This licentiate thesis investigates the use of digital visualisations for knowledge production and communication of maritime heritage located underwater. The archaeological practice that takes place in response to development, contract archaeology, is the field that is being investigated. Much of the practical and administrative aspects of contract maritime work involves the survey, excavation and interpretation of archaeological remains. In addition, shifts in heritage policy emphasise that the results of this work move beyond their own value to provide access and democratic participation to heritage and be of benefit to society (e.g. Faro Convention, 2005).

Since the inaccessibility of maritime archaeology underwater makes outreach especially challenging, digital, and in particular 3D, technologies have been recognised as having great potential to meet the needs of both maritime archaeological researchers and public audiences. Advances in methodologies for digitally documenting and visualising archaeological sites, both on land and underwater, are providing a range of innovative and multidisciplinary solutions for both archaeological analysis and outreach activities.

The aim of this research is to understand current uses of digital visualization for knowledge production and communication of maritime archaeology located underwater, in order to identify knowledge gaps that would benefit from future research. This aim is met through a study drawn primarily from the fields of digital archaeology, maritime archaeology and heritage studies, as well as discourse and thematic analysis of the factors that influence the use of these technologies in the sector. The case study is the contract maritime archaeology sector in Scandinavia, with a primary focus on the practice in Sweden and also including perspectives from the Danish and Norwegian sectors.

The results show that an emphasis on efficiency within the contract sector shapes the understanding and use of digital technologies, in some instances limiting their potential for archaeological interpretation and communication. While the maritime sector was found to be partly defined and restricted by a distinct identity, at times operating independently from mainstream archaeology, it was also found to be open to innovation. This represents great potential for digital workflows aimed at enhancing both interpretation and communication to be applied to the maritime archaeological sector in the future.
Digital Maritime Sights

Digital visual documentation and communication in Scandinavian contract maritime archaeology

Licentiate thesis
Delia Ní Chíobháin Enqvist
DIGITAL MARITIME SIGHTS. DIGITAL VISUAL DOCUMENTATION AND COMMUNICATION IN SCANDINAVIAN CONTRACT MARITIME ARCHAEOLOGY

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Abstract

This licentiate thesis investigates the use of digital visualisations for knowledge production and communication of maritime heritage located underwater. The archaeological practice that takes place in response to development, contract archaeology, is the field that is being investigated. Much of the practical and administrative aspects of contract maritime work involves the survey, excavation and interpretation of archaeological remains. In addition, shifts in heritage policy emphasise that the results of this work move beyond their own value to provide access and democratic participation to heritage and be of benefit to society (e.g. Faro Convention, 2005).

Since the inaccessibility of maritime archaeology underwater makes outreach especially challenging, digital, and in particular 3D, technologies have been recognised as having great potential to meet the needs of both maritime archaeological researchers and public audiences. Advances in methodologies for digitally documenting and visualising archaeological sites, both on land and underwater, are providing a range of innovative and multidisciplinary solutions for both archaeological analysis and outreach activities.

The aim of this research is to understand current uses of digital visualisation for knowledge production and communication of maritime archaeology located underwater, in order to identify knowledge gaps that would benefit from future research. This aim is met through a study drawn primarily from the fields of digital archaeology, maritime archaeology and heritage studies, as well as discourse and thematic analysis of the factors that influence the use of these technologies in the sector. The case study is the contract maritime archaeology sector in Scandinavia, with a primary focus on the practice in Sweden and also including perspectives from the Danish and Norwegian sectors.

The results show that an emphasis on efficiency within the contract sector shapes the understanding and use of digital technologies, in some instances limiting their potential for archaeological interpretation and communication. While the maritime sector was found to be partly defined and restricted by a distinct identity, at times operating independently from mainstream archaeology, it was also found to be open to innovation. This represents great potential for digital workflows aimed at enhancing both interpretation and communication to be applied to the maritime archaeological sector in the future.
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Much of the work behind my graduate studies thus far has been a collective effort and so I would like to express my sincere appreciation to all who are involved. In particular I would like to thank Mikael for suggesting that I not dismiss the idea of graduate studies altogether; Roger and Julia for advice and encouragement; Cornelius for inspiring us to think innovatively; Anders for critical and detailed appraisal, a skill that I strive to achieve; the teachers and students of the DialPast course and workshop on digital archaeology, you have all inspired my position on the discipline; my colleagues at Bohuslän’s museum, especially Magnus for never-ending cartoon material; Fredrik for coaching me in the various Swedish dialects and for being my digital confidant; and Clara for your loyalty, support, translations and enthusiasm for planning our time in an effective and sane manner.

My PhD candidate classmates and I left the comforts of familiar work routines to embark on a journey into the academic world, I am grateful to have encountered all the surprises with you all and look forward to more. I would like to thank the participants of the research case study, you all have my sincere gratitude, not only for offering you time and assistance but for the enjoyable discussions.

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To my friends who will likely never read this thesis, yet who have politely enquired as to its progress, I thank you all. Your supportive WhatsApp conversations and our reunion trips are welcome reminders that there is more to life than old things caked in mud or dusting in museums. To my family, who are slightly more likely to read this, I greatly appreciate your support and patience during the long periods of radio-silence.

Thank you Ollie, Sanna and Majken for reminding me to walk outside. Thanks to King, the creators of Candy Crush, for creating an addiction of harm only to my social life (level at the time of writing: 2607). And finally, to my dearest, long suffering, Johan – your medal is in the post!
Preface

In 2003, while studying archaeology, I joined the university scuba diving club with the purpose of becoming a maritime archaeologist. Many dives, however, were not related to archaeology and so being underwater was as much a recreational pursuit as it was a part of my career ambitions. At one point my grandmother asked what it was that I actually did underwater. I created a slideshow of photographs and video taken underwater and we sat together as I told her about my underwater adventures. Watching footage of coral reefs, shipwreck sites and limestone caverns I realised that while she was listening to me describe locations and projects, my grandmother was more fascinated by the fact that cameras could be used underwater than by the history of shipwreck sites. Her attention focused on the colourful marine life rather than on the archaeological objects they swam around.

Experiences like this have since led me to think about how an alien environment can be appreciated by those who have not physically been there. If the act of diving underwater gives a particular vantage point and physical sensation, does this mean that underwater visualisations represent something different to non-divers? The term Virtual Reality (VR) suggests the promise that one can indeed be transported to another place and time, making the underwater environment and archaeological remains a case worthy of investigation.

Working as a maritime archaeologist I have witnessed the enthusiasm in adopting digital recording methods to allow underwater heritage sites to be viewed by anyone with an internet connection. The realities of working in the contract sector mean that archaeological projects are coordinated in tandem with development timelines and therefore require efficient means of data recording and documentation. The availability of digital visualisation tools and software has therefore seen the creation of 3D models of underwater sites within contract projects and an enthusiastic distribution and sharing of the results to online and museum audiences.

I have approached this trend, not at all unique to the discipline of maritime archaeology, with cautious optimism. What kind and whose version of “reality” is being transmitted when those of us with a professional interest in underwater heritage are making these visual experiences? As more emphasis is placed on the benefit and relevance of archaeological research, is it enough that underwater heritage is now easier to see? These questions initiated the following research. This is not intended to be a guide on how there are “right” or “wrong” ways to visualise maritime heritage sites. It is about understanding the practices that inform those visualisations.
Part 1

1.1 Introduction

This licentiate thesis considers the use of digital visualisations for knowledge production and communication of maritime heritage located underwater. The archaeological practice that takes place in response to development, contract archaeology, is the field that is being investigated. The aim is to understand the use of digital visualisation for knowledge production and communication of maritime archaeology. This aim is met through a study drawn primarily from the fields of digital archaeology, maritime archaeology and heritage studies, as well as discourse and thematic analysis of the factors that influence the use of these technologies in the sector. The case study is the contract maritime archaeology sector in Scandinavia. While the research is primarily focused on the contract sector in Sweden, the case study also includes perspectives from the Danish and Norwegian sectors.

If archaeology in popular culture is perceived as fascinating as claimed (see Holtorf, 2005) then maritime archaeology generates fascination on a completely different level. The remarkable preservation qualities in some waters have allowed entire shipwreck sites to remain largely unchanged for hundreds of years. Indeed, perhaps even more so than the underground environment, the underwater one can also be host to “unexpected surprises and unknown hazards” (Holtorf, 2005: 46). So, while the underwater realm creates popular interest and helps to preserve many archaeological sites, it also presents challenges for those working with submerged maritime archaeology.

Human ingenuity over time has allowed for the development of salvage, exploration and eventually archaeological practice underwater. Today that development continues with the adoption of digital and 3D technologies to investigate and study underwater maritime archaeological sites. Research and development of digitally documenting and visualising sites underwater is also providing the means for enhanced archaeological analysis and outreach.
activities. As archaeologists in many disciplines develop new methodologies to meet these two objectives a range of innovative and multidisciplinary solutions are arising. These solutions offer new means to engage with archaeological sites and represent a source of inspiration for this research. The inaccessibility of maritime archaeology underwater makes outreach especially challenging. As a result digital, and in particular 3D, technologies have been recognised as having great potential to meet the needs of both maritime archaeological researchers and public audiences.

The term *contract* implies a set of agreements relating to a task requiring completion. In contract archaeology heritage authorities ensure legislation and guidelines are followed to guarantee that developers and archaeological companies uphold their responsibilities of collecting and archiving archaeological knowledge. In Sweden this involves a contract with society and to ensure this is upheld archaeological companies are required to create a record of their scientific activities on society’s behalf. The contract also stipulates the production of knowledge and ensuring access to the results of this process (Högberg & Fahlander, 2017: 15). Much of the practical and administrative aspects of contract maritime work in Scandinavia involves the survey, excavation and interpretation of archaeological remains. In addition, it is now emphasised that the results of this work move beyond their own value, be accessible, allow for democratic participation to heritage and be of benefit to society (Faro Convention, 2005; Council of Europe, 2005).

The research presented here takes place within the Graduate School for Contract Archaeology (GRASCA). GRASCA was established to develop proficiencies within the archaeological sector, proficiencies that will enhance the sectors’ capability for meaningful social engagement and competitiveness. Extending the market of the contract archaeology sector of Sweden is one of the aims of the graduate school, and also one which this research project is contributing to. The overall goal of the PhD project, which this thesis stems from, is to develop workflows for the documentation of archaeological sites underwater, in particular workflows that consider analysis, communication and archiving of digital data that can expand its reuse potential.

The case study (Part 2) for this research is the contract maritime archaeology sector in Scandinavia. The research is informed by theoretical perspectives from the fields of maritime and terrestrial archaeology, digital archaeology, gender and heritage studies. It draws on discourse analysis and thematic analysis methodologies for the analysis of material resulting from interviews with contract maritime archaeologists working in Sweden, Norway and Denmark. This approach is applied to identify the priorities that influence the use of digital and 3D technologies in the sector and how they are used for knowledge production and communication. The results are intended to further the understanding of how digital and 3D technologies impact the contract sector and provide a basis for future research.
This thesis is organised into three main parts. Part 1 begins with a presentation of the research problem and the questions guiding the research aim. Terminology and concepts used in the study are briefly outlined. Then, a background of contract and maritime archaeology is presented, followed by a discussion of outreach objectives, after which come perspectives from the field of digital archaeology. Thereafter theories and concepts drawn on for the research design of this study are presented, as well as the case study methods. Part 2 comprises the case study and opens with an overview of contract maritime archaeology operations in Sweden, Denmark and Norway. The results of the analysed interview material are then presented and discussed, structured according to the identified themes. In Part 3 the results of the analysis are summarised, after which an outlook and identified areas for future research are outlined.

1.2 Research problems and questions

This research is concerned with the digital documentation and visual communication of maritime archaeological heritage within the contract sector. There is much ongoing research and development of methodologies that aim to enhance archaeological data acquisition underwater for analysis. Speeding up the process of recording sites underwater enables resources to be reallocated for research and analysis objectives. Furthermore, improved means of visualising archaeological sites underwater allows for more participation with heritage sites that are difficult to visit. The identified benefits for maritime archaeological knowledge production and communication are extensive, and particular emphasis is placed on testing and developing workflows for technologies that create visualisations. A prominent method used is photogrammetry which involves the process of using geometrical and optical principles to extract measurements from a series of photographs (Remondino, 2014: 65).

Of interest for this research is the frequent reference made in publications that emphasise the potential for digital and 3D technology visualisation to appeal to wider, public audiences (e.g., Balletti et al., 2015; Bojakowski, Bojakowski & Naughton, 2015; Drap et al., 2015; Drap, 2012; Nornes et al., 2015; McCarthy & Benjamin, 2014). An example is as follows:

The visual character of 3D surface modeling offers enhanced output-possibilities allowing a better documentation of in-situ structures for future research and a higher public participation and awareness for the archaeological heritage (De Reu et al., 2013: 1119).

