Promoting Traditional Craftsmanship Through Digital Technology

Subjects: Others

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The success of assisting Cultural Heritage (CH) valorization through digital technologies (availability, accessibility, and engaging and interactive presentations) is due to the captivating content of stories, memories, and meaning that CH offers. Traditional Crafts (TCs) have a paramount cultural value and offer a thematic thesaurus of stories and narratives related to the origins of modern societies, history, and culture, the origins of industrial development and design, economic factors and societal outcomes, as well as, personal and family memories, all of which general audiences can relate to.

traditional crafts craft presentation augmented reality

1. Introduction

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TC representation and preservation comprise a very demanding topic, as they cover a broad spectrum of tangible and intangible dimensions. Perhaps, the biggest threat to TC viability is due to the declining numbers of practitioners and apprentices [1].

2. Digital Representation of Traditional Crafts

A staggering amount of research on the digitization of artifacts and archives has taken place in the last two decades [2][3][4][5]. This enormous effort has led to sophisticated digitization techniques for artifacts and documents, as well as, guides of good practice for digitization streamlining, i.e., [6]. Moreover, efforts in the preservation of digital assets have produced standards in digitization formats, and enabled the production of knowledge bases open to the public for general knowledge or application development, i.e., Europeana. More recently, the CH community has had an advanced interest in capturing, modeling, and digitally preserving the intangible aspects of CH.

TCs are recognized as a form of CH by prominent organizations. In 2003, UNESCO adopted the Convention for the Safeguarding of Intangible Cultural Heritage (ICH), and in its authoritative text [1], it enumerates traditional craftsmanship as an independent category of ICH. TCs comprise a scientifically challenging domain of CH because they have both tangible and intangible faces, qualifying TCs as “the most tangible manifestation of intangible cultural heritage” [1]. TCs exhibit a wide thematic range of CH topics of historical, societal, anthropological, and ethnographic interest.

To date, research efforts on TCs have been scattered through materials and places of production, and very few have treated the topic of TCs as a source for the renovation and innovation of knowledge. Despite its importance in the mid-19th century, the scientific literature on the preservation and curation of TCs started to emerge recently; only a few studies are treating the topic in an integrated manner, given its multifaceted nature. Efforts towards appropriate treatment have emerged, through the collaboration of a wide range of experts by UNESCO [1], providing a theoretic basis towards this effort. Besides case studies, there has been no effort devoted to the representation of all TC dimensions and the curation of the corresponding digital assets.

The multifaceted nature of TCs has provided a range of definitions that are explored in seminal attempts to thereotically define the notions and contexts of TCs [7][8]. Though a crisp definition is elusive, it is conceded that TCs are characterized, as a minimum, by (a) traditional materials and technologies of their manipulation, (b) a certain type of product, (c) the dextrous use of tools and/or hand-operated machinery to make or repair useful things, and (d) a type of making that involves the knowledge and application of traditional designs.

TCs have both tangible and intangible dimensions. The tangible dimensions regard artifacts and buildings, clothing, tools and machinery, documents and archives, as well as the materials and the physical environment of practice. Their digitization has been addressed by past digitization projects, and a breadth of methods and best practice guides are now available. The intangible dimensions of TCs also have multiple faces that include the required skills, the learning process, as well as the cultural, religious, social, economic, and creative faces [8].

There exists a theoretical and technological gap that calls for: (a) a formalized process for the representation of TCs that copes with the challenges that stem from the representation of the multidimensional nature of TCs and the diverse range of experts involved, and (b) a technological infrastructure that supports these goals, copes with the large data volume, and avails collaboration between these experts.

3. Digital Storytelling Technologies

The approach is rooted in the idea that humans exhibit a limited capacity for memorizing inventories, such as a list of events, as opposed to stories imbued with meaning or causal dependencies [9]. In this work, an approach is proposed that binds the cultural and socio-historic context of TCs with engaging stories that enhance the museum-visiting experience. As such, among the available technologies, Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) exhibit a high capacity to empower experiences in multiple contexts of use, and can be gracefully used to augment physical items and physical spaces, or their digital representation [10], with information.

3.1. Augmented Reality for Overlaying Information on the Real World

AR refers to an interactive experience in a real-world environment where the objects that reside in the real world are enhanced by computer-generated information [11][12] with or without the help of markers. According to [13], the evolution of the capabilities of mobile devices, combined with affordable Internet access and advances in networking, computer vision, and cloud computing, transformed AR from science to reality. In 2016, the mobile game “Pokémon Go," which essentially made AR technology popular throughout the world, became a great example of how mobile gaming can take place in an augmented world [14].

One of the manifestations of AR regards the augmentation of Cultural Heritage (CH) objects and sites, aimed at improving the visitors’ experience in these spaces. Mobile museum guides use AR technology to enrich exhibits with information [15][16][17][18], giving rise to new forms of digitally augmented tours [19][20][21]. In the same vein, mobile AR has been used to enhance archaeological sites with virtual and real scenes [22][23][24] where virtual avatars are employed to present contextual information. Today, museums are starting to realize that AR can be an effective way to build user interest in museum collections and exhibits.

