

# Preface

There is tremendous interest among researchers and creative industries professionals for the development of virtual and augmented reality and gamification technologies for cultural heritage. To date, the major applications of these technologies include photogrammetric modeling, artifact-whole heritage site digitization, museum guides, and a wide range of virtual museum applications. Recently there has been a renewed rapid proliferation in virtual reality (VR) and augmented reality (AR)—together termed mixed reality (MR)—due to the renaissance in MR hardware (such as Oculus Rift, Google Cardboard, etc.) and respective intensive commitment from the ICT industrial sector (Google, Microsoft, Sony, Facebook, etc.) that propels this field dramatically by instilling “Presence” (feeling of being and doing there in the virtual or augmented world). To aid in this direction, recent advances in gamification (employment of game design elements in nongame contexts and activities) have become the central focus of the creative industries, resulting in a new breed of smart education and heritage applications. Many recent studies have identified the benefits of employing mixed reality in these applications by further fusing it with gamification principles.

This research volume on virtual and augmented reality and gamification for cultural heritage offers an insightful introduction to the theories, development, and applications of the latest advances in the enabling technologies of VR/AR and gamified interaction in cultural heritage and, in general, the creative industries. It is divided into two sections following a pedagogical model realized by the focus group of the first EU Marie S. Curie Fellowship Initial Training Network on Digital Cultural Heritage (ITN-DCH) project fellows, which has been undergoing such training:

- *Section I: Describes all recent advances in the enabling technologies of MR and gamification that include chapters in the following four parts:*
  - (a) Part II: Digitization and Visualization (acquisition, capturing, modeling, Web3D–WebGL)
  - (b) Part III: Content Use and Reuse (semantics, ontologies, and digital libraries)

- (c) Part IV: Geospatial (3D cultural web GIS and historic BIM for VR/AR)
- (d) Part V: Presence (mobile VR/AR, multisensory rendering, and multimodal serious games)
- *Section II: Describes all recent advances in interaction with 3D tangible and intangible cultural heritage in the following thematic areas:*
  - (a) Part VI: Intangible Heritage (interactive virtual characters and ancient gamified sports simulation)
  - (b) Part VII: Ambient Intelligence and Storytelling (robotic curators, gamified smart environments, and digital-epigraphy narratives)
  - (c) Part VIII: Museum Applications (3D printing, e-learning, and 4D modeling)

This book is directed toward heritage professionals, scientists, researchers, professors, scholars, and students who wish to explore the enabling technologies and applications of virtual and augmented reality and gamification in cultural heritage and creative industries further.

*Mixed reality (including virtual and augmented reality: VR/AR)* and its creative concept of cyber-real space invoke interactive 3D digital narratives that promote new patterns of understanding in communicating *tangible* (such as monuments and artifacts) as well as *intangible* (such as oral practices-traditions/storytelling, performances) *cultural heritage*. The word “narrative” refers to a set of events happening during a certain period of time—and under different circumstances—providing aesthetic, dramaturgical, and emotional element recreation, as well as 3D static objects associated with their metadata and semantics, as *new information* storytelling *attitudes*.

Combining such aesthetic heritage reconstructions with virtual augmentations and adding dramatic tension has developed over the recent years these narrative patterns into an exciting *new VR/AR edutainment* and gamification medium for both computer science and digital humanities. The digital information fusion of virtual restitutions of static 3D cultural artifacts with interactive, augmented historical character-based event representations is an important component of this redefinition. Although several successful publications in cultural computing cover various case studies, the field still lacks a textbook that aims to train heritage researchers in employing digital documentation’s engineering principles in their fields.

For digital narratives realized with mixed reality, the conditioned notion of a 3D artifact gives way to a far more liberated concept, as suspended in virtual and augmented reality space, the modern scholar or layman leaves the strict notions of petrified cultural heritage and emerges in a contextualized world of informative intangible and tangible sensation. In such a digital heritage world, “the dream of perfect FORMS becomes the dream of information and knowledge (the story).” The aim of this book is to *highlight* the extensive value *chain* in knowledge engineering for the documentation of the past by illustrating the *3D digital pipeline* from museums and artifacts to digital, mixed reality technologies via multiple disciplines examining their role in the redefinition of the cultural “memory institution” itself as “communication engine and storytelling machine.”

Such “interactive contextualized narratives” and “hermeneutic experiences” are in fact stirring the fleeting notion of history and time travel, based on the new emerging cultural fabric of the twenty-first century (novel dynamic storytelling). These result in intriguing possibilities and advances as described in this book for new digital narratives based on computer vision, computer graphics, systems engineering, human-computer interaction, photogrammetry robotics, as well as knowledge engineering and archaeology, history, arts, and cultural studies. These computational digital humanities that will pervade the information age are now challenging and raising new issues on cultural heritage representation, space, time, interpretation, interaction, identity, and the real. With this book, a new, unique light is being shed in that particular area, where *3D real and virtual cultural heritage elements* are studied together as part of a *new creative gamified medium* for digital humanities and science students as well as cultural heritage and creative professionals.

The *aim* of this book is twofold: (a) it offers a *novel platform for researchers* in and across the cultural-related disciplines to share with peers and to critique and to reflect on each other’s studies and (b) it serves as an introductory textbook to *train early-stage as well as experienced researchers* in the emerging field of interactive digital cultural heritage based on *VR/AR and gamification* enabling technologies (the *scope of this book*).

This book contains selected contributions from some of the most experienced researchers and professionals in the field of VR/AR, gamification, digital heritage, and documentation of the past, based in large part on their experience in the last decade. The aim of this book is to provide an insight into ongoing research worldwide and future directions in this novel, promising, and multidisciplinary evolving field, which lies at the intersection of VR/AR, serious games and gamification, digital heritage, digital humanity, archaeology, computer science, civil/electrical engineering, mathematics, material science, architecture, surveying engineering, and geoinformatics. The objective of this book is to illustrate the new avenues in the digital documentation of cultural heritage: A complete 3D digital pipeline from museums and artifacts to digital, mixed reality simulations in multiple disciplines is described in detail, highlighting a new, different model for creating, authoring, gamifying, and distributing knowledge (the story) in cultural heritage. Having as a starting point the *first international European-funded Initial Training Network in Digital Cultural Heritage (ITN-DCH: [www.itn-dch.eu](http://www.itn-dch.eu))*, this book aims to significantly contribute to the multidisciplinary training of the next generation of heritage-related early-stage (Ph.D. candidates) as well as experienced researchers (post-docs) and heritage professionals. This book follows a pedagogic approach based on the secondments, training, conferences, workshops, and summer schools that the ITN-DCH fellows have been following. The book also contains an introduction from digital humanities (including the activities of the London and Seville Charters, as well as the *EU DARIAH ERIC European Research Infrastructure Consortium on Digital Humanities: [www.dariah.eu](http://www.dariah.eu)*) and their relationship with latest 3D multimedia disciplines.

In closing, this book was conceived to be a catalyst for debate in the area of computer graphics documentation and knowledge engineering in cultural heritage by focusing on MR and gamification 3D interactive computer technologies used in a manner whereby, for instance, computer scientists/engineers, digital humanities researchers, creative industries-heritage professionals, museum specialists, human-computer interaction practitioners, and creative industries professionals are encouraged to communicate with each other. From this position, we anticipate your reading and reactions to these chapters as a step in furthering this goal, as well as to contribute to formalizing the diverse training of early-stage and experienced researchers and professionals in these exciting fields.

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