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From Data to Situated Knowledge: Designing Metadata for Plural and Participatory Cultural Heritage

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Abstract

This paper investigates metadata as a cultural, situated and participatory design practice, reframing it as an interface for reappropriating minoritized and plural memories in digital cultural heritage. Against the background of national digitization strategies driven by technical efficiency and standardization, the study critically addresses the epistemic risks of abstraction and exclusion. Drawing on the notion of metadata as a co-produced narrative, the research outlines three design trajectories— generative, culturally situated and civic—emerging from a comparative analysis of over 100 design-driven case studies. Through a qualitative methodology, the study explores how metadata can become an active, affective and negotiated device for inclusion, digital literacy and memory activation, particularly in marginalized communities. The findings suggest a redefinition of metadata not as neutral descriptors but as cultural artefacts fostering relational infrastructures, inclusive knowledge production, and new modes of collective sense-making.

CCS Concepts • *Information systems* → *Digital libraries and archives*; *Metadata*; *Information extraction*; • *Human-centered* **computing** → *Participatory design*; *User-centered design*.

1. Introduction

With recent developments in the digitization of cultural heritage digitization practices, critical issues are emerging that extend beyond the objectives of preservation and accessibility. Recent Italian national initiatives, most notably the National Recovery and Resilience Plan (PNRR) and the National Digitization Plan (PND), have accelerated digitization processes within cultural institutions and across the broader cultural and creative industries. While essential for the preservation and dissemination of heritage, these interventions are often driven by the logic of technical efficiency and interoperability, which tend to produce functional and standardized forms of representation. The proposed approach to metadata, however, does not exclude the need for standards and interoperability; rather, it complements them by introducing more flexible, relational, and situated structures of representation. In the absence of design approaches attentive to the culturally situated dimension—that is, to the role of social, historical, and affective contexts in defining the value of heritage, such processes risk generating abstract outputs, detached from the local and everyday modes through which meaning is attributed [Gia12].

This research is situated within the critical strand that challenges the normative universalism underpinning computational processes applied to cultural heritage, highlighting how such processes can marginalize plural perspectives, including minoritized memories (such as those excluded from canonical historical discourse), personal recollections, and local modalities of meaning-making [Esc18].

2. Contribution to the research

To address these challenges, this research proposes to reframe metadata as a cultural, participatory, and context-based practice, capable of restoring agency and visibility to marginalized communities and heritages. The contribution offers a critical reinterpretation of the role of metadata in the digitization of cultural heritage, framing them as participatory design tools. From a User-centred Design perspective [Nor13], participation is understood as an epistemological and political horizon, shaping the conditions under which cultural data become meaningful and actionable: it is the necessary condition for making cultural data proximate, recognizable, and genuinely actionable by

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communities, that is, by those groups that collectively attribute meaning to heritage [Cou05]. Within this framework, the research identifies three design trajectories: generative, culturally situated, and civic. These trajectories share the concept of metadata as a collaborative act, where institutions or lead researchers who initiate and frame the project, designers, and participants openly negotiate how to construct and interpret data during the collection process.

The contribution is structured on two levels. Theoretically, we propose a design-oriented reconceptualization of metadata as a cultural interface operating at the intersection of narrative, identity, and participatory practices. Methodologically, we advance a critical-comparative framework to analyze metadata in design-driven projects, covering institutional, artistic, and civic case studies.

3. Innovation description about how the work extends the state of the art

The starting point of this contribution is the growing awareness, also emphasized in recent international analyses, of the risk of erosion of collective cultural memory associated with non-inclusive digitization and preservation practices. The concept of *vanishing culture* underscores how the increasing inaccessibility of digital content, due to factors such as dependence on closed platforms, license volatility, and the absence of inclusive metadata strategies, may result in the marginalization of stories, languages, and perspectives, particularly those of underrepresented communities [MFZ24]. In this context, the research seeks to contribute to the ongoing debate by reconceptualizing metadata as a potential design tool for countering the progressive loss of accessibility and visibility of digital memories. The objective is to explore models and tools capable of fostering community participation, thus promoting a more inclusive vision of digital memory. The approach adopted in this work is grounded in a view of design as a relational and anticipatory practice, capable of exploring and enhancing the plurality of local meanings and emerging usage patterns within communities. In this perspective, design not only serves as a mediator between technology and users but also plays a strategic role in interpreting real needs and guiding the conscious adoption of digital technologies [Cel08], [SS14].

