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ABSTRACT

This article focuses on the dialogue between Intangible Cultural Heritage (ICH) and technology, specifically within the domain of traditional craftsmanship. We begin by establishing the current methods of safeguarding traditional crafts, as described in previous issues of this journal, and the benefits and limitations of these. This is followed by an introduction to the concept of digitisation and the Tripartite Digitisation Model (TDM) for capturing, representing and disseminating ICH through digital means. Through a case study of digitising a traditional joinery technique, we explore different methods for capturing data about ICH and reflect on their use for digitisation. The ICH is represented through 3D models, video clips and audio voice-over, and disseminated in an interactive VR simulation. After evaluating the simulation with the people whose ICH we were trying to safeguard, we discuss the benefits and limitations of moving the ICH from its original context into a digital one.

Keywords

craftsmanship, virtual reality, digitisation, joinery, dovetailing, Information Computer Technology (ICT), TDM, carpentry, Håndværkerhuset

Introduction

There is little doubt about the fact that modern technology is the reason why many traditional practices are threatened. One might even argue that there can be no reconciliation between the expressions originating within traditional ways of living (the intangible cultural heritage (ICH) of communities) and practices often manifested in indigenous contexts, and the cultural backdrop for the development and world-views manifested by computing devices (hereafter referred to as Information Communication Technology (ICT) to convey the broadness of the category).

In general and historically, ICT was not conceived and constructed with the intention of safeguarding ICH. It was invented to support the production capabilities of the Western world. Similarly, ICH came about in contexts and communities before the existence of computing devices and was never intended to become intertwined with digital constructions and their inscribed agendas.

In this article, we take a step into one of the most futuristic digital technologies of the 21st century - Virtual Reality (VR), and use it to record traditional craftsmanship. Our ambition with this work is manifold, but we wanted to bring traditional craftsmen into the discussion of VR as a plausible safeguarding method for their craft. During this process we take a critical look at the various ethnographic methods (a methodology of safeguarding) applied in trying to understand and document the specific craftsmanship practice of dovetailing, as well as how these methods are used for turning dovetailing into bits and bytes. The study entails full documentation of dovetailing using four ethnographic methods and a fully working VR prototype where the user can try out a traditional practice in a digital space. First, we will begin by establishing a common ground for traditional craftsmanship and methods for safeguarding it.

Related works - safeguarding traditional craftsmanship

To get an overview of previously used methods for safeguarding traditional craftsmanship we reviewed every article published in the first thirteen volumes of the *IJIH* to identify methods concerned with safeguarding ICH in the domain of traditional craftsmanship (UNESCO's domain E). Sixteen articles were found through Rodil and Rehm's (2015) categorisation of the first nine volumes, in which they sorted every article according to UNESCO's five ICH domains (UNESCO: n.d.). The remaining four volumes were examined based on the titles and abstracts of papers and three more articles concerned with safeguarding traditional crafts were identified and included. Our primary agenda was to discover which methods different entities employ in safeguarding, and which tension fields or gaps exist between traditional (often ethnographical) methods and the digitisation of ICH for public dissemination.

In total, nineteen articles were subjected to careful analysis and sorted according to similarities with the method(s) they either implemented or described as

Table 1
Methods for safeguarding traditional craftsmanship

Safeguarding method	Articles
Workshops and educational programmes	Horjan [2010]; Karakul [2015]; Kennedy [2010]; Ktori [2017]; Moon [2013]; Tranter [2010]; Van Huy [2006]
Written media	Achanzar [2007]; Hoekstra [2010]; Labi [2009]; Song-Yong [2010]; Svensson [2008]
Demonstrations	Fu, Kim and Mao [2017]; Bucur [2007]; Minho [2007]; Musinguzi and Kibirige [2009]
Exhibitions	Han [2007]; Horjan [2010]; Svensson [2008]; Van Huy [2006]
Databases/inventories	Cabral [2011]; Horjan [2010]
Conferences	Horjan [2010]; Minho [2007]
N/A	Keitumetse and Nthoi [2009]; Sarashima [2013]

being implemented by others. In the end, six categories were identified. An overview of our findings can be seen in Table 1. Below, we briefly describe and discuss the various methods.

Workshops and educational programmes

Workshops and educational programmes refer to cases where training in a craft is conducted by trained instructors, either in a more formal setting such as vocational schools or in more informal settings like limited-time workshops. As is obvious, this method requires the active participation of those who attend. Examples of this are the various educational programmes described by Ktori (2017), which aim to safeguard the practice of Lefkara embroidery in Cyprus. The programmes are all taught by practised embroiderers with the aim of transmitting knowledge to younger generations. A more short-term example is described by Karakul (2015), whose study focuses on a one-week workshop for traditional building methods in Turkey. The workshop consisted of master builders teaching groups of students through a master-apprentice relationship. It also involved interviews with the builders, conducted by the students, about their education, apprenticeship and experience.

The direct involvement of the craftspeople makes this method arguably one of the more authentic methods for disseminating information about a craft. Participants (or students) actively performing the craft themselves ensures the added learning benefits that the 'learning-by-doing' approach involves, such as higher engagement and deeper understanding of the material (Felder and Brent: 2003). However, both for short-term and longer-term solutions, this method has the disadvantage of being place-specific, meaning the information is not disseminated outside of the immediate physical context. For short-term solutions, it is also restricted by time. Furthermore, the method requires a certain amount of resources (tools, materials, etc.) which can be costly. Finally, long-term solutions rely on pre-existing interest in the craft from the public to get people to commit on a long-term basis.

Written media

In the case of written media, the articles themselves become the *de facto* method of safeguarding. While most of the articles in the *IJIH* could be seen in this way, what we refer to is when the ICH is explicitly written up and thus documented in a published (and publicly accessible) format. An elaborate account is Song-Yong's (2010) operational sequence analysis of Korean pottery-making techniques. In this study, the process of pottery-making is described and documented step by step. Another example is from Svensson's (2008) ethnographic studies of Hopi pottery and Sámi basketry. Svensson does not go into detail about the processes themselves, but instead describes the other intangible elements surrounding them, such as how they relate to the ways of life of the people who practise the crafts.