While 3D models do indeed present many enhanced research possibilities for maritime archaeologists, lacking elaboration is what in particular makes visual
and interactive of digital visual output effective communication mediums of maritime heritage to public audiences. It is likely that the widespread use of digital communication technologies in Western society, such as the rise in digital tools for display at museums (Petersson, 2018: 70), and the ease with which online and social media can be used to share digital content, influence this idea. It remains largely uncontested that visual results of digital and 3D technologies created for maritime archaeology research and management purposes are of instantaneous use for outreach with public audiences.

Emerging, however, are critical perspectives from the field of digital archaeology that question the adoption of technologies and methodologies without fully understanding or researching the implications they have on the archaeological process, or on those who are a part of it (e.g. Open Archaeology topical issue, 2015 v.1:1). Framing this research problem are digital archaeology themes and discussions that point to the gap between documentation and communication processes. Also of influence are new approaches to archaeological practice that inform a range of multidisciplinary research, where communication and storytelling are considered early on (Petersson, 2018; Börjesson et al., 2016: 12). The starting point for this investigation is problematizing the presupposition that digital visualisations of in themselves are a favourable means of communicating maritime archaeology to non-expert audiences.

On this basis, the study is guided by the following research questions:

- What are the primary professional priorities, identities and interests that prevail in the Scandinavian contract maritime archaeology sector, and what influence do they have on visualisations and communication of archaeological sites underwater?
- What are the primary motivations for adopting digital documentation technologies in the contract maritime archaeology sector?
- How is communication understood by contract maritime archaeologists working in the Scandinavian sector?

The first question aims to gain an understanding of what factors, in the course of contract maritime archaeology work, are emphasised as important, and to understand what drives these factors. These identified factors are then studied in relation to the digital output, visualisations and outreach activities to understand their potential influences. The second question is aimed at clarifying the reasons for why certain methodologies are used in the contract sector from the perspective of field maritime archaeologists. Finally, the third question aims to determine how communication is understood within the context of contract projects.
1.3 Terminology and concepts

Here a number of terms and concepts that are used in this text will be outlined. To begin with, this thesis is concerned with maritime archaeology in the contract sector. References, however, will also be made to maritime and underwater heritage. There has been much debate on the nature, meaning and uses of heritage. In particular among these are academic criticisms of equating heritage with physical remains, argued to stem in part from the influence that archaeology has had on the legislation and policies that defined it at the expense of intangible heritage. At the core of this position is the recognition that heritage is not a thing, but refers to a range of attitudes to the past (Waterton & Smith, 2009; Harvey, 2001; Waterton & Watson, 2015: 3-9; Harrison, 2013: 14-20). A discussion of the various meanings of heritage and its distinction from archaeology are beyond the scope of this study. Though I agree with the position that “archaeological sites, artefacts and even knowledge may be heritage, not all heritage is archaeological” (Waterton & Smith, 2009: 4), both terms are used intermittently in the text to relate to particular cases.

The term maritime archaeology encompasses far more than underwater sites. While the commonly known and investigated sites are those of shipwrecks (Gibbins & Adams, 2001: 279), other types such as submerged settlements, harbour installations, or fishing traps are encountered in Scandinavian waters. Maritime archaeology also examines a range of heritage activities and archaeological remains in both wet and dry environments that inform of humanity’s long and changing relationship with oceans, seas, rivers and lakes. The terms attributed to archaeology situated in, or connected to, a body of water are numerous (Flatman & Staniforth, 2006: 168; Flatman, 2007b: 171) and references will also be made to research and projects carried out in the related fields of nautical (concerning vessel construction and use) and underwater archaeology (all archaeology situated in a body of water). To confuse the situation slightly, maritime archaeology is often referred to as marine archaeology (pertaining to the sea) and this is also the case in Sweden, where the Swedish term marinarkéologi is widely accepted and used (Rönnby, 2014: 22-23). Unless referring to a particular sub-field, the term maritime archaeology will be used in this text when referring inclusively to all underwater, nautical, coastal and marine archaeology (Ransley, 2007: 221).

Contract archaeology is used here to refer to archaeological work carried out under the direction of state agencies prior to development. While a number of other titles such as development-led and commercial archaeology are sometimes used to describe this system of archaeological practice, contract is chosen for being descriptive, when projects are placed out for competitive tender the awarded archaeology organisation is awarded a contract.

References are made to work relating to and resulting from the field of digital archaeology. While it is a discipline of archaeology, the approach taken in this research is in line with the thinking that digital archaeology “is not so much a
specialism, nor a theoretical school, but an approach—a way of better utilizing computers based on an understanding of the strengths and limits of computers and information technology as a whole” (Daly & Evans, 2006:2). While many active in digital archaeology would claim that all archaeologists are digital archaeologists (Costopoulos, 2016; Morgan & Eve, 2012), explicit reference is made to digital archaeology in an effort to introduce concepts that could be of relevance to ongoing and future developments in the sector of contract maritime archaeology.

The topic under investigation, the use of digital and 3D technologies, includes a number of digital tools and methodologies. The subset of photogrammetry most commonly used by maritime archaeologists is known by a number of terms, such as Structure from Motion (SfM), however, in this paper the term Multi-Image Photogrammetry will be used to distinguish between methods that are based on stereo pairs (McCarthy & Benjamin, 2014: 96). Multi-image photogrammetry describes the process of images incorporated into computer software to generate 3D spatial data, or 3D models from large datasets (McCarthy & Benjamin, 2014; Remondino, 2014: 65) Additional terminology will be described as required or when clarification is needed, for instance in the following section that will position maritime archaeology within the contract archaeology sector.

1.4 Background

1.4.1 Contract maritime archaeology

In Sweden the National Heritage board is the central authority responsible for cultural heritage. County Administrative Boards in each of Sweden’s 21 counties are responsible for making decisions pertaining to archaeology and cultural heritage resource management. The contract sector operates on a semi-regulated market, where companies compete in a tender process for archaeological contracts, in accordance to competition criteria as outlined by the National Heritage Board’s regulations and guidelines (Börjesson, 2017: 35).

In accordance with the Historic Environment Act (Sw. Kulturmiljölagen) the costs for archaeological work are generally borne by the developer (SFS 1988:950). Currently, contract archaeological companies are part of museums, operate as private companies or as government agencies and all work is directed by national heritage legislation, regulations and guidelines (e.g., SFS 1988:950; Prop. 2012/13:96; KRFS 2017:1; Riksantikvarieämbetet, 2015a).

Contract companies can be awarded a number of different kind of contracts, depending on the level of knowledge required by the County Administrative Board on which to base planning decisions. There are three primary categories of projects that maritime archaeology companies are contracted to carry out. Archaeological surveys are an initial stage in order to identify the presence of
archaeological remains along with their nature and significance. Archaeological investigations are carried out on known sites in order to determine and decide their character, age, size and complexity. Finally, the purpose of archaeological excavations is to document, archive, and report to heritage agencies and communicate results to the general public (Riksantikvarieämbetet, 2015b). The majority of projects that concern maritime archaeology located underwater are comprised of surveys whereas excavations are seldom carried out. One explanation for this is the large areas within which maritime developments take place also offer more options for avoiding archaeological sites located during contract archaeological surveys (Bergstrand, 2017: 19).

Overall the activities of contract companies’ account for more than 90% of all archaeological excavations conducted in Sweden (Nilsson & Rudebeck, 2010: 11; Börjesson, 2017: 33-34). Since 1989 this expanded to areas underwater, increasing the level of maritime archaeological activities and developing of the sector (von Arbin & Bergstrand, 2008: 10). The most recent national survey carried out on maritime archaeologists’ skills and institutional resources relates to data from 2003. While the survey was not only concerned with contract maritime archaeology, it provides information on institutions that were active in the sector (von Arbin, 2004a). The survey identified six institutions with the required competencies and preparedness to conduct maritime archaeological research underwater. While a number of the institutions identified are no longer active in maritime archaeology research and a new company was recently established, the overall situation has not altered dramatically. The survey also reported a total of two County Administrative boards employing case handlers with the required management skills and experience for handling maritime archaeological cases. Twelve boards were lacking in specific management skills for maritime archaeology cases but had individuals with some experience (von Arbin, 2004a: 4). No current registry of country administrative board case handlers with education or experience particular to maritime archaeology exists. However, the Swedish National Heritage Board provided a mailing list that included nine individuals with maritime archaeology responsibilities in eight of Sweden’s 21 County Administrative Boards. Problematic issues that were raised by the most recent report included the low number of maritime archaeologists employed and the perceived lack of priority awarded to maritime archaeology by the National Heritage Board, the County Administrative Boards and the responsible regional museums (von Arbin, 2004a: 5).

Relating to the skills and competencies within Swedish maritime archaeology, the report was lacking data on gender ratios within the field. This omission may be due to how aspects of maritime archaeology in general, both academic and professional areas, have been identified as being male-dominated (Ransley, 2005, 2008; Flatman, 2003). As a result the accepted norm of a predominantly male Swedish maritime archaeology could have led to
overlooking this information in earlier studies. The perceived male-dominated discipline contrasts with figures from maritime archaeology programs. Female graduates from maritime archaeology programs in the United States and the United Kingdom over the last 30 years have accounted for 40% to 55% of students, as well as 37% of university faculty positions (Maritime Archaeology, 2014). During the time that the case study was undertaken (2017) the contract maritime archaeology workforce in Sweden was primarily male (table 1), which may be explained by a number of factors. The low number of contract companies operating in the sector may account for fewer steady employment opportunities, thereby creating a low number of employed over all. Another factor may be related to legislation where in accordance to Swedish Work Environment Authority statutes (AFS, 2010:16), under which contract archaeology operates, diving employees are required to inform employers of pregnancy, following which they are no longer permitted to dive. Since much of the diving medicine studies that current knowledge is based on was conducted on male military personnel and the obvious ethical dilemma of experimenting on pregnant women, current best practice is to avoid diving throughout pregnancy (DAN, 2012). The low turnover of full-time employment positions and aspects of diving legislation partially explain the underrepresentation of women in the contract sector. Another factor, however, may relate to the emergence of the discipline.

Reading the history of archaeological practises one is met with references to “great archaeologists” and “great men” commended for their contributions to archaeological systems and structures, many which are still in place today. As a consequence it is often so that they “have all been related to legendary and near to mythologized personalities” (Jensen, 2012: 9; Roberts 2012: 211). Western maritime archaeology has no shortage of such influential early archaeologists. For instance, one of the best known, American maritime archaeologist George Bass, is frequently recognised as the “Father of Underwater Archaeology” (Meide, 2013: 5). Another disciplinary influence was the military, initially in the development of diving technologies. From as early as the 1500s diving equipment was used by militaries to assist in the recovery of material from sunken warships, most notably guns (Ekman, n.d: 37 as cited in Rönnby, 2014: 29). Early diving efforts with archaeological orientations in Sweden were initiated by military men, and so-called pioneers, Carl Ekman and Arvid Zetterling, during the 1920s and 1930s (Cederlund, 1983 as cited in Rönnby, 2014: 32; Varenius, 1983). Not only may the military practices and influential personas have associated the discipline with masculinist themes, but it could also have further distanced it from wider archaeological practice.

Operating somewhat like a curiosity then is not only a perception of contract maritime archaeologists in Sweden, but is also a reality for the females employed. Like many specialist areas and sub-disciplines, the very prerequisite
specialised skills and equipment required of maritime archaeologists, may in part contribute to feeling of being estranged. It must also be taken into account that the discipline of maritime archaeology as it is known today has not been established for as long as the terrestrial tradition. It began to be recognised as a scientific archaeological field from the 1960s, following which a number of major developments of the field began, including notable examples from Nordic and Scandinavian waters.

The best known scientific excavations and contributions to setting standards during the early decades include a number of shipwrecks in the Mediterranean (Bass, 1966, 1967; Bass & Van Doorninck, 1971, 1982), the excavations in Denmark’s Roskilde of five Viking ships (Olsen & Crumlin-Pedersen, 1978; Crumlin-Pedersen & Olsen, 2002) and the excavations of submerged Mesolithic sites at Tybrind Vig in Denmark between 1977 and 1983 (Dal, 2014). The 1961 raising and excavation of the warship *Vasa* in Sweden (Cederlund & Hocker, 2006) and of England’s *Mary Rose* warship in 1967 represented grand feats of engineering as well as maritime archaeology (Rule, 1982; Marsden, 2003). These are but a few well known examples of the many sites located and excavated, largely possible to the development and availability of diving equipment, following the production of the aqualung in 1946. Internationally, the early disciplinary concerns tended to focus on issues of safety (Bass, 1966:150); on the creation of databases and typologies, and placed emphasis on materials and techniques (Bass, 1983:97; Watson, 1983:27-28; Hocker, 2004). Many of the earlier projects, while supervised by archaeologists, employed divers who later became archaeologists. It has been proposed that diving rather than archaeology experiences contributed to the prioritising of methodologies and technologies at the cost of theoretical archaeological discourse (see Flatman, 2003, 2007a, 2007b).

