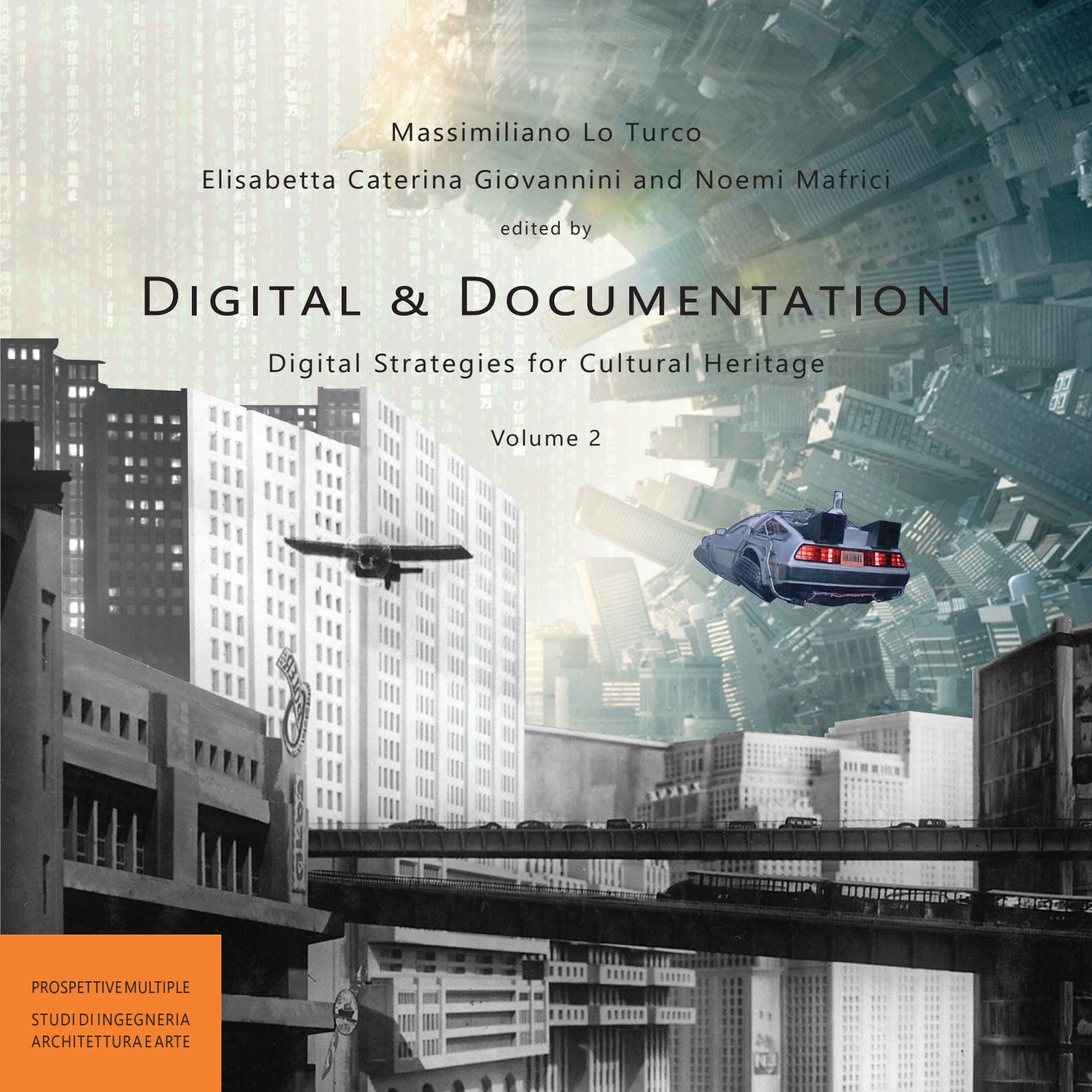
Massimiliano Lo Turco
Elisabetta Caterina Giovannini and Noemi Mafrici
edited by

Digital & Documentation

Digital Strategies for Cultural Heritage

Volume 2



PROSPETTIVE MULTIPLE
STUDI DI INGEGNERIA
ARCHITETTURA E ARTE

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PaviaUniversityPress

Digital & Documentation. Digital Strategies for Cultural Heritage / Massimiliano Lo Turco, Elisabetta Caterina Giovannini and Noemi Mafrici (edited by) - Pavia: Pavia University Press, 2020. - 205 p. : ill. ; 21 cm.

(Prospettive multiple: studi di ingegneria, architettura e arte ; 2)

ISBN 978-88-6952-123-2 (brossura)

ISBN 978-88-6952-124-9 (Open Access)

The present publication is part of the series "Prospettive multiple: studi di ingegneria, architettura e arte", which has an international referee panel. "Digital & Documentation: Digital Strategies fo Cultural Heritage" is a scientific text evaluated and approved by the Editorial Scientific Committee of Edizioni Pavia University Press of University of Pavia.

