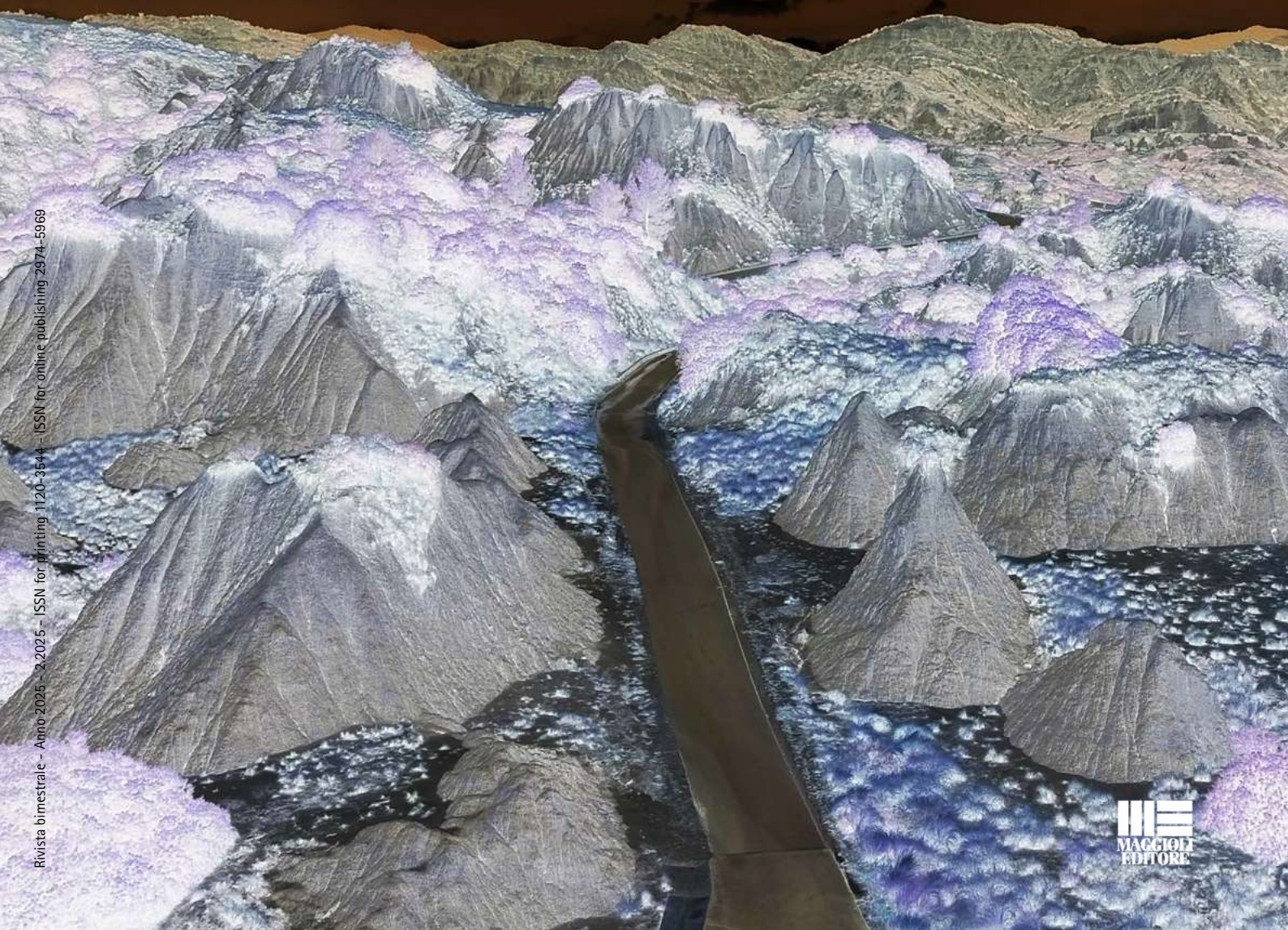


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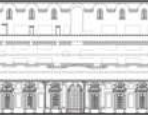


