



Special Section Preface: Informative Models and Systems for Virtual Museum

Guest Editors

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This *Virtual Archaeology Review* (VAR) Special Section (SS) follows the 2nd International Conference of Geomatics and Restoration GEORES 2019 (8-10 May, Milan), organized by Politecnico di Milano (POLIMI), in conjunction with Università degli Studi Firenze (UNIFI) and Politecnico di Torino (POLITO) to boost the value of networking among academies and scientific research centres working at a national and international level on the digital Cultural Heritage (CH). It has been the natural prosecution of the 1st International Conference on “Geomatics and Restoration: Conservation of Cultural Heritage in the Digital Era” GEORES 2017 (22-24 May, Florence, Italy). It has been an occasion for the experts of the two worlds of Geomatics and Restoration of CH in its extended meaning, to meet, share and explore common needs and new approaches in the domain of heritage documentation, preservation and management. AUTECH (the Academic Association of Topography and Cartography), SIRA (the Academic Association of Architectural Restoration), SIFET (the Italian Society of Photogrammetry and Surveying), which work in different realms of the CH sector, permitted and guarantee the results achieved. GEORES 2019 has been organized as an ISPRS (International Society for Photogrammetry and Remote Sensing) and CIPA –ICOMOS International Committee on Heritage Documentation– event, and it has been supported by ISPRS (WG II/8, WG III/5, WG V/I), CIPA, ICOMOS, UNESCO Chair in Digital Cultural Heritage at the Cyprus University of Technology and EU ERA Chair on Digital Cultural Heritage, under the patronage of IGMI (the Italian Geographic Military Institute), and professional organizations of Architects and Engineers. It received sponsorships by the Carleton Immersive Media Studio (Carleton University, Ottawa, Canada), Microgeo Srl, GEOMAX Srl, STONEX® Srl.

This VAR SS has been obtained from the selection of a restricted number of contributions further implemented after the 165 presentations covering methodological advances in documentation and preservation of heritage sites, as well as advances in technologies, informative models, instruments and data management, protocols and procedures, internship training programmes and dissemination, with new jobs opportunities. The contributing authors were invited to submit revised versions of their papers to VAR journal for publication in this SS. Many presentations were made by co-authors from the two different worlds; in this way, it has been possible to present case studies where, truly, joint reflections allowed an enhancement in knowledge related to the preservation of our fragile heritage.

Particularly the usage of eXtended Reality (XR) –Virtual Reality (VR), Augmented Reality (AR), & mixed reality (MR)– for explaining CH to wider audiences finds its place in this VAR SS. It has been conceived as an opportunity for experts from Geomatics and Restoration to exchange ideas and the challenges they face in the virtualization process of architectural heritage, archaeological sites, built environment, heritage urban landscape in a multi-temporal and multi-scale fluid environment.

Often we grapple with applying information technology (IT) in an effective manner, surveying methods, data processing, data modelling, data management, data dissemination have to deal with the complexity and unicity of the CH. Technologically proposed solutions must consider if it is economically viable, with efficient use of time to get reliable interpretations. Increasing multiple data access by different users allows to lower the cost impact and to maximize the knowledge effort and expected results.

Modelling tools represent nowadays one of the most powerful technology for GEORES experts as their use can greatly augment the interpretation, object knowledge, decoding and data transfer to citizens especially when related to content-based information. Many challenging tools are on developing to this purpose, as in the case of HBIM (Heritage Building Information Modelling). They need to undertake innovative generative modelling approaches and new protocols capable to embody the complexity of CH, overcoming the limits of BIM adopted for new constructions with a simplification of object modelling, families, libraries, and related information. Surveying precision and modelling accuracy achieved in advanced scan-to-HBIM by shaping the complexity of geometries can play an important role in knowledge acquisition within a holistic approach generating unexpected relations



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connecting the morphological-metric aspects with the construction technologies, the archive, the recording and documentation, identifying the transformation occurred and the stratigraphic sequences.

The HBIM potential to merge models with all the information acquired allows experts to better address the decision making toward the preservation of the authenticity of materials and construction techniques, including the preservation of the structural behaviour and sustainable functionalities of the architectural heritage, limiting the sacrifice of the material canvas also by improving virtualization techniques. As in the case illustrated by the contributions on virtual anastylosis or virtual reconstruction of missed portions of architectural heritage samples here described.

We can relate within the HBIM a wealth of information ('I') spanning from historical data, materials, stratigraphic units and construction techniques of the different objects models (masonries, columns, vaults, domes, trusses, covering systems, decorations, frescos, bass relief, and so on) together with multi-temporal historical and current maps, documents from archives and collections, but also energy data, structural data, seismic data, climate data, and open data coming from different sources. Such richness of data and models is expected to allow the different users to derive and relate the history of arrangements, of ancient skilled workers, of family workers across Europe and not only, to improve the knowledge, preservation, and monitoring of sites, architectural heritage and museums, where semantics and vocabularies can play an important role in the co-relation of information to the models across space and time for different purposes.

Unfortunately, models and information once gathered and achieved, are often destined to be left in the digital drawers after the research analysis and conservation phases, including HBIM. Such systems –born within a professional framework– can be used as a 'live' data source enriched by contents feeding Virtual Museums with an extraordinary richness of contents circulating models and data to nonprofessional experts with the support of the XR: an opportunity to contribute to awareness-raising among citizen toward an informed society supported by enriched storytelling. A wide variety of technical and non-technical themes have been interpreted to answer this SS call.

HBIMs have to be considered just a node of a complex chain, including the design phases and decision-making levels, the on-site construction, the maintenance and monitoring across the time, environmental monitoring under pressures until to the dissemination processes; it requires an integration with other environments –HBIM-GIS (Geographic Information System), BIM-to-FEA (Finite Element Analysis), HBIM-to-XR– within the whole informative model. Informative models and systems, such as HBIM can be considered part of a DCH (Digital Cultural Heritage) ecosystem, where to be coupled by GIS/WEBGIS, but also with virtual hub platforms, as in the case of virtual museums, M-BIM (Museum-BIM), addressing the management and maintenance contents with the dissemination purposes, or in the case of archaeological site monitoring under flooding as here faced by the different contributions.

Informative models can be used as 'live' data sources to enrich the content of VR of architectural heritage, basilicas, museums, with the support of the XR, by developing new tools capable to re-use data models: they can contribute to feeding virtual museums in the different forms with an extraordinary richness of contents circulated by the informative models to non-professional experts but also for the maintenance programmes or the management of collections. The usage of XR has enormous potential in information dissemination for explaining CH to wider audiences transferring the contents detected by the researches: an extraordinary opportunity to awareness-raising among citizens toward an informed society supported by content-based narratives circulating the informative models from the expert's circuits to the non-expert channels.

Many of these challenging topics have been faced by the authors contributing to this VAR SS, opening critical aspects and new demand of research advancements for the future being. We would like to thank all the authors, the reviewers, and the editorial board members for their valuable contribution to this publication.

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