Preface

Interpretative digital 3D reconstructions have been extensively used in the context of cultural heritage for almost 30 years especially for rebuilding not physically extant historic artifacts (no longer extant, altered, or never existent). While 3D reconstructions were used and seen as digital substitutes for analog research and presentation methods such as drawings and physical models in the beginning, over the years a unique epistemology of digital 3D reconstruction has evolved. This process is highly driven by the opportunity of digital modelling to support research beyond reconstruction and visualization: by supporting an evaluation of historic sources and their correspondence, a detection of geometric principles in a historic creational process, or the classification and systematization of historic objects with respect to dependencies, similarities, or singularities. Even suppositious objects, like idealistic buildings, based on architectural rules are created using 3D construction technologies. Moreover, digital 3D reconstructions are created within socio technical systems employing various sources of knowledge and created by cross-disciplinary work teams. This raises questions about procedures and strategies for accessing, exchanging, and archiving digital assets along with the underlying knowledge base. Such knowledge has to be defined widely, and deals with query, compilation, harmonization, and contention related to information sources and resulting genetics.

There is a large amount of literature on 3D reconstruction and digital heritage as well as many elaborated concepts for digital libraries and platforms for cultural heritage such as Europeana, DARIAH, and the UNESCO Memory of the World. Closely related are intense research and development efforts for technical tools as well as several methodological questions about procedures and strategies for data management and processing as well as for the organization and representation of related knowledge. But there is a gap between theory and practice: On the one hand many highly elaborated theoretical approaches, principles, and guidelines as well as data schemes and infrastructures are proposed to foster the quality, compatibility, and sustainability of 3D cultural heritage objects. On the other hand, in practice 3D reconstruction projects are often based on unique, and prototypic semantics, workflows, and infrastructures, and are customized for a specific purpose.

A previous volume has focused on insights into ongoing research and future directions in the field of digital heritage preservation; the aim of this volume entitled *How to Manage Data and Knowledge Related to an Interpretative Digital Reconstruction of Cultural Heritage* is to reflect the current state of the art and future perspectives of digital heritage focusing on non-interpretative reconstruction and including and bridging practical and theoretical perspectives, strategies, and approaches. Moreover, comprehensive key challenges are related to knowledge and data handling within a digital reconstruction of not physically extant cultural heritage including aspects of digital object creation, sustainability, accessibility, documentation, presentation, and more general scientific compatibility. A workshop on these topics was organized by the

editors of this volume at the International Conference on Cultural Heritage 2014 in Cyprus. Based on the outcomes from this workshop, as well as additionally invited contributions, this volume covers: (a) basic concepts and the current state of the art, (b) grounded strategies, practices, and principles, as well as (c) innovative approaches, concepts, and technologies for data and knowledge management in digital heritage. Overall, the three parts of the book reflect the following challenges.

The first challenge is to gain an overview of the scope of usage scenarios, the current state of infrastructures such as digital libraries, information repositories for an interpretative reconstruction of cultural heritage as well as basic concepts and workflows of 3D reconstruction. Moreover, various large-scale cultural phenomena, such as general technology acceptance as well as open data and science, influence the use of digital technology in the context of cultural heritage. Despite various high-ranking publications and charters proposing guidelines and standards as well as many infrastructures and platforms dedicated to 3D reconstruction, there is a low level of acceptance and practical implementation of these extant approaches within a majority of 3D reconstruction projects. Moreover, for these projects there is little information on daily practices and strategies for knowledge and data object management, especially when they are based more on pragmatic decisions and needs and less on academically validated input.

The second challenge is to highlight strategies, practices, and principles currently used to ensure the compatibility, reusability, and sustainability of data objects and related knowledge within 3D reconstruction work processes on a day-to-day work basis. A special concern is to obey the variety of data, modelling approaches (i.e., BIM, GIS, VR, CAD), purposes, and output qualities. Cross-disciplinary teamwork brings with it the knowledge of many authors, various sources of information as, well as a high level of tacit knowledge. This causes non-transparency of genetics, which is in contrast to negotiability as an important prerequisite of academic culture. Last but not least, no silver bullet exists on where and how to publish resultant data.

As an overall consequence, challenges for the development of cooperative infrastructures go beyond the technical development of libraries and platforms as well as joint standards, schemes, or guidelines and include corresponding human- and purpose-related aspects, too. A third challenge is to develop innovative concepts for the exchange, publishing, and management of 3D objects and for inherit knowledge about data, workflows, and semantic structures. This includes not only solutions for data acquisition and modelling but also an information enrichment and documentation including paradata and the exchange, archiving, and managing of 3D models. Moreover, the scope covers approaches for visualization and information systems to link 3D objects to other forms of information and make them traceable and accessible on a multimedia level.

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We dedicate this book to the memory of our colleague, good friend and pioneer Dr. Ewald Quak from the Institute of Cybernetics, Tallinn University of Technology, Estonia, who passed away suddenly last year. Ewald was the visioner of this unique series of publication in 2014 and the co-author of the first Volume published by Springer Verlag in 2015.

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Sander Münster
Mieke Pfarr-Harfst
Piotr Kuroczynski
Marinos Ioannides

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3D Research Challenges in Cultural Heritage II
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Münster, S.; Pfarr-Harfst, M.; Kuroczyński, P.; Ioannides, M. (Eds.)

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