Sweden’s maritime archaeology discipline followed a similar trajectory. A recognised lack of data pertaining to underwater shipwreck sites justified an emphasis on precise recording methodologies, a topic dominating Swedish scientific maritime archaeology literature from the 1960s (Cederlund, 1997: 13). From 1964 research and development efforts expanded to documenting archaeological layers in Swedish waters, with provisions for poor visibility. Measuring tools and underwater photography methodologies were developed to ensure, for example, that artefact positions could be determined on multiple levels in situations of compromised visibility (Cederlund, 1975: 231). Recognising shipwrecks as the most frequently encountered underwater site category, both in Sweden and internationally, an inventory of lost ships was established following the 1967 provision for ships older than 100 years to be included to the Antiquities Act (Cederlund, 1976: 71). By the 1970s Swedish maritime interests expanded to sites on land including industrial establishments, harbours, wharfs, military installations, settlements, ballast sites, and fairways. However, despite the strides in recognition of the discipline and the establishing
of practices, there was a noted lack of specialists with holistic competencies for maritime archaeology. Writing in 1980 Cederlund points out that only a handful of individuals at the time who could be called marine archaeologists (Sw. marinarkeologer), trained with the knowledge, both theoretical and practical, required to conduct scientific maritime archaeological work (Cederlund, 1980: 12-13).

The call for more archaeologists with maritime knowledge and expertise has since been answered by MA programs offered by a number of European universities (Ransley, 2008). Developments in diving, survey and excavation equipment for archaeological work underwater are largely what led to the disciplines integration into the Swedish system of archaeological practice from the early 1990s. This integration, however, was in a specialist capacity (von Arbin & Bergstrand, 2008: 5) and the identified lack of maritime archaeology resources at the County Administrative Boards (von Arbin, 2004a :4-5) illustrate that maritime archaeology’s position in the contract sector is not as established as terrestrial archaeological practice.

This contrasts with the well-worn reference by the aforementioned George Bass who stated that archaeology underwater differs to land archaeology only in its methods (Bass, 1966: 151), a position often since emphasised (Rönnby, 2014). Although specialist journals and conferences are common within general archaeological practice, the establishment of maritime focused forums from the 1970s resulted in maritime discourses being peripheral to those of mainstream archaeology (Adams, 2013: 6). Another factor that sets maritime archaeological practice apart is the investment in additional resources, such as training, equipment and diving legislation, making the enterprise more expensive than similar project types on land. The possibility for developments to avoid archaeological remains underwater, as noted above, coupled with higher costs involved, both work to differentiate maritime from terrestrial projects in the contract sector. Experiences from the raising of the Vasa and Mary Rose ships illustrate the enormous costs required for conserving waterlogged wood. While in-situ preservation is not the only recommended option for managing underwater sites (UNESCO, 2001; Maarleveld, Guérin & Egger, 2013; Maarleveld, 2015: 250), its application in Swedish maritime contract archaeology contexts (von Arbin, 2017) nonetheless illustrates a difference from terrestrial practices.

The background presented here is intended to place maritime archaeology within the context of Swedish contract archaeological practice. Similarities and differences were discussed in an effort to understand whether George Bass’s belief still held any truth. What emerges is a somewhat mixed situation where maritime archaeology is recognised in some parts of the country, but overall it is not a widely integrated element of the Swedish heritage system. The following section moves on to discuss the sentiment expressed in contract
archaeology regulations which states that knowledge produced from contract archaeological research is to be of relevance to society (KRFS, 2017).

1.4.2 Archaeology’s social contract

While contract archaeology in Sweden is generally paid for by developers (SFS 1988:950) the intended benefactor of this work is in fact society. Guidelines for contract archaeological practice, as an illustration, outline that the purpose of archaeological work is to ensure that both archaeological sites and the knowledge resulting from investigations are preserved, used and developed. Furthermore, in addition to allowing people to participate, the results of contract archaeological work are to be a source of knowledge and experiences (Riksantikvarieämbetet, 2015b: 4). Placing emphasis on societal aims in archaeological work is part of a wider trend in heritage management and resulting policies (Guttormsen & Swensen, 2016). Notable efforts include the Faro Convention which, among other goals, was created to “secure the rights of people to access, participate, and benefit from cultural heritage and cultural life, and contribute towards its enrichment” (Faro Convention, 2005; Council of Europe, 2005). Another is The Amersfoort Agenda of the European Archaeological Council, which identified a number of areas in which European archaeology can address the needs of society in the face of economic pressures and the increasing use of information technologies in the archaeological sector (Schut, Scharff & de Wit, 2015).

In Sweden the Operation Heritage (Sw. Agenda Kulturarv) project initiated in 2001 represented a shift in policy within the heritage authorities and agencies where efforts were made “to renew the direction, democratic legitimacy and effectiveness of Swedish heritage management” (Agenda Kulturarv, 2003; Operation Heritage, 2004). A governmental enquiry into the purpose of contract archaeology in 2005 (SOU 2005:80) recommended that the sector had purposes beyond those of excavation, documentation and research (Högberg & Fahlander, 2017: 15). How ideas emphasising cooperation with society have translated into practice are evident in recent (2014) changes to the cultural heritage law that allow for the County Administrative Boards to demand that results of contract archaeology excavations be mediated to the public (Högberg & Fahlander, 2017: 15; Arnberg & Gruber, 2014: 158; SFS 1988:950).

This mediation, or outreach, is in the form of popular scientific summaries and is in addition to the formal archaeological reporting of excavations. The summaries are aimed at society, defined as “the general public, municipalities, schools and science journalists” (Populärvetenskaplig sammanfattning, 2016). Popular scientific summaries are not, however, required if excavation results are deemed to not be of “sufficient relevance to the public” (my translation), whereas they can be demanded by the County Administrative Board for survey and investigations if the results are deemed of high relevance to the public (KRFS 2015:1, 29§: 10). Considering the difficulty in providing on-site
outreach visits or tours of contract projects underwater the medium of popular scientific summaries would appear a suitable form of communication for contract maritime archaeology. While the guidelines and definitions of the summaries themselves could be interpreted as being restrictive (e.g. there is a limit to the number of pages a summary can be) a more obvious limitation is the concept of relevance attached to them.

As was discussed earlier, not all County Administrative Boards have identified resources relating to maritime archaeological knowledge. Among the boards that do have staff with the relevant knowledge and expertise, considerations of relevance are decided upon by a few individuals. While guidelines issued for the subject matter or identified themes in popular scientific summaries do not make specific reference to maritime archaeology, other studies have identified a number of key interests and themes in popular culture commonly associated with the discipline. As will be discussed later on, priorities in the field of maritime archaeology have been argued to lean toward the material, rather researching the societies that behind them (Flatman, 2003: 143-144). A study on the representation of nautical archaeology on English-language television shows over 30 years (Sperry, 2008), illustrated how cooperation between documentary producers and nautical archaeologists since the 1960s has allowed for some control over the way the discipline was portrayed. However, the unique selling point of maritime archaeology largely involves underwater sequences, emphasising methodology over interpretation. This format of presentation used to introduce the discipline to wider audiences and potential students worked to define what maritime archaeologists do, emphasising little relationship between maritime and land archaeology (Sperry, 2008: 335).

Another study (Gately & Benjamin, 2017) on the portrayal of maritime archaeology via a reality-style series analysed the methodological and theoretical presentation of the field. High-level theory was found to be presented in two out of 32 episodes analysed, whereas methodological elements such as artefact recovery, underwater excavation or salvage occurred more frequently (Gately & Benjamin, 2017: 11-13). A cause for the bias associating maritime archaeology with the recovery of large objects and architecture is evident in definitions of the discipline that “exclude the study of marine-focused coastal societies, including prehistoric or pre-contact, indigenous (non-European) cultures, within a contemporary definition of maritime archaeology” (Gately & Benjamin, 2017: 14). The studies cited above were not intended to illustrate the positions of Swedish County Administration Board case handlers or contract maritime archaeologists. Rather, they highlight the problematic concept of designating relevance to maritime archaeological sites when often the communicated results closely relate to the interests and priorities of those deciding on content.
1.4.3 The digital turn

The digital turn refers to the increasing affordability and accessibility of digital software and hardware available in recent years. In addition, the widespread use of computers, smart devices, as well as the ever increasing emphasis placed on interactive technologies and social media, has provided a profusion of outlets for archaeologists to disseminate results to experts and wider public audiences (Olivito, Taccola & Albertini 2016: 481). While understandings and definitions of what archaeology actually is varies, a fundamental aim of archaeology and associated data is the creation of new knowledge of past human activities (Huvila, 2018: 3-4). It must also be remembered that many of the established practices of archaeological fieldwork were developed during a time where computers and digital tools were not used (Dell’Unto, 2018: 54). With archaeologists increasingly adopting digital tools, new standards and codes are not only being currently developed but constantly re-evaluated and revised.

Rather than placing focus on the digital tools themselves, more recent critical perspectives of the digital turn are questioning the effects the tools have on knowledge production within the archaeological process. In moving beyond questions of how to apply certain digital methods in specific circumstances it is suggested that archaeologists consider the ways that digital technologies “may have changed what we do, how we do it, how we represent what we do, how we communicate what we do, how we understand what we do, and how others understand what we do” (Huggett, 2015b: 88). It is also understood that a focus on the technical aspects of digital technology can threaten the possibilities that they offer archaeological research. Early use of 3D applications in archaeology, for example, were found to be too technically focused and not based on specific research questions (Forte et al., 2012: 355).

A critical stance of questioning the effects of digital tools on the archaeological process is in contrast with the view that within the sector of contract archaeology the “adoption of technology has generally been undertaken in a reactionary and sporadic way: we have a problem, this may be a solution.” (Backhouse, 2006: 43, italics in original). The early digital solutions used by maritime archaeologists were largely a response to cope with ever increasing amounts of data. An example of such as system was the 3H Site Recorder documentation system (3H Consulting, 2011) developed in 1997 to incorporate geographical data, find and survey data, and image management. Early efforts to digitise shipwrecks, such as those at the Viking Ship museum at Roskilde since the late 1990s (Ranchin-Dundas, 2012: 18), were focused on creating digital data for archival and research purposes. Building on the recording strategies developed at the Viking Ship museum, a number of large excavations of ship remains discovered in contract archaeology contexts were digitally recorded. While the primary goals of the digital recording were aimed at accurate archaeological recording for analysis and interpretation, the potential for visualising models and hypothetical reconstructions were also

Today the digital turn is inspiring the maritime archaeology community to develop workflows for the digital documentation and visualisation of archaeological sites located in water depths previously inaccessible (Ritondale, 2014; Eriksson, 2015a). The ease at which digital tools for the production of 3D and visual content can be used, as well as their affordability has also led to their increasing application in contract maritime contexts. Another factor influencing their adoption is efficiency which is emphasised in policies of implementing digitalisation into the heritage sector, on the basis of using resources in the best possible way (Digisam, 2016a; Statens Maritima Museer, 2015). Efficiency is also emphasised in the contract sector and has been suggested to have led to the adoption and development of digital tools in European contract archaeology (Backhouse, 2006). With an increasing emphasis on communicating the results of contract archaeological projects, the ability to visualise archaeological data is of greater importance. However, to understand their benefits only in relation to the archaeological process results in the tendency for many digital methods to prioritize information and aspects that are of primary interest and relevance to heritage experts. Rather than being a format that can allow audiences to engage with archaeological sites, the risk is that visualisations such as 3D models instead alienate those lacking specialist knowledge required to understand them (Jeffrey, 2015: 145).

While on the one hand some digital archaeology theory warns of how the creation of 3D models may distance archaeologists from the archaeological material (Huggett, 2015b) a critical approach can also illuminate benefits for the archaeological process. A number of projects have illustrated the potential benefits of visual models to fulfil the goals of rapid and efficient data capture, while also enriching the interpretative process of archaeologists. In the case study of a house in Pompeii, the creation of a workflow for 3D GIS allowed for archaeologists in the field to work in real time in visual relation to the archaeological site, also allowing them to edit elements recognised during the 3D acquisitions. Furthermore, by combining previous databases from earlier archaeological projects it was possible to visualise all of the data in direct spatial relation to one another (Dell’Unto et al., 2015: 84). In this way models need not exist as stand-alone elements or the culmination of archaeological projects but provide the basis for continual interaction with an enquiry of the archaeological material.

Ongoing critical discussions in digital archaeological research should not be taken as negative or calling for a shunning of digital applications, but instead as constructive direction for future developments. An example of such relates to elements of what was discussed in this section relating to the place of outreach in contract maritime archaeology. In researching how digitisation affects the presentation of archaeology in museum Bodil Peterson discusses processes that
make it possible to connect the processes of fieldwork and digital presentation. A guideline given to ensure successful reuse of data suggests:

Whenever the aim is to use digital presentation techniques to communicate actual digital archaeological field data, it would be highly useful that field documentation is conducted digitally from the beginning and that a seamless workflow will be developed to transfer and translate the field data for display purposes. There are still relatively few examples of continuous processes that span from digital recording and display from the field to an exhibition (Petersson, 2018: 81-82).

