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# An approach to boat documentation

## Examples of photogrammetry vs. analogue recording

### **ABSTRACT**

*In this contribution, I present a methodological approach for the documentation of craft objects, including a comparison of traditional analogue methods and modern digital photogrammetry. From a boat builder's perspective, I document traditional boats. In my current PhD project, I investigate how documentation of objects, from a craft person's perspective, can be used to reconstruct craft processes. The case study is on the 'öka' from the Stockholm archipelago, a local variation of the Nordic clinker boat tradition. In this contribution, I present the basic structure of my boat documentation work and pinpoint some specific examples from the use of digital methods in comparison with analogue measuring. A good practice of documentation needs to consider both the advantages and the possible shortcomings of digital methods.*

### *Keywords:*

Documentation, Interpretation, Boat building, Photogrammetry.

### **INTRODUCTION**

From my former work as a boat-building teacher, I have experience of both documenting and reconstructing traditional boats and have seen that there are often questions raised about the methods of documentation and reconstruction. For the documentation and building of traditional boats, I have conducted surveys with analogue methods for recording the boats' shapes. These analogue methods include measuring with a plumb line and measuring tape, as well as sketching details and photo documentation. In recent years, I have explored the advantages of photogrammetry as a new way of recording a boat's shape (Leijonhufvud, 2019). In my PhD project, I will conduct an in-depth analysis of the relationship between documentation, reconstruction, tradition, interpretation and prejudice.

### **Current case study: the Öka**

In the 19th and early 20th centuries, the öka was a common boat type in the Stockholm archipelago; this is the object of my PhD case study. These boats were open sailing boats used for transportation and fishing that were built in several sizes, from 5 to 10 metres in length. These boats were built with hewed

planking in the lower parts of the hull; this means that the boat builder had to split and sculpture spiral-grown logs into a twisted shape, mainly using an axe (Hasslöf, 1953; Törnroos, 1968). This was a labour-intensive way to build boats, but the result was that the boats performed very well under sail. In the early 20th century, the tradition of building these boats was broken with the advent of the use of motors in boats and the widespread use of sawn, steam-bent planking in boat building. Today, there are no living tradition bearers, and we are left only with the boats as evidence of the past craft. Even though this craft tradition has been lost only for a relatively short period of time, the problems of interpretation are similar to those in experimental archaeology.



**FIGURE 1.** An old *Storöka*, the island Tjockö, Stockholm archipelago 1928. The Nordic Museum archives, Kustundersökningen.

### **Approaching the object with a forensic method**

The starting point of the documentation is a study object, in my case a boat. To be more specific, it is a boat with hewed planking of a type belonging to a local, broken tradition. The boats that are documented are, in this case and in many other cases, often threatened by poor preservation resources. One purpose of the documentation is therefore to preserve the information that the object can mediate for the future. This can include the boat's shape and technical characteristics, as well as information about the building process and use. The concept of forensic method (Almevik, 2017) means that in a documentation work, a palette of different perspectives and methods is used to get as much information as possible from an object. The forensic method is used to analyse the happenings: what has it looked like, what has happened and how the object has changed (Almevik, 2017, p. 261). Mental impressions, analogue and digital measurements and studies of written and oral sources are some of the methods that can be included in a forensic method.

The first stage of the forensic method, which I use, is to investigate the boat, the object, as it appears to me. This includes sensory impressions, material, form, tool traces and traces of use, repair and alterations, as well as measurable values. Measurable values include technical properties, analogue as well as digital. In addition to the object, as it appears to me, the forensic method also includes documenting written and oral sources, for example, older photographs, inventories and interviews. The geographical context of the boat and its historical and cultural environment is documented.