This method can theoretically provide all the relevant data concerning a specific craft and is more easily disseminated across space and time than most other methods. However, since articles such as the examples described above are often written by people other than the craftspeople, they will to some degree rely on the author's understanding and interpretations of the craft, as well as their ability to describe it. The written method approach does not offer a way for people to physically interact with the craft, or to experience it, the way other methods allow.

Demonstrations

By 'demonstrations', we mean cases where craftspeople perform their craft in a place where other people can see them, such as a museum or a fair. For example, Bucur (2007) describes the National Festival of Folk Traditions in Romania, an annual event where, among other heritage-related events, craftspeople demonstrate traditional folk crafts in live performances. Fu, Kim and Mao (2017) describe craft demonstrations in the Arts and Crafts Museum Cluster in China, where traditional craftspeople are given a free space both to perform their craft in full view of attendees and sell their products.

Demonstrations share both the benefits and disadvantages of workshops and educational programmes, especially in the case of interactive demonstrations. Both a benefit and disadvantage of this method is that it requires little commitment from audiences for dissemination, however, this dissemination is without experiential learning (hands-on, first-person experience).

Exhibitions

In exhibitions, information about a traditional craft is displayed, usually in museums or at sites relevant to the craft. This often means showing tangible elements such as tools and craft products, but can also be in the form of e.g. pictures and video. For example, Van Huy (2006) describes exhibits created by the Vietnam Museum of Ethnology, where photographs taken by craftspeople were organised into three exhibitions. Two of these were located where the craftspeople lived which added to the understanding of the local community regarding the value of their craft.

Similar to demonstrations, this is a low-commitment method, although just as for written media, this method can end up being dependent on the creators' ability to interpret the crafts or the methodologies used to make them.

Databases/inventories

Databases or inventories refer to digital inventories of ICH data, such as pictures, video and questionnaire results. Horjan (2011) created a database with the purpose of storing information that could (and has been) used in further safeguarding efforts, such as educational programmes and workshops. In a rather different example of this method, Cabral (2011) proposed (but did not have time to implement) an interactive online database through which anyone could provide information on the ICH by filling out questionnaires.

Notably, this is the only method we found that is inherently digital, which gives it the same benefits in terms of sharing as written media. However, just as with written media, it does not require active participation from the craftspeople or from participants.

Conferences

Conferences refer to gatherings of stakeholders relevant to the ICH they are seeking to safeguard to discuss issues related to safeguarding. These stakeholders can, for example, be craftspeople as well as people from the tourism sector. An example is Horjan's (2010) study, where one of the outcomes was an expert conference where professionals in heritage and tourism discussed legal issues, development opportunities and education related to traditional crafts in the border area of Croatia and Slovenia.

This method is more suited to the planning of other safeguarding methods, just as in the example above, since it does not involve the public at all. However, it also suffers from the same disadvantages as most other methods already described, namely time- and place-specificity.

Summary

In summary, in the review we have identified the various methods employed for safeguarding traditional craftsmanship as each having their own set of strengths in terms of dissemination. However, it is clear that the immediate challenges for dissemination (and the ability to invoke interest among the public) are primarily limited by the spatial confinement of the crafts or the inability of audiences to experience them beyond being spectators. From this point of tension, we found it interesting to explore how virtual reality could perform as a method for dissemination and as a method for engaging with traditional craftsmen in conversations about their own practice as a potential subject for digitisation and dissemination.

Digitisation

Article 13 of the UNESCO *Convention* states that, while attempting to safeguard ICH, one should *foster scientific, **technical** and artistic studies, as well as research methodologies, with a view to effective safeguarding of the intangible cultural heritage* (UNESCO: 2003). This suggests technology as a means of preserving ICH. For traditional crafts, one of the main threats is technology and industrialisation, which has led to many changes in the way they are practised. Demands for increased production have meant that traditional methods have become altered or even obsolete, replaced by machinery (Song-Yong: 2010; Tranter: 2010). As we come from a background in ICT, we see an opportunity to use the very thing that is often a threat to traditional crafts as a means to safeguard them, via the process of digitisation. Digitisation has the same benefits as written media - i.e. accessibility and shareability - while it also has the potential to incorporate the benefits of workshops and demonstrations. But to what degree they are reconcilable is a more complicated concept to come to understand and relates to the research methodology employed in safeguarding and the reflections of its consequences.

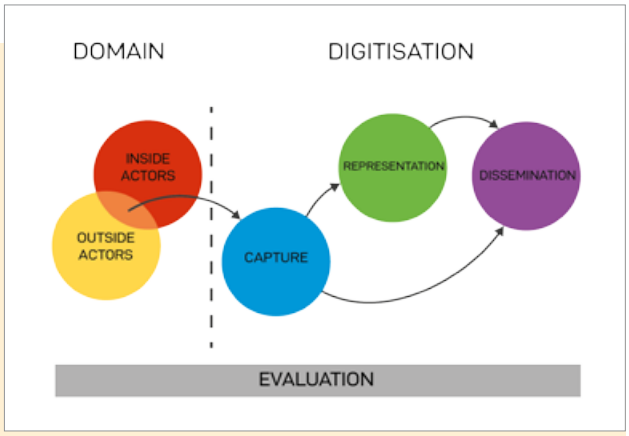

Figure 1
The Tripartite Digitisation Model, based on Figure 2 in Rodil and Rehm (2015).

The Tripartite Digitisation Model

In order to digitise ICH, we made use of the Tripartite Digitisation Model (TDM), as presented by Rodil and Rehm (2015; 2017). This model (as seen in Figure 1), can be broken down into two main stages. The first one, the domain, refers both to the domain as classified by UNESCO (2003), but also more specifically to the context and knowledge associated with the particular ICH to be digitised. Two types of actors exist within the domain: inside actors and outside actors, where the inside actor is the 'owner(s)' of the ICH, and the outside actor is the person or group attempting to safeguard it. As illustrated in Figure 1, the outside actors bring their own (usually technical) domain into that of the inside actors, and it is in this overlap that the second part of the process, digitisation, takes form.

