

DIGITAL EDUCATIONAL EXPERIENCES ON SILK WEAVING

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ABSTRACT: This paper presents the advances in the context of the Mingei project towards the provision of technologies for the representation and presentation of the socio-historic context of Heritage Crafts and specifically the craft of textile weaving at Krefeld, Germany. The purpose of this work is to facilitate the rich semantic representation in the form of multimodal narratives as created by Mingei for this craft instance to deliver new cultural experiences. Such experiences have an educational and information role and are delivered through a plethora of platforms, technologies and application scenarios.

1. INTRODUCTION

Mingei is exploring the possibilities of representing and making accessible both tangible and intangible aspects of craft as cultural heritage (CH). **Heritage Crafts** (HCs) involve craft artefacts, materials, and tools and encompass craftsmanship as a form of Intangible Cultural Heritage. Intangible HC dimensions include dexterity, know-

how, and skilled use of tools, as well as, tradition, and identity of the communities in which they are, or were, practised. HCs are part of the history and have an impact upon the economy of the areas in which they flourish. The significance and urgency to the preservation of HCs is underscored, as several are threatened with extinction.

Despite their **cultural significance** efforts for HC representation and preservation are scattered geographically and thematically. Mingei is providing means to establish HC representations based on digital assets, semantics, existing literature and repositories, as well as, mature digitisation and representation technologies. These representations are authored in a web-based authoring environment the Mingei Online Platform (www.mop.meingei-project.eu) aiming to **capture and preserve tangible and intangible dimensions of HCs**.

Central to craftsmanship is the **skill** and its **transmission** from master to apprentice. Mingei is capturing the motion and tool usage form recordings of HC practitioners and archive documentaries, to preserve and illustrate skill and tool manipulation.

The represented knowledge is availed through compelling **experiential presentations**, using storytelling and educational applications and based on AR and MR and the Internet.

The engaging cultural experiences created by Mingei are foreseen to have a positive impact on **interest growth** and **tourism**, which support HC **communities** and **institutions** and foster HC sustainability and preservation.

2. APPROACH

To apply Mingei's vision multiple information types, people, and disciplines are required to work in the context of populating the HC model with knowledge and create an HC representation, as well as, instructions, guidelines, and best practice guides.

To address these requirements Mingei has implemented a **HC representation protocol** that provides a blueprint for this

collaborative effort. This protocol defines the *format, order, and interdependence* of steps for achieving a HC representation, such as the acquisition of digital assets, the acquisition of contextual information, as well as the semantic annotation and linking of digital assets. The goal is to represent knowledge about a HC in a meaningful, preservable, and usable fashion for stakeholders. The protocol can be described as a series of steps (see Figure 1). In STEP 1, we wish to acquire documentation in the form of digital assets that relevant to the representation of a craft. Based on these assets, knowledge about a craft will be formed (STEP 2). This knowledge is to be semantically represented availing a digitally reservable representation of a craft (STEP 3). This representation provides the foundation for curating narratives (STEP 4), which are to shape the presented content. This content is to take the forms of informational tools, multimodal presentations, and experiences (STEP 5), which will be used for the purposes of HC preservation, Tourism, and Education (STEP 6).

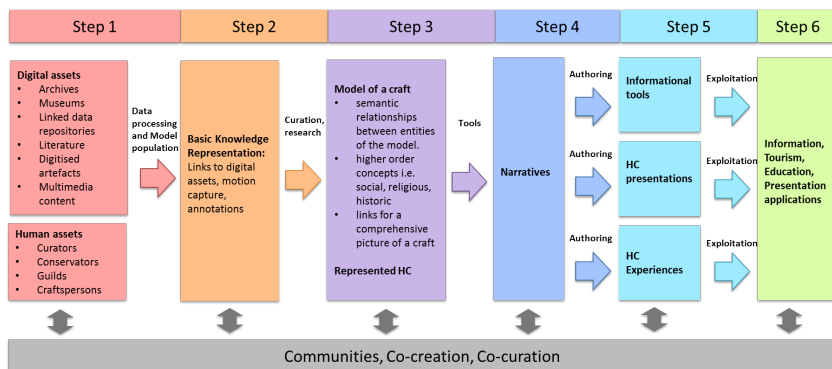


Figure 1. Illustration of protocol steps.