### **Approaching the object with prejudice**

My research method is primarily hermeneutic, which means focusing on understanding through interpretation processes and evaluations of source material (Gadamer, 1997; Ödman, 2016). The interpretation will be a result of my prejudice, which is based on my role as a researcher and craftsman, which in turn is a result of my contemporary craft tradition. The hermeneutic interpretation process then means continually and critically reviewing and testing the source material and the parts against the prejudice to create an understanding of the study object as a whole. In the example of a boat built in an older broken tradition, my present boat building and craft skills can be used to interpret the object and the craft processes. However, my understanding of the modern boat-building tradition can also contribute to errors in interpretation. Therefore, it is important to continuously return to the studied object and make sure that the interpretations are based on what the studied object really conveys. I have seen examples of how certain details of boats have been smoothed out in documentation and reconstruction, as they do not fit into the contemporary view of what a boat should look like (image 2).

In June 2020, a selected group of professionals with experience in boat documentation were invited to a webinar called 'Objective and subjective boat documentation'.<sup>1</sup> This webinar was held as a part of my PhD project, as a way to map previous research and experience in boat documentation and reconstruction. Each participant had their personal experience of boat documentation, from traditional boat-building points of view to academic perspectives of university archaeology. The fact that almost all invited participants attended the seminar shows that the interpretation process in boat documentation is a significant subject.