Digitisation consists of three parts. The first one, capture, is where data about the ICH is gathered and analysed, with the purpose of gaining an understanding of the domain and collecting the elements to be digitised. This can, for example, be through traditional ethnographic methods like interviews with inside actors, photos and/or video recordings, or it can be through more technical methods such as 3D-scanning or motion capture. The choice of method depends on the nature of the ICH, and a single method will not necessarily be able to capture all important aspects.

The second part, representation, is where the captured data is structured and translated into digital representations, such as 3D models or as audio narration. The possibilities for representation are of course limited by the types of data captured, as it would be difficult to create e.g. 3D models of something that had not been captured visually. The choice of representation method(s) is often considered in advance of establishing the method of dissemination. But it is also likely that large sets of various types of represented data can be utilised in various combinations in future dissemination forms.

Finally, in dissemination, a digital medium is used to showcase the digitally represented ICH, ideally allowing it to reach a wider audience. This can, for example, be an interactive 3D simulation, a video, webpage, an augmented reality application, etc. Just as for representation, the choice of dissemination is informed by the types of data available, and just as for capture, it is informed by the nature of the ICH. For example, it might make more sense to choose an interactive medium for disseminating a craft process with the purpose of teaching it to users, whereas video(s) might be sufficient for informing people about the importance of a craft to the people practising it. In any case, they can both be digital.

The choice of methods for all three parts is informed by the nature of the ICH, just as the choice of capture and representation is informed by the intended method of dissemination and the disciplinary background of the outside actors. Underlying the process is a continuous evaluation of the process with the inside actors to guard against misinterpretations. For an example of this, we refer to recent work by Rodil and Winschiers-Theophilus (2018), where the continuous community/researcher dialogue enabled outside actors to better gauge their misunderstanding of the ICH in question.

Case study: the practice of dovetailing

To investigate the potential benefits and shortcomings of digitising traditional craftsmanship, we conducted a case study in collaboration with a traditional Danish joiner. Traditional joinery might not be the most obvious choice when talking about ICH, since over time ICH appears to have become almost synonymous with indigenous people. However, as per UNESCO's definition, ICH is *the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural*

spaces associated therewith – that communities, groups and, in some cases, individuals recognise as part of their cultural heritage. (UNESCO: 2003). Thus, traditional joinery can be recognised as ICH as long as the individuals practising the craft see it as part of their identity. The specific ICH we are working to digitise is the process of dovetailing, a traditional joinery technique that is no longer taught at Danish vocational schools. The benefit of this case study has been our ability to return to the confined space of the practice for numerous talks and experimentation with our safeguarding methodology.

Throughout the following subsections, we describe our case study in terms of the different parts of the TDM.

Domain

The domain of our case study is traditional craftsmanship (domain E). More specifically, it is traditional Danish joinery within the institution called Håndværkerhuset (the Craftsman House) in Aalborg. Håndværkerhuset was created in 1987 with the purpose of giving local traditional craftspeople a place to practise their crafts in order to preserve them. It contains workshops for seven different traditional types of craft, including clockmaking, carpentry and joinery, where they do both restorations and create new wooden craft products using traditional craft methods. The restoration service is especially interesting, as many of the tasks performed are only possible to complete using traditional techniques - such as dovetailing. Håndværkerhuset is open every Wednesday, and they welcome anyone to come in and observe demonstrations of the different crafts. They also offer tours and demonstrations for vocational schools in the area, however, they have found that interest from these institutions has been decreasing.

During a preliminary visit to Håndværkerhuset, a joiner (hereafter known as 'the joiner') expressed concern about how his craft has changed in recent years and feared that much of the knowledge and skill he learned from his masters would be forgotten. According to the TDM, the joiner is the inside actor having complete domain knowledge of the field, but very limited in terms of technological knowledge. We, on the other hand, are without any form of domain knowledge, but as developers we are aware of the various technological opportunities. Thus the first step is to establish a dialogue between ICH and ICT and

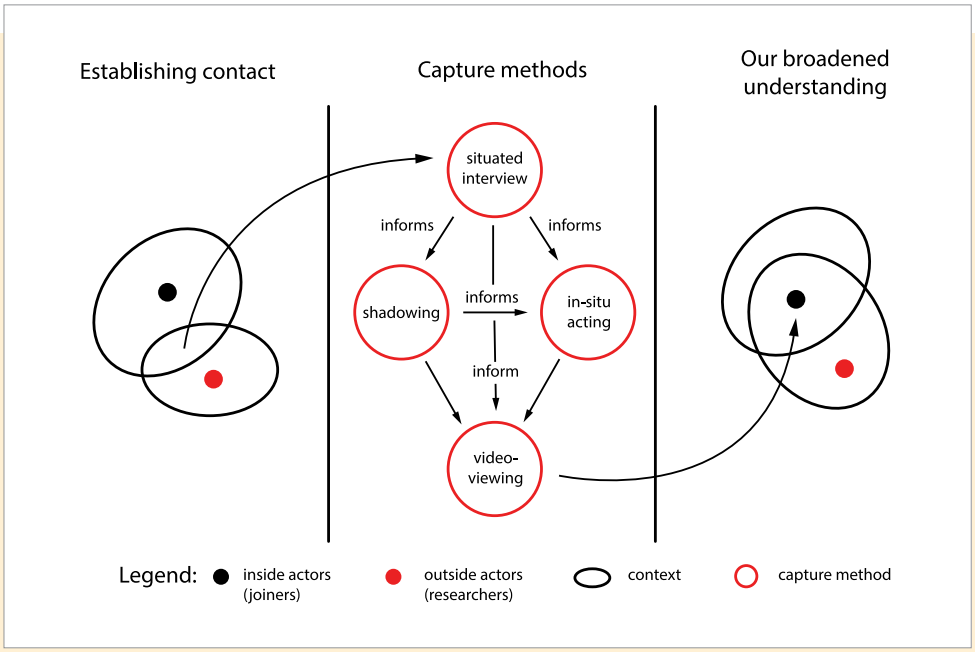

Figure 2
A model representing our capture process, illustrating how the different methods of capture informed each other.
Source: Illustration produced by authors, 16 Dec. 2018.

maintain a dialogical frame for continuous scrutiny of the two fields' ability or inability to be reconciled.

