critical consideration of the overall method by those involved in its implementation. Interviewees were supplied with questions ahead of time (Appendix A) and sessions were audio-recorded, lasting between 55 minutes to nearly two hours. The questions were designed to ease interviewees into frank discussion of the project, then to critically explore their own everyday applications of REPLACE's values, concluding with reflection on both their previous experiences in values-based or ethical modes of working, and their observations about REPLACE colleagues' wider handling of the project's values. As described in Section 3.3, they were also informed by scrutiny of the project's outputs to date and multiple conversations with the project team.

Interview transcripts were approved by interviewees with only very minor edits (primarily to simplify or cohere language), then hand-coded for recurring themes. Coding followed a similar, mixed deductive and inductive logic (with the former shaped by the interview questions themselves), and themes were reviewed by Perry with her co-authors before being written up into a document that was then circulated back to interviewees for comment and reflection. Where responses to the document were critical, Perry replied to the individual interviewees to clarify points, then produced a final version which incorporated minor edits where necessary. As an example of the coding process, the theme "mixed reactions to values" was derived from codes such as "lack of skills", "different understandings of values" and "uncertainty around values application". This theme reflects team members' struggles to consistently enact values, revealing the assumptions and gaps that undermined ethical alignment in practice. To respect anonymity amongst the small cohort, quotes from all the transcripts woven into the discussion below are demarcated by general attributions, such as "one team member" or "one interviewee".

3 RESULTS

REPLACE's values-led design framework was established through a sequence of three workshops, hosted in different locations - during a fieldwork campaign in Italy, online and in person at the University of Essex - and attended by most or all of the team (four academics and two 3D content creators) as outlined in Table 3. Each workshop was organised around prompts provided by the design cards - although some were more structured and systematic in their running (e.g., Workshop 2), whereas others were relatively unstructured and flowed according to the concerns of team members. By the close of the third workshop, REPLACE had in place a set of seven values (Figure 3), as well as several prototypes of 3D technological interventions, from WebGL interactive environments and digital archives to VR experiences of lost places and 3D prints. The workshops were supplemented and informed by ethnographic fieldwork and 3D data collection, as well as community events outlined in Table 2.

Table 3: Summary of values-led design workshops, illustrating how REPLACE's values, vision, and concepts were developed and embedded into the design process.

Workshop	Resources	Activities
Values (March 2023)	Values Cards, Ethics for Designers Toolkit	Definition of core values guiding the project's practice
Vision (May 2023)	Vision Cards	Definition of team's goals, motivations and project's vision
Concept (November 2023)	Concept Cards	Development of core elements of 3D technological interventions guided by ethnography; preliminary results

3.1 Defining the Values

The first workshop, aimed at defining REPLACE's values, took place during a fieldwork campaign in southern and central Italy. Here the entire team was together for the first time for both ethnographic and 3D data collection in the case study areas. The context offered an opportunity for collective reflection on the project's ethics, as it allowed us to engage directly with community members and observe their interactions with their environments. For this event, the Values Card Deck and the additional resource of the moral agent cards from the Ethics for Designers Toolkit [46] were used. First, we read aloud each card to familiarise ourselves with the content; then we started screening the values cards we deemed less applicable to REPLACE. Lastly, we reviewed the remaining cards and used them one-by-one as prompts for the definition of each project value following the process detailed below.

When the values-led design toolkit was first developed by Dolcetti and colleagues, the co-designers identified Equity -defined by Gispen [46] as "being fair such that peoples' needs guide the distribution of opportunities for well-being" - as a fundamental value for the archaeology and heritage sectors' pursuit of delivering public benefits [49; 50]. In the case of REPLACE, discussions that emerged during the first workshop made us realise that Equity not only operates on a project and sector level, but is also a core value of the University of Essex. For this reason, we decided to embrace the university policy on Equity, Diversity and Inclusion, which foregrounds a commitment to: "addressing under-representation where it exists, celebrating the diversity of our students and staff, nurturing communities of belonging in which all are accepted without exception, promoting inclusion, well-being, resilience and empowerment to enable everyone to reach their full potential" [51, 2].