VR is “a very powerful and compelling computer application by which humans can interface and interact with computer-generated environments in a way that mimics real-life and engages all the senses” [25]. As such, VR has gained the attention of the CH sector for reviving the past [25], and thus opening a window in time and space where users can travel and experience the past with all of their senses. VR achieved this by combining computer graphics, interaction, and novel approaches towards the digitization of CH components such as artifacts and monuments of material heritage. In this context, VR can be exploited for bridging the gap between the virtual representation of an artifact and the visitor, allowing multiple forms of interaction and storytelling with CH in the virtual or physical museum setting [26][27].

3.2. Mixed Reality

MR refers to the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real-time. According to [28], several studies demonstrate that the use of new and combined media enhances how culture is experienced. In this regard, CH uses such technologies for different purposes, including education, exhibition enhancement, exploration, reconstruction, and virtual museums. Among the multiple manifestations of MR for CH most relevant to this work is the usage of augmented artifacts to access and interact with information and artifacts (e.g., [29]). Previous approaches include multimodal interfaces to augment physical CH artifacts with information [30][31], CH-inspired games that employ physical items and digitizations of physical items and sites [32][33][34], informative art displays [35][36][37][38], and immersive mixed reality environments for CH [39].

4. Virtual Humans

Virtual Humans (VHs) have been recently employed in CH applications [40][41]. For example, in [42] the effective potential, persuasiveness, and overall emotional impact of VHs with different professional and social characteristics was studied. The authors underline the importance of aligning and fine-tuning narrative styles and content to VHs, which should correspond to their roles in terms of appearance, and highlight the importance of effective components in their storytelling approach. In [43][44], the authoring of multimodal narratives through an online platform is presented. Furthermore, a study of alternative storytelling solutions [45] concludes that VHs presents an empathic medium capable of engaging with new audiences. In the same work, narratives are highlighted as a "new way to discover hidden treasures from the past." In other works [46], VHs are used for guiding users in CH environments. VHs have also been used for preserving and simulating cultures [47] and teaching crafts. For example, [48] utilizes VHs in a virtual environment for teaching the craft of printmaking, [49] utilizes VR as a tool for communicating the craftsmanship of engraving, and [50][51][52][53] present solutions developed for craft training using tools and machines manipulated by VHs. In [54], Danks et. al. combine interactive television storytelling and gaming technologies to immerse museum visitors into the artifacts on exhibition, engaging the user into the physical space using virtual stories, while [55] describes the use of a VH as a means for providing interactive storytelling experiences at a living history museum.

Research has shown that VHs can affect the virtual experience and stimulate attention and involvement [56][57][58]. Furthermore, their contribution to achieving the suspension of disbelief has been recognized [59]. Narratives, when successfully used for guiding the user through a Virtual Museum, motivate visitors to stay longer and see more [60]. VHs can bring these experiences to a wider audience, including people with disabilities [61], as well as provide a welcome invitation for discovery [62][63]. As such, several approaches have been presented for the implementation of realistic VHs, including segmentation of the motion files acquired through the recording of craft practitioners and narrators (e.g., [59][61][62]).

5. Socio-Historic Context

Pure silk, one of the oldest known natural fibers, is still highly fashionable even after thousands of years. The history of Krefeld is closely linked to this magical material. Today, there is a small museum called Haus der Seidenkultur, which shows how the history of silk has shaped the development of the town over the past three centuries. At the beginning of the 17th century, Krefeld came under the rule of the Netherlands, and the town became an island of religious tolerance. Consequently, in a period in which the denomination of the population was determined by the denomination of the ruler, Mennonites from near and far came to Krefeld and settled there. This immigration had far-reaching consequences that have shaped the profile of the town right up to the present day.

The religious refugees brought with them linen-processing skills, and as they were also mostly successful businessmen, they laid the foundation for economic growth and prosperity. The von der Leyen family, immigrants from Radevormwald, also contributed significantly to the development of the "Town like Silk and Velvet." Originally linen weavers, they increasingly changed the emphasis of their business to silk weaving.

In 1702, Krefeld became Prussian and silk weaving became the most important economic factor, with sales to the Prussian court in Berlin flourishing. In this period the silk weavers were out-workers who received orders to weave fabrics from merchants and traders. The looms were set up in front of the light window in the typical small cottages, some of which still exist today. The head of the household was normally the weaver, and other family members helped with tasks such as reeling the thread onto the bobbins for the shuttle. On one of the main avenues of the town, there is a monument to the weavers, “Meister Ponzelaar.” He wears a frock coat (his Sunday best)—called a “Laakesserock” in the local dialect—and a high-necked waistcoat, a small collar with a silk scarf, and a “Jraduutkapp” (a black cap). At the end of the week, he takes the finished fabric on the beam to the merchant’s office, together with a bag containing any leftover thread. There, he was paid and received a new prepared warp beam and thread for the week ahead. Such weavers were a typical sight in the town until the beginning of the 19th century. Their craft required a rapid comprehension and rhythmic movement of hand and foot.

In 1785, Edward Cartwright invented his first mechanical loom, and he continued to make improvements to it. The enhanced looms then went on sale in 1820. With the advent of mechanization, the silk entrepreneurs started to build factories where all the machines were powered by one source of energy and the workers were responsible for more than one loom.

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