Capture

The capture process consisted of four different capture sessions, each using different ethnographic methods to gain an insight into the domain practice. The choice to use four different methods was not made at the beginning of the case study, rather it became obvious along the way that one method would not suffice in bringing a proper understanding of the domain when looking at the captured data. Thus the method for each session following the first one was chosen based on results from previous sessions, with the purpose of filling in the blanks in our understanding and to facilitate future dissemination, (as illustrated in Figure 2).

Capture 1: situated interview

To gain an understanding of some of the intangible qualities that the joiner recognised as part of his identity, as well as to narrow the scope of the study to a specific topic, we conducted a situated interview. *The situated interview is focused on studying the 'real' person in the 'real' setting ...This allows a more detailed discussion on the particular relationship between the person and the issues in focus* (Ylirisku and Buur: 2007). It was an open format interview, with only an overall entry point to establish a dialogue about the differences between joinery today and traditional joinery, as well as potential topics for digitisation. The interview was audio-recorded and transcribed for analysis.

Based on the interview, we identified three main differences in the intangible qualities between current and traditional joiners' self-perception of their identity. Firstly, traditional joiners were taught through a master-apprentice relationship. The master (*mestersvend* in Danish) did not just teach joinery techniques, but also functioned as a life mentor. The apprentices respected him, and he respected and expressed pride in his apprentices, which in turn taught them to be proud of their work. According to the joiner, current apprentices *don't learn that pride that we learned. In a way, we had it knocked into us, that you should be proud of being a joiner. They don't get that today ... You just need to get money out of them today.*

Secondly, knowledge about the tools and how to maintain them has been devalued. For example, the joiner explained how he was taught to sharpen saw blades. Today, he explained, modern craftspeople buy several blades at once and then throw them away once they get dull.

Thirdly, the approach to a project is different when looking across generations. Much of this is due to the technological advancements that have automated

Plate 1
An example of a dovetail joint.
Photo: Milo Marsfeldt Skovfoged, 2018.

Plate 2
Footage from our shadowing-capture, from both the stationary and handheld cameras.
Photo: Miroslav Kalinov Sokolov and Milo Marsfeldt Skovfoged, 2018.

many of the processes, which has left many traditional techniques obsolete. Today, [all] *components come more or less ready for assembly. It doesn't give that pride in the craft, because it's assembly, and you shouldn't underestimate assembly, but it really isn't anything other than screwing some things together or assembling things that have been finished in a factory.* It was during this capture session that the joiner mentioned dovetailing, which he described as one of the most essential techniques for traditional joinery. Dovetailing is the art of combining wood, without the use of nails or other aids (as shown in Plate 1), often used for making drawers, doors, window sills, etc.

Reflection on the situated interview method for the digitisation of ICH

As an initial capture method, the situated interview provided a surface-level overview of the ICH and the challenges that it faces from the point of view of the inside actors. Locating the interview in the context of where the ICH is practised was beneficial for when the joiner wanted to show us something, e.g. a tool or a craft product, to make his point clearer. The open format of the interview allowed the inside actor to more or less control the conversation, thus focusing on topics important from his perspective. While the situated interview gave insight into the identity of the joiner, it didn't provide much insight into the process of dovetailing, nor the interactions in a master-apprentice relationship.

Capture 2: Shadowing

In order to capture the process of dovetailing, we were inspired by the video-shadowing method described by Ylirisku and Buur (2007, p.65), who explain the following about the method: *...many work activities are automatic and are thus difficult to verbalise or to detail, or may even escape conscious awareness altogether.*

By using two cameras, one handheld and one stationary, (as shown in Plate 2), we were able to get a total overview of the workstation while at the same time getting close-up shots of the joiner's actions. During the capture session, there was no verbal interaction between us and the joiner as it was pivotal that he could direct the rhythm and content as he saw necessary.

By analysing the videos, we were able to break down the process of dovetailing into smaller steps and get an overview of the different tools used. It also provided an understanding of the joiner's movements within his work space, and his use and interaction with the tools.

Reflection on the video-shadowing method for the digitisation of ICH

Shadowing allowed us to capture every step involved, how it was performed, which tools were used, etc.. The use of two cameras was especially beneficial, as we were able to fill in gaps from the hand-held camera footage with that of the stationary camera, and

vice versa. For example, through the hand-held, we could see in detail how the joiner drew lines on a plank, while we had an overview of where in the workshop this took place through the stationary. Using two cameras also diminished the shortcoming of using a camera, namely that if the view is obstructed then the data is not captured. The choice not to communicate with the joiner allowed for a more natural capture of the process. However, while shadowing showed *how* dovetails are made, it did not explain *why* it was done this way.

Capture 3: *in-situ* acting

To fill in blanks from the previous methods, for instance, understanding the stepwise process (inspired by Song-Yong, (2010)) and the master-apprentice relationship, we decided to use *in-situ* acting (Ylirisku and Buur: 2007), where one of the researchers played the role of a new apprentice being taught how to make dovetails. This allowed for natural interaction, asking questions and receiving feedback, between researcher and joiner. This was done immediately following the shadowing session and was documented using two cameras following the same set-up as shadowing.

Reflection on the *in-situ* acting method for the digitisation of ICH

This capture session provided further insight into the process of dovetailing, as it explained the reason and importance of different actions. For example, when outlining the dovetail the exact angle of the dovetail is not as important as the aesthetic, which differs according to personal taste.

The capture session also provided an understanding of the 'feeling' for the master-apprentice relationship, with the use of language, attitude, type of feedback, etc. Having one of the researchers create dovetails themselves, we feel, brought us closer to an understanding of the process of dovetailing from an insider actor's perspective, although of course, it is only partial. Having the joiner act as the researcher's master was also valuable in terms of understanding the master-apprentice relationship. However, it should be kept in mind that a single session is not enough to recreate the year-long bond between a master and apprentice.