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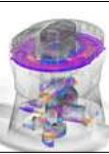


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From digital survey to conservation: integrated approaches for contemporary art documentation

Dal rilievo digitale alla conservazione: approcci integrati per documentare l'arte contemporanea

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In recent years, digitalization has taken on an increasingly strategic role in the field of cultural and artistic heritage conservation, opening up new methodological and operational perspectives. Within this framework, the paper presents part of the ongoing research carried out within the National PhD Programme in Heritage Science, focused on the analysis and application of digital surveying tools to contemporary artworks. Starting from a methodological approach that combines the potential of emerging technologies with conservation requirements, the contribution focuses on the digital documentation of three artworks exhibited at the *Centro per la Scultura Contemporanea* in Cagliari. The research proposes an interdisciplinary approach aimed at developing a replicable workflow capable of integrating metric, morphological, and diagnostic data within a digital environment, supporting the knowledge and understanding of the artworks. The application of integrated surveying tools and analytical methodologies represents the research framework in which possible innovations emerge for the effective use of digital data by conservators and restorers.

00.

View of segmentation
point cloud of
Torre Martiniana
Contemporary Sculpture
Centre in Cagliari.



01.

Photos of the Torre Martiniana Contemporary Sculpture Centre in Cagliari (a) and its exhibition spaces: first floor (b), entrance (c), basement (d), second floor (e); (photos and graphic design by the authors).

Negli ultimi anni la digitalizzazione ha assunto un ruolo sempre più strategico nel campo della conservazione del patrimonio artistico e culturale, aprendo nuove prospettive metodologiche e operative. All'interno di questo scenario, il contributo presenta parte della ricerca in corso di svolgimento nell'ambito del dottorato nazionale in Heritage Science incentrata sull'analisi e l'applicazione di strumenti di rilevamento digitale applicati alle opere d'arte contemporanea. A partire dall'impostazione metodologica che unisce il potenziale delle tecnologie alle esigenze conservative, il contributo si concentra sulla digitalizzazione di tre delle opere esposte al Centro per la Scultura Contemporanea di Cagliari. La ricerca propone un approccio interdisciplinare per lo sviluppo di un flusso di lavoro replicabile, capace di integrare dati metrici, morfologici e diagnostici in un ambiente digitale, utile sia per la conoscenza dell'opera. L'applicazione di strumenti per il rilievo integrato e di una metodologia analitica rappresentano lo scenario di ricerca in cui sono contenute possibili innovazioni per un utilizzo fattivo del dato digitale da parte di conservatori e restauratori.

INTRODUCTION

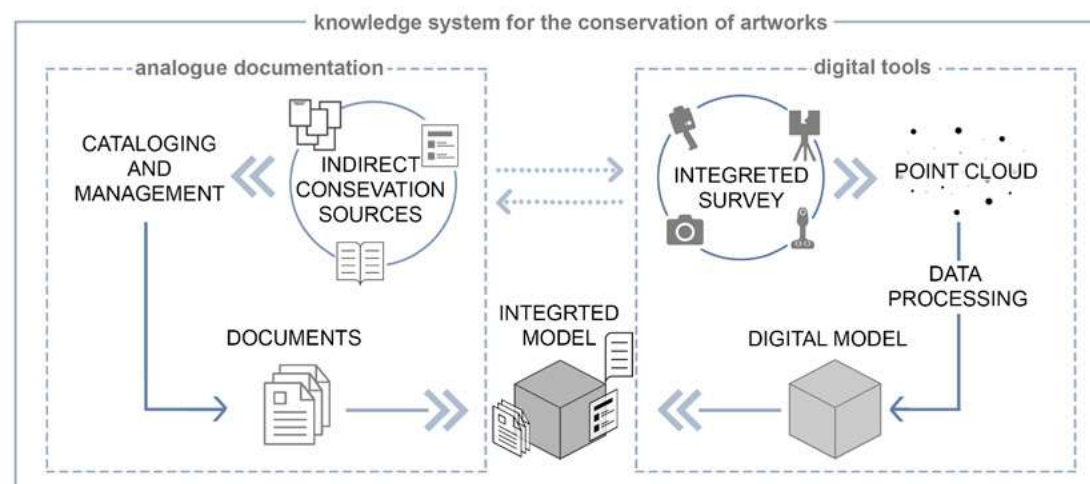
The digital transformations taking place in the field of conservation reflect a broader transition process which, supported by European and national initiatives, aims to adopt innovative tools for the management of cultural heritage (European Commission, 2024). Three-dimensional acquisition technologies enable the accurate documentation and representation of the geometric and morphological characteristics of artworks, for conservation and valorisation processes (Apollonio et al., 2021; Spallone et al., 2021).