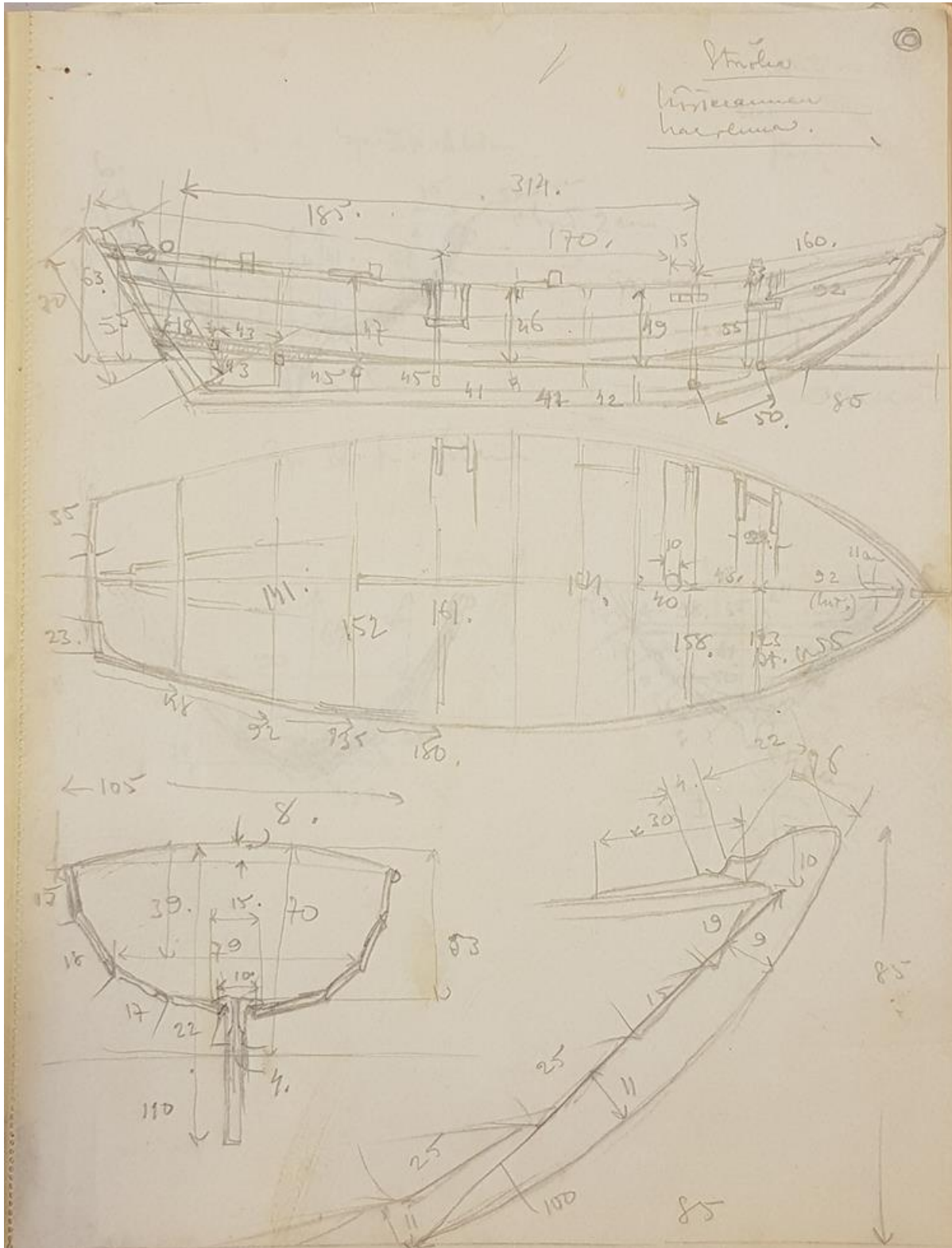


**FIGURE 2.** Original boats (top), documentations and well-built replicas. The shape of the sterns was smoothed in the documentations and replicas by professional boat builders. Image by author.

### **PROFESSIONAL GENRES OF BOAT DOCUMENTATION**

The fact that documentation has been conducted within different disciplines and by various professionals with a spectrum of perspectives is visible in the methods and results of the documentations. Within the professions of boat building and ship engineering, documentation has been undertaken at least since the 18th century (Chapman, 1768). In archaeology and ethnology, boat documentation have been conducted since the late 19th century. There are a number of books and articles with guidelines on how to document boats, these references are just a few examples: (Blake, 1935; Ficatier et al., 2004; Hasslöf & Magnusson, 1948; Godal, 1995; Lipke et al., 1993). An awareness of different approaches to documentation can contribute to a documentation practice where these different perspectives are taken into consideration. Until recently, most documentations have used traditional analogue methods. The process of recording shape and details has been dependent on the genre. Boat builders and engineers have mainly recorded the (outer) shape of the boat's hull, often trying to restore and improve the shape of the hull during the documentation process. Archaeologists and ethnologists have often

focused on the details of the boat in situ, measuring the inside of the boat, often resulting in drawings that resemble photos that also appeal to a wider audience. In many cases, vital information about the shape of the hull is lacking in these documentations. The boat builder's results are often in the form of lines plans or technical drafts that are helpful for the boat builder to build a replica; however, this information can be difficult to grasp for people who have not studied boat construction. This is a simplified overview of the genres within boat documentation; the reality is often more complex. For example, there are different ways of describing and measuring shape in the diversity of local boat-building traditions. For example, when building a Norwegian Oselvar, the shape is ruled by a stick with markings that define the shape of the hull (Planke, 2001, pp. 146–148). There are also a few documentations created by museum professionals that meet the demands of boat-building professionals (Hasslöf & Magnusson, 1946). A final remark on boat documentation genres is that for replica building, the best practice is to build the new boat next to the original boat. The original boat is always a better source of information than photos, drawings or digital models.



**FIGURE 3.** A draft from a documentation of a Storöka by the Nordic Museum in the 1920s — an example of a documentation created by museum scholars. There is interesting information for boat builders in this document, but it lacks specific information about the shape of the boat. Nordic Museum Archives, Kustundersökning.

### **The craftsperson's interpretation of historical objects**

Archaeologists are trained in the interpretation of historic material culture and how it has evolved through history. With this knowledge, archaeologists can place an object in a context of evolution; in boat building, a ship archaeologist can refer to the evolution of the ship and compare it to other wrecks; however, the timeline to present time craft is seldom visible in archaeological interpretation. For a boat builder, the interpretation starts in the boat builder's own practice, the knowledge tradition learned from older masters and even from stories shared within the boat-building community about how people used to build boats (Hasslöf, 1962, pp. 6–8). This means that the craftsperson interprets the historical object going backwards in the timeline, finding analogies to present craft knowledge. Both the archaeologists' and the craftspersons' perspectives are fruitful in the interpretation of historical craft objects, as they represent two different approaches. In recent studies, the craft perspective in archaeological studies has been explored as a way for archaeologists to achieve a better interpretation (Kuijpers, 2017; Schenck, 2015). There are also examples of archaeological research in which the craftsperson's interpretations have been in focus, as the researcher is both a trained craftsperson and an archaeologist (Høgseth, 2007; Botwid, 2016).