Capture 4: video-viewing

As outsider actors, we knew it was impossible to get a complete understanding of the intangible heritage of the entire craft when it had taken the joiner over sixty years to reach his level of expertise. However, if our understanding was incomplete, our dissemination might have provided an incorrect depiction. This is not limited to digitisation but is a constant challenge when safeguarding. Therefore, inspired by a method used by Rodil *et al*. (2014), to minimise the chance of error by exposing our own understanding to the inside actor, we edited the video from our shadowing session to showcase our current understanding of the process. We then asked the joiner to watch the video while commenting (see Plate 3). If the joiner wished to add to the video, either directly regarding the content in the video or generally about joinery, we paused the video and recorded his clarification.

Reflection on the video-viewing method for the digitisation of ICH

This capture session assisted us in understanding the process of dovetailing more thoroughly, as well as the importance of certain elements (tools and techniques) that we otherwise would not have thought about. The method also allowed the joiner to see how others understand the meaning of his craft from the situated methods (and their inability to capture everything), thus he could comment on what others would see.

Plate 3
Footage from the video viewing, with the joiner viewing our edited shadowing footage on a laptop and commenting on it.
Photo: Jedrzej Jacek Czapla, 2018.

Plate 4
A comparison between the real object (left) and our 3D model (right).
Photo: Jedrzej Jacek Czapla, 2018.

Plate 5
A screenshot from our VR simulation.
Source: in-game screen capture made by the authors, 16 Dec. 2018.

Thus, this capture session was very useful in filling in the gaps we were able to identify in our data. Furthermore, by giving the data back to the inside actor, we gained a perspective on the ICH that we, as outside actors, could not have achieved by ourselves. For example, we found out that the pencil the joiner used in drawing measurements, which we had previously dismissed as 'just a pencil', was a very specific type of pencil which was important for making accurate dovetails.

Discussion of capture methods

We found that the various capture methods we used worked well together, due to how data from one capture session could fill in gaps in the data from other sessions. Had we only used one method, e.g. the situated interview, we would have needed to ensure that we were extremely thorough which would have been challenging for several reasons. As an example, we would not have had enough prior knowledge to know which data was missing. Instead, by using four methods, we were able to analyse the data from one session, see what was missing, and adjust accordingly for the next session. This ties into the second reason, namely that using only one method would have restricted the types of data we could gather. Knowing what data we were missing, we could discuss which method was best suited for filling in the gaps of our understanding. In other words, the results of each session informed which method we used next, (as illustrated in Figure 2).

Through the situated interview, we gained an understanding of the joiner's feelings towards the evolution of his craft and what he felt it was important to safeguard. We identified elements that were important for further capture sessions, which we did through shadowing (capturing the process of dovetailing) and *in situ*-acting (understanding the process of dovetailing and the master-apprentice relationship). While reviewing our data, we identified the gaps in our understanding, which we then attempted to fill through the video-viewing session.

An important element in three out of four capture sessions was the use of video recording, which ensured that we gathered as much data as possible, even data we might not find important during the capture session. This proved especially useful in the shadowing session, where we could get a more natural recording of the joiner creating dovetails, but were still able to record all his movements and the tools he used without interrupting him so we could write it all down.

That being said, we have no illusions about having captured everything that is essential to the craft of dovetailing. As previously mentioned, as outside actors we are aware that we will never understand the intangible heritage in the way that the inside actors do. It is worth noting that we chose not to conduct any further capture sessions after the fourth since we deemed that we had a sufficient understanding of dovetails to make the digital representation and ultimately create a dissemination prototype. However, it is entirely possible that a more thorough understanding could have been gained by continuing the capture process.

Representation

The different capture sessions resulted in various types of data in the form of pictures, voice recordings, videos, notes, sketches and transcripts. In order to organise and represent both the tangible and intangible parts we used different technological media.

The tangible parts, such as the tools and materials required for making dovetails, were represented through 3D models. The models of the tools were based on reference images and measurements taken during capture sessions. The result was a set of thirty-five fully textured 3D models, an example of which can be seen in Plate 4. The models were created with Autodesk Maya, while the textures were edited using Adobe Photoshop.

Representing the intangible aspects was more challenging. The process of dovetailing itself was represented by editing the footage from the shadowing session into thirteen shorter video clips. The resulting videos showed the steps the joiner performed throughout the process. Furthermore, to accompany the videos, we wrote a voiceover script, which explained the meaning behind the actions that were happening in the footage. The content of the script was based on the information from the *in-situ* acting, situated interview and video-viewing. Furthermore, the script was written in the joiner's native language, using as many of his phrasings as possible, and from the perspective of a joiner telling the story of how his master had taught him. In order to visualise the joiner from whose perspective the script was taken, we created a 3D model of a human with the traditional uniform of the joiners at Håndværkerhuset (see Plate 5). This model was created using Adobe Fuse CC.

Dissemination

VR as a technical domain and the content for dissemination were chosen by comparing the six identified methods in the nineteen articles found in the review. For example, both workshops and demonstrations provide the possibility of interacting with the inside actor directly, and at the same time, it is possible to try/learn the craft yourself. However, the downside of this is that the dissemination is limited to a specific time and place. Both written media and database/inventories are easier to disseminate across space and time as both can be digitised and sent/read online. This is a common quality to most digital media. However, written media lacks the interaction with the inside actor and is only able to showcase a 'frozen' depiction of the ICH based on the writer's current understanding, a problem most digital solutions also suffer from. This also means that it cannot provide additional information if the reader has more questions. At the same time, the reader only gets visual input in the form of words and in some cases, images, where a workshop provides input to all the bodily senses. Here a digital medium such as virtual reality (VR) also provides multi-sensory input, where the user is able to interact with a virtual world through embodied interaction, i.e. interaction through bodily movements, rather than just interacting through e.g. a mouse and keyboard, thereby combining the 'try it yourself' approach from workshops with the easy dissemination of written media. We therefore chose to experiment with VR as the digital medium for dissemination.