Contemporary art often contradicts artistic tradition, both in terms of materials and forms and in terms of concepts and deterioration, opening up new paradigms in conservation (Laura et al., 2023). In this context, the need for knowledge is more important than practical operation (Chiantore, Rava 2005, p.38), and it becomes essential to understand the many aspects that characterise artwork, favouring preservation and monitoring as a conservative strategy (Chiantore, Rava 2005, p.184).

The principal purpose is to define an integrated method that, starting from three-dimensional surveying, allows for the multi-level management conservation, historical and material data, as well as its tangible and intangible characteristics through analytical data processing and interpretation (Marra et al., 2021). This contribution is part of a broader research activity focused on the application of digital tools for the

02.

The methodological framework combines analogue and digital tools to construct a knowledge system for the conservation of artworks. (graphic design by the author).



documentation and conservation of artworks, specifically referring to the ongoing experimentation at the *Centro per la Scultura Contemporanea Torre Martiniana* in Cagli (Pesaro–Urbino) [Fig. 01].

The work, characterised by a strong interdisciplinary component, aims to promote continuous synergy between professionals, involved in metric surveying and digital representation, and conservator-restorers responsible for the analysis and documenting the state of conservation, with the goal of strengthening the connection between different methodological approaches.

METHODOLOGY AND APPLICATION CONTEXT

Digital documentation practices have an essential role, constituting a necessary phase within the knowledge and conservation processes (Maietti et al., 2023).

The methodological framework proposed here is conceived as a descriptive and interpretative process that combines traditional conservation records and digital tools to construct a coherent and shared knowledge system for the artworks documentation. The investigation focuses on the definition of integrated descriptive models capable of containing heterogeneous data (archival sources, historical-artistic information, conservation states, and decay phenomena) within usable systems, that are not only tools for visualisation, but actual environments of knowledge that can be queried and updated over time [Fig. 02].

The case study for the experimentation of integrated digital documentation is the *Centro per la Scultura Contemporanea Torre Martiniana* in Cagli (Clini et al., 2015), a military building converted into a museum space in 1997. The works exhibited inside the tower are site-specific installations, that establish a direct and permanent dialogue with the architectural space that houses them. This strong connection inspired reflections on documentation needs, leading to the development of a methodology involving the use of different digital acquisition technologies designed to operate across multiple levels of investigation (architectural, object-based, and detailed), in order to capture the spatial and material complexity of the site and the artworks.

One of the research objectives is to test low-cost tools that combine automation and accessibility, ensuring replicable and accurate documentation. During the research, the comparison and analysis of the data obtained will provide insight into how different tools, with specific capabilities and limitations, can contribute to the construction of a multiscale dataset. The aim is not to define a rigid workflow, but a system that can be adapted to resources and conservation needs.

Three artworks were selected as pilot cases for experimentation, based on their characteristics and conservation needs. The first artwork, *Senza titolo* by Jannis Kounellis, is exhibited in the basement of the tower; *Agnello Mistico* by Hidetoshi Nagasawa is located on the top floor, in the central body



03.

Application examples: "Untitled" by Kounellis, underground environment; "Mystical Lamb" by Nagasawa, top level viewed from the balcony; "Untitled" by Zorio, top level interior environment (photos and graphic design by the authors).

of the tower; and finally, *Senza titolo* by Gilberto Zorio, suspended at the centre of the same level and anchored to a wooden beam in the ceiling [Fig. 03].