Executing the steps of the protocol linearly would mean that the entirety of digital assets would be acquired a priori. However, it is possible that knowledge acquired in the second step may refer to non-digitised items, which are only then identified, and may be needed to be digitised as new digital assets in the context of the first step. Moreover, additional, more sophisticated digitisations of an

asset may be acquired later on, if judged so by CH professional. Thus, although the flow of information is presented linearly in these steps, it is executed **iteratively** by revisiting earlier steps, as new insights are obtained, through knowledge collection, curation, and broadening of involved stakeholders. Thus, the protocol allows the iterative revisit of previous steps and the enhancement of their outcomes.

The exhaustive presentation of the steps of the protocol as applied in the context of Mingei for the textile weaving craft instance at Krefeld exceed the objectives of this research work and can be accessed through other publications of the consortium [3, 4, 5, 6, 7].

In this paper, the fundamental narratives produced as part of steps 1-4 of the protocol for the silk weaving craft instance will be presented together with the approach followed by Mingei for the transformation of these fundamental narratives to educational experiences available in various contexts and through various technological instantiations.

3. NARRATIVES ON TEXTILE WEAVING AT KREFELD

According to the Mingei protocol the work on knowledge collection and craft understanding in steps 1-2 of the protocol results to several fundamental text-based narratives that represent in the form of text the stories that a community wishes to tell for presenting a craft instance. These stories are then transformed into semantic representations of narratives that bind textual information with events and digital representation of the tangible and intangible dimensions of the craft.

In the case of textile weaving at Krefeld, the application of the protocol resulted in the following fundamental narratives. These are part of the Mingei knowledge and comprise a document reported by the project:

- Roles and Processes Exercised by the Krefeld Weaving Community
- History of Haus der Seidenkultur

- History of Krefeld
- Chronicle of the Casaretto Family
- Hubert Gotzes Weaving Workshop
- Story of the Jacquard Invention
- Story of the Cloth in the Shrine of Charlemagne and Its Motif
- History of textile motifs

3.1. A short version of a text-based narrative

As these narratives are very long to be presented in this work, in this section we provide a shortened version of the main narrative on the evolution of the craft instance.

The Thirty Years' War was a war fought primarily in Central Europe between 1618 and 1648. One of the most destructive conflicts in human history, it resulted in eight million fatalities not only from military engagements but also from violence, famine, and plague. The deadly clashes ravaged Europe; 20 per cent of the total population of Germany died during the conflict. One of its enduring results was 19th-century Pan-Germanism when it served as an example of the dangers of a divided Germany and became a key justification for the 1871 creation of the German Empire. Many religious refugees settled in and around the town of Krefeld, which formed part of the territory ruled by the House of Orange, under which the town received the status of a "religious asylum".

The growth of Krefeld began in that century, partially because Krefeld was one of few towns spared the horrors of the Thirty Years' War (1618–1648). During the 17th century, Mennonite settlers transformed the "insignificant little town" of Krefeld into a bustling capital of the linen trade. Protestant minorities, such as the Mennonites, were excluded from political office and landownership. Through family connections, they created a network or transfer system for commodities, money, and information which endowed them with considerable economic advantages that were collaboratively exploited (as in an association). The Rhenish political environment

and system provided tolerance and protection, was socially open and allowed the economic success of minorities.

The 7th expansion of Krefeld: Düsseldorf government building officer Franz Anton Umpfenbach draws the designs of the 7th expansion of Krefeld. Strict geometric road network was planned. Diagonally traversing Alte Linner Strasse, was retained as the historical route to Linn. Luisenplatz and Albrechtplatz were developed as new public squares. Street naming: names Prussian royal family given to streets running north to south. - “Crown Prince Street” was a reference to the then Crown Prince Friedrich Wilhelm IV who visited Krefeld in 1833. The other street names also refer to members of Prussian nobility, Luisenstrasse (Louise of Prussia), Mariannenstrasse (Marianne of Oranien-Nassau), Elisabethstrasse (Elisabeth of Bavaria).

The Mennonite minority: Workers were adept new tasks and skills required for silk production from foreign experts: novel tasks and manipulations for the silk industry. During the 17th century Mennonite settlers transformed the “insignificant little town” of Krefeld into a bustling capital of the linen trade. Through family connections, Mennonites created a network or transfer system for commodities, money, and information which endowed them with considerable economic advantages that were collaboratively exploited (as in an association). The political environment and Rhenish system provided tolerance and protection and was socially open. It allowed the economic success of minorities.

