

Chapter 20

Visualization and Fruition of Cultural Heritage in the Knowledge–Intensive Society: New Paradigms of Interaction With Digital Replicas of Museum Objects, Drawings, and Manuscripts

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ABSTRACT

The knowledge-intensive society paradigm fosters relationships between technology and human actors with data, values, and knowledge that become mutual drivers for social innovation. The cultural heritage sector is naturally influenced by this vision, and museums and cultural institutions have a prominent role in dissemination of cultural values. This chapter focuses on a method developed to combine the power of the computer visualization technology with the cultural elements spread across collections, introducing some notes and remarks on how digital replicas of drawings, manuscripts, and museum objects can be successfully employed to spread knowledge. Through a custom application called ISLe, aimed at visualizing 3D models that accurately replicate the original items, some experiences in the production of digital replicas are introduced, highlighting opportunities and criticalities to be considered in the adoption of technology that can be potentially shared and exploited by many possible figures involved in cultural heritage.

DOI: 10.4018/978-1-6684-4854-0.ch020

INTRODUCTION

Over the last decades many digital technologies bound to the cultural dissemination improved, leading to brand new ways to make information accessible at different levels, enhancing how it can be shared among interested people. Key concepts like dynamic web applications (i.e., Web 2.0), eXtended and Augmented Reality (XR and AR), Artificial Intelligence (AI), virtual space and metaverse represent today intertwined terms, often combined to explain how technical expertise can be useful to share cross-sectional knowledge (Tenenbaum, 2006). However, this scenario is frequently too technology-centered, with most of the relevance dedicated to the Information and Communication Technologies (ICT) rather than to the cultural values they can convey. The many possible implications of themes belonging to tangible and intangible Cultural Heritage (CH), for example, have been more and more influenced by recent digital platforms and data schemes, often developed to shift the attention of users from the computer application *per se* to the extended fruition of the knowledge it can trigger. What was still not enough pervasive in the information society (the so-called *Society 4.0*), becomes now largely considered in a context where, in the words of Deguchi et al. (2020), relationships between technology and society contribute to describe a knowledge-intensive society, in which data, information, and knowledge are mutual drivers for social innovation, as the *Society 5.0* paradigm suggests (Fukuyama, 2018).

Following these premises, this chapter introduces the visualization outcomes of a more general and complete workflow, meant to produce a system able to replace, investigate, describe and communicate Cultural Heritage objects; these goals are reached through the generation of digital communicative artefacts, dedicated to fine drawings, objects belonging to museum collections and ancient manuscripts, following a research path that started more than ten years ago. The working pipeline that will be presented, travelling through the *Society 5.0* model, follows a basic scheme made of data collected from the real world and processed by computer applications; it leads to output results applied back to the real world for an extended fruition by many different human users, though a custom visualization interface at the core of this chapter discussion. These processes are rooted on the assumption that all the elements that were investigated, even with apparently flat geometry, are actually 3D objects with specific behaviors in terms of color, light reflectance and shape.

With particular care to visitors in museums, art historians, scholars, conservators and restorers, who rely more and more on digital applications meant to visually explore and understand the characteristics of surfaces and materials belonging to many kinds of objects, a novel process to replicate and exhibit CH artefacts is detailed here with a focus on visualization purposes, whose main fruition directives are *realism*, requiring accurate shapes and surfaces representation, and *responsiveness*, since models have to change their appearance when directly manipulated by observers in museums or laboratories. The visualization framework evolved to display artefacts including a wide set of different features, from diverse materials to complex fabrication or drawing techniques and tools usages. Beginning from some experimentation on ancient drawings, in which the third dimension was reasonably less perceptible than the whole surface, the proposed system later proved its versatility in managing digital replicas originated from many input sources, surrogating the user experience on real 3D objects. More in general, this contribution focuses on this interactive manipulation, illustrating the paradigms and technical features behind the platform authored by the research team who introduced it, its methodological approach based on a consolidated scientific foundation and the final interface targeted to users with heterogeneous ergonomic needs.

After a proper section, referred to as *Introduction*, where main themes and cultural contexts are presented, the *Background* section expresses a wide state-of-the-art in scientific literature related to

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