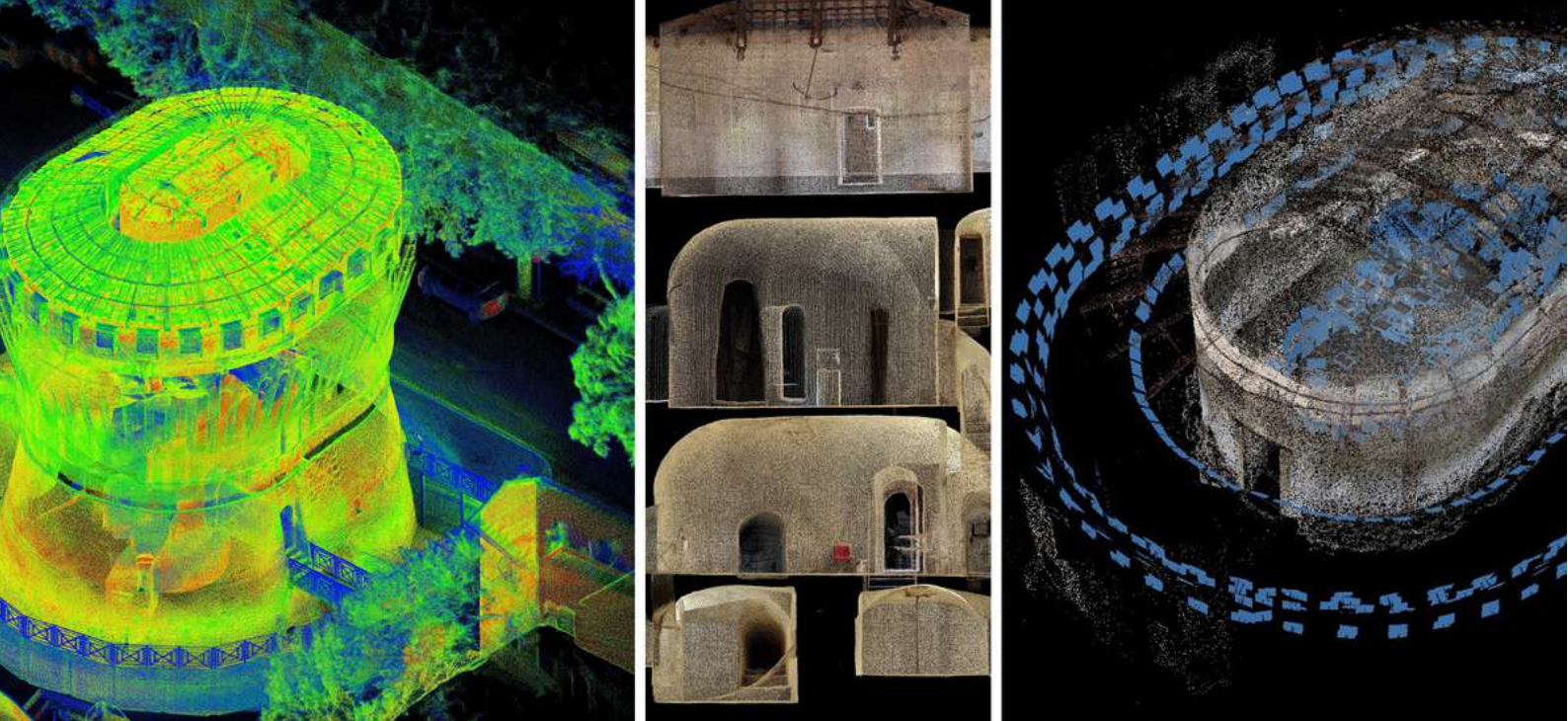
At present, the research is in its first investigation phase, focusing on the definition of multiscale analyses of survey data. This phase represents an important step towards developing a system for multilevel data management and extraction, making information accessible in a stratified, comprehensive, and functional way for the various actors involved in the conservation process.