### **My boat documentation method**

The digital measuring technique that I have used for this study is digital photogrammetry or structure-from-motion, a method of measuring the geometric shape of an object by using a number of photographs taken from different angles. A computer program then generates a 3D model from the photographs. Using photogrammetry as a source of technical data collection of a boat's shape is a method that can potentially serve all the previously mentioned genres of documentation, producing 3D models that appeal to different professionals and which are suitable for popular presentation as well.

The basis of my method is to perform either an analogue or a photogrammetry recording of the boat's hull shape. In addition to measuring the shape, all construction details are documented with regard to materials, dimensions, joining, surface treatment and traces of tools, use and other wear. I use a system where I go through all parts of the boat. Sometimes I find myself surprised about how the boat has been constructed and, for example, which types of wood have been used in different parts of the construction. That surprise is often due to the prejudices of my own boat-building tradition. In the detailed investigations, it is possible to discover traces of what has happened over time and to create an image of the boat's original construction and what changes may have taken place later. This is a forensic investigation method that provides in-depth answers to what the boat is and what has happened to it since the boat was built.

In the boat surveys, I try to switch focus between detail and wholeness to find patterns. It is important to try to understand the boat's system of design in order to use this abstraction of the boat in the future when working with reconstruction. When studying patterns, it is also interesting to study the boat type thematically by comparing how the different boats have common shapes and constructions. For example, how scarfs are distributed and designed, angles of the planking and other details where similarities or differences in detail can be found. These common features can define the boat type within a local tradition, making it possible to distinguish it from other boat-building traditions. Planke & Stålegård (2014) presents an interesting case study in which mapping and analysing design patterns is used in the process of building a replica of a disintegrated, fragmented boat.

Time, prejudice and awareness are three important concepts in the interpretation of the boats. A basic documentation of measurements can be carried out quickly, but a good boat survey needs time for the process of investigation and interpretation. On the other hand, there is a need to achieve time efficiency and limit the amount of fieldwork time. With sharpened focus and concentration, it is possible to reach a higher level of awareness and become more efficient in interpretation. Systematics, as in the documentation of details mentioned above, is a way to sharpen attention and ensure that no details fall out of focus. Another way to sharpen the attention can be to put thoughts into words through the process. By recording short videos where I film details of the boat and explain how I interpret these details, I force myself to focus on the issues and put the interpretations into words. Examples of themes

in these video clips are interpretations of how the boat has been repaired or why the boat builder has chosen to design a part of the boat in a special way. In these clips, I try to include details where there are question marks about how they should be interpreted. The prejudice from my own background as a boat builder affects the interpretation – although boat-building knowledge is a door opener for interpreting the old craft, one must be careful when using one's own understanding; otherwise, the interpretations may be incorrect.

### My experience with digital methods

In my documentation, photogrammetry is used mainly as a way to record the shape of a boat's hull. The level of detail in the 3D model is dependent on the number of photos, the quality of the photos and the quality of the processing. A 3D model of a boat made from fewer than 70 photos can actually provide enough level of detail for the shape of the hull from a boat builder's point of view. The photos are, in that case, taken from the outside of the boat, and only from one side of the boat, creating a half-model sufficient for the production of a lines plan (boat lines plans are always in the form of a half-model). If the purpose of the photogrammetry is to produce a fully detailed 3D model of the boat, the number of photos must increase; in my experience, about 170–250 photos are necessary for a six-metre open boat. Still, this full 3D model does not provide the level of detail that can be found in the real boat; however, the 3D model can be viewed virtually from any perspective, including from perspectives that may be impossible to reach at the site of the boat.