Prompted by other moral agent cards - namely Health and Safety (defined, respectively as "the state of being free" and "the condition of being protected from injury") - we started a discussion around the theme of community members' wellbeing, which also stemmed from the results of the *Italia Terremotata* project presented in Section 2.1. Findings from this study highlighted how displaced communities express the need for replicas of their lost heritage, suggesting that 3D replicas can have a therapeutic role in the recovery process. This insight laid the ground for early reflections on how 3D replicas can contribute to community resilience in the aftermath of disasters. Reflections on the values of Health and Safety that emerged in the weeks following REPLACE's first workshop highlighted how these values closely related to the project's aim to support communities in becoming more resilient and ultimately led to the definition of Resilience as one of REPLACE's values.

We then moved on to the theme of Sustainability as a core value and on its meaning for the team and the project. The value was considered related to both the imperative of reducing as much as possible the project's environmental impact, and the need to ensure the longevity of the project's outputs and outcomes. Per one team member, "[what] we're doing is to provide the facility for the communities to take over and manage the content after our project is finished so that, for example, they can upload their stories." The topic then led to discussion of empowerment, i.e., sharing the know-how and providing the means for communities to autonomously engage with the project's design. We felt that REPLACE should support self-determination through a commitment to Freedom, Mastery and Autonomy, as shown in the following quote from one team member:

> "Autonomy is something you can only apply to certain things where we provide them with tools ... if they have a VR [Virtual Reality] experience using Oculus, whatever it is, we're not going to give them autonomy because they won't have the tools to develop it, if we build a website, they can have autonomy, then they can do anything with it."

In other words, we decided that a fundamental component of REPLACE's digital practice should be devising technological interventions that rely on well-known technologies, easy-to-learn tools and devices commonly used by communities and stakeholders in everyday life, to ensure a longer lifespan of the project's designs and minimise technological waste. However, the importance of REPLACE promoting the values of Curiosity and Innovation was also discussed, with a focus on developing designs that encourage communities to imagine alternative future scenarios. This imagination requires the design of different kinds of technological intervention: some based on communities' needs and abilities, others meant to challenge assumptions and offer communities something they might not have envisioned otherwise. The challenges arising from developing researcher-driven designs within a project prioritising a community-led approach, led to the topics of Humility and Respect as central values for the project. We reflected on the need to always make ourselves conscious of our roles as facilitators rather than experts and to stay mindful of the trauma communities are still suffering. These values closely align with the ethical framework guiding *Italia Terremotata*, which foregrounded "empathy" and "vulnerability of communities affected by environmental trauma" as core values of the co-design process [4, 104].

Interestingly, while reading through the moral agent cards, we commented that the value of Pleasure - defined as "a feeling of happy satisfaction and enjoyment; avoiding boredom or inactivity" - was one of the few that felt inapplicable to REPLACE, considering the trauma experienced by the communities the project aims to support. However, subsequent informal conversation around REPLACE's findings from ethnographic data collection in all the case study areas led to reconsideration of the concept of pleasure. Specifically, younger community members face challenges engaging in intergenerational discussion about the earthquakes, and how the memory of these disasters can be burdensome and overwhelming for post-earthquake generations. In the case of Senerchia, for example, the generation born after the earthquake experienced the ruins in the old town as places of exploration and adventure rather than memorials of a lost time full of grief. Additionally, the discussion highlighted the pleasure experienced by a group of elders interacting with a VR reconstruction of Amatrice's lost church and square [52]. This led us to consider how to make enjoyment a project value without engendering mere forms of escapism [53; 54]. Drawing upon Calvino's Six Memos for the Next Millenium [55, 7], we decided to embrace the value of 'Lightness', meant as a way to shed some of the weight of living, and to look at the world from a different perspective without "escaping into dreams or into the irrational."

Based on these reflections, we undertook an iterative reflexive process of values drafting and collective discussion, leading to the definition of seven REPLACE values: Equality, Diversity and Inclusion; Resilience; Sustainability; Respect and Humility; Freedom, Mastery and Autonomy; Curiosity and Innovation; Lightness (Figure 3).

