

DIGITAL LANDSCAPES

PAESAGGI DIGITALI

**DIGITAL PROCESSES FOR THE REPRESENTATION
OF CITY, ARCHITECTURE, PRODUCT**

**PROCESSI DIGITALI PER LA RAPPRESENTAZIONE
DELLA CITTÀ, L'ARCHITETTURA, IL PRODOTTO**

Direttori

Massimiliano Lo Turco
Politecnico di Torino

Michele Calvano
CNR ISPC – Institute of Heritage Science

Comitato scientifico

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Università degli Studi Roma Tre

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La collana adotta un sistema di valutazione dei testi basato sulla revisione paritaria e anonima (*peer-review*). I criteri di valutazione adottati riguardano: l'originalità e la significatività del tema proposto; la coerenza teorica e la pertinenza dei riferimenti rispetto agli ambiti tematici propri della collana; l'assetto metodologico e il rigore scientifico degli strumenti utilizzati; la chiarezza dell'esposizione e la completezza d'analisi. Per temi specifici la revisione anonima è effettuata da esperti esterni scelti dal comitato scientifico.

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Digital landscapes / Paesaggi digitali

Digital processes for the representation of city, architecture, product

Processi digitali per la rappresentazione della città, l'architettura, il prodotto

Landscape is not scenery, it is not a political unit; it is really no more than a collection, a system of man-made spaces on the surface of the earth. Whatever its shape or size it is never simply a natural space, a feature of the natural environment; it is always artificial, always synthetic, always subject to sudden or unpredictable change.

J.B. JACKSON

La collana mette in luce il ruolo della rappresentazione digitale come metodo di prefigurazione del progetto e come strumento di indagine per la conoscenza. Le rappresentazioni, che siano rivolte al pensiero, alla comunicazione o alla costruzione, sono generalmente improntate su processi impliciti che scaturiscono nella mente del progettista. La digitalizzazione impone la necessaria esplicitazione delle azioni per la costruzione dei modelli. Gli ambiti indagati sono il paesaggio, la città, l'architettura e il prodotto. Attraverso esperienze teoriche e casi studio si dimostra quanto le scelte insite nei processi siano foriere di creatività e invenzione. L'interesse verso le procedure per disegnare prevede l'utilizzo di processi aperti e condivisi anche per agevolare il dialogo tra le discipline, rendendo il modello informato e creando un nuovo legame tra modello concettuale e modello costruttivo.

The book series highlights the role of digital representation as a method of foreshadowing the project and as an investigative tool for knowledge. The representations, whether they are aimed at thought, communication or construction, are generally based on implicit processes that flow into the mind of the designer. Digitisation imposes the necessary explicitation of actions for the construction of models. The areas investigated are the landscape, the city, the architecture and the product. Through theoretical experiences and case studies it is shown how much the choices embedded in the processes are the harbingers of creativity and invention. The interest in procedures for designing involves the use of open and shared processes also to facilitate dialogue between disciplines, making the model informed and creating a new link between conceptual model and construction model.

DAVIDE MEZZINO

DIGITAL DOCUMENTATION WORKFLOWS FOR CULTURAL HERITAGE KNOWLEDGE

INTEGRATED SURVEY STRATEGIES
FOR THE UNESCO SITE OF BAGAN

Foreword by

MASSIMILIANO LO TURCO

Afterword by

ALFONSO IPPOLITO





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*In loving memory
of my aunt Francesca*

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FOREWORD

I had the pleasure of meeting Dr. Davide Mezzino about ten years ago, in the context of a Ph.D. lecture at the Politecnico di Torino, held with Professor Pina Novello — Full Professor of Drawing at the Politecnico di Torino.