In being forced to “think beyond the tool” (Huggett, 2012) it can be possible to connect the processes of fieldwork and digital presentation, which is especially useful for archaeology located underwater. In the following section the discussion will move onto a toolbox of sorts, comprising of the theories and concepts drawn on for the research design of this study.

1.5 Theoretical and conceptual framework

1.5.1 Heritage discourses

Heritage studies is identified as emerging from: academic research on how heritage was used by governments to create a sense of nationalism (Harrison, 2013: 96); debates in the UK from the 1980’s that questioned the economic exploitation of heritage; and from social and political discussions concerning rights to heritage in countries that had been settled or colonised (Waterton & Watson, 2015: 4-5). Investigating the various discourses surrounding heritage in order to understand what heritage is and does in the present is a growing area of research (Wu & Hou, 2015: 37). Laurajane Smith’s 2006 book *Uses of Heritage* represents a key contribution to the field with the concept of the authorised heritage discourse, which challenges traditional ideas of heritage that influence how both the past and present are understood today (Smith, 2006). It is a discourse that:

emphasizes the materiality and the assumed innate universal value of heritage, draws on and reproduces a consensual view of nationhood and national history, and affirms that it is heritage experts that must act as stewards of the past to protect and maintain heritage values, so that they may be passed on to ‘future generations’ (Smith, 2008: 162).
The authorised heritage discourse is argued to be a professional one that tends to dominate national and international Western debates concerning the nature, value and meaning of heritage (figure 1). Since the discourse emerged from the experiences of elite, educated European upper- / middle ruling classes, the subsequent legitimized values and perceptions of heritage were shaped by their ideals. In particular, masculine values of the elite social classes have dominated the ways in which heritage has been defined, identified, valued and preserved (Smith, 2008: 162).

The Authorised Heritage Discourse (AHD)
• ‘Grand’, ‘tangible’, ‘old’ and ‘aesthetically pleasing’ sites, monuments and buildings;
• Feel good, comfortable;
• Value inherent;
• Conserve as found for future generations;
• Expertise has ‘duty’ to act for and steward a universal past.

Figure 1. An outline of the Authorised Heritage Discourse after Smith, 2009: 6.

Romanticism in the 19th century provoked an interest in sites that were deemed to be of monumental importance, grandeur and worthy of preservation. Experts, primarily stemming from the disciplines of architecture and archaeology, acted as trustees and guardians responsible with safeguarding sites for following generations and educating the public on their importance. Central to this concept was the notion that only the educated elite knew best what was worthy of monument status and conservation. Since then, the care and protection of sites has become institutionalised in the roles of heritage professionals, along with communicating the value and meaning of sites to audiences. These communications place emphasis on conservation that works toward increasing conservation awareness, as well as the appreciation of a nation’s cultural heritage (Smith, 2006: 19-21). Through heritage laws, such as those which define who is permitted to dive on or excavate a site, the authorised heritage discourse suggests that only certain actors in society have a legitimate voice in defining parameters for heritage sites and their value to society.

These early concepts of heritage lingered on to influence the more recent emergence of heritage management as directed by legislation from the 1970’s, including a number of significant global and regional heritage charters. Heritage policy has since worked to shape legitimate state-sanctioned activities that are bolstered by national and international protection laws. Central to these laws are individuals “holding expert knowledge” and who “must identify the innate value and significance, which are often defined in terms of historical, scientific, educational or more generally ‘cultural’ significance” (Smith, 2006: 26). Emphasis on the expert role of heritage professionals relegate public audiences as passive consumers of the heritage message. Professionalization has also created distance between enthusiastic members of the public and amateurs.
In more recent decades the rise of tourism and leisure activities has seen the streamlining of preordained ways to engaging with heritage sites (Smith, 2006: 29-31).

The knowledge that is primarily handed down about heritage often emphasises materiality, placing significance on “the age, monumentality and/or aesthetics of a place” (Smith, 2006: 3). The tradition of heritage having a material nature is connected to the ways in which it is possible to map, collate and manage it. By conducting these actions, however, they work to reinforce and legitimise the authorised value of sites. Preservation and conservation of heritage are also emphasised in the authorised heritage discourse, where the stewards of heritage work to preserve sites on behalf of society. Today the emphasis on preserving and recording the past for the future is to ensure that the information will not be lost (Högberg et al., 2018). Yet, focusing on saving the past for future generations, rather than for people living today, only underlines the importance of heritage professionals who act as stewards while “disempowering the present from actively rewriting the meaning of the past” (Smith, 2006: 29).

The hierarchical structure between expert and non-expert dictates that information is passed from those with knowledge about heritage to those without. The top-down nature of heritage management and communication, where experts, such as archaeologists, are responsible for delivering knowledge, has the disadvantage of devaluing alternative means of engaging with heritage. This is not to suggest succumbing to relativism but instead to understand how current discourses can alienate and exclude not just groups in society, but also other means of engaging with heritage. Alternative means of engaging with heritage, such as deep water wreck exploration or re-enactors are often dismissed or condemned by professionals. These activities, however, challenge elements of the authorised discourse illustrate other means of engaging with heritage.

Biological reproductive functions that define “female” and “male” impact the way in which all associations of gender in western society’s binary gender categories of “woman” and “man” are taken for granted. The categories of identity that are constructed by these identifiers, woman and man, are rarely questioned in authorised accounts of heritage. Heritage is argued to be gendered, and while it is often too male-centred, discussions on gender and heritage have predominantly been focused on women, “as if men have no gender” (Smith, 2008: 159-160). It has also been argued that the many ways in which maritime heritage is defined, understood and communicated favours a masculine version of the past and the present (Flatman, 2003; Ransley, 2005, 2008). In maritime archaeology efforts have been made to negotiate and address power relations in discourses on nationalism (Cederlund, 1997) and to expand the disciplinary focus on “great men” and associated warships to include the
The maritime activities of everyday people (Eriksson, 2015b: 46), though often these everyday people also happen to be male.

The concept of the authorised heritage discourse was inspired by critical discourse analysis, where linguistic and social theory are combined to understand how the ways in which people talk or write about a topic have real-world consequences (Smith, 2006). However, discourses of heritage are not confined to what is written or spoken but are equally embedded in visual output. Images that contain particular political agendas or that favour certain classes in society legitimise and maintain particular ways to view heritage. Emma Waterton’s analysis of visual imagery was used to promote heritage sites in England (Waterton, 2009) identified how certain elements in the images work to reaffirm notions of power. Images of sites, monuments or buildings were found to be presented in ways that promoted a sense of timeless and preserved heritage. This worked to remove heritage from the normal and everyday life, and that instead suggested that it should not be engaged with. The absence of people in images with heritage sites served to reinforce the role of heritage visitors as passive onlookers, not required to ascribe meaning or value to the site since it is already assumed. By visualising the heritage sites in ways that privilege the cultural values of elite social groups, the discourse worked to exclude those who did not share the same cultural experiences. Despite initiatives in the heritage sector to promote social inclusion, the sterile presentations of the sites had the opposite effect by contributing to social distances (Waterton, 2009: 41-49). An important conclusion is that “Simply ‘opening the doors’ fails to acknowledge the hidden power of discourse, which is utilised to sustain a range of subject positionings and practices…” (Waterton, 2009: 52).

A similar study conducted by Anders Högberg considered signage that was placed by the County Administrative Board in southern Sweden. Analysis of texts and images informing visitors about ancient monuments identified the privileging of white, middle-class male perspectives in over half of the signs. These included assumptions of prior archaeological knowledge and illustrations that displayed misrepresentations of children, women and men. Not only did the signs work to prioritise a particular worldview, but the authorised discourse was continued and reaffirmed by continual interaction by visitors (Högberg, 2012).

By limiting the understanding of heritage to material things or quantifiable parameters, many other forms of engaging with and understanding heritage are overlooked. A response to the recognised power relations within authorised heritage discourses does not, however, mean abandoning registered monuments or professional expertise. Rodney Harrison’s proposal of a dialogical heritage model has the potential to challenge the traditional separation of specialists and stakeholders in the identification, conservation and management of heritage (Harrison, 2013: 205) and is described below:
A dialogical model of heritage based on an ontology of connectivity not only flattens the hierarchies of relationships involved amongst the various heterogeneous actors, human and non-human, that bind time and place to keep the past alive in the present, but also suggests important dialogical models of heritage decision-making in hybrid forums, which break down the conventional barriers between experts, politicians, bureaucrats and interested laypersons or stakeholders (Harrison, 2013: 226).

Rather than viewing heritage as a separate field, a dialogical model takes the view on the relationships between heritage and other social, political and environmental issues as being interconnected in fundamental and complex ways. Since most people think about and experience heritage as both related to and emerging from connections between people, objects, places and practices, a dialogical model is of direct relevance to contemporary society (Harrison, 2013: 226).

Another view that challenges the authorised discourses normally associated with the past is in accepting popular culture understandings of archaeology as legitimate (Holtorf, 2005). Instead of privileging the factual knowledge relating to archaeological sites, Cornelius Holtorf has argued that “the perceptions of the many matter as much, or more than the factual knowledge of the few, especially since that factual knowledge, too, is not really privileged but simply based on one particular perception of archaeology, archaeological objects, and perhaps the world” (Holtorf, 2005: 8).

A critical analysis of the discourses present in contract maritime archaeology will enable the identification of power relations and assist in understanding what perceptions of heritage are promoted. The authorised heritage discourse provides a point of departure for this research in understanding the use of digital and 3D technologies for knowledge creation and communication of maritime archaeology.

1.5.2 Digital visualisation

A visual tool that has been in use by maritime archaeologists since the 1960s is the scanning sonar. There are various types but all work by directing a sound pulse downwards into the water column to reflect information about the environment (Blake, 1995; Green, 2004: 74-75). The most common applications of their use for contract maritime archaeology in Scandinavia are either towed by a vessel to map an area, or placed stationary on the bottom to scan sectors. The method is especially useful in underwater contexts to easily survey large areas, rather than having to swim. Additionally, the resulting images allow for objects to be measured and georeferenced. A recent article discussing the application of sector sonars for the survey and management of submerged archaeological sites concludes:
Sonar technology is taken up here to illustrate a common understanding in maritime archaeological practice that visualisations resulting from survey tools can automatically serve outreach purposes to non-expert audiences. This is, however, contested by research on the use of images in archaeological practice. The value of images in archaeology is generally understood “as related to their provision of information, but once the mediation of images is taken into account that evaluation is far from simple” (Moser & Smiles, 2005: 1). The meaning of an image is determined by the reasons behind its creation, as well as its proposed function and audience. The side-scan image of a shipwreck in figure 2 was created in 2015 during the search for the missing Malaysia Airlines Flight 370. Created with the goal of finding a modern aircraft it does not provide much useful information to archaeologists other than basic dimensions and location. Similarly, sonar scans created for contract maritime archaeology surveys are created in accordance to project goals and objectives, and thereby primarily serve the actors involved in the sector. Practical and technical constraints, as well as the individuals recording data, all influence the creation of an image and thus impact the viewer’s response. This applies for a 3D model as it does an image created in the last century (Moser & Smiles, 2005: 2-6). The shipwreck in figure 2 likely evokes a number of responses, depending on the viewer, but it is questionable as to whether it allows for the interpretation, visualisation and understanding of the site.

This suggests that archaeologists would benefit from engaging with the complex factors that impact how images transfer archaeological knowledge. This includes rejecting the assumption that imagery use in archaeology can be made in a transparent way, devoid of coding or reflecting certain forms of knowledge. It also requires that the study of images to be included in the “real” work of archaeology, rather than being overlooked as it has been in the past (Perry, 2014: 189-190). Furthermore, a potential outcome of studying imagery in archaeology could result in empirical methods and objective analysis becoming replaced by an interest in the creation of knowledge (Moser & Smiles, 2005: 2-6).
Figure 2. An example of a side-scan sonar image of a shipwreck on the seabed (ATSB, 2015. CC BY 4.0)

The widespread use of digital technologies in western society, and the internet in particular, has also given rise to another common assumption, that it represents a major change in how traditional social hierarchies are broken down (Bevan, 2012: 1-2). Despite the democratising and empowering promise that digital access is thought to afford, the authorised heritage discourse has been identified as reinforced by the digitisation process (Taylor & Gibson, 2017: 6-10). The consideration of inequalities that exist online, as well as offline, have been raised, such as how archaeological institutions have transferred their authoritative role to their online presence (Richardson, 2014) and how by only focusing on the positive potential of social web that archaeologists ignore power
structures and abuses online (Perry & Beale, 2015). It has been recognised that abolishing traditional power hierarchies in archaeology are at odds with the expectation for archaeologists to exhibit authoritative pronouncements. As the authoritative and expert voice is built in to the recording systems and academic publication structures in archaeology, it is natural for this to continue on in communications to public audiences since:

there will probably always remain a creative tension, as our efforts at multilateral engagement can only ever be piecemeal and, if we are honest, often conceal a desire to retain control over the final consensus or narrative (Bevan, 2012: 4).

