

Capturing Our Cultural Intangible Textile Heritage, MoCap and Craft Technology

Eva Andersson Strand^{1(✉)}, Stefan Lindgren², and Carolina Larsson²

¹ Archaeological Department, Centre for Textile Research (CTR), SAXO Institute,
University of Copenhagen, Copenhagen, Denmark
evaandersson@hum.ku.dk

² Humanities Lab, Lund University, Lund, Sweden

Abstract. Textile craft and textile design have always had an important social, cultural and economic impact on both individuals and societies. The cultural heritage of textiles does not end with the preservation and collection of costumes and other textiles in museums. It also includes living traditions inherited from our ancestors. Furthermore, understanding craft and craft processes are crucial when considering both past societies and the cultural heritage of humankind. The study of intangible processes, hidden within archaeological objects, crafts, action and activities as well as cognitive processes, involves both practical and theoretical considerations. Today, computer applications such as Motion Capture can enhance our knowledge of the complexity and variety of artifacts, their production, and how various craft traditions develop over time, yielding new insights and perspectives applicable to ancient societies as well as to traditional craft today.

Keywords: Craft · Textile processes · Motion capture · Archaeology · Theories of practices

1 Introduction

How do we decide to make things? How do we learn to make things? The study of craft and craft production is fundamental for understanding the underlying causes for the complexity of ancient societies as well as traditional craft performed today. In the following we will *illuminate how the body and mind are involved in the production processes behind ancient and traditional textile technology and how this can be further explored by developing the use of 3-dimensional method, Motion Capture*. Craft and craft production can, in a broad sense, be said to meet the social and psychological needs of human beings, and facilitate social coherence (Costin, 2007, p. 146). In recent years, the assumed dichotomies between technology (practice) and theoretical knowledge are being questioned. Theories of practice are being developed, and how professionals think in action and how their skills are transmitted are investigated (e.g. Bourdieu, 1977; Schön, 1983; Latour, 1999; Ingold 2000; Bender Jørgensen 2012; Sutton, 2015). Combining theory and practice permits us to understand, e.g. how we learn craft, how we record the differences of skills and abilities of craftspeople and how old traditions

affect the possibility to learn new techniques and improve skills - questions pertinent to craft transmission and developments in past societies. Thus, it is essential to develop methodologies through which tacit or embodied knowledge can be translated into a form that goes beyond mere textual analysis but which can also be observed and described from an anthropological perspective (Bender Jørgensen, 2012).

2 Experimental Archaeology and Documentation of Crafts

A combination of craft knowledge with experimental archaeology has already proved to be a significant method enabling new interpretations and perspectives on the archaeologically invisible parts of ancient societies (e.g. Andersson, 2003; Renfrew and Bahn, 2004; Grömer, 2010; Olofsson et al., 2015). However, this method has also been criticized. One of the post-processual arguments was that designs of experiments were influenced by subjective values of the present, which would have affected the outcome of any experiment (Brattli and Johnsen, 1989). Yet even though debated, this method has been, and is still, used today (e.g. Olofsson et al., 2015; Belanová-Štolcova and Grömer, 2010). The performance of experiments and *traditional textile craft* is often photographed and/or filmed and the objects produced are sometimes documented and preserved. However, using these methods to obtain a full 3-dimensional coverage of the process, would require a multiple video camera setup, preferably using cameras with a higher frame rate than ordinary cameras. Such a setup would produce a large amount of data which would prolong the post-processing significantly.

3 Motion Capture: A New Method in Documenting Textile Craft

New innovative methods are necessary and also available in order to come closer to both ancient societies and the people themselves. Motion capture (MoCap) is the process of recording the movement of objects or people in 3D. A MoCap system also uses a multiple camera setup, but the cameras only work in the infrared spectrum, and they only record markers placed on the subject or the tools used by the subject. The markers are placed to get a good representation of the subject studied, which means it is possible to focus only on the parts of interest. Since it is only the markers being recorded, the amount of data is not particularly large, which makes the post-processing relatively simple. Movements are sampled c. 250 times per second to capture all types of movements with high precision.

In the commercial sphere, MoCap is famously used to develop videogames and movies. But it is a useful method in several different research fields as well. In medicine it is used to study rehabilitation of different types of injuries. In the humanities, it is used to study body language and gestures. We believe this method permits new innovations when conducting and studying different craft experiments and recording craft processes. MoCap can enhance our knowledge of the complexity and variety of artifacts, their production, and how various craft traditions develop over time, yielding new insights and perspectives applicable to *ancient societies* as well as to *traditional craft today*.

The possibilities of combining MoCap and textile experimental archaeology, and determining how far these results can be used in our interpretation of intangible craft production, will be explored in this research project via systematic experiments in collaboration with textile technicians.

4 The First Tests

Our aim is to document, measure and study various textile activities and parameters. In order to test MoCap, its possibilities and limitations, we have so far conducted two spinning tests with suspended spindles copied from Viking Age originals. The reason for choosing spinning with this type of spindle is that the production of yarn has been of the highest importance and one of the most time-consuming tasks in all ancient societies. For example, to produce two Viking Age costumes, one male and one female in a general quality, more than 40 000 m of yarn, which took c. 800 h to spin, was used. To produce a sail used on one of the Viking Age longships, one would need to spin more than 200 000 meters of yarn (Andersson, 2003; Andersen and Nørgård, 2009). Furthermore, spinning tools are frequently found on archaeological excavations, and spindles have been used at least since the Neolithic era all over the world. It is also essential to note that hand spinning is a technique which is still used in some places by craftspeople producing traditional textiles, for example, Peru and Jordan. However, in many places such as Turkey and Scandinavia, machine spun yarn is frequently used and the knowledge of how to spin is rapidly disappearing.