At that time, I was a young research fellow working on the issues of BIM modeling applied to new buildings, while Davide was a young Ph.D. student eager to know and begin his research path. In that circumstance, he shared with Professor Novello and me his intention of undertaking a Ph.D. in co-tutelle between the Politecnico di Torino and the Carleton University in Ottawa, Canada. Under the supervision of Dr. Mario Santana Quintero — Professor at the Department of Civil and Environmental Engineering at Carleton University, Director of the NSERC Create program Heritage Engineering based at the Carleton immersive Media Studio Lab (CIMS) and Secretary General of the International Council of Monuments and Sites (ICOMOS) — he started his doctoral research that laid the basis to the present publication.

I can certainly say that Davide chose for the best, undertaking an interesting and international research

experience. Indeed, I believe that the Bagan documentation activity has been all-encompassing, allowing him to face case studies of a very high degree of complexity and astonishing allure.

Secondly, the research topics he wisely addressed were, and still are, a very topical issue, highly debated by intellectuals and experts in the architectural documentation and representation field. Only a few years earlier, Maurice Murphy and Eugene McGovern introduced definitions and possible approaches to what we commonly name HBIM (Historic Building Information Modeling), identifying it as a useful tool to replicate historical buildings in the digital world. HBIM was introduced to support the in-depth study and analysis to orient the interventions (conservation, maintenance, repairs, restorations, etc.), and to apply the coordinated and multidisciplinary management processes of the BIM methodology to the complex field of Cultural Built Heritage.

Apart from these considerations, I want to underline that the work goes far beyond the mere application of a methodology, albeit extremely virtuous, to case studies of high geometric and formal complexity.

The volume describes in detail the different phases that characterize integrated digital documentation processes applied to the context of Cultural Heritage, proposing workflows tested and validated through structured approaches in which information, its preservation, and its consultation over time constitute the centrality of the whole process.

Concerning the publication, the volume is structured into five chapters.

The first chapter describes the opportunities for using new techniques and tools for the knowledge and digital documentation of Cultural Built Heritage. This section illustrates multiple approaches useful to outline the state of the art, with an excellent critical review that allows the reader to evaluate the limits and opportunities of various experiences conducted at an international level. The chapter's final remarks outline a series of open questions that will be addressed in the following chapters.

The second chapter introduces the historical, geographical, and cultural context of the site of Bagan. The chapter also highlights the scarcity of written sources and graphic material on the existing temples, thus recognizing knowledge as the first activity necessary to implement protection and intervention activities.

The third chapter is dedicated to the description of Bagan built heritage with a focus on the formal, geometric analysis as well as on materials and construction techniques adopted for the different types of architecture on the site. This section lays the basis for the definition of a catalog of components, whose definition of variants and invariants constituted the first step for the definition of libraries of digital, parametric, and informed objects, usable for the modeling of the temples object of study.

The fourth chapter focuses on the definition of the best strategies to be used for documentation purposes, aimed at the production of informative material needed to support integrated conservation, management, and promotion of

the recorded historic structures. The adopted strategies range from the integrated metric survey activities, whose outcomes are used to build the database necessary for the subsequent modeling activity. This section clearly illustrates how the alphanumeric information previously described can be functionally used for the characterization of the parametric model, also highlighting some operating methods adopted to solve unconventional modeling issues.

The last chapter proposes a critical reflection on the usability of the collected information, illustrating the possible purposes of the documentation processes undertaken, including but not limited to knowledge, interpretation, conservation, and communication.

In conclusion, the book illustrates a complex and very well-structured work. It wisely highlights the role of representation as an investigation tool for cultural heritage knowledge.

In addition, the book considers how digitization workflows require the necessary clarification of the actions employed for the construction of digital models. Indeed, this volume provides several examples and virtuous creative solutions, in a scenario enhanced by the use of open and shared processes that place the informed model at the center of the entire process, aimed at promoting the dialogue between the different disciplines involved.

INTRODUCTION

Good practices in heritage conservation are based on timely, relevant, and accurate information about the conditions, materials, shapes, geometries and transformation of built heritage. Therefore, the processes of documentation, recording, visualization, and analysis of heritage sites are an essential part of their management and conservation.