The lack of methodologically sound and quantitatively significant audience research that allow archaeologists to gain an understanding of their audiences has been identified as a cause for this blind spot. Required therefore is a “holistic re-evaluation of archaeological communication, based on data rather than supposition and faith” (Bonacchi, 2015: xiv-xvii). Recent scholarship of digital communication of archaeology (see Bonacchi & Moshenska, 2015) has aimed at shifting the focus from authoritative narratives where objects or sites from the past are simply shown to audiences, to instead allow for meaningful contributions to current debates in society (Bonacchi, 2012) and digitally enabled co-production (Bonacchi & Petersson, 2017). Understood together, the positions that contest both the transparency of images and the inherent democratization of digital online data are worthy of consideration with the use of digital and 3D technologies for knowledge production and communication.

Rather than adopting digital tools for archaeological use, it has been suggested that the discipline instead takes a more innovative role and develop transformative new tools and approaches (Huggett, 2015a: 81). In recognising gaps in theorisation and the under valuing of digital archaeology, Jeremy Huggett (2015b: 89) suggests a number of areas which warrant further investigation to further introspection within the field, two of which are:

Data capture: There is a need to understand consequences of changing from traditional approaches to recording to digital approaches (Huggett, 2015b: 89-90). The growing use of gathering data in 3D and remote sensing, most notably in maritime archaeology multi-image photogrammetry, may in some ways distance us more from the archaeological material. Furthermore, the tools themselves are designed to record differently to how humans perceive, interpret and sketch, and while this point has been acknowledged as an important avenue of enquiry it has not generated sufficient discussion in maritime archaeology.

Visual perspective (Huggett, 2015b:92): The way in which digital technologies have changed our perspective on our world, for example, the increasing
availability of images posted to social media from space or from the seabed, is important to think of in relation to how people in the past did not have these viewpoints. The perspectives that are afforded in reconstructed virtual prehistoric landscapes or in a shipwreck site modelled in 3D represents a privileged viewpoint on the past that has not yet been extensively researched or understood.

Critique has been aimed at the traditional use of three dimensional archaeological models for displaying final reconstructions rather than for discussing scientific interpretation (Forte, 2011: 13; Perry, 2018). In more recent years, however, the use of 3D data acquisition systems, such as laser scanning, photogrammetry and computer vision techniques, is being combined with spatial data and integrated into geographical information system (GIS) environments (Dell’Unto et al., 2015: 73). The ability to view 3D models within GIS allows for an understanding of individual sites from a visual perspective. Seeing sites within their wider contexts results in a more reflexive interpretation and provides researchers “with the opportunity to visualise multiple patterns through different data connections” (Dell’Unto et al., 2015: 75). Furthermore, efforts made to open up the archaeological visualisation process for peer review (Opitz, 2015), along with proposals such as the London Charter (2014) and the Seville Principles (Seville Principles, 2016), all represent efforts that allow for an honest creation of digital productions.

Visualisations of archaeological interpretations or reconstructions have often been treated as final components of intensive research (Ch’ng, Gaffney & Chapman, 2013: 356). There has also been a lack of clearly stated connections between images in published excavation reports and the interpretative process, such as notes made in the field rarely being included in published material (Sanders, 2012: 40). However, the development and testing of appropriate methodologies is ongoing and multiple areas of priority are being identified. While efficiency is one outcome, recording in digital workflows ensures a continuous updating of data and interpretations. The ability to access past and present data of varying types during the excavation process provides a “reflexive-loop” in the creation of knowledge (Berggren et al., 2015: 443-444). Research on the ability for 3D data in particular to enhance the archaeological process emphasises the importance of the interpreter. The resulting model should reflect the observations made following intellectual, practical and multi sensorial engagement with the archaeological material. The likelihood for resulting models to be of use for future re-use and allowing information to be examined from different perspectives is dependent on careful interpretation (Dell’Unto, 2018: 58-66). The call for interpretation as part of the digital workflow is further emphasised based on the limitations that technologies have in contextualising archaeological data (Perry, 2018). In his concept of Slow Archaeology (Caraher, 2016) William Caraher frames these priorities by
highlighting how the use of digital tools on the basis of efficiency changes the nature of the practice, the knowledge produced and skills of the archaeologists.

A number of future avenues for this work has come by thinking beyond the confines of the digital technologies that are available today. Bodil Petersson proposes an empathetically multisensory approach for expressing interpretations. Allowing information to go from research to communication and vice versa would have potential for a continued feedback (Petersson, 2018: 98-100). A suggested framework to allow for both the representation and investigation of the past, while also expanding upon merely replicating or reproducing an archaeological site as accurately as possible, involves the creation of a plot or a narrative that evokes feeling and emotive responses in the viewer (Gillings, 2005: 234-235).

The above approaches to the use of digital technologies for the recording, analysis and visualisation of archaeological material propose a critical but also innovative approach to digital tools. An understanding of how precisely digital technologies affect the archaeological process is crucial. This is required in order to take advantage of and benefit from new forms of engaging, interpreting and creating knowledge. The potential biases and power structures that digital visualisations can contain can be mitigated by studies of imagery, visualisation and virtual communication of archaeological knowledge and, as many of the above examples suggest, involves multidisciplinary and transdisciplinary approaches.

1.5.3 Multidisciplinary approaches

Maritime archaeology has long been a discipline to ask questions of itself (Flatman, 2008: 121) and in recent years attempts have been made to push discourse in the discipline along the same lines as in archaeology in general. These have ranged from discussions of how maritime archaeology is primarily gendered as male (Ransley, 2005); on how the history of salvage and the privileging of artefacts results in the neglect of archival sources (Ransley & Satchell, 2014); how theoretical discussion in maritime archaeology operates largely outside of “mainstream” archaeology (Flatman, 2003); and that broader theoretical engagement should be regarded as a more important aspect of the discipline (Gately & Benjamin, 2017).

As a reaction to the disciplinary focus on the sensational finds associated with great kings and representatives of great military strength, the material turn has influenced many areas within the humanities to study everyday objects in order to gain understanding of social life. As well as allowing for multiple perspectives and narratives of the past, this also serves as an alternative to those relating only to elite echelons and sensational finds (Eriksson, 2017: 198-199). This has influenced a number of academic researchers in the United Kingdom and Sweden to advance research on maritime archaeological sites, most notably those of shipwrecks, beyond the technological towards a richer understanding
of groups in past societies and their lives. Rather than suggesting the abandonment of traditional research focusing on shipbuilding and design of vessels, this body of work instead highlights the potential in multidisciplinary approaches to the maritime archaeological record.

It has been suggested (Ransley, 2007) that in order to allow for the inclusion of multiple pasts and alternative dialogues in maritime archaeology it is first necessary to reflect on what motivations drive policy and law associated with heritage management. The nature of heritage management in England was shown to include a number of priorities influenced by an authorised heritage discourse. By claiming that “The practice of archaeology, the doing, is still left to archaeologists and the classes of information, they types of sites and the ‘factual knowledge’ is provided by them, so that the alternative element is the interpretation and consequent desires about the treatment and management of ‘heritage sites’” (Ransley, 2007: 223), Jesse Ransley points out that the concept of alternative elements in maritime archaeology needs to move beyond disciplinary centred concerns and to instead ask new questions of the material. Further, rather than dismissing the role of heritage managers and the value of maritime archaeology interpretation, she calls for a broader understanding of heritage beyond the material remains and for maritime archaeologists to not only understand but also challenge their own assumptions relating to heritage management (Ransley, 2007).

It could be argued that the study on the building sequence of ships has become a kind of ship-archaeological paradigm, where the detailed recording of ship timbers allows for the possibility to reconstruct the building sequence itself (Eriksson, 2014: 32). To illustrate this tendency within ship archaeology research, where there is a failure to discuss and build upon broader theoretical models, Matthew Harpster’s research is a useful example. By conducting an analysis of the contents of the *International Journal of Nautical Archaeology* (IJNA) published between 1972 and 2008, it was possible to identify research trends relating to the tradition of the idiographic approach used by nautical archaeologists. This approach involves application of affiliations, such as ship names from historical records or specific nationalities, to shipwreck sites and assemblages. Harpster identified four main categories evident in the literature and while the frequency of identification methods altered from year to year, it was not possible to identify any preferences, consensus or critical dialog among the authors on methodologies. The most prevalent tradition evident employed a variation of historical or culture history archaeology, lacking any identifiable methods or dialogue relating to methodological choices (Harpster, 2013: 614).

Instead of relying on archaeological data, historical records often shaped not only the perceptions of the archaeologists by relaying information on vessel size, origin, contents and design, but in some cases shaped fieldwork methodologies (Harpster, 2013: 596). The analysis concludes that methods used were predominantly intuitive and that it confirms critique levelled at the
discipline of its idiographic nature. By following seemingly established and uncontested methodologies, much research of shipwreck sites applies modern presumptions on past societies, thereby ignoring the multicultural nature of seafaring and disenfranchising other cultures present on board by prioritising only one (Harpster, 2013: 617). In addition, this particular research illustrates the importance of engaging in discussions occurring within the broader archaeological sphere on how maritime archaeological data can be used to answer new questions (Harpster, 2013: 590).

By using the example of the Dutch ship type fluits, maritime archaeologist and researcher Niklas Eriksson’s research approached a vessel type that was so common in the 17th and early 18th centuries so as to be rendered invisible. By applying phenomenological approaches to archaeological shipwreck data his analysis was aimed at understanding how the physical structure formed everyday life onboard (Eriksson, 2013; 2014; 2015b). As it is impossible to attempt to record every detail of a shipwreck site, especially of those located underwater, the details of most importance and interest are determined by the specific research questions and aims. In addition to recording the extent of shipwreck sites and their structures, the architectural elements relating to living spaces were investigated in more detail. In discussing the choices made Eriksson states that “the structures that define space such as the location of a bulkhead, a hatch, a window or a deck level, are regarded are more relevant than the dimensions and number of nails that hold these constructions together” (Eriksson, 2014: 42).

By placing emphasis on the living spaces aboard fluits, Eriksson’s conclusions bring into question earlier interpretations that relied heavily on historical and written sources. Common arrangements of space based on documentary sources and emphasised by popular culture placed crew lodging in the forecastle and officers in the stern. Rather than a strict distinction between low or high ranks within a hierarchy, the archaeological analysis of living space revealed a picture of a small group of familiar individuals living with a space that did not significantly distinguish between ranks (Eriksson, 2014: 123). This proposed methodology is appropriate for challenging authorised heritage discourses in maritime archaeology in that it builds upon established archaeological recording methodologies by combining them with multidisciplinary perspectives and questions that challenge established assumptions.

Two dimensional black and white projection of the sites were chosen on the basis that was best suited to interpretation of the everyday life and movement aboard fluits, in particular sheer plans where one “sees” in the side of a ship on the same level, or from above, in the way house plans are laid out. Due to the difficulties in presenting levels of uncertainty with 3D visualisations, Eriksson opted for projection in two-dimensions, yet stresses the importance to think in three dimensions (Eriksson, 2014: 50-51). This rejection of 3D visualisations is
understandable in the context of maritime archaeology, where the use of multi-image photogrammetry has often been used for survey or visualisation purposes, thereby involving little site investigation. However, research on digital recording methodologies incorporated as an additional tool for recording and interpretation, rather than a replacement or the sole methodology employed, reveals the potential for enhancing reflexive methodologies, as well as democratizing access to primary data, thus enhancing interpretative discussions of the archaeological record (Taylor et al., 2018).

Whether one is referring to a hand sketch or a digital model, neither visualisation will be objective. Just as Eriksson describes how research questions decide the elements that will be illustrated in detail, so too do research aims and goals inform a digital model. Understanding digital documentation as a tool for enabling a spatial link between fieldwork and analysis, rather than simply as a storage device for archaeological data (Taylor et al., 2018), it would be possible to apply Eriksson’s methodology to digital recording of shipwreck sites. The advantage of 3D of being highly visual and allowing for accurate geometrical information over 2D recording methodologies (Taylor et al., 2018) compliments Eriksson’s need for thinking in three dimensions (2014: 51). Just as sketching involves both recording and analysing at the same time (Eriksson, 2014: 47) so too is the creation of a 3D model. Furthermore, the changing nature of publishing, from traditional linear text based hard copy to visual, such as live-streaming from Remotely Operated Vehicles and divers, not only affords access opportunities for non-archaeologists but also opens up possibilities for interactive interpretation (Flatman, 2003: 145).