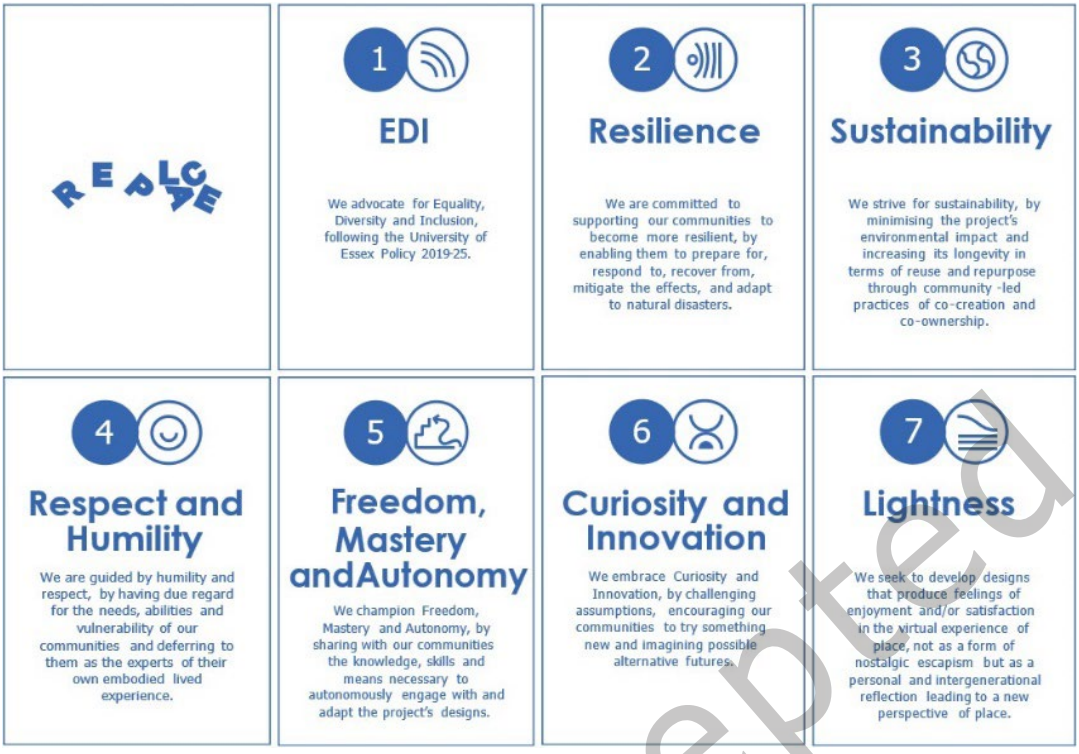

Figure 3. REPLACE's values represented in the form of design cards

While unique to REPLACE, these values meaningfully intersect with wider frameworks in ethical and participatory design, per Table 4 (also see Section 1.2).

Table 4: Illustrative positioning of REPLACE's values in relation to key ethical and participatory frameworks, highlighting areas of resonance and convergence.

REPLACE Values	**Participatory Design** [21;22]	**Value-Sensitive Design** [23]	**Inclusive Design** [24]	**Design Justice** [25]	**Ethics of Care** [26;27]
Equality, Diversity & Inclusion	Addresses power dynamics and democratization	Emphasis on fairness and inclusivity of stakeholder values	Central focus on diversity and access	Focuses on marginalised voices	Recognises inequities
Resilience	Supports community capacity-building	Encourages design for short- and long-term societal benefit	Promotes sustainable user engagement	Supports self-determination in crisis	Emphasises wellbeing
Sustainability	Facilitates co-responsibility for outcomes	Acknowledges long-term impacts of design choices	Advocates for longevity and accessibility	Encourages environmentally and socially sustainable outcomes	Focuses on ecological care
Respect & Humility	Requires reflexivity from designers	Values stakeholder dignity and autonomy	Encourages empathy in design	Challenges normative expertise	Central to relational ethics
Freedom, Mastery & Autonomy	Encourages co-design over top-down solutions	Supports user agency in technology use	Emphasises choice and sense of agency and control	Respects lived experience, local knowledge, and vernacular heritage	Values empowerment through an iterative process