Ecclesiastical garment and parament production in Krefeld: The Krefeld textile industry and trading companies provided all the services and materials required to manufacture ecclesiastical fabrics: colour-fast yarns, equipment, design drawings workshops, point paper designs and punched cards to weave patterns. The influx of Catholic workers from the surrounding region meant that many new churches were constructed in the new districts on the outskirts of the town towards the end of the 19th century and beginning of the 20th century and consequently the demand for ecclesiastical textiles was high. Orders were completed quickly despite the complicate

handicraft involved. Depending on the pattern, a weaver could weave the fabric for a priest's vestment in two to five days on average. Velvet brocade took more than 10 days. The fabric was then cut out, sown together and embroidered so that the order was completed within 2 to 3 weeks. The Krefeld producers of ecclesiastical textiles had a good reputation for their very high-quality products and for the colour fastness of the fabrics.

The shift to silk: Krefeld's industrial dynamism stood in marked contrast to the helplessness of many languishing linen centres unable to cope with the prospective loss of their main outlet, the English market. In the course of the 18th century, this export market virtually dried up, supplanted by the meteoric rise of a resilient North Irish linen trade. Bolstered by governmental subsidies and a protective tariff, the Ulster linen industry not only established its ascendancy within Great Britain but soon became a formidable competitor in the world at-large. The Krefeld textile industry moved toward the manufacture of silk products, as its principal source of employment. The old linen industry provided a solid basis from which to launch this change.

Metropolitisation of Krefeld: Population influx young men attracted to Krefeld by the higher earnings and ample employment opportunities resulting from industrial growth. Textile operatives recruited from among local population. Locals succeeded in staving off the influx of outsiders into this realm, which they considered their exclusive preserve. Newcomers were pressed into the "residential" and tertiary sectors. This prosperity influenced the expansion of tertiary sectors in Krefeld.

The prosperity of the silk and velvet ecclesiastical textile industry at Krefeld: In the 18th century, sophisticated capitalist arrangements and sustained protoindustrial growth became the order of the day. The successful Krefeld silk industry was built almost exclusively by private entrepreneurship. In contrast, the less successful Berlin industry was heavily dependent upon the assistance of the Prussian state. Production of more specialized patterned and

fashionable silk fabric and ribbon remained under the merchants' direct control in Krefeld itself.

Decline of Ecclesiastical Textile Industry: Many workshops producing ecclesiastical fabrics in Krefeld had to close down. Despite the severe losses suffered by the ecclesiastical fabric business as a result of the Second Vatican Council the Gotzes company was able to hold out for a long time at its original location. Over time, the number of skilled manual weavers declined. In 1989, the last weaver dies. the Gotzes company, closes the weaving workshop and just maintains sales.

A new hope: Despite the end of the Gotzes enterprise, it was important to the entrepreneur that the last Krefeld silk weaving workshop with its Jacquard looms in their authentic place should be preserved for posterity. He contacted the town of Krefeld and initiated a process which finally led to the Association of Friends acquiring the property and its contents from the Maus family with the aid of funds made by available by the Kulturstiftung NRW and the Sparkassenstiftung Krefeld (cultural trusts) in 2000. Since that year, the Association of Friends has run the former weaving workshop for ecclesiastical textiles as a museum supported by a team consisting mainly of volunteers.

4. PRESENTING NARRATIVES

In this section, the presentation of narratives in multimodal forms and through multiple technologies is presented. Towards this direction the following use cases are presented: (a) a handbag to act as a fashion accessory but also a storyteller, (b) a museum app that guides visitors to the museum through storytelling, (c) web-based narratives for delivering information from the web, (d) a virtual museum experience for presenting ecclesiastical garments created at Krefeld and (e) presentation of major events described in narratives through interactive timelines.

Each of the aforementioned use cases is briefly discussed in the following sections.

4.1. Web-based narratives

The simplest form of informational narratives is demonstrated through web-based multimodal text presentations. In our example, one narration, titled “The Krefeld textile industry”, has been created to describe the contained in the “History of Krefeld Silk Industry” Fabula. To generate the Web preview SPARQL queries are executed within the HTML page to fetch and display related data in an organized way. The result of the page is displayed in Figure 2. On the left, the whole Webpage is displayed. On the right, two-page fragments are displayed.