Sherman and Craig (2002) describe VR as the product of four essential elements: a *virtual world, immersion, feedback,* and *interactivity*. In the context of a computer system, a *virtual world* is one that is built and consists of 3D and 2D models. *Immersion* is divided into physical immersion - how much the system is affecting the user's sensory feedback - and mental immersion - how engaged is the user with the generated virtual world. *Feedback* relates to whether the user's actions are accurately translated from the real to the virtual world, and *interactivity* is whether the user's action has an effect on the virtual world.

An example of a previous attempt to safeguard a traditional craft method through VR is in the work of Carrozzino *et al.* (2011). In their work, they capture the process of statue-making in Italy by following a local statue-maker and documenting the process step by step. They represent the process through video clips and 3D models of the materials and tools and disseminate it through a virtual environment that can be experienced either on a regular desktop setup or in an immersive VR system. An evaluation of the system showed that participants enjoyed their method of safeguarding and said that they enjoyed the mix of 'traditional' (the videos) and less traditional (3D models) representations. Regarding the immersive VR setup, they found that participants were expecting to be able to move and act more freely than the system allowed

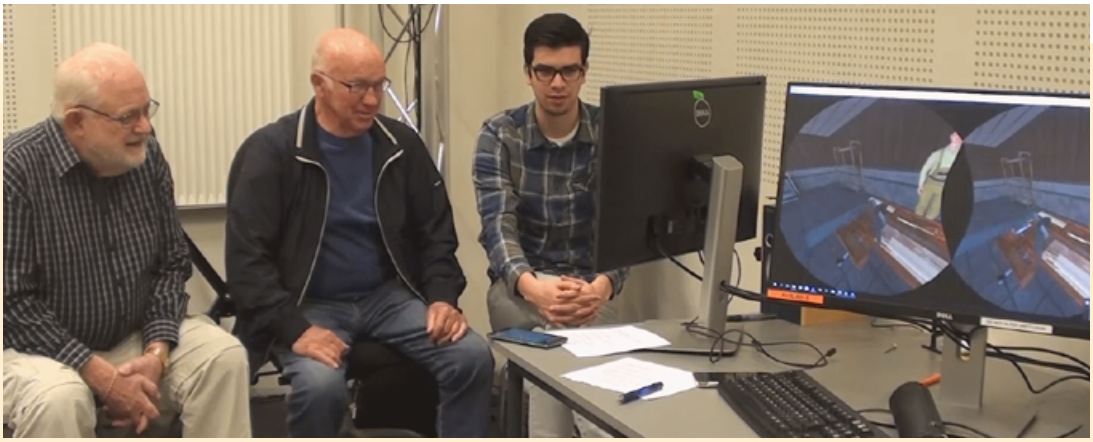

Plate 6
Footage from our evaluation with the joiner (left) and the carpenter (middle).
Photo: Miroslav Kalinov Sokolov, 2018.

them to. Participants also expressed that being able to move around and interact with the virtual environment helped them focus on the content of the ICH (Carrozzino *et al.*: 2011).

Implementing the VR

Considering how VR has previously been used in the context of ICH, we developed a simulation that can be experienced through a head-mounted display (HMD). It was developed in the game engine Unity 3D, using the C# programming language and Virtual Reality Toolkit (VRTK) to implement bodily interaction. For testing it, we used an HTC Vive VR system. This system makes it possible for the user to experience and interact within a virtual world, being inside the simulation as opposed to interacting with a virtual world through a monitor and input devices such as a mouse (an example could be Minecraft).

When a person enters the simulation, they find themselves within a workshop environment with a workbench in front of them and a virtual joiner standing behind it. This can be seen in Plate 5. When the user feels acquainted with the world, they can start the play-through. They learn about the process through step-by-step narrated videos, displayed on a virtual speech bubble coming from the virtual joiner. These videos are the edited footage from the shadowing and the narrative is based on quotes from the situated interview, *in-situ* acting and video-viewing. The user has the freedom of choice to watch the full video first or to perform the steps as it plays. To complete the simulation, they are required to themselves perform the bodily actions they see in the videos (like marking with a pencil, sawing, etc.), using the 3D models provided of the tools that lie on the workbench.

Evaluating the VR simulation with the inside actor

To evaluate the authenticity of the VR simulation, we invited the joiner and a colleague to view it. We were interested to see how well they felt we had managed to represent their craft, as well as how they responded to the method of dissemination, namely VR, something that was new to them. This evaluation was conducted in a lab at Aalborg University, which also allowed us to see if the inside actors were able to recognise their ICH in a different context than their workshop.

As the joiner and colleague had no prior experience with VR, we feared that making them go through the simulation would result in us needing to guide them through every step, distracting them from providing us feedback on our representation of their craft. We therefore decided instead to let them view a screen showing a member of the research group playing through the simulation live. The joiner and a carpenter colleague were sitting together with another researcher, allowing them to discuss what they were seeing, as shown in Plate 6. As the play-through was happening in real time, the player was able to 'pause' when they began to talk, so as to get as much feedback

Plate 7
The carpenter trying the VR application.
Photo: Miroslav Kalinov Sokolov, 2018.

as possible. The evaluation was recorded with a video camera and lasted approximately an hour.

The overall response from the craftsmen was positive. They were especially happy with the voice-over and felt that it managed to incorporate some of the most important intangible aspects of the craft, such as the master-apprentice relationship and the importance of using the right tools. They also noted that we had included all the necessary tools and that they thought they were well represented and easy to recognise. However, we became aware that we had named one tool inaccurately in the voice-over. Through their discussion, we were made aware of two points regarding how to use specific tools that we were unaware of and therefore had not included in our simulation.

At the end of the play-through, we gave the experts the opportunity to try our VR simulation. The colleague tried it briefly (see Plate 7), but he had difficulty interacting with anything and seemed confused about how it worked. Within two minutes, he wanted to go back to the 'real world' and commented that he felt like he was in a completely different world and forgot his surroundings while in VR. Yet, we find it important to mention that the concept of overlapping technology and ICH domain is not only for the benefit of the researchers' understanding of ICH, but also to open up the space of technology for the inside actors - enabling them to also become critical (over time) about their own practices' digital future. The concept of mutual learning within an ICH digitisation discourse is covered in more depth in Rodil and Rehm (2015).