Curiosity & Innovation	Enhances iterative, exploratory practices	Encourages critical engagement with novel solutions	Promotes creative solutions to accessibility	Fosters co-creative, experimental approaches	Linked to openness to technology, expertise, and others' experience, knowledge and lifeworld
Lightness	Acknowledges emotional needs in co-design	Encourages meaningful, affective experience	Allows for joyful and engaging participation	Recognises emotional healing and relief in contexts of crisis	Connects with care through emotional connection

3.2 Values in Practice

Actualising the project's values proved to be challenging and filled with tensions. These challenges arose not only from potential misalignments or conflicts between REPLACE's core values, the desires and expectations expressed by various community members and stakeholders, and the design of technological interventions, but also from dynamics within the team itself.

In the months following the first workshop on values, two other workshops were organised (per Table 3), one online and one in person, to set REPLACE's vision and concept, and to discuss the work we were conducting simultaneously on ethnographic data collection and on development of 3D content. Since REPLACE's researchers and 3D content creators could not meet and interact frequently, we felt it was crucial to have dedicated spaces of knowledge exchange and collective reflection. For this reason, the workshops also served as checkpoints where we would gather to inform each other on progress, reflect upon the insights gained from ongoing ethnographic research, discuss affordances and limitations of 3D technologies, and ensure that the development of technological interventions aligned with the project's values.

These events allowed us to explore tensions arising from interviews and informal discussion with community members in our case study areas, specifically Accumoli in central Italy (2016 earthquake). Here, members of the local association Radici Accumolesi, which is mostly composed of non-residents who had relocated prior to the earthquake for work-related or other reasons, expressed the desire to collaborate on a proposal for a virtual museum to historicise their town. Our concerns were that such a request might not align with or be representative of the broader community's needs, especially those of the residents who remain in the area. These reflections revealed the emergence of potential conflicts between technological interventions and REPLACE's core values of Respect and Humility, and Lightness. The discussion highlighted the importance of identifying the appropriate use of 3D technologies to navigate the fine line between supporting communities throughout the healing process - e.g., by developing immersive VR reconstructions to mourn and reminisce about the places they have lost - without falling into the pitfall of nostalgic escapism.

The themes of healing and nostalgia, and the intricacies of supporting the former while avoiding the latter, emerged again in later discussions, highlighting potential criticalities of enacting REPLACE's values of Resilience and Lightness. While challenging (see for example Wheeler's [54] investigation of the role of productive nostalgia in place-attachment and heritage practices), preliminary results from interviews with community members both in central Italy and Irpinia (1980 earthquake) highlighted how memory and the community's right to memorialise and re-experience its lost places, albeit virtually, could provide a way to deal with the past while envisioning the future, without being trapped into frozen nostalgia. Feedback gathered during a series of community events in central Italy, where we presented our ongoing work on VR reconstructions of Amatrice and Accumoli, seemed to confirm this notion. In those areas, where reconstruction has barely started and city centres are still in ruin, community members were keen on exploring the VR reconstruction and seemed to find comfort in virtually roaming again through the streets of Accumoli's historic centre or re-experiencing familiar and everyday moments, such as standing in Amatrice's square and looking up at the civic tower's clock (Videos 1 and 2).

Video 1: Amatrice VR experience April 2024

Video 2: Accumoli VR experience September 2024

While the VR experience was often quite intense and emotionally charged, several people asked to expand the reconstructions and include multi-sensory details (plants, signs of wear, the sound of bells or people chatting outside the square's cafés) and places meaningful to them, even when they are associated with pain and grief - such as their homes, streets or areas of the town where their lost loved ones lived. For many community members, the opportunity provided by VR reconstructions to revisit the familiarity of pre-earthquake environments, evoked vivid memories of everyday moments and communal life. This experience appeared to help them make sense of the individual and collective significance of their lost places while also inspiring forward-looking reflections on the future of their towns, as exemplified in the following quote from a resident of Amatrice and board member of the Case delle Donne Association:

> "Returning [virtually] to places that have been closed to us for almost eight years, for more than eight years, and having this perspective, this projection of places that were part of our daily lives—our streets, our bell tower, the square, the fountain, our usual shops—was an emotional and beautiful experience. From there, a small reflection began, as we realised that over time, many people are losing their memories, their points of reference, and even the smallest details are starting to fade. So, we seized the opportunity offered by this [REPLACE] project to expand a little, to search for fixed memories, situations, and perhaps even future perspectives. We wanted to listen to and engage with the community to try to understand what they still remember and what they would like to see [in the future]."