The photo credits in the "Event Photo Gallery" are by Elisabetta Caterina Giovannini and Francesca Picchio.

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Graphic project
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Printed by
DigitalAndCopy S.A.S., Segrate (MI)

ISBN 978-88-6952-123-2 (brossura)

On cover: Graphic photocollage by Elisabetta C. Giovannini

The volume consists of a collection of contributions from the seminar "Digital & Documentation: Digital Strategies fo Cultural Heritage", realised at the Politecnico di Torino on June 14th, 2019. The event, organized by the "BIM Acquisition as Cultural Key TO Transfer Heritage of ancient Egypt For many Uses To many Users REplayed" - B.A.C.K. TO T.H.E. F.U.T.U.RE. Project - team of DAD - Department of Architecture and Design of Politecnico di Torino, promotes the themes of digital modeling and virtual environments applied to the documentation of architectural scenarios and the implementation of museum complexes through communication programs of immersive fruition.
The event has provide the contribution of external experts and lecturers in the field of digital documentation for Cultural Heritage. The scientific responsible for the organization of the event is Prof. Massimiliano Lo Turco, Politecnico di Torino.

This publication is made with the contribution of DAD, Department of Architecture and Design of Politecnico di Torino, through the “BIM Acquisition as Cultural Key TO Transfer Heritage of ancient Egypt For many Uses To many Users REplayed” - B.A.C.K. TO T.H.E. F.U.T.U.RE. Project, in collaboration with Fondazione Museo delle Antichità Egizie di Torino. The project is one the winner of the call “Metti in rete la tua idea di Ricerca” partially financed by Compagnia di San Paolo.

POLITECNICO DI TORINO

Dipartimento di Architettura e Design

Compagnia di San Paolo

The event “Digital & Documentation - Vol. 2” has seen the participation of professors, researchers, scholars and private institutions

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Fondazione Museo delle Antichità Egizie di Torino

University of Rome “La Sapienza”

University of Catania

PIN - Educational and Scientific Services for the University of Florence

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Institute for Heritage Sciences of the National Research Council

University of Camerino

University of Ferrara

Free University of Bozen

The event is promoted by Unione Italiana del Disegno (U.I.D.)

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Cecilia Bolognesi

Politecnico di Milano

Cecilia Bolognesi is University Associate Professor, researcher and Architect. She focuses in teaching and research activities on representation, geometry, modelling, BIM, VR AR XR in Politecnico of Milano. She is Msc in Architecture at Politecnico and Phd in Design of Architecture in Venice. From 2016 – now she was scientific coordinator of the Digi Skills Project in Politecnico of Milano, member of the Scientific Committee of Modelling Laboratory, member of the Teaching Committee of ABC department, member of scientific Master BIM in Politecnico. Among previous position covered she was member of the Landscape Commission of the Municipality of Milan, member of the Board of Order of Architects in Milan, Editor in Chief of the Magazine of the Association of Builders in Lombardy. She is academic tutor of double degrees In Computational Design between Politecnico and SDU, civil and Architectural Engineering Department of Technology and Innovation, professor at Research doctorate in ABC department, member in H2020 BIM4EEB project and in some national Research Projects.

FROM HERITAGE TO MASSIVE FUTURE FRUITION

Postface

The European Commission, the research financed, the organizations that deal with the collection and enhancement of the historical heritage, whether they are artefacts in the open air or museum exhibits, indicate with increasing insistence the digitization as an essential process for the dissemination of our culture and its transmissibility. The digitization of whole cultural heritage sites is driven by the fear that natural or war events can erase them from our memory; moreover, when we deal with artefacts that are already part of collections or part of a museum, we are encouraged by the desire of a wider circulation in an era of cultural competition among institutions or sometimes with too difficult possibilities in circulation. Frequently we are faced with collections that are closed to the public or confined to areas that cannot be visited.

Preserving in a landscape like our, rich in artefacts but often lacking in dissemination out of its boundaries, is no longer sufficient; neither it is because we are in an area where historical research is relevant, progresses and widens its boundaries, placing itself in relation with other researches and traditions.

The creation of the first digital databases reveals an articulated panorama, full of attempts, or structure researches, where the hot topics deals with acquisition and reverse modelling themes, such as accuracy of the models and reliability; fast or automated methods of form extraction; semantic enrichment, or modelling for virtual or augmented fruition for dissemination.

Cultural heritage is transmitted us with a richness of meanings due to the interpretation of the space-time relations that forged it; however, its life now is restarted by the possibility that the technique offers together with the amount of data that belongs to it, the development of the way they are used. As in the next years much physical reality will be largely replaced by a digital reality the historical responsibility that the new digital models assume goes far beyond that of simple contemporary dissemination.