Fifty-six markers were put on the spinner's body, and additional markers were put on the spindle which gave us the possibility to also see the spindle's movement. After the tests, the spun yarn was analyzed which gave another and comparative perspective, as it was then possible to see how the yarn was affected by a certain movement. It is our expectation that this new knowledge will be applicable on archaeological textiles, and bring information on the craftsmanship in ancient societies and the spinner's skills and abilities.

The first test results clearly demonstrated the movements of the spinner, how fast the spindle was moving, and when it started to wobble. The data consists of the 3D-position of all of the markers relative to each other in every single time frame. By choosing the interesting parameters, for example the z-coordinate of a marker on the spinner's hand, it was possible to see the up and down movement of the arm. The recordings showed how regularly the spinners were working. By looking only at the 3D-position of the marker placed on the spindle, it was possible to see if it started to wobble. Two parameters strongly affect the outcome of the spun yarn; if the spindle is wobbling, and if the spinner does not work regularly, the yarn will be unevenly spun. By looking at several markers at the same time, it was, for example possible to see how the movement of the hand affected the spindle.

Certainly it is necessary to be able to connect the measurement to the resulting yarn, so it is possible to assess what effect a particular motion in the recording has on the produced yarn. To do that, it is just a matter of adding the distances that the hand travels in each pull in the recording, which gives a reasonable value of the length of the yarn.

In the second test, two spinners were conducting simulations with the same tool and raw material. While the preliminary results show that the working positions/spinning techniques were slightly different, even so and in this case, the yarn spun by the two spinners were similar and could be used in the same fabric. This is important as it suggests that several spinners, given the same tools and raw material, could spin a yarn used in the same fabric which is necessary if one wants a homogenous fabric, for example a sail cloth.

5 Expectations of New MoCap Recordings and Future Research

Thanks to MoCap, we can study the movements in detail. Also other textile tools, for example different types of looms will be tested, e.g. how the weaver beats the weft, how much work is done in any given length of time, how/if the weaving speed changes, how different movements influence the final result - the produced object, and what separates and connects skilled spinners or weavers. With the use of MoCap we will be able to see how different textile technicians use the textile tools and how this affects the outcome, but also their bodies, for example, the joints in the arms and hands. What are the differences between a professional craftspeople and a beginner, an adult and a child, how does the age affect the result etc. are other interesting questions. It will, furthermore, be possible to compare how different raw materials such as wool, flax and silk influence spinning and weaving techniques, for example, the choice of spinning tool, which will allow more secure interpretations on the types of fibre material that were used in specific places- something which is frequently debated today. These results can make an important contribution to the discussion on the use of different types of textile tools, whether it is a cultural tradition and if the type of tool really affects the outcome.

Additionally, MoCap is not only a method which can be used in textile experimental archaeology. With MoCap as a method, it is possible to record the details in, for example, flint-knapping, bronze casting and many other crafts. It is clear that this application, combined with the traditional experiments, enables us to develop an innovative method to compare data from different experiments involving different actors. This provides new possibilities for analyses of the recorded data and for experiments, thereby raising new research questions to pursue. All this new information will be applicable to the archaeological material and will help us study the tools and the processes with new eyes and give new information on craft and craft traditions.

6 MoCap and Traditional Craftsmanship

Finally and perhaps more importantly, is how MoCap can help us to preserve, document and also develop traditional craftsmanship. Today, there is a consciousness of the importance not only of preserving craft objects but also of encouraging craftspeople to produce and to pass on their skill to others (see for example the UNESCO convention on traditional craftsmanship: UNESCO. 2016. *Traditional craftsmanship*. [Online]. [Accessed 14 October 2016]. Available from: <http://www.unesco.org/culture/ich/en/traditional-craftsmanship-00057>). This is a challenge. Thanks to the industrial

revolution, textiles have never been as cheap or as easily mass produced, with the sad consequence that traditional textile craft skills and knowledge are not always valued. The skills required for the complexity of textile craft are partly forgotten. It is, indeed, very time consuming to produce a textile by hand, and such textiles have become expensive with few people being able to afford them. Thus, the market for them becomes ever more restricted with the result that it becomes less advantageous for craftspeople to maintain their skills. Old (traditional) designs go out of fashion and it can be difficult for the craftspeople to use traditional techniques to produce new designs. There is a negative circle of cause and effect which results in the diminution of traditional textile craft and a loss of knowledge. This loss is often invisible and has so far been definitive. However, many designers are now exploiting the potential of traditional craft in their work and revitalizing practices. It is essential to preserve this knowledge and skill, and also to make its importance more visible and available to a wider audience. A digital MoCap library will make old textile techniques accessible for a large audience interested in learning, studying, and practicing.

7 Conclusion and Further Remarks

The first results have clearly demonstrated its potential, but much more has to be done in order to develop the methodology and improve the use of the MoCap techniques. Still, there are many questions to be asked, for example: What are the possibilities and what are the limitations? How can we bring the MoCap method out to the workshops? As there is an endless number of possibilities, how do we decide what to record and analyse? Which parameters could be combined and compared in each process and craft? How long time do we need to record in order to get a reliable result? etc.

However, it is our expectations that MoCap, combined with experimental archaeology and craft technology, will enable us to record movements of craftspeople today for a new understanding of tacit craft knowledge and craft practice in producing objects both ancient and modern.

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