

INTRODUCTION

On the occasion of the 5th International Conference on Metrology for Archaeology and Cultural Heritage, held in Florence under the initiative of the University of Florence and the University of Sannio, a special session was organised by the Institute for Heritage Science of the Italian National Research Council. The session was dedicated to the interaction between logic and computing as a benchmark in the history of computer applications in archaeology, a topic closely related to the Conference aims. Since the first edition organised in Benevento in 2015, MetroArchaeo has been devoted to the expanding interest of archaeological sciences in new technologies and analytical techniques, thus favouring the use of numerical and metrological systems and the scientific relationship with exact sciences.

The history of archaeological computing has long been characterised by the distinction, and at the same time by the interaction, between the application of mathematical and statistical techniques, as part of the movement of quantitative archaeology, and the use of databases and information systems for descriptive and documentary purposes. The aim of the session, therefore, was to focus on the evolution of these methods, to discuss their application for data encoding and the electronic treatment of archaeological data, and to further explore some key issues raised by documentation strategies, modelling and simulation studies, and visualisation techniques.

By following this systematic approach, the first papers offer an interdisciplinary contribution to the theoretical and epistemological underpinnings of computational and digital archaeology. P. Moscati summarises the critical steps of the theoretical debate on logic and computing, starting from the pivotal early phases of computer applications. A. Caravale and I. Rossi evaluate the improvement of documentary systems for cataloguing purposes, focusing on the heuristic process of descriptive and taxonomical activities and exploring their impact on the specific domain of digital epigraphy. A. Di Ludovico draws attention to the computer analysis of a class of artefacts, the Western Asiatic cylinder seals, whose first outcomes appeared in the scientific literature in the 1950s. The papers also show that the natural evolution of conceptual and logical models for data recording and representation has experienced the increasing expansion of ICTs, thus facilitating and promoting the consultation, transmission, and dissemination of large digital archaeological *corpora*.

M. Ramazzotti shifts the discussion to the role of modelling and simulation in interpreting complex archaeological systems. Whenever Clarke's Analytical Archaeology remains a point of reference, the records of the past – intended as a human construction – benefit today from the progress of neurosciences

in simulating the principles which regulate memory, orientation, classification and mapping of reality. By illustrating the ArchaeoBIM method, which fosters the possibility of integrating research with the process of conservation and dissemination, S. Garagnani and A. Gaucci explore the central theme of digital restitution/visualisation methods that mark the heuristic path of Virtual Archaeology. The new frontiers of Virtual and Augmented Reality are the core of F. Gabellone's approach, based on the new 5G technology, which will increase the spatiality of reconstruction and the immersive enjoyment of cultural heritage.

The volume is enriched by a number of cutting-edge digital applications in archaeological and cultural heritage research projects of different scales, chronological contexts and cultural milieu. All the issues dealt with reflect the new paradigm of data integration that enables today's researchers to process and investigate disparate data sources and to address simultaneously many of the issues raised by archaeological research strategies. Ranging from the study of the millenary process of human occupation in the Erei uplands, Sicily (E. Brienza, M. Cultraro, and E. Draia), to the metrological analysis of a Late Republican monumental infrastructure in the city of Cori, Lazio (G. Caratelli), an increasing interest in survey methods and spatial analysis tools, both at landscape and urban scales, can be observed.

Monitoring activities and 3D survey techniques are employed in two diverse archaeological contexts in the Lazio Region: the Ninfeo Ponari, located in the ancient city of *Casinum* (M.A. Caponero *et al.*), and the cave of San Michele on Monte Tancia (M. Carpiceci and A. Angelini), where damage diagnosis of the masonries and the plane digital representation of walls and frescoed surfaces were tested. The following three papers provide a range of insights into the conservation and rehabilitation of heritage buildings. As case studies, we can quote the medieval castle of Rocca Janula in Cassino (M. Walek), the Masseria Don Cataldo (S. Bruno *et al.*) and the church of SS. Salvatore (V. Sangiorgio *et al.*) in Bari, which have been analysed, respectively, thanks to the HBIM technology, the development of a rule-based logical inference tool, and an innovative decision support system based on Analytic Hierarchy Process (AHP). The last paper (T.D. Panova *et al.*) deals with the qualitative and quantitative analysis of the elemental composition of the unique human remains of the Russian nobility of the Middle Ages, thanks to an archaeometric data analysis approach.

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ALESSANDRA CARAVALE, PAOLA MOSCATI
Istituto di Scienze del Patrimonio Culturale – CNR