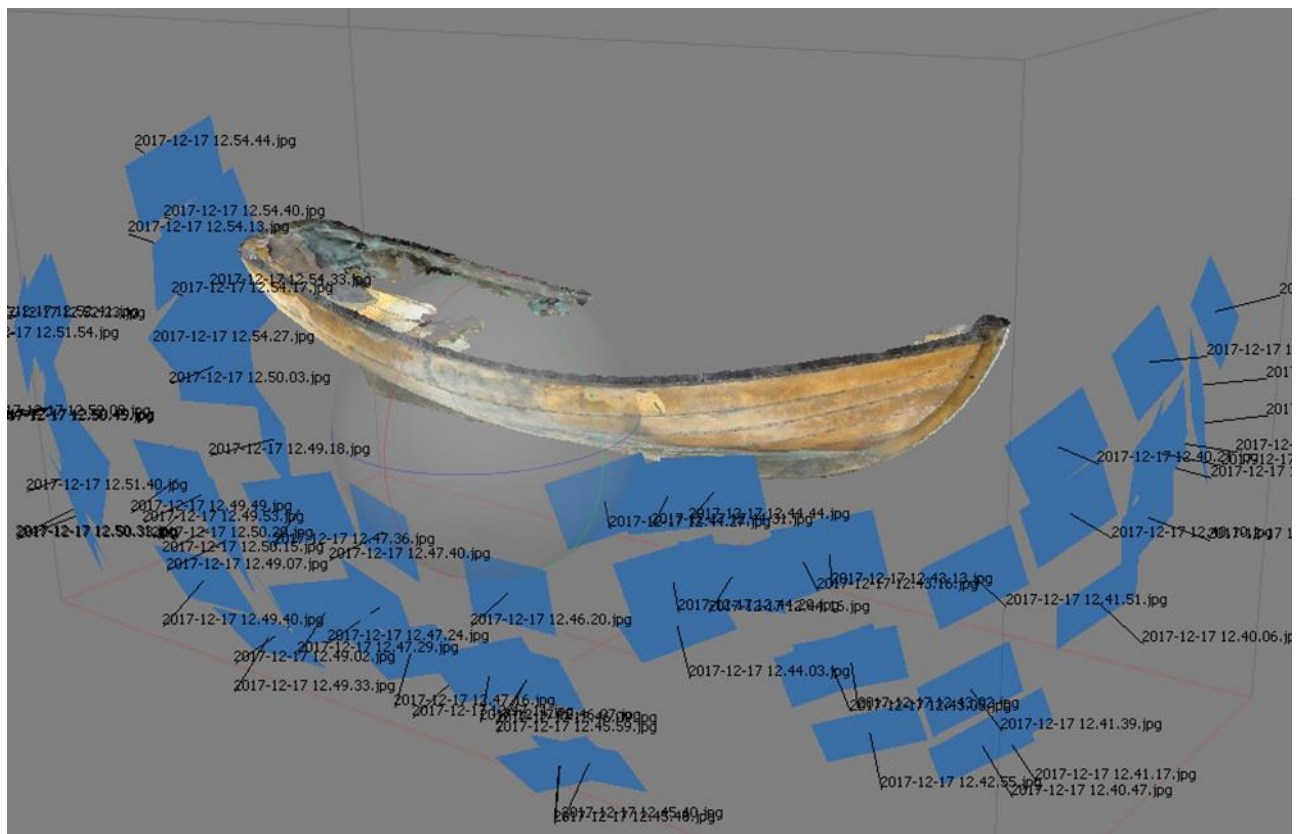


FIGURE 4. Screenshot of the photogrammetry software. The blue squares show the locations of the cameras. Image by author.

### Advantages of documentation with digital photogrammetry

A comparison of the analogue method I used in the past and the new experience of digital photogrammetry that I use today shows that there are advantages and potential shortcomings of the new digital methods. Photogrammetry can be made cost-effective and time-efficient, especially if



several similar documentation efforts are performed. There is an initial cost for technical equipment and software, and there is also a learning curve that needs to be taken into consideration. Digital methods are well suited for documentation of complicated shapes, such as the doubly curved surface of a boat hull; these surfaces are hard to record with analogue methods. The photo documentation can potentially be performed remotely with the help of clear instructions. This is not an ideal situation for documentation, especially when it comes to sensory experience and interpretation of the object, but when other options are not available, a remote photographer using instructions from an expert can record a photoset for photogrammetry.