By addressing research priorities to answer questions related to life onboard ships it is possible to challenge the established modern assumptions that are unquestioningly assigned to past societies (Flatman, 2003: 148). In looking ahead, British archaeologist Joe Flatman proposed a number of new theoretical approaches that could be applied to maritime archaeology. One such approach would be to use class, race and engendered perceptions of social interaction to understand the nature of ship-based societies and their impact on mainstream societies. Another suggestion, in order to challenge and demystify the technological evolution of ship forms, would be to evaluate social acts and impacts of mainstream society upon maritime cultures. In order to open up maritime archaeological research to new narratives Flatman identifies the need embrace intercontextuality, that is to acknowledge the different strands of studies that interrelate in various levels and ways to allow for further or new interpretative conclusions (Flatman, 2003: 151).

Researchers Mirja Arnshav and Anna McWilliams combined perspectives from maritime archaeology and contemporary archaeology to show how new possibilities for research of modern shipwrecks were available from non-archaeological sources (2015). Aware of the more classic research questions of maritime archaeology research concerned with vessel identity, construction
sequences, or vessel types, the authors argue that these avenues of research hold a valuable place in the discipline and have the potential to lead to additional questions relating to lived experiences of those associated with them. Their research centred on the poorly researched case studies of two Soviet submarines located in the Sea of Åland since 1942, neither of which had been previously investigated archaeologically. Rather than rely on archaeological sources alone, they studied the sites using photography and film made by divers, historical photographs, archival material, and interviews with divers and a former submarine officer (Arnshav & McWilliams, 2015: 80-81).

In addition to increasing the understanding of the technical aspects of the sites, their results provide new understandings of how those onboard the submarines lived and died, challenging assumptions previously made about submarine interiors. While difficulties were encountered in using material not originally created for archaeological purposes, their analysis concludes that film material created by divers represents a useful source of information for research, which could provide a cost effective alternative to costly fieldwork investigations and raise the quality of desk based surveys and analysis (Arnshav & McWilliams, 2015: 78). Their work also demonstrates a potential model for collaboration with groups that have a vested interest in modern wreck sites but are not typically afforded authority within the heritage sector.

Recent changes to heritage legislation in Sweden now allow for the incorporation of younger and modern sites to be afforded heritage status and protection. The analysis on the submarine sites illustrate the lack of standards by which modern wreck sites can be evaluated (Arnshav, McWilliams, 2015: 63-83), since established practices in maritime archaeology are concerned with historical and ancient vessel types and construction. As a characteristic of the authorised heritage discourse, where (Smith, 2006: 18-19) protection and conservation is concerned with sites classified as “ancient” or “antiquities”, priority in heritage management is traditionally associated with older sites, rather than those from recent history. An important conclusion from Arnshav and McWilliams’ research is how the studying of modern wrecks can greatly extend understanding and knowledge of contemporary history through challenging historical narratives, contributing to knowledge and by posing new questions (Arnshav & McWilliams, 2015: 83). Additionally, the authors state that research of this kind could also have been possible to combine with other disciplines such as battlefield archaeology or forensic archaeology in order to uncover further dimensions to the material (Arnshav & McWilliams, 2015: 79).

Relative to archaeology in general, maritime archaeology has lagged behind in its application of gender critique. While the absence of material evidence may not always allow the definite identification of different genders present at a site Flatman called for a challenging of general assumptions. Assumptions of gender developed in the 18th century continue to influence the belief that “women never went on board ships, played only a small role in influencing maritime
societies, and that once on board, all the men fitted into a set of stereotype behaviour” (Flatman, 2003: 145). Also prevalent are narratives implying the superiority of heterosexuality; the threat that homosexuality posed to the chain of command on board; general narratives relating to shipboard society, power, hierarchy, division of labour, social relationships; and minority groups identified by race, class or gender (Flatman, 2003: 146). In a similar vein Ransley has called for the queering maritime archaeology in challenging the dominant narratives of the discipline, like recognising that there are multiple ways to be male and female or that it is an erroneous assumption to envision past societies as gendered heteronormativity (Ransley, 2005: 627). This would not only allow for multiple and less restrictive interpretations of past societies and help to counter the marginalisation of maritime archaeology from the wider discipline of archaeology, but also allow for richer interpretations that resonate with and are of relevance to wider groups in society (Ransley, 2005: 622).

In discussing gender in relation to the authorised heritage discourse, Smith argues that heritage itself is gendered and while it is too often “masculine” this does not mean that gender discussions should only be concerned with women’s issues. Rather, they can provide the means to understand how differing and changing concepts of gender interact with heritage. Why gender is an important aspect of heritage is the way by which identities are formed, how heritage discourses subsequently shape the way women and men value and perceive their social roles, and understand the historical justifications for these roles (Smith, 2008: 161).

Echoing Smith’s view on heritage being gendered and too often portrayed as masculine (Smith, 2008: 159), Ransley argues that the traditional association of maritime and seafaring activities as being masculine endeavours restricts the possibility to reconstruct multiple maritime pasts from interpretations (Ransley, 2005). She views the celebrated excavated and displayed warships of Sweden’s Vasa and England’s Mary Rose as containing the magic ingredients for male fantasy: “the lost vessel, pride of the legendary king, the warship with all the power dynamics associated and the big engineering project, science and technique that beat nature” (Ransley, 2005: 625). Some shift in this view is evident, for example, the most recent exhibition at the Vasa museum, “Vasa’s Women: Always present – often invisible” that centres on the lives of four women associated with the ship and rewrites the narrative that Vasa was a male project or male cultural heritage (Vasa museum, 2017).

Naturally, maritime archaeological heritage and remains can be used to bolster positions beyond gender, like how the vessels of the Mary Rose, the Vasa and HMS Victory “have all been used in the past to project right-wing, broadly nationalistic agendas” (Flatman, 2003: 150). Nevertheless, the rich maritime archaeological record also presents the opportunity to highlight multiple experiences and interpretations of the past. An example are traditional narratives of European and global maritime history from the 16th century and
onwards where nuanced discourses of Asian sailors have been largely absent, despite their contribution of maritime knowledge, seafaring skills and labour skills on board European ships. Recent scholarship (e.g. *Journal for Maritime Research*, 2014 v.16:2) has begun to include their experiences into histories of empire, for example, demonstrating a multifaceted life on-board European vessels (Ransley, 2014). The above approaches are varied and relate to different stages of the archaeological process. Collectively, however, they represent just some of the possibilities for maritime archaeological research to relate to multiple audiences and to include diverse narratives.

### 1.6 Method

#### 1.6.1 Methodology

The methodological approach taken for the case study (Part 2) draws from approaches developed in the fields of discourse analysis and thematic analysis. The term discourse in this research is understood as “an analytical concept that acknowledges the active role of language in the production of knowledge and power through text and talk, genre and representation” (Livholts & Tamboukou, 2015: 4). Discourse analysis is used here as an inclusive term for a concept that developed from the work of Michel Foucault in the 1970s. Foucault’s theory of power/knowledge understood power as being spread across different social practices, rather than belonging to any groups or organisations. It is through power that the social world is produced. Power is also intertwined with knowledge, where both require one another. As power is responsible for both creating the social world and for the ways in which the world is talked about, it also works to rule out alternative ways of being and talking (Winther Jørgensen & Phillips, 2002: 13).

While there are various approaches to conducting discourse analysis (Winther Jørgensen & Phillips, 2002: 13), most contain a social constructivist epistemology, meaning that language is viewed as an object of enquiry and constructs the ways that people understand social reality. This involves approaching a social reality by attempting to describe how it is created, rather than defining or describing it (Silverman, 2018: 32-33).

Building on discourse analysis by striving to highlight and combat social injustice, the field of critical discourse analysis emerged with the aim of questioning the status quo and uncovering patterns of power imbalances (Hidalgo Tenorio, 2011: 187). By implementing methods for empirical investigation, critical discourse analysis investigates the relations of power, dominance and inequality and the ways that these are reproduced or resisted by people through talk or text (van Dijk, 1995: 18). Taking a constructivist approach to knowledge production assumes the central agency and power of language (Livholts & Tamboukou, 2015: 48). This means taking the position
that the social world is connected to the language that is used to describe it (Byrne, 2018: 218-221).

Viewing language as an object of enquiry and constructing the ways in which people understand social reality served as a basis for choosing to interview maritime archaeologists who work with contract archaeology in Scandinavia. Interviews are a form of communication, producing different forms of information with individuals, allowing them to talk about particular topics, often at length. The resulting data provided more than just a means to collect facts and knowledge relating to contract maritime archaeology. Rather, the methodology allowed for the identification of patterns and order that explained how the actions and attitudes of the participants were accomplished, constructed and understood (Nikander, 2008: 415). The everyday words used by participants in explaining, for example, their professional roles, their positions on digital technologies and interpretations, were considered by viewing how realities are created with words.

Studies approaching heritage discourses with, or inspired by, critical discourse analysis methodologies provided starting points for this case study (Smith, 2006; Waterton, 2009; Högberg, 2012; Taylor & Gibson, 2017). The concept of the authorised heritage discourse (Smith, 2006) provided a framework for analysing discourse relating to the use of digital technologies in the contract sector. How language was used to construct facts or taken for granted positions on these technologies were positioned in relation to knowledge production and communication of maritime archaeology. The possibility to analyse interview responses in order to query opposing positions on data recording and communication provided diverse responses that are often absent in published material on methodologies.

Thematic analysis informed the method used for the coding of the transcript material into categories and themes. Thematically analysing the content allowed for making sense of the data by reducing the volume of data and to create meaning (Rivas, 2018: 430). A broadly deductive approach was taken initially, where the research problem had informed a number of categories. These were related to the maritime contract sector, how the nature of the sector defines the roles of the individuals or research goals, digital technology with an emphasis on those that produce visualisations, and concepts of communication.

During the course of transcribing, reading and rereading the material an analytical memo was created. Throughout this process notes and time codes of phrases and broad impressions of significance were made, as well as the reasons for why they stood out. This provided a structure for a process that, at times prompted reflections that ranged over many subjects and influenced the direction of the analysis. Memo writing was also used for the ongoing refining of coding.

The coding procedure involved assigning keywords to sections of interviews that linked them to an interpretation. These included experiences, events,
opinions and words that reflected a stance on legitimate or alternative positions in heritage management practices. Sections of transcripts relating to a theme were printed on paper to allow for arranging and rearranging in relation to one another and also in relation to categories. The physical process of constant comparison was chosen over a computer screen so that all excerpts could be seen all at once. Following this, all categories and codes were arranged digitally.

The interviews carried out with participants working in the Swedish sector were conducted through Swedish. The recorded interview material was transcribed in Swedish and later translated by the author. Participants working in the contract sectors in Denmark and Norway were interviewed through English.

1.6.2 Data collection and transcribing
Initial contact was made with all participants inviting them to participate in the interviews. An introduction to the research project was given, along with information of what the process would entail, the proposed length of time, the condition of anonymity and the possibility to review transcript material prior to publishing results. Informed written consent was obtained from all participants and the interviews were recorded with their permission. Interviews with participants working in the Swedish sector were conducted face to face and those conducted with participants working in the Norwegian and Danish sectors were carried out online via video calls. The goal was to create a relaxed atmosphere and for the process to feel like a conversation. Generally, this was achieved even with participants that were previously unknown to the author. At the beginning of each interview an introduction to the research topic was given and participants were given the opportunity to ask questions regarding it.

An effort was made to employ a representative sample of practitioners working with contract maritime archaeology in Scandinavia. Factors taken into consideration were the genders of the participants and their experiences with using digital technologies in their work. The institutions where the participants were employed was also considered. Six participants working in the contract sector in Sweden were interviewed. At the time that the data was gathered (2017) they were employed at two institutions active in contract maritime archaeology. The individuals were all known to the author in a professional capacity.

Sampling of participants working in the Norwegian and Danish sectors also considered their place of employment. Perspectives from institutions that were located in or responsible for areas with both high and lower levels of development activity were also sought. A number of participants were known to the author in a professional capacity. For two institutions, one in Denmark and one in Norway, the author requested recommendations of colleagues to interview. A total of four participants were interviewed from the Danish sector and five from the Norwegian, from a total of four institutions responsible for
contract maritime archaeology projects. It was not possible to obtain exact figures of all maritime archaeologists employed in the Scandinavian sector. From the available data a general picture of employment divided among females and males employed the Scandinavian contract maritime archaeology sector can be made. Seen in table 1 there are more males employed than females. This trend is also reflected in the case study (part 2) where three out of the total fifteen participants were female.

Figures obtained for archaeologists employed in the three countries are also presented in table 1 with respect to the gender of those employed. Swedish figures from the Swedish Occupational Register (Sw. Statistiska centralbyrån) for 2016 show that of those employed within the area of archaeology, 55% identified as female and 45% as male (SCB, 2016: 19).