The perspective of *Creative Data Literacy* [DIg17] highlights how data-related competencies are unevenly distributed and stresses the need to promote literacy pathways that go beyond technical skills, enabling citizens, communities, and cultural practitioners to critically interpret, discuss, and reuse data [DB20]. Creativity and participatory approaches thus become fundamental tools for bridging the gap between data producers and data subjects, fostering shared meaning-making and the transformation of knowledge practices. Relational informatics and digital literacy further invite us to consider data as dynamic elements within complex networks, where value emerges from relationships among people, technologies, and usage contexts [Mat21]. In this study, metadata, reimagined as cultural interfaces and relational activation tools, are at the core of three design trajectories: generative, culturally situated, and civic, explored through the analysis of selected case studies. The analytical framework has been integrated and aligned with theoretical references from *critical heritage studies* [Smi06] and *design research* [Lau03].

4. Methods and Results

This study is part of a broader research trajectory involving the development of an open database that collects, categorizes, and compares projects employing design methodologies in the context of cultural heritage, primarily through the use of digital tools. Initiated in January 2025 within the Design Research Unit, [University details removed for blind review], the project currently includes over 100 case studies, ranging from institutional initiatives to artistic experiments and civic projects. This tool has enabled the mapping, comparison, and categorization of diverse design practices, and the extraction and analysis of case studies specifically addressing metadata practices that revealed relevant patterns.

The research adopts a qualitative, comparative, and critical approach. This contribution presents an analysis of three specific case studies selected for their ability to represent emerging approaches in the metadata of digital cultural heritage. Case observation revealed that user participation is a necessary element for rethinking how metadata is generated, configured, and negotiated. This involvement takes multiple forms, from participatory tagging and semantic annotation to more experimental modes such as narrative, visual, or anticipatory metadata.

The selection of the three case studies, *Synthetic Memories*, *The Sloane Lab*, and *Data Challenge* and *Youth & Culture* was guided by criteria of methodological diversity, design relevance, and innovation in metadata conceptualization. These projects originate from distinct disciplinary and operational domains, including artistic experimentation, institutional heritage infrastructures, and civic-oriented educational initiatives. Summarized in Graph 1, they embody three emerging trajectories through which metadata can be reimagined as participatory and culturally embedded design tools, specifically addressing the dimensions of data generation, configuration, and negotiation.

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Case Study	Metadata Trajectory	Level of Participation	PluralityOriented Theme	Project Type	Function of Metadata
Synthetic Memories	Generative	Personal	Affectivity and identity	Artistic / Speculative	Narrative matrix for generating visual data from oral memories
The Sloane Lab	Culturally Situated	Cultural	Decoloniality and semantic negotiation	Institutional/Community based	Semantic reinterpretation and critical recontextualization
Data Challenge – Youth & Culture	Civic	Civic /School Participation/ Students	Inclusion, data literacy, and education	Educational / Anticipative /Service Design based	Civic activation and interpretation of complex social phenomena

Graphs 1: *Summary of case studies with the description of metadata trajectories.*

4.1 Synthetic Memories: Generative Metadata
The first case study "Synthetic Memories" is a speculative-artistic project initiated by the collective Domestic Data Streamers, based in Barcelona, in 2022. Its objective is to offer an experimental public service for reconstructing lost or undocumented memories through visual reconstruction using artificial intelligence. At the core of the project is the creation of a collective physical archive of synthetic memories: images generated from personal narratives and subjective experiences. This archive is accessible and designed to assist individuals in the reconstruction of their personal memory. Here, metadata does not serve a descriptive function but constitutes the very origin of visualization: it is a narrative, personal, and affective matrix from which the symbolic form of memory emerges. Participation occurs on an interpersonal and intimate level, based on direct individual engagement in sharing personal experiences. This form of involvement emphasizes the identity-related and emotional function of metadata, transforming data into a vehicle for self-representation. The project exemplifies a generative trajectory where metadata is not a classificatory filter but a creative and effective device that initiates new processes of symbolic activation. In this sense, metadata acts as a primary cultural interface situated between individual memory and visual generation.