The generation of the - digital twins - of the heritage of the past is the bet on which the preservation of the historical heritage for the next generations is based as well as, in a similar field, the progress of new buildings is based.

The researches here produced emphasize three themes individually and as a whole: the method of acquisition and survey procedures as a research theme running; the aim of cataloguing and therefore the semantic enrichment of the objects produced; the possibility to forecast scenarios for future research and development.

The acquisition of the point cloud: assuming the fact that the digital model is a data repository coming from different sources that contribute to the description of the object, the first objective of the acquisition is to produce a metrically accurate 3D model, possibly provided with material representations faithful to the existing one.

The point clouds generated by laser scanners or the colorimetric information derived from photogrammetry require skills not easily available, and warn us about issues related to the accuracy of the models. While the lack of accuracy could be

negligible in some areas related to the use the survey for entertainment it can't be in the research field. As the accuracy of the point cloud falls proportionally to the number of different acquisitions made post processing phases need high skills to assure good results. More skills in texturizing phases or mesh modelling: reliability is an ambitious goal.
The aim of cataloguing: its structure and organization raises questions from the earliest stages of model segmentation and semantic enrichment of the objects that are identified within it.
The geometric segmentation in itself, sometimes automatically offered by software, may not make sense for some artefacts and implies again the intervention of the researcher that must know the structure of the final database. The enrichment of the model is determined by the materials found as well as by the need for dissemination: sometimes it is necessary to integrate historical information but also managerial or related to the type of maintenance as well as alphanumeric or multimedia data.
The purpose of the database must be defined from the beginning of the segmentation phase being plenty possibilities of its goal. The variables of the single researches offer often tailor-made workflows that demonstrate the state of the art and the difficulty of finding a completely shared procedure or even more model cataloguing standards.
If document digitization procedure of existing paper materials has produced regulations and by now consolidated rules the procedures for the digitization and cataloguing of monuments or artefacts of smaller size is far from such a scenario. In a foreign context, some large institutions such as the Smithsonian started in defining parametric parameters for the digitalisation of collections, currently offering traces or guidelines to support colleagues to build workflows by creating sustained high speed, high quality digitization processes, by pairing up the digital surrogates they create with the collection records stored in the various collection databases. It is about sharing a responsibility in finding, as Smithsonian says, the best technologies and processes to achieve these goals; to conduct mass digitization projects to test and implement these new technologies and processes; to educate and train ourselves to understand these new approaches; and finally to integrate digitization operations into the day-to-day operations in order to give the world access to the collection sometimes hidden the public.
Finally, the topics of future research progress for a wider fruition: as museums have not been immune to the advent of technologies linked to the world of Web-related technologies and generally to first-generation digitization and to the development of Web Pages (and social media in a second stage) the imminent moment seems to invoke research on the development of interaction between digitalization and technologies 4.0. The museums have realized the potentials of digital technologies on reaching a wide public and increase their attractiveness. Now that digital technologies offer some low-cost scenarios, as user-friendly tools, they multiply the way in which "users" use interactive technologies in their

everyday life, including visits to cultural places. We slide towards a digital enjoyment that does not therefore lend itself only to scientific research and dissemination but will allow the introduction of a wider public, friendly user, and all kinds of devices.
All these changes will oblige museums and institutions to think about reinventing themselves in more digital involving ways, where modelled contents accurate and reliable will be probably exported to a wider market; this last one will offer further experiences probably customized by the single user, founded on previous deep and accurate models previously acquired.

Cecilia Bolognesi

Printed in April 2020 for Pavia University Press
Edition of the University of Pavia

Cultural Heritage is as rich as complex and its documentation is an increasing challenge. The digital solutions are numerous and their potential is a topic of constant investigation by the scientific community, that is requested to deliver digital strategies to make heritage permanently open and shared. The volume collects the contributions to the second conference of the 'Digital & Documentation' series, extending the debate to a multidisciplinary network of experts. It presents a frame of strategies for the documentation of Cultural Heritage in a wider perspective, stimulating reflections on: the relationships between physical and digital assets; the consistence of digital data and its management; digital representation as a mean to the transfer of cultural heritage. It comprehends theoretical studies and best practices on tangible and intangible heritage, taking into account applications for the research and the communications of Cultural Heritage as 3D representations, digital anastylosis, Augmented and Virtual Reality, Artificial Intelligence, semantics and databases. Aiming to give a comprehensive view on digital and documentation, the volume involves multiple perspectives from cultural institutions and universities, from experts in representation, geomatics, history, architecture, archaeology and ICTs for a multidisciplinary outcome.

ISBN 978-88-6952-124-9

PaviaUniversityPress

€ 20,00