Because computers are inhuman machines, they can provide honesty that is hard to find in human interpretations. Photogrammetry presents 3D models without interpretation, as long as no one edits them. This can provide details that otherwise would be smoothed out or edited away by the interpretations of the researcher. Computers can handle a large amount of information; a single digitalised picture can have more numerical data than a full analogue boat documentation. Most of this data will not be used in the documentation, but it can easily be kept in the raw data files for future use (de Reu et al., 2013, p. 1118). A digital 3D model is well suited for educational visualisation and to gain a better understanding of the shape, compared to a technical drawing that can be hard to grasp for an inexperienced viewer. With photogrammetry, it is also possible to record the object gently without touching or moving the object. This is an advantage when handling fragile museum objects; however, it can also induce negative effects when it comes to the sensory interpretation of objects.

### **Disadvantages of documentation with digital photogrammetry**

Computers are fantastic calculating machines, but they lack common sense. A computer will work according to its input values and will sometimes come to conclusions that any person using reason would disqualify as being wrong. In the photogrammetry process, the computer can calculate the exact position of individual cameras, but it can also place them in positions that are obviously wrong. The common sense of a human being is still needed to control the work of the computers. There is also uncertainty about the value of the digital fieldwork in comparison to the analogue methods. In an analogue process of documentation, the researcher is in control of all the measurements, but with digital photogrammetry, a blind spot may result where the photo documentation does not provide the information needed. It is not until the photogrammetry process has been conducted on the computer that the final outcome of the fieldwork can be evaluated.

The time efficiency of photogrammetry can be a disadvantage, as the time spent with the object is reduced. This could be compensated for by spending more time on the fieldwork, but this is not the most rational solution. There is also a quality aspect to the time spent. The time aspect of the interpretation of art works is described by Bresler (2006), emphasising how observers can learn to structure and organise their thinking over a longer period of time. I think the insight of art studies can be applicable to the interpretation of other craft objects. Through experience and training, the attention of the observer can be enhanced. The documentation method can also be designed in a way that encourages the observer to focus on and describe interpretations, for example, in scheduled brief video reports. If digital documentation takes place with physical distance from the object, it will have a negative impact on the interpretation process, similar to the time aspect mentioned above. This can be dealt with by taking conscious measures in an effort to compensate for the lack of sensory experience. Still, it is harder to compensate for physical distance than for a reduction of time spent with the object. The sensory experience of objects is of importance in the interpretation of cultural heritage (Owman, 2015).

Digital methods often come with a certain learning curve that needs to be overcome in order to work effectively. This problem can be aggravated by people's scepticism about combining traditional craft objects and digital technology. The digital output has a tendency to feel estranged from the tangible reality. The object is taken out of its original context and put into a new academic, technical

context, creating a risk that the digital artefact becomes decoupled from the original physical artefact (Gartski, 2017).

## **CONCLUSIONS**

In this text, I present methodological approaches to documentation practice, which are grounded in theory, and a specific example of the impact of digital methods on the documentation process. The survey of a historic craft object is performed as a forensic investigation, leading to interpretations of a craft tradition of the past. These interpretations are a product of the researcher's prejudice, and when the researcher is also a craftsman, this prejudice opens up a perspective where the craft tradition of the present can be used to decipher the past. In the survey, it is important to be aware of the prejudices that exist and their potential impact on the interpretation. As traditions change over time, modern craft traditions cannot be directly applicable to past traditions. The craftsman-researcher has to be aware of the potential problem of applying modern craft knowledge without employing critique and reflection. The specific example taken from the evaluation of the digital methods connects to the documentation process as a whole. A consciousness of the possible disadvantages of digital methods can be used to redevelop the methods of investigation and incorporate awareness within the method.

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<sup>1</sup> This Nordic seminar was held with 14 participants on 15–16 June 2020. Each participant contributed with a short presentation of boat documentation experiences. Participants were boat builders, museum professionals and archaeologists from the Vikingmuseum of Roskilde, Vikingskipshallen Oslo, Oselvarverkstaden, Norsk Maritimt Museum, Norsk institutt for kulturminneforskning, Museet Kystens Arv, Herøy Kystmuseum and the Universities of Gothenburg, Trondheim, Sørøst-Norge and Tromsø.