Discussion of VR as a method of safeguarding

The choice of dissemination through VR proved to be a challenge. Due to the relative novelty of VR, and perhaps more importantly, the inside actors' limited relationship with technology, it proved difficult to properly convey to them what the actual purpose of the VR was. However, we also conducted a separate evaluation of the system with nine students in their twenties, who also had limited experience with VR. This evaluation showed that they were able to understand and use our solution without any particular confusion regarding how VR itself works, indicating that our solution could effectively fulfil the purpose of transmitting the ICH to the wider public as playful, embodied interaction with ICH.

All the decisions in this technical domain were made by us and are thus influenced by our perspective on the ICH. All the capture sessions were based on our presumption that they were the best methods for capturing the specific ICH, in doing so we also chose the type of data received, thereby influencing how the ICH was disseminated. Had we chosen not to do shadowing then we would not have been able to edit the footage

down to the smaller clips that were used to show the process in the VR simulation. It should also be noted that we not only chose how to represent the data, but also what data to represent.

Despite our four capture methods we still did not manage to capture every aspect of the dovetail-making process. One of the tools was accidentally named after its bigger counterpart, and up until this point we did not know the tool had different names based on size. We had also missed the fact that two of the tools had to be used in a specific way. One such tool was the saw, where it was important to use small movements to make the cut precise. Going back and looking at the shadowing with this new information we could see that the joiner does indeed use smaller cuts when sawing the dovetails compared to when sawing a piece of wood in two. So while we did manage to capture the data, we did not always manage to identify its significance. This is a problem all outside actors have to deal with, determining when an action is 'just' an action and when it has a significant meaning.

The question then becomes: how can we avoid missing the importance of actions? During the shadowing and video-viewing, the movement of the saw was correct since it was the joiner who performed the task, thus the topic of the movement did not come up and we did not know to ask about it. It was not until the researcher first used the saw wrongly in the VR simulation that the joiner commented on it. One explanation is that for the inside actor, the ICH, in this case the movement of the saw, is second nature so they do not think about how they do it and only when confronted with an incorrect representation do they start to reflect on how they do it themselves. By this example, we were able to confirm what was pointed out by Rodil *et al.* (2014) on how video captured ICH data brings embedded information which is decoded differently by different stakeholders. Only in the dialogue (made possible by the research frame) between outside actors and inside actors can points of confusion, relevance and irrelevance be deconstructed for a proper understanding, and allow for integration into a technological construction.

This problem of identifying the importance of certain steps also shows the downside that all static media is confronted with. If a static medium presents an incomplete or inaccurate representation of the ICH then the recipient will get an inaccurate understanding of it. As outside actors, it could be argued that it is impossible to ever get a complete understanding of the ICH. So the most important thing is to present and confront the inside actor with one's own (incomplete) understanding, enabling them to reflect on their own ICH, to make sure that the data is respectfully representing the insiders' views and skills. With that said, the evaluation showed that the inside actor did recognise the digital representation of dovetailing as being part of his ICH.

Due to the project's limited scope, elements such as the maintenance of tools, choosing the correct type of wood, etc. were not included in the solution, despite the inside actors recognising them as important to the craft. Thus, the final VR simulation is ultimately a product of our choices and agendas and not the inside actors'. While this seems banal, it highlights the fact that few outside- and inside-actor collaborations can continue indefinitely, and although it could be argued that involving the inside actor more would provide a more accurate representation over time, it is hardly the reality of many safeguarding projects. After all, we are working with complicated topics involving identity, world-views and techniques perfected over many years. The fundamental question is now more obvious to us; what really is the objective of dissemination? By querying this point, we wish to expose, in light of our experiences, that the methodological choices will have consequences for the ICH as one cannot capture it all - digitally or otherwise. We would like to suggest that the outside actors at least establish a continuous dialogue between themselves and the inside actors in a more holistic way. In our case, it has been beneficial to our understanding of the domain to expose the joiner to the dissemination of his own craft.

Conclusion

By analysing the nineteen articles from the *IJIH* that focused on traditional craftsmanship, we were able to categorise their methods of dissemination into one of six categories. Based on the benefits and disadvantages of these different methods, we suggested that a digital solution, and specifically a virtual reality solution, could be explored as another way of disseminating ICH. The idea was to combine some of the benefits, like the embodied actions from the workshops, with the wider

dissemination of written media, thereby accommodating some of the shortcomings from these media.

Based on this assumption, we designed a VR simulation of the process of dovetailing. The process was captured using four different ethnographic methods, each chosen based on the shortcomings of the other methods. This provided a more complete picture of the ICH than any of the methods could have provided on their own. Both the video-viewing method and the final evaluation turned out to be particularly insightful as they both confronted the inside actor with his own ICH as seen from the perspective of an outside actor, enabling the inside actor to reflect on his own practice.

The VR solution was designed using data from all four captures, and while the inside actor was able to recognise his own ICH practice, he did not seem to understand VR; it is likely that he also did not understand the benefits of it in relation to other safeguarding methods. Ensuring that the inside actors feel their ICH is being safeguarded is just as important as ensuring that the ICH is spread to new generations. We therefore do not intend for VR, and digitisation in general, to be a replacement for more traditional safeguarding methods. Rather, we believe it could be an addition - or enhancement - with its own benefits, that could potentially attract more attention among younger generations. In light of this work it is a priority to continue to investigate the role of VR as a method where the first step is to ensure that inside actors are better equipped to be critical about technology.