DATA ACQUISITION

Before the surveying operations, a preliminary activity was carried out to collect and organise conservation information through the compilation of digital forms by the conservators involved in the project¹. This phase provided the knowledge base and methodological framework for the hierarchical structuring of data, for its subsequent integration into the three-dimensional digital model.

The most widely used tools for heritage documentation today are terrestrial laser scanning (TLS) and photomodelling based on Structure from Motion (SfM), which have been extensively tested and consolidated (Bianchini et al., 2022; Remondino, 2011). Moreover, the evolution of surveying systems has enabled the introduction of Simultaneous Localization and Mapping (SLAM) technologies, initially designed for the rapid mapping of urban environments but increasingly adopted for the surveying of architectural heritage (Calvano et al., 2023), opening new application scenarios within museum contexts. The integrated survey operations involved the use and comparison of different acquisition technologies². The instruments employed included a dynamic SLAM laser scanner (XGRIDS Lixel K1), a static scanner (GALOIS M2), a digital reflex camera (Canon EOS 1100D) [Fig. 04], and a structured-light scanner (Scantech IREAL 2E).

The SLAM scanner enabled rapid and continuous mapping of indoor and outdoor spaces, which was useful for understanding the volumetric configuration of the complex and the spatial relationships between the works and the architecture. The static scanner was used for accurate documentation of the interior spaces, integrating metric and chromatic data and producing navigable three-dimensional models. Photogrammetry provided fundamental support for high-resolution recording of the surfaces characteristics. Finally, the structured light scanner was used to acquire detailed images of selected portions for diagnostic purposes. Each technique had specific advantages and limitations (accuracy, speed, automation, detail capability). These complementary potentials make it possible to address the multiscale survey and material complexity of the case study. The data collected through the survey will form the basis of a critical interpretation process that takes into account the needs of conservators, providing useful data for defining conservation approaches.



04.

View of digital acquisitions with different scales and detection methodologies: Tower and surrounding area acquired with SLAM K1, longitudinal section of interior spaces detected with Galois (RGB data), processing of cloud from photographic survey (from left to right). Elaborated by the authors.

CONCLUSIONS

The analysed case studies are subject to inevitable transformations, linked both to the heterogeneity of their materials and to their intrinsic relationship with the architectural space. This condition raises issues that are typical of contemporary art, where the boundary between conservation, transformation, and the poetic integrity of the work is often debated: to what extent is intervention legitimate, and what is the role of the artist's intention? In such contexts, digital documentation becomes a fundamental tool for narrating and describing the artwork, making its transformations traceable over time.

However, it is crucial to operate with the awareness that metric acquisition is a part of a broader knowledge process, which must also consider many other aspects such as the collection of historical information, archival sources, curatorial observations, and diagnostic analyses.

The integrated surveying is conceived as a pre-diagnostic tool capable to describe the characteristics and specificities of the object, to define its state of conservation, and also to represente the context in which it is found (Maietti, 2023).

Additionally, the interpretative potential of the graphic representation derived from the survey can be fully exploited when digital environments and virtual processing are not used for practical and operational purposes in support of conservation needs, such as the systematisation of data useful for planning interventions (Gasparetto et al., 2020, p. 470).

The experimentation has allowed for the development of a methodological workflow integrating surveying, conservation recording, and historical–curatorial documentation.

This evolving method aims to be replicable in other museum contexts, even where the works of art do not necessarily have a strong relationship with the place of exhibition.

In the current research scenario, where digitisation is indispensable, there is a necessity to define which tools are most useful for the documentation of contemporary art.

In conclusion, the experiment conducted has highlighted the need to establish a synergistic connection between surveying, documentation and conservation, an integration that can only be achieved

NOTES

- 1 | Project of the Municipality of Cagli (Pesaro–Urbino): “Cagli con Pesaro Capitale della Cultura 2024”; Scientific Coordinator: Prof. Laura Baratin. The project served as an opportunity to test the research methodology and foster effective collaboration among different professional figures, in particular with conservators Mariella Gnani, Francesca.
- 2 | Survey instruments provided by MicroGeo S.r.l. and Dyna-Tech S.r.l., and Livia Marinelli.

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