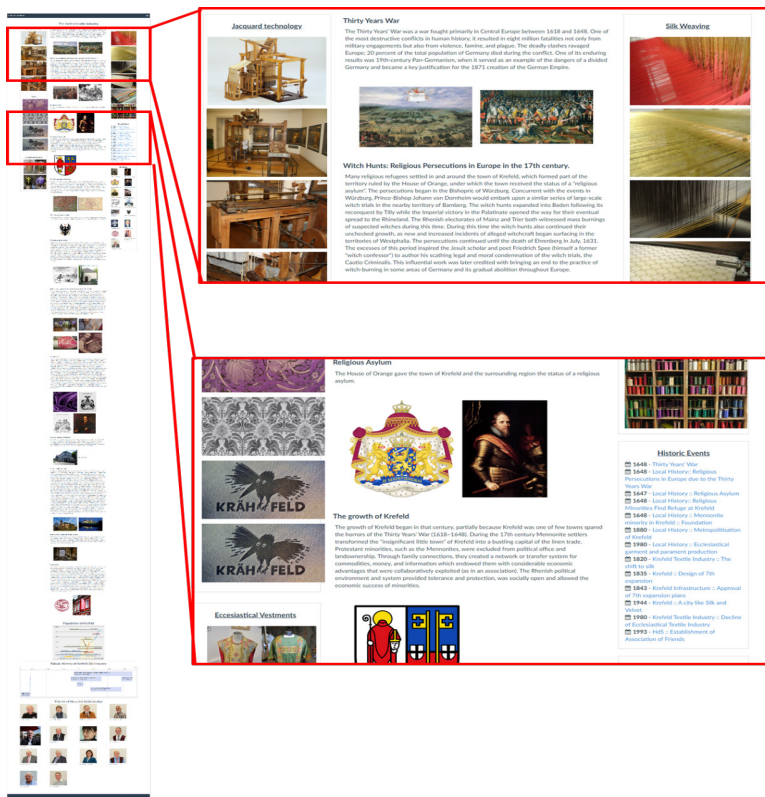


Figure 2. The Krefeld narrative presentation Webpage (Web-based narrative demonstration available at https://youtu.be/zENUV_1KcXk).

4.2. *The museum app*

The museum app is based on the concept that each space of the museum has a story to tell that can be presented through a combination of socio-historic events and their connection to the material heritage presented in the museum. An example of a tour guide designed for the Haus der Seidenkultur case is presented in Figure 6. Based on this concept the tour guide initiates the interaction with its users through the provision of the different narratives that can be experienced within the museum. The selection of each narrative allows the visitor to experience the museum in an alternative way to explore and learn the story in combination with the tangible remains as exhibited in the museum.

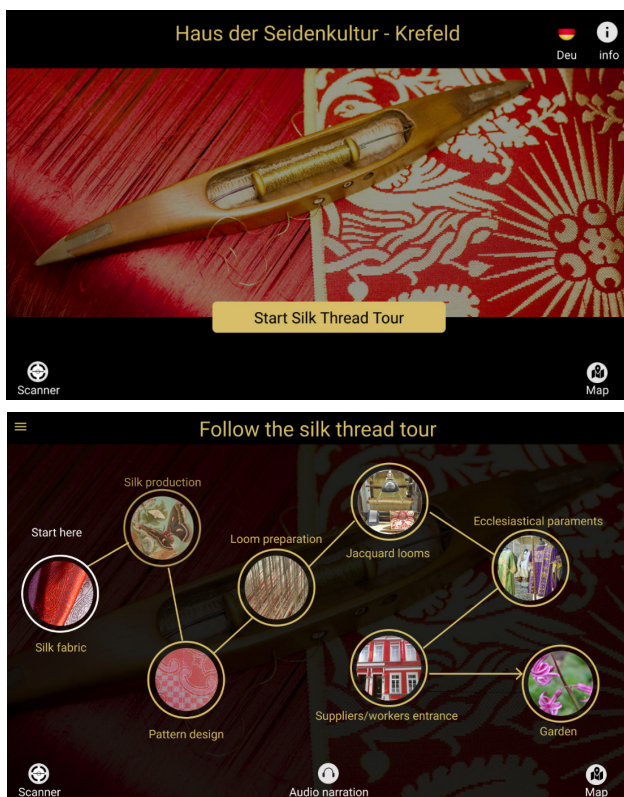


Figure 3. Selection of tour-based narrative

4.3. Virtual Museum

The Virtual Museum Experience of Mingei builds upon existing and new digitisations to present virtually collections in a physical or digital space accessed through 3D virtual environments, VR experiences, mobile and web applications possibly enriched with AR technologies. In this context, the presented VE presents a narrative regarding the creation of ecclesiastical textiles at Krefeld through a collection of digitisations (see Figure 4).