Table 1. Figures relating to employment within maritime archaeology and archaeology in Scandinavia grouped according to gender.

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sweden</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maritime archaeology</td>
<td>22%</td>
<td>78%</td>
</tr>
<tr>
<td>Archaeology</td>
<td>55%</td>
<td>45%</td>
</tr>
<tr>
<td><strong>Norway</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maritime archaeology</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>Archaeology</td>
<td>63%</td>
<td>37%</td>
</tr>
<tr>
<td><strong>Denmark</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maritime archaeology</td>
<td>8%</td>
<td>92%</td>
</tr>
<tr>
<td>Archaeology</td>
<td>54.25</td>
<td>45.76%</td>
</tr>
</tbody>
</table>

The most recent figures available relating to employment in Norway are from 2010 (SSB, 2010). Employment figures for archaeologists are counted in the same category as historians and philosophers and so it is not clear how many of these were employed within archaeology. Of the people employed within these areas 63% identified as female and 37% as male (SCB, 2016: 19).

Figures relating to employment of archaeologists in Denmark were obtained from a study report on archaeologists working in the country that ran from 2012 to 2014. At the time of the data collection (Feb 2014) there were a total of 453 individuals working within archaeology, 54.25% who identified as female and 45.76% as male. The report authors suggest that the trend is more pronounced
for the entire country since one of the museums that was part of the study had a higher proportion of men employed than the general picture (DISCO, 2014: 7-59).

The fifteen interviews ranged in length from 45 to 100 minutes and interviews were transcribed, almost in their entirety. Certain sections of interview dialogue were not transcribed verbatim if the discussion deviated from the discussion topic, however, a summarising transcription was made along with notes if the passages were later deemed necessary to return to. Throughout the interviews, brief memos were kept of comments that reflected elements an authoritative discourse, of topics or projects relating to communication, audiences, technologies, or the contract sector. The coding process involved elements of both discourse analysis and thematic analysis, concerning both attitudes and factual information.

A more detailed process of memo writing occurred during the transcription process, where there was the opportunity to pause or playback sections in order to elaborate on thoughts, reflections on literature contrast with perspectives of other participants. A refining of codes was undertaken during the re-reading of transcripts, where excerpts were chosen to illustrate their connection to codes. These coded excerpts were printed out, separated and related to one another in accordance with connecting themes that had emerged during the analysis and also related to the research questions. This resulted in the three main and subsequent nine subthemes.

Excerpts presented in part 2 include the interview participant (IP) reference code followed by the time stamp referring to when they spoke. For example: IP03 (34:15) “… response to question”.

1.6.3 Ethical considerations
From the outset the decision was made to anonymise interview participants (table 2). This was due to the community of professional maritime archaeologists in Scandinavia being relatively small, where most are known to one another. The author’s role as a researcher, rather than a colleague, was made clear in the initial contact.

All text data resulting from the interview analysis was pseudonymized. Following analysis all material pertaining to each participant was allocated a new reference code. No personal data was collected and markers relating to the identities of the participants were removed from text data. No additional copies of the files were made and are secured in a password protected device. The interview sound recordings have not been edited to remove personal information, this was in order to preserve time codes. File names were pseudonymized and any additional back-up recordings were deleted. All sound files are stored and are secured in a password protected device separate to text data. The key which identifies the participants to the interview material is
digitally stored separate from all interview data. Anonymised versions of transcriptions can be obtained upon request.

Table 2. Interview and participant data.

<table>
<thead>
<tr>
<th>Reference code</th>
<th>Country of employment</th>
<th>Participant gender</th>
<th>Interview date</th>
<th>Interview duration</th>
<th>Interview location</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP01</td>
<td>Sweden</td>
<td>Female</td>
<td>2016/10/20</td>
<td>1:02:30</td>
<td>Office</td>
</tr>
<tr>
<td>IP02</td>
<td>Sweden</td>
<td>Male</td>
<td>2017/03/01</td>
<td>56:45</td>
<td>Office</td>
</tr>
<tr>
<td>IP03</td>
<td>Sweden</td>
<td>Male</td>
<td>2017/03/03</td>
<td>1:03:15</td>
<td>Office</td>
</tr>
<tr>
<td>IP04</td>
<td>Sweden</td>
<td>Male</td>
<td>2017/03/02</td>
<td>1:00:49</td>
<td>Office</td>
</tr>
<tr>
<td>IP05</td>
<td>Sweden</td>
<td>Male</td>
<td>2017/03/02</td>
<td>51:01</td>
<td>Office</td>
</tr>
<tr>
<td>IP06</td>
<td>Sweden</td>
<td>Male</td>
<td>2017/04/18</td>
<td>1:44:56</td>
<td>Online</td>
</tr>
<tr>
<td>IP07</td>
<td>Denmark</td>
<td>Male</td>
<td>2017/03/09</td>
<td>1:14:43</td>
<td>Online</td>
</tr>
<tr>
<td>IP08</td>
<td>Denmark</td>
<td>Male</td>
<td>2017/03/09</td>
<td>45:07</td>
<td>Online</td>
</tr>
<tr>
<td>IP09</td>
<td>Denmark</td>
<td>Male</td>
<td>2017/03/21</td>
<td>1:03:58</td>
<td>Online</td>
</tr>
<tr>
<td>IP10</td>
<td>Denmark</td>
<td>Female</td>
<td>2017/03/23</td>
<td>57:52</td>
<td>Online</td>
</tr>
<tr>
<td>IP11</td>
<td>Norway</td>
<td>Male</td>
<td>2017/03/30</td>
<td>1:09:17</td>
<td>Online</td>
</tr>
<tr>
<td>IP12</td>
<td>Norway</td>
<td>Male</td>
<td>2017/04/19</td>
<td>54:28</td>
<td>Online</td>
</tr>
<tr>
<td>IP13</td>
<td>Norway</td>
<td>Male</td>
<td>2017/04/19</td>
<td>1:15:48</td>
<td>Online</td>
</tr>
<tr>
<td>IP14</td>
<td>Norway</td>
<td>Female</td>
<td>2017/04/26</td>
<td>1:07:37</td>
<td>Online</td>
</tr>
<tr>
<td>IP15</td>
<td>Norway</td>
<td>Male</td>
<td>2017/04/28</td>
<td>1:23:13</td>
<td>Online</td>
</tr>
</tbody>
</table>

1.6.4 Interview questions

All questions (table 3) posed to the participants were the same open questions and these were shown to the participants as soon as the interview began. Open questions, such as asking participants how they came to work with maritime archaeology, were chosen as they offered participants the opportunity to formulate answers using their own words. In this way they were not inclined to
reply in a way that the interviewer wished them to (Seale, 2018: 201). The category and coding scheme employed in the analysis is presented in table 4.

Table 3. Interview questions and accompanying text.

<table>
<thead>
<tr>
<th>Number</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Can you tell me about your career path leading to your current job?</td>
</tr>
<tr>
<td>2.</td>
<td>How do you describe your job to others, for example what job title do you use?</td>
</tr>
<tr>
<td>3.</td>
<td>What digital methodologies do you use in the field, and why? How do you consider/account for Long term archiving; Use/re-use of the data; Target groups for the data</td>
</tr>
<tr>
<td>4.</td>
<td>Please rank the following factors/aspects of project design in order of your priority, and explain why: documentation, longevity of data, creation of new knowledge, dissemination of knowledge, equipment, safety, efficiency, developing methodologies &amp; technology.</td>
</tr>
<tr>
<td>5.</td>
<td>Do you see public outreach as part of your job description/responsibility? If yes, who are the target groups? If no, why not?</td>
</tr>
<tr>
<td>6.</td>
<td>English language interviews: Here is a brief description of the Faro convention, please read. What does this mean related to your work?</td>
</tr>
<tr>
<td>6.</td>
<td>Swedish language interviews: Here is a reference to contract archaeology from the latest version of the Heritage Policy (Kulturarvspolitik) as well as a summary of the National Goals for Cultural Heritage Work (Nationella mål för kulturmiljöarbetet), please read. What does they mean, in relation to your work?</td>
</tr>
<tr>
<td>7.</td>
<td>Without any budget, time or any other limits, what kind of digital tools would you incorporate into a project in order to achieve “societal relevance”?</td>
</tr>
</tbody>
</table>

Text accompanying question 6 for participants working in Sweden (translated from Swedish here)

*Cultural Heritage Policy 2016: 115*

"The government's assessment is that it is crucial to be able to agree on the perspective of the role of contract archaeology for scientific advances. Responsible authorities and other actors should therefore take a clear
The core of the interviews consisted of seven questions, accompanied with excerpts of texts that participants were asked to read and reflect upon. Additional questions were often added for clarification. The design of the interview questions made for an informal and open conversation between colleagues, which was particularly useful when interviewing participants whom the author had not met or spoken to before.

Question 1 asked participants how they first became interested in maritime archaeology and how this interest led to their current employment. This served
to put participants at ease by opening with an informal subject that set the conversational tone for the subsequent interview. The information supplied by the participants also served to inform the study of the various means by which people come to work with maritime archaeology and the particular aspects of the subject that inspire individuals to pursue a career in the discipline.

Question 2 asked participants how they described their job to others, and in particular what job title they used. This question was in relation to the many terms and definitions used in describing and understanding the work involved with maritime archaeology. This question was also asked in an effort to understand whether the professional identities of individuals held any influence on their professional priorities or interests.

Question 3 asked participants to list the various digital methodologies they used in their line of work. They were then asked how they accounted for three elements relating to digital technologies: long term archiving, the use or re-use of the digital data created, and the intended target groups for the data that was created. The goal of the question was to first get an understanding of the various methodologies currently in use by institutions and secondly to understand how they are being used. The three elements that the participants were asked to elaborate on are of concern to both digital archaeology and the heritage management sector.

Question 4 was related to the priorities of the maritime archaeologists in the course of planning a contract maritime archaeology project. Eight factors or aspects of projects were presented and participants were asked to first rank the factors in order of priority, if possible, and to then explain their choices. The aim of this question was to understand whether any individual, institutional or regional similarities or differences were identifiable in the planning process of projects within the contract sector.

Question 5 asked participants whether they understood public outreach as a part of their job description or an area of their responsibilities. In the event of answering yes they were then asked to describe the target groups they understood for outreach, and in the event of responding no they were asked to explain why.

Question 6 asked the interview participants to read a section of text and to reflect on whether they found the subject matter or meaning to be of relevance to their work as contract maritime archaeologists. Participants working in Sweden were asked to read an excerpt from the Cultural Heritage Policy (Sw. Kulturarvspolitik) (Prop. 2016/17:116: 155, Kulturarvspolitik, 2016) relating to contract archaeology and the role that the government envisioned concerning scientific progress and knowledge production, for which there is a pressing need in society. They were also asked to read the goals for cultural heritage work in Sweden (Nya nationella mål för kulturmiljöarbetet, 2015: 2). Participants working in Denmark and Norway were asked to read a summary of the Faro convention (Faro Convention, 2005; Council of Europe, 2005) that emphasises
the role of cultural heritage in people’s lives and citizen’s roles in the management of cultural heritage. This question was asked in order to understand whether or not the participants felt the policies that direct their work were in line with their day-to-day experiences and work.

Question 7 asked interview participants to imagine a project without budgetary or time constraints that they would be interested in, and then asked to suggest potential digital documentation solutions that could in some way achieve the goals of the previous texts, or as it was stated in the question “societal relevance”. This question was formulated to allow participants to elaborate on their opinions without the restrictions that are normally associated with archaeological projects, and considering the high costs associated with certain emerging technologies. The focus was on the potential of the techniques rather than explaining how they would practically include technologies into projects for the benefit of wider audiences. Also of interest was learning of proposed subject matter and vision for digital visualisations, where as examples that participants had already conducted had been detailed in earlier questions.