Moreover, framing REPLACE's work within a values-led paradigm highlighted tensions between declared values and design decisions, most notably in relinquishing the authority of normative expertise in terms of both collaboration among team members and community co-creation. Sometimes, there was a tendency towards resorting to previously adopted solutions for design of our technological interventions (e.g., pre-existing engines and WebGL that allow quick and user-friendly development but limit further changes or implementations) without exploring alternative options [57]. While such tendencies were motivated by technological feasibility, reliability and cost effectiveness - all important aspects for empowering communities to autonomously engage with our designs in a long-term sustainable way - they sometimes limited the extent to which the project's technological interventions could be meaningfully informed by the insights gradually emerging from the ethnography. Conversely, the exploration of more creative and innovative applications of 3D technologies, while promising in terms of developing powerful and emotional experiences for the communities based on ethnographic data, is also problematic in terms of Autonomy and Sustainability. This approach to technological intervention, in fact, showed limitations to community co-creation and ownership as it relied mostly on the highly specific expertise of the 3D content developers, commercial software and expensive equipment (e.g., gaming computers and VR head-mounted displays).

Such issues could be expected and considered inherent in a project based on a technological ethnography and a collaborative approach involving different stakeholders (university, private companies and local communities), each with their own knowledge, requirements and agendas. The timeframe of longer-term, slow ethnographic research can be difficult to reconcile with industry demands. So too can dialogues among people with different backgrounds and expertise prove challenging, particularly in relation to 3D technologies, where things can get "lost in translation" (see Section 3.3). These circumstances caused tensions within the project's team that were extremely difficult to navigate - including lack of mutual understanding on the meaning and modalities of community participation. At points in the project's development, collaborative work needed to be paused to re-assess the overall approach. While the project initially set out to include several iterations of participatory design workshops, to engender a more community-led development of REPLACE's technological interventions (i.e., a design process guided by and conducted with communities from the onset), the challenges encountered made clear that such an approach was not feasible and a more effective way to move forward was

community consultation and collaboration, bringing in community members as part of a later phase of evaluation, testing and implementation [58; 59] (Figure 4).

Despite its challenges and tensions, this process allowed us to slow down and reflect on how to develop and apply technological interventions in a way that better aligned with both the project's values and the communities' needs, through continuous dialogue, collaboration and direct community interactions with prototypes.

Figure 4: images from community events and evaluations of 3D content.

For instance, while the development of WebGL interactive environments was guided by a more solution-driven approach, over time it seems to have fostered Curiosity and its value in terms of Sustainability and Autonomy and Mastery was seemingly recognised. In Accumoli, members of the Radici Accumolesi Association expressed their interest in adapting this digital intervention into a shared digital archive of the place that can collect and connect all past-present-future research projects and initiatives in the area, a tool that would allow them to retain control over narratives and contents in the long term. This expression of interest led to adjustments in terms of enabling user-generated content and adapting the WebGL archive for compatibility with widely available devices and online infrastructures. As for other technological interventions, specifically VR constructions, the iterative process of testing and feedback helped the 3D creators to align the modelling work with the community's needs and make design decisions guided by respect for people's vulnerability and trauma - e.g., modification to the VR lighting settings to shorten nighttime scenarios and enable people to experience the reconstruction in their preferred light setting, made after a community member felt particularly distressed by her experience of Accumoli's VR in the nocturnal scenario. These examples demonstrate that the values-led framework was not just theoretical: it actively shaped design decisions, technological choices, and community engagement strategies.