Figure 4. Virtual Museum experience.

4.4. *Interactive Timelines*

Interaction with historic timelines provide a context (the Fabula) to historic events and can be considered as a way of presenting the Aristotelian truth to the visitors of the museum. In an attempt to allow visitors to formulate their vision of Cultural Heritage immersive timelines bring an immersive and interactive way to experience the time-space sequence of events as presented in Figure 5.



Figure 5: Interaction with Historical Timelines.

4.5. *The hand bag*

The handbag concept is about combining history and traditions with contemporary consumer goods. As such interest in the commercial part of AR is vivid in Mingei possibilities are explored to make AR

beneficial for companies and brands contributing to the creation of customer satisfaction, as other forms of experiential marketing have done [1]. However, its use remains rather limited in the realm of heritage education [2]. In this vein, the handbag concept is experimenting on the usage of AR technology to enhance the capacity of the contemporary HC sector to delivering stories and through stories enhancing their meaning and moving them from aesthetic objects to objects that are barriers of stories and memories. Through this approach, we expect that new forms of bonding with HC artefacts will be made possible, thus empowering the capacity of companies exploiting traditional crafts to achieve innovation and reach new target audiences. An overview of its design and application concept is presented in Figure 6.

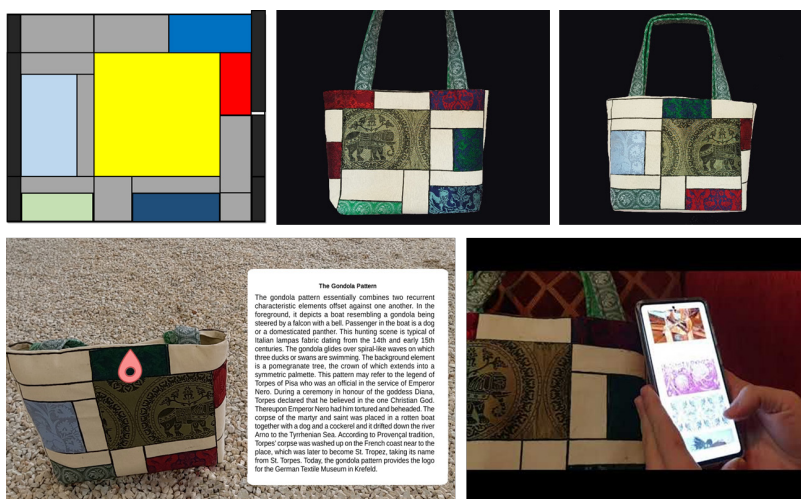


Figure 6. The Hand-bag concept
(video available at <https://youtu.be/bIXLhPm0FIg>)

5. DISCUSSION AND FUTURE CHALLENGES

This paper briefly presented the formulated by Mingei scientific protocol for craft representation and presentation and its application in the context of the silk weaving craft instance as practised by the

community of weavers at Krefeld, Germany. Based on the protocol the paper presents the formulated narratives for craft presentation and their transformation to experiential content by facilitating several technologies and application contexts.

Regarding future work on the presented methodology, the formulated protocol and the defined steps entail tasks that are executed manually and that in the future can be enhanced by a more automated approach considering the research outcomes achieved in several application domains. Considering that currently, the protocol has achieved its goals in three research pilots the needed adaptation should focus on the automation tasks described above.

In terms of experiences presented in this paper, these are considered as the first step towards a new approach to the presentation of content on HCs. As such, it is foreseen that in the future improvements of the ways that these experiences are transmitted can enhance the overall user experiences. For example, the **involvement of more senses can be achieved by exploiting research outcomes on** multimodal display technologies that seamlessly fuse visual, auditory, and haptic renderings. These span visual augmentations through projection or wearable displays are coupled with 3D spatial audio effects to provide realistic experiences. The research could target haptic experiences that believably support and characterize experiences and make them interactive. At the same time for enhancing the **suspension of disbelief which is considered a crucial part of the experience** the full potential of AR, VR and MR has not yet been used. In this context, more immersive mixed-reality experiences can be created that enrich interaction of users with CH collections and site to support 'suspend disbelief' together with haptic and tactile interaction technologies described above to excite more senses (vision, touch and hearing).

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