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REFERENCES

- Bucur, Corneliu Ioan. 2007. 'Project Report: the National 'Human Living Treasures' Programme of the Astra Museum, Sibiu, Romania' in *International Journal of Intangible Heritage* 2: pp.111-116.
- Cabral, Clara Bertrand. 2011. 'Collaborative internet-mediated ICH inventories' in *International Journal of Intangible Heritage* 6: pp.36-43.
- Carrozzino, Marcello, Scucces, Alessandra, Leonardi, Rosario, Evangelista, Chiara and Bergamasco, Massimo. 2011. 'Virtually preserving the intangible heritage of artistic handicraft' in *Journal of Cultural Heritage* 12, no. 1: pp.82-87.
- Dalgarno, Barney, and Lee, Mark J.W.. 2010. 'What are the learning affordances of 3-D virtual environments?' in *British Journal of Educational Technology* 41, no. 1: pp.10-32.
- Felder, Richard M., and Brent, Rebecca. 2003. 'Learning by doing' in *Chemical engineering education* 37, no. 4: pp.282-309.
- Fu, Yi, Sangkyun Kim and Mao, Ruohan. 2017. 'Crafting Collaboration: Conflict Resolution and Community Engagement in the Hangzhou Arts and Crafts Museum Cluster' in *International Journal of Intangible Heritage* 12: pp.60-75.
- Horjan, Goranka. 2011. 'Traditional crafts as a new attraction for cultural tourism' in *International Journal of Intangible Heritage* 6: pp.45-56.
- Karakul, Özlem. 2015. 'An Integrated Methodology for the Conservation of Traditional Craftsmanship in Historic Buildings' in *International Journal of Intangible Heritage* 10: pp.135-144.
- Ktori, Maria. 2017. 'Lefkara Lace: Educational Approaches to ICH in Cyprus' in *International Journal of Intangible Heritage* 12: pp.78-92.
- Liu, Dejian, Bhagat, Kaushal Kuma, Gao, Yuan Gao, Chang, Ting-Wen and Huang, Ronghuai. 2017. 'The Potentials and Trends of Virtual Reality in Education' in *Virtual, Augmented, and Mixed Realities in Education*: pp.105-130. Springer, Singapore.
- Melatti, Michael and Johnsen, Kyle. 2017. 'Virtual Reality mediated instruction and learning' in 2017 *IEEE Virtual Reality Workshop on K-12 Embodied Learning through Virtual & Augmented Reality (KELVAR)*: pp. 1-6. IEEE.
- Rodil, Kasper, Winschiers-Theophilus, Heike, Koch Kapuire, Gereon, Stanley, Colin and Chivuno-Kuria, Shilumbe. 2014. 'Participatory exploration of digitalising cultural content: Getting married. are we ready?' in *Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium papers, and Keynote abstracts-Volume 2*: pp.93-97. ACM.
- Rodil, Kasper and Rehm, Matthias. 2015. 'A decade later: looking at the past while sketching the future of ICH through the tripartite digitisation model' in *International Journal of Intangible Heritage* 10: pp.48-60.
- Rodil, Kasper and Winschiers-Theophilus, Heike. 2018. 'Why Is She Naked?: An iterative refinement of the digitisation of ICH with the OvaHimba tribe in Namibia' in *International Journal of Intangible Heritage* 13: pp.143-154.
- Sherman, William R. and Craig, Alan B.. 2002. *Understanding virtual reality: Interface, application, and design*. Elsevier.
- Song-Yong, Park. 2010. 'Operational Sequence Analysis Applied to Pottery Making Techniques in Korea' in *International Journal of Intangible Heritage* 5: pp.100-112.
- Svensson, Tom G. 2008. 'The management of knowledge of the intangible heritage in connection with traditional craftsmanship at the ethnographic museum of the University of Oslo' in *International Journal of Intangible Heritage* 3: pp.117-26.
- Tranter, Deborah. 2010. 'Safeguarding Australian heritage trade skills' in *International Journal of Intangible Heritage* 5: pp.87-97.

- UNESCO. n.d. 'Intangible Cultural Heritage domains in the 2003 Convention'. Accessed November 29, 2018. https://ich.unesco.org/en/intangible-heritage-domains-00052
- UNESCO. 2003. 'Text of the Convention for the Safeguarding of the Intangible Cultural Heritage'. Accessed November 29, 2018. https://ich.unesco.org/en/convention
- Van Huy, Nguyen. 2006. 'The role of museums in the preservation of living heritage: experiences of the Vietnam Museum of Ethnology' in *International Journal of Intangible Heritage* 1: pp.35-41.
- Ylirisku, Salu Pekka, and Buur. 2007. *Designing with Video: Focusing the user-centred design process*. Springer Science & Business Media.

REFERENCES FROM TABLE 1 NOT USED IN TEXT

- Achanzar, Honey Libertine R.. 2007. 'Gomek Gomanan: Ritual and Power Among the Tagabawa Bagobos of Davao, Mindanao, The Philippines' in *International Journal of Intangible Heritage* 2: pp.23-30.
- Han, MinHo. 2007. '2007: The year of Jeju folklore project-reviving the cultural heritage of nature's paradise' in *International Journal of Intangible Heritage* 2: pp.117-121.
- Hoekstra, Daan. 2010. 'Fresco: intangible heritage as a key to unlocking the links between the conservation of biological and cultural diversity in Alamos' in *International Journal of Intangible Heritage* 5: pp.61-71.
- Keitumetse, Susan and Nthoi, Olivia. 2009. 'Investigating the impact of World Heritage site tourism on the intangible heritage of a community: Tsodilo Hills World Heritage site, Botswana' in *International Journal of Intangible Heritage* 4: pp.143-150.
- Kennedy, Thalia. 2010. 'Safeguarding traditional craftsmanship: a project demonstrating the revitalisation of intangible heritage in Murad Khane, Kabul' in *International Journal of Intangible Heritage* 5: pp.74-85.
- Labi, Kwame Amoah. 2009. 'Reading the intangible heritage in tangible Akan art' in *International Journal of Intangible Heritage* 4: pp.41-57.
- Moon, Okpyo. 2013. 'Challenges Surrounding the Survival of the Nishijin Silk Weaving Industry in Kyoto, Japan' in *International Journal of Intangible Heritage* 8: pp.71-86.
- Musinguzi, Dan, and Kibirige, Israel. 2009. 'The role of cultural and heritage education at Bakoni Malapa Open Air Museum: demonstrations of cultural practices and craftwork techniques' in *International Journal of Intangible Heritage* 4: pp.152-158.
- Sarashima, Sumiko. 2013. 'Community as a landscape of intangible cultural heritage: Fasho-fu in Kijoka, a Japanese example of a traditional woven textile and its relationship with the public' in *International Journal of Intangible Heritage* 8: pp.135-152.