3.3 Evaluating the Values

Committed to a reflexive and ethical approach, and mindful of the project's dedication to imagining alternative futures (per its Curiosity and Innovation value), REPLACE commissioned a qualitative review of its values-led process. As described in Section 2.3 (also Appendix A), this review entailed independent interviews with each team member, informed by watching of selected segments of video recordings of the values definition workshops, multiple reflective group meetings between the authors of this paper, and critical reading of both

the project's original funding application and an in-progress academic article on REPLACE's values. Per above, the focus of the interviews was not only on current engagements with REPLACE's values, but also on how previous personal experiences and colleagues' treatments of values affected people's outlooks.

Of the struggles noted above (Section 3.2), the majority centre around interprofessional group dynamics (i.e., negotiating normative expertise, mutual respect, and differing understandings of community participation), specifically amongst REPLACE's core team of six. Yet most of the project's values are public-facing, concerned with community impacts and catering to community needs. As one team member put it, "They're about communication with the outside … to a large extent, as well as a little bit inside". This external focus of the values is, perhaps not unsurprisingly, accompanied by a sense of internal disconnect or misunderstanding. Team members speak of "a lack of trust" or postulate that within the group "sometimes there is something that is lost in translation. It's like we don't speak the same language".

The values elicit different emotions and manifestations from the team, a consequence of the inherently personal nature of the concept of values. For instance, Lightness is interpreted by some as enjoyment, others as uncanniness, others as self-awareness, and still others as about a state of mind wherein one works to avoid internalising concerns or problems. However, per one interviewee, who implies that Lightness could have been applicable to navigating inter-team conflict, there is a sense that "We're not all coming from the same kind of jumping off point." An opportunity appears to have been missed for the values to have been used to more consciously align and unite team members from the outset of the project. Instead, the values primarily focus outwards - on community members who were neither part of the values-setting process itself nor the actual digital design work. This predicament leads to some degree of recognition within REPLACE that "I think we've been working with values without probably being fully aware of the fact that the values were there and embedded properly in our actions".

At the same time, however, other team members suggest that "we use the values a lot in the sense that...when we realise that we are doing something that is actually not in conflict but it's not properly or completely reflecting one of our values … we use the values to take a step back". As discussed in the previous sections, while the process of values definition was conducted internally, the values were fundamentally shaped by ethnographic engagement with affected communities before and during this process, and community voices were central to defining the key values that structured the project. However, there were still discrepancies in how values were practiced and interpreted, leading to mixed opinions about their effectiveness in negotiating friction or guiding behaviours. While some team members saw the values as integral to decision-making, others questioned their practical impact. As one REPLACE member explains, "I don't think it's [i.e., having values] made any difference whatsoever...you know, the values themselves are all perfectly good values, they're laudable...but...if you don't adhere to them...They are subjective, you know, I mean it's about setting boundaries". Even where team members indicate the positive impact of the values, they also acknowledge the labour involved in applying them: "What is the line? OK, it is my work [but] what is the line? What do we do? It's a work that requires constant reflection and you know…the constant questioning of yourselves, to be honest, sometimes is exhausting." These reflections highlight a key challenge: values can guide, but their impact depends on the structures that support them. In REPLACE, this became clear when tensions arose between academic researchers and collaborating companies. Disagreements centred on each company's role in designing and implementing interventions, community engagement approaches, balancing technical expertise with community control, defining sustainability, and whether certain digital reconstructions reinforced nostalgia rather than resilience. These tensions underscored the need for shared ethical principles among team members before resuming community engagement, ensuring consistency over competing institutional priorities.

While internal workshops and constant engagement in ethnographic research and iterative design helped to a certain extent in navigating these challenges, some team members struggled to apply the values in practice. Notably, multiple interviewees remarked on the possibility that they lacked the skillsets - or support mechanisms - to deploy and stay true to the values. As one team member highlighted, "Yes, we can set a lot of values, but then we might not be able to activate these values according to our personal aptitude and it might be...that I think certain training could help?". Another remarked, "Also, I do have to say that I was not equipped and I didn't have the right amount of experience in order to be able to handle difficult situations...". Still another hints at the fact that, to be fully lived, the values needed active monitoring by multiple parties within and

beyond the team: “I'm sure there are ways to hold people to account and I will be very specific here...there are boundaries that are set. And those boundaries have not been respected”.

Ultimately, it appears that at the time of the interviews the values were not authentically realisable within the REPLACE team, which could explain the tensions that emerged between declared values and design decisions discussed in Section 3.2. We might postulate that the values (and the wider values-setting process) were assumed to be mutually-understandable and implicitly-actionable amongst team members. But such assumptions meant that when challenges began to manifest internally, the values were not easily deployable to negotiate the issues. As one team member put it, “ethics are …no stronger than the ethics of the people who are adopting or not adopting them. And there's a whole range…whether it comes to anything…like what is respect?”. Another noted about the team, “we have researchers and people with different knowledge, skills and past experience. So I think it would have been useful for us to discuss that, because you can't take for granted something about the person that you don't know very well. Sometimes even...a person that you know very well...sometimes you have to discuss.” In other words, per one interviewee, “it's very difficult to work on values on an abstract level”.

4 DISCUSSION

Organising dedicated values-led design workshops provided spaces for collective discussion, critical reflection and knowledge sharing among team members. The critical reflection facilitated by this approach allowed us to explore themes that might be considered unexpected given the focus of the project, such as pleasure and lightness, and fostered discussions informed by preliminary insights gained from the ethnographic data collection. At the same time, this approach led to critical examination of the very nature of participation and forced us to confront the contradictions of co-production and challenges of long-term collaborations with communities. While the values guiding REPLACE reflect our commitment to a grassroots, community-centred approach, we had to ask ourselves whether the needs expressed by some stakeholders are actually for the benefit of the whole community, while also acknowledging potential misalignments between their desires and the project’s values. There were instances where our position as researchers and experts was challenged, requiring us to debate how to stay true to Respect and Humility, by deferring to communities, while embracing Curiosity and Innovation, by providing constructive criticism and facilitating the envisioning of alternative scenarios. We repeatedly faced the challenge of balancing values while engaging with communities and stakeholders. This included respectfully managing somewhat unrealistic expectations and deciding whether to continue encouraging Curiosity when we noticed that, despite initial interest, there was a disinclination to engage with certain technological interventions.

Positively, the essence of some of the values over time became embedded in our designs (e.g., Curiosity, Lightness, Resilience), as reflected in the reactions and feedback from communities discussed above. While we did not organise dedicated public events to consider the values, through the continuous engagement provided by our ethnographic research, discussion on the project’s values with communities emerged in a less structured - arguably more organic - way, e.g., in the form of informal and relaxed conversations with community members and local associations. However, because the values were not inherent in some of the team members’ working methods and conceptual paradigms, the extent to which the values themselves led to these outcomes remains debatable.

Moreover, working within a values-led design framework revealed ethical tensions between declared values and practical decisions, exposing misalignments both internally (among team members) and externally (between the project and stakeholders). These misalignments led to moments of friction and frustration, underscoring the limitations of a values-led paradigm in offering clear guidance for navigating conflicts that arise when attempting to actualise values in practice. Where conflicts between the values and the community emerged, it was also difficult to see how the values really supported the navigation of the issues. This limitation appears to be common to most values toolkits, which generally “consider their recipients as disembodied, impartial actors, who can engage with and work through the expected processes of reflection, identity work, and required action without any emotional reaction to the necessary shifts of perspective and awareness of positionality and responsibility” [60, 5]. This kind of work inevitably results in stress for both the design team

themselves and for communities, but there is a scarcity of accompanying tools to manage the outcomes and support people in grappling with the challenges.

However, we felt it crucial to use insights from REPLACE's work as a starting point for critical self-reflection on the criticalities of co-design, which often remain unspoken and are rarely reflected upon [61]. Providing an honest account of this experience about potential negatives and perhaps unavoidable limitations of technological ethnography, offers a meaningful contribution to a much-needed open discussion within and outside the research community, as also highlighted by Tuhkanen [62].

5 CONCLUSIONS AND FUTURE DEVELOPMENTS

Working with values is a deeply challenging task, one that requires commitment and multiple iterations and often manifests as a process of trial and error. Values are living entities that naturally change and develop over time, which makes purposeful revisitation and nuanced understanding essential. A key insight from REPLACE is that values-led design must be dynamic, evolving with community needs, researcher reflections, and real-world challenges. Initial workshops were held internally, not to impose values on communities but to address tensions among collaborators. The values were shaped by ethnographic data and community narratives, grounding them in lived experiences rather than theory. Internal alignment was essential to bridge disciplinary frictions between academics and industry, particularly in balancing community engagement with technical constraints. By addressing these tensions first, we aimed to ensure more coherent, transparent, and ethically-responsible subsequent community engagement.

This process highlights an important consideration for future values-led design projects: meaningful community involvement does not always require immediate co-design but can be staged iteratively, informed by research insights, and refined over time [58]. Future work should explore how to balance early stakeholder inclusion with the need for internal cohesion, ensuring that community engagement is both ethically grounded and practically feasible. Achieving this balance requires not only methodological planning but also a commitment to continuous critical self-reflection, ensuring that values are not just theoretical ideals but actively guide decision-making. Effectively adopting a values-led framework requires establishing positionality at the outset of the collaborative process, alongside continuous efforts to nurture reflexivity and accountability. While values provide the foundation for initiating the work, true mutual understanding is only possible when there is explicit acknowledgment of positionality and an awareness of individuals' backgrounds, belief systems, and their compatibility with one another. Finally, values need to be articulated with an awareness of the skills required to deploy them, and appropriate training and support must be offered to develop these skills across team members, even where values seem self-evident.

The REPLACE project produced a set of concrete outcomes that reflect the societal relevance of its values-led design framework. These include immersive VR reconstructions of Amatrice and Accumoli, a WebGL-based digital archive prototype, and several community exhibitions. Local participants interacted directly with these outputs, contributing feedback that led to specific design changes (e.g., the adjustment of lighting conditions in the VR environments to reduce emotional discomfort) and suggesting new, autonomous uses for the digital archive. These engagements show how values such as resilience, respect, and autonomy have been put into practice. Importantly, the REPLACE outputs have opened up opportunities for long-term cultural preservation and community resilience, particularly through ongoing discussions with local groups such as the Radici Accumolesi association about future uses and ownership of the 3D content. An analysis of some of these social impacts is presented in Di Giuseppantonio Di Franco et al. [63], which documents how immersive technologies fostered sense of place and emotional reconnection in disaster-affected settings.

Despite challenges, we believe that explicitly deploying a values-led framework will help researchers and practitioners in the digital heritage field to develop more ethically-aware and socially-engaged practices and to create real value for the communities in which their work is embedded. This collaborative process is essential for scrutinising and refining set values, enabling a deeper understanding of the impact and implications of a values-led design framework. Furthermore, it promises to offer insights into a more conscious and reflective evaluation of research practices, emphasising the importance and ethics of community-led approaches for the participatory design of intangible cultural heritage.

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APPENDIX A

Questions posed to REPLACE team members in interviews as part of a reflective evaluation of the project's values-led design framework.

	REPLACE Team Consultation Questions
1.	Tell me about your experiences working on REPLACE so far. What have you been doing? What are your overall impressions of the project at this point in time?
2.	Using some of REPLACE's values as prompts, What have you been doing in REPLACE that's made you feel 'lightness'? What has made you curious? At any point, have you had to activate the value of 'respect & humility' in order to work through a situation you encountered in the project? If not, when do you imagine you might need to call on the value to manage your approach (either in working with external audiences or internally within the project team)? To what extent do you feel you have the tools/skills you need to work through a predicament where a value is obviously breached (whether by you, by one of your team, or by a community member)? To what extent do you believe the project is enabling your own sense of freedom, mastery and autonomy? What efforts have you made - or do you plan to make - in embedding sustainability into your workflow?
3.	Tell me about your past experiences in working with values. If you used different methods to hold yourself and your teams to account, what were they (e.g., ethical frameworks)? How well or poorly did these work for you in the past?
4.	How have you seen your team members using the values? What questions or concerns has this use of the values generated for you?