4.2 The Sloane Lab: Culturally Situated Metadata
The second case study "The Sloane Lab: Looking Back to Build Future Shared Collections", is a project led by University College London, launched in 2021 and funded by the Arts and Humanities Research Council as part of the "Towards a National Collection" initiative [TNF24]. The project aims to digitize and reconnect Hans Sloane's collections -distributed among the British Museum, the Natural History Museum, and the British Library, through the creation of a digital archive activated via semantic negotiation processes with diasporic communities culturally linked to this heritage. Adopting a culturally situated approach, the project fosters active participation of multicultural communities and stakeholders through workshops and co-design practices. Metadata here is not fixed but contested: its taxonomic categories are reinterpreted, challenged, and rewritten. Participation is cultural and oriented toward a critical and decolonial reinterpretation of heritage. The project illustrates how metadata can serve as a tool for epistemic justice: a space where power relations are redefined, marginalized perspectives recognized, and alternative narratives around heritage constructed. Metadata thus functions to re-integrate meaning by embedding data within community and transcultural frameworks.

4.4 Data Challenge – Youth & Culture: Civic Metadata
The third case study "The "Data Challenge – Youth & Culture" is a project that was launched in 2023 as a civic and educational initiative aimed at rethinking the role of public cultural spaces. such as libraries and youth centers, in the post-pandemic context [AC25]. Promoted by the Advanced Design Unit of the University of Bologna in collaboration with the Library Department of the Municipality of Bologna, the project adopted an integrated approach of co-design and data visualization to highlight the perspectives of younger generations and transform these spaces into more inclusive, participatory, and responsive environments.

Through co-creative workshops with students and young citizens, and by employing methodologies from service design and citizen science, the project developed tools for interpreting and communicating complex social phenomena, including gender inclusion, professional orientation, and relationships with cultural institutions. Metadata is collectively constructed and functions as an educational and civic device that activates processes of reflection, appropriation, and transformation. Participation is civic-school based, with a local scope but policy-driven implications: project outcomes engage with educational institutions and public administrations. Metadata is framed as a tool of collective agency and mediation between youth communities and decision-making contexts. This project represents a civic trajectory of metadata, where it becomes not just an informative index but a catalyst for awareness and social change.

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4.4 Reflections and Perspectives

The outlined trajectories do not represent an exhaustive classification, but rather a critical and open design model, a lens that guides the analysis and experimentation of participatory metadata practices within digital heritage design. These perspectives frame metadata as a cultural interface capable of reflecting plural viewpoints, personal and minoritized memories and local modes of meaning-making, across the dimensions of data negotiation, configuration, and generation. The case studies demonstrate that participatory forms are not uniform: they span an axis from intimate and affective, to collective and transcultural, to civic and institutionally oriented.

The analysis illustrates how participation enables metadata processes where metadata is not added after the fact, but rather generates, negotiates, or transforms content—becoming an active agent in meaning-making. Within institutions, the framework embeds participatory metadata practices into curatorial, archival, or policy workflows, enabling stakeholders to co-shape narratives and structures in real time. This fosters a shift from static documentation to dynamic co-production, institutionalizing participation as a generative process. While rooted in qualitative and participatory methods, the approach generates structured knowledge such as emergent categories, conceptual maps and collective priorities that may inform quantitative analysis. Participatory metadata thus acts both as an engagement tool and a mechanism for data collection and transformation. The case studies reveal the plural nature of collected data and their capacity to represent and convey the complexity of contexts, acting on the dimensions of data generation, configuration, and negotiation. In this perspective, metadata moves from a technical phase to a cultural and relational process. Reconfigured in this way, metadata is not a neutral descriptor but an active cultural artefact that does not exclude the need for standards and interoperability but complements them with flexible, relational, and situated structures. While grounded in qualitative and design-oriented analysis, the scope of this work remains exploratory and requires further validation through long-term empirical application and crosscontextual testing. Future developments will focus on expanding the database and applying the framework across diverse contexts. To enable this, simplified operational processes will be developed, not to reduce complexity, but to make participatory metadata practices more accessible and adaptable in different environments.

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