The documentation of cultural heritage is also experiencing rapid growth in innovation, which is unfortunately matched by the alarming rate of destruction by natural events, conflicts, and negligence.

New tools have appeared in the last decades including 3D scanning, rapid prototyping, high dynamic range spherical and infrared imagery, affordable drone photography, augmented and virtual reality, and computer rendering in multiple dimensions. These tools are giving visions and data that are all at once enticing and even sometimes, deceptive. Their applications are used in conservation education, research, risk assessment, and planning and design.

In contemporary built heritage conservation, digital workflows are increasingly being used as tools to capture, generate, visualize and manage built heritage.

This publication provides a methodology for implementing the effective acquisition of posterity records, to ensure the appropriate collection, processing, and sharing of heritage information. The described approach is aimed at safeguarding the values of heritage places for future generations and eventual repair, maintenance, physical conservation, and cultural dissemination. Exposure to first-hand heritage recording projects, in collaboration with intergovernmental organizations, private foundations, governments, and consulting companies, has provided adequate knowledge and experience for the following contribution.

Within this framework, this contribution illustrates the comprehensive documentation and representation strategy adopted for the living religious heritage site of Bagan, Myanmar, inscribed in the World Heritage List (WHL) in 2019.

The described research proposes and tests on the ground a methodology to document, know and represent, the tangible as well as intangible aspects embedded with cultural built heritage, such as the knowledge and skills associated with craftsmanship in the architectural field. Therefore, the research explores the combination of digital workflows and anthropological investigations to carry out a comprehensive “*progetto di conoscenza*” (knowledge project) (Dalla Costa, 2000) to support the knowledge of

“[...] what is important and understanding how that importance is vulnerable to loss.” (Matero, 2003), p. viii.

The metric survey was the beginning of the documentation activity, allowing the generation of 2D measured drawings and 3D models, essential for obtaining a geometric reference, as well as for geo-referencing and locating data and information relating to the surveyed buildings.

The data acquisition phase was conducted using terrestrial and aerial photogrammetry as well as terrestrial laser scanning techniques coupled with total station measurements.

The digital metric survey techniques adopted showed their potential in terms of documentation and visualization of the acquired data, allowing a significant advancement in the knowledge of the tangible components (location, shape, geometry, size, and state of conservation) of the recorded temples. Additionally, these techniques have allowed an evaluation of the effectiveness of the restoration materials and techniques adopted in the conservation and recovery of the recorded temples, as well as a quantification of the level of seismic risk for the built heritage of Bagan, identifying the elements more vulnerable to seismic actions.

The techniques and tools employed in the described on-field recording activities in Bagan — as well as in the workflows and software adopted in the data processing phase — are off-the-shelf made applications. Finally, limits (increasing threats and fragmentation of data), challenges (scale enlargement and development of new

themes in cultural heritage), and perspectives (increasing pace of innovation, in cultural heritage documentation) are discussed in detail considering the international framework and current debate.

In this process, intangible aspects play a key role in documentation processes. They consist of knowledge, skills, beliefs, ideals, values, schemata and mental models which are deeply ingrained in society and are vulnerable to oblivion and manipulation (Vit-Suzan, 2014), even if their resilience is often taken for granted. Although such knowledge is used by all people, key actors in the preservation process are not necessarily able to easily articulate it (Vit-Suzan, 2014). While difficult to articulate, this cognitive dimension shapes the way heritage is perceived.

A key organizing principle of the proposed approach consists in the establishment of information-enriched environments developed by digital means. Such spaces aim at knowing, engaging, promoting, and safeguarding cultural built heritage and the traditional knowledge associated with it.

The proposed approach is designed to expand into a comprehensive information repository to enable to capture, preserve and make available to interested stakeholders the intangible dimensions of artisanal design and production processes that would be relevant to future conservation initiatives.

More specifically, through the survey of four selected temples in the site of Bagan, Myanmar, conducted in 2016, the results obtained and the potential applications of