Table 4. The coding and thematic scheme of the data analysis.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract sector</td>
<td>System</td>
<td>Benefits/disadvantages, regional/institutional differences, concepts of communication</td>
</tr>
<tr>
<td></td>
<td>Education / training</td>
<td>Background, how individuals came to work with maritime archaeology</td>
</tr>
<tr>
<td></td>
<td>Identity</td>
<td>How individuals identify professionally</td>
</tr>
<tr>
<td></td>
<td>Passion / interest</td>
<td>The source of interest in maritime archaeology</td>
</tr>
<tr>
<td></td>
<td>Positive / discouraged</td>
<td>Outlook and attitudes on discipline</td>
</tr>
<tr>
<td></td>
<td>Professional interests / private interests</td>
<td>Archaeology, diving, other</td>
</tr>
<tr>
<td>Digital technology</td>
<td>Digital potential</td>
<td>For the sector and society</td>
</tr>
<tr>
<td></td>
<td>Education / training</td>
<td>Specific to digital methods</td>
</tr>
<tr>
<td>Reflexivity</td>
<td>Interpretative role of digital technologies</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Interest / indifference</td>
<td>Toward adoption of new technologies</td>
<td></td>
</tr>
<tr>
<td>Benefits / barriers</td>
<td>Of technology’s use in knowledge production and/or the sector</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access</td>
<td>As a goal of communication</td>
<td></td>
</tr>
<tr>
<td>Audience</td>
<td>Audiences &amp; groups</td>
<td></td>
</tr>
<tr>
<td>Professional responsibility / personal interest</td>
<td>Part of their job or taken up themselves</td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>Topics considered important / relevant</td>
<td></td>
</tr>
<tr>
<td>Relevance</td>
<td>How communication efforts were valued</td>
<td></td>
</tr>
</tbody>
</table>
Part 2

2.1 Case study

This part presents the case study of contract maritime archaeology operations in Sweden, Denmark and Norway. It will first provide a brief background of the sector in each of the countries. Following this the results of the discourse and thematic analysis are presented in order of the main themes and associated sub-themes identified. The results and analysis of the interview material within each subtheme are then followed by a discussion.

The contract archaeology sectors included in this study operate according to slightly different models. The sectors of Denmark and Norway are not competitive, based on the premise that this model would not result in increasing scientific quality. Instead, contract archaeology is conducted by research institutions and an emphasis is placed on the importance of maintaining a link between contract archaeology and research (Andersson, Lagerlöf & Skyllberg, 2010: 14-15). However, a distinction is made between the responsibility of the developer, to pay for the removal and securing of source material, and that of the research institutes which is to provide society with the results of knowledge production (Glørstad, 2010: 29-30).

In Sweden today there are a number of individuals with specialist education in and experience of maritime archaeology. Despite this, there are a limited number of actors actively involved in the contract maritime archaeology sector; one private company and two companies associated with museums. The limited number of trained individuals and active companies in the sector has been recognised by the National Heritage Board, with recommendations that the County Administrative Boards should consult with specialists in the event of maritime projects arising (von Arbin & Bergstrand, 2014: 12).

In both Denmark and Norway responsibility for contract maritime archaeology is divided on the basis of geographical regions. In Denmark, overall responsibility lies with the Danish Agency for Culture and Palaces (Da.
Slots- og Kulturstyrelsen). Five regional museums are allocated responsibility for cultural heritage located underwater, and each museum has at least one maritime archaeologist employed (Slots- og Kulturstyrelsen, 2017a). An evaluation of maritime archaeology activities in Denmark (Slots- og Kulturstyrelsen, 2017b), while largely concerned with the need for developing maritime archaeology of guidelines, also recommended the periodic evaluation of maritime archaeology cases with links to society at large.

Cultural heritage management in Norway is divided among three types of institutions. Surveys and assessments of areas of development are under the responsibility of county administration. The evaluation of the scientific value of monuments impacted by development is carried out by university museums. This also includes project planning and budgetary responsibilities. Decisions of development plans are made by the Norwegian Directorate of Cultural Heritage (No. Riksantikvaren), evaluating the reliability of museum suggestions (Glørstad, 2016: 86).

2.2 Sector

2.2.1 Identity

This theme encapsulates the professional identities of the individuals in their positions as contract maritime archaeologists. The interview excerpts and answers are largely in response to Question 2 (table 3) where individuals were asked how they identified professionally and what job title they used when presenting their work to others.

Many participants stated that the job titles or job descriptions they used were largely dependent on the audience that was being addressed. Two individuals framed their work within the contract setting, where IP02 stated he was a contract archaeologist for both maritime and land cases, and IP12 described his role as being part researcher and part contract archaeologist.

There were four individuals who identified primarily as archaeologists, three who stated the title archaeologist (IP07, IP14, IP09), and one (IP01) adding additional information, such as her diving qualifications if they were relevant to the situation or the audience in question.

The nine remaining respondents identified as being maritime archaeologists. However, in the case of participants working in Sweden they responded with the term marinarkolog, the Swedish term for marine archaeologist, while many of them acknowledged they would use the term maritime archaeologists if speaking in English. Participants who responded with the marinarkolog term were aware of previous debates on the subject (see Rönby, 2014: 23 for an overview) and were aware that it did not reflect the maritime nature of their work. For some (IP03) it was an easier term to use in speaking (with fewer syllables), and also easier for understanding since it was an established term in
Sweden that had spread to other Scandinavian countries, and thereby was less likely to cause confusion. IP04 used the term *marinarkeolog* but lamented how it often becomes confused with the term for marine biologist, and so in cases where confusion might occur he opted to describe his job as a diving archaeologist. If speaking publicly or to media he used the term *marinarkeolog* but pointed out that his official job title was in fact museum curator. IP06 also reflected on how the term *marinarkeolog* is not always understood by people, but also concluded that it was easier to pronounce in Swedish than saying *maritimarkeolog*.

Participants working in Denmark and Norway also offered their opinions on the Swedish use of the term *marinarkeolog*. IP10 suggested that the more accurate term *maritimarkeolog* had a pretentious element to it, and conceded that while the term *marinarkeolog* reflected associations with the Navy marines, that it was such an established term explained its prevalence today. IP11 also suggested the connection with the military as explaining its use in Sweden:

> Yeah, in Sweden there's a tradition that all of the marinarkeologs, they come from the military. So, they don't care that much about the archaeology, they just care about shipwrecks and not other parts of the landscape, which from what I understand has only come with Christer Westerdahl and people like him that are more theoretical (IP11, 14:37).

Participants working in Norway and Denmark who identified as maritime archaeologists tended to use the term in both English and the respective Scandinavian languages. IP11 used the Norwegian title *maritimarkeolog* as it was a more accurate description of the archaeological work that he did, despite the urging of the museum institution where he worked to use the term *marinarkeolog*. IP15 preferred to use the term maritime archaeologist but also used the term underwater archaeologist with audiences unaware of the former. IP13 used the term maritime archaeologist but also stated:

> Well, honestly, I say that sometimes it's really difficult to call it a job because it's very close to being a dream job. We have quite a lot of freedom in the way we plan things, and how we organise things. So, sometimes it's really difficult to think of going sailing with the motorboat, diving, doing archaeology, getting all this new equipment [as simply a job], it's very very close to being a dream job ... I am a maritime archaeologist. In Norwegian, *maritimarkeolog* (IP13, 19:48).
Diving was also a defining characteristic of the work that IP10 did, by highlighting how her job was different to that of archaeologists excavating on land:

Yeah, I’m diving so we do what archaeologists do on land so we just go underwater and do excavations and yeah, it’s a lot easier because you can “fly” over the pit [laughing], you don’t have to sit on your knees and dig, you can just hover over it, it’s really cool (IP10, 05:12).

Finally, IP15’s reflection on how his job is sometime difficult to describe is perceived as a lack of general knowledge relating to maritime archaeology:

Yeah, there’s [sic] still big problems with understanding, because archaeology is well established and everybody knows what an archaeologist is, but maritime archaeology is still like a weird breed of archaeology not everybody understands (IP15, 18:12).

Discussion

The responses to Question 2 provided a means to understand how individuals communicated their profession to various audiences. The answers to this question also provided an explanation for the use of the term marinarkeolog (marine archaeologist) by Swedish colleagues in the Swedish language but the term maritime archaeologist in English, a phenomena long discussed in Swedish maritime archaeology (Rönnby, 2014: 22-23). The responses, however, provided much more insight into language use alone, they also revealed aspects of professional identity, specifically within the contract archaeological sector.

The responses to Question 2 contained combinations of the titles of archaeologist, marine or maritime archaeologist and contract archaeologist. The variety of titles used by the individuals raised a number of questions, such as what does it mean to identify as an archaeologist, a contract archaeologist or a maritime contract archaeologist? Further, was the act of connecting or distancing one's identity to the contract sector connected to the individuals’ opinions on the sector itself?

That only two participants employed in the contract sector referred to being contract archaeologists is of significance. An emphasis on maritime or diving aspects, rather than the contract sector, may be explained by the interests of the individuals, rather than any aversion to or denial of the contract sector. Many participants alluded to the maritime elements such as working on boats, diving and the underwater archaeological process as enjoyable and as activities that they pursue non-professionally, which may explain this focus in their job descriptions. Furthermore, the specialist training and education required for the
position may be a contributing factor in the tendency to identify as a maritime specialist or expert, separate to other contract archaeologists in the sector.

The choice to use the term maritime archaeologist was in large part due to it being an accurate description of the archaeological material that the participants engaged with in their work. In some cases the title was not stated in their employment contracts and in one instance went against the wishes of the institution where they were employed. Often, elaborations or explanations were required to explain the precise nature of their work, suggesting a general lack of awareness of the profession or the sector in which they work.

Of the individuals who identifying as archaeologists, this may be related to their education and experience of working on terrestrial archaeological projects rather than their current employment status. While some participants who identified as maritime archaeologists also had work experience on terrestrial sites, the four who used the term archaeologist all had educational foundations in terrestrial archaeology and gained extensive experience excavating on terrestrial projects prior to specialising in maritime archaeology. For these individuals, all archaeology is archaeology and diving merely a tool to access sites submerged underwater.

The perception of maritime archaeology by audiences outside the sector is related to how outreach or communication of maritime archaeological results are received, and by whom. The example given above of the Swedish tradition of maritime archaeology associated with the military has been discussed and acknowledged in relation to Scandinavian maritime archaeology (Cederlund, 1997) but is explained as being due to the experiences of early pioneers rather than an ingrained element of the discipline’s aims. Further, the suggestion that maritime archaeology was not generally understood by people raises a problematic situation for communicating archaeological results from a discipline that is obscure or unknown.

The lack of uniformity and shared perception of the profession by the interview participants themselves could be explained by the lack of collaboration between institutions, a consequence of the competitive sector in Sweden and the allotted regions of responsibility in Norway and Denmark. A recommendation was made for more cooperation between the five Danish museums responsible for maritime archaeology and to establish a network to allow more discussion of administrative and practical issues (Kulturstyrelsen, 2013: 19). Annual meetings occur in Norway (No. Marinarmeologisk samarbeidsmøte) between the five museums responsible for maritime archaeology and the Swedish annual maritime archaeology advisory meeting (Sw. Marinarmeologiska rådet) invite all involved with contract or research maritime archaeology to discuss policy, exchange information and network (von Arbin, 2004b). Despite these exchanges, the opinions of the participants reveal an array of identities and by extension, diverse professional expressions when presenting the sector to various audiences.
2.2.2 Interest

This theme builds on the previous theme of identity but captures the passion that inspired the initial interest of the interview participants in the subject and subsequent participation in the contract maritime archaeology sector. The interview excerpts and answers are largely in response to Question 2 (table 3).

As well as the professional identities of individuals just discussed, another part of the interview was designed to investigate their education and work experience backgrounds. This was partly to understand if certain backgrounds influenced current views of the contract system, but was also to understand what drove these individuals to pursue a career that has much fewer employment opportunities than terrestrial contract archaeology and that has a lower ratio of females employed.

While obvious and expected factors were mentioned, such as education, work experience, lucky breaks, what became especially pronounced was an interest and passion in many aspects of maritime archaeology, such as diving, historical shipwrecks or the lifestyle of working at sea. While each individual’s background is unique it was possible to identify four different paths by which individuals came to work as maritime archaeologists today:

**Individuals who were active hobby divers or experienced professional divers, had an interest in history and studied archaeology in order to combine diving with their careers.** IP03, IP04, IP05, IP06, IP10.

These individuals were active SCUBA or qualified professional divers, had an interest in the ocean as well as history and decided to combine these interests in their careers. For example, IP04 and IP05 were both experienced divers, interested in shipwrecks and history, and were through encouragement and connections with maritime archaeologists in academic and professional circles, encouraged to study archaeology, leading to their current positions as contract maritime archaeologists.

Likewise, IP10 was an experienced diver and who through the course of her commercial diving education was introduced to the field of maritime archaeology by an instructor who had partaken in an excavation during the 1970’s as a volunteer. She subsequently visited an exhibition of the excavation and was inspired to pursue a career in maritime archaeology. Both IP03 and IP06 pursued careers in maritime archaeology due to their experiences as hobby and military divers respectively. To continue diving within a professional capacity was an important aspect when pursuing their careers, and because both also had an interest in history, with IP03 actively involved with the Swedish maritime archaeology society (MAS, 2015), they both reflected that maritime archaeology fulfilled these interests.
While all of these individuals may not have had maritime archaeology in mind initially, their combined interests of history and diving gradually led them to pursue their current careers. Another common denominator with the individuals in this group was how they all identified professionally as maritime archaeologists, or *marinarkeolog* in the case of participants working in Sweden.

**Individuals who studied archaeology and later combined their interest in the underwater world with the subject.** IP01, IP11, IP12.

This grouping of career paths includes individuals who were divers prior to studying archaeology and who later combined this interest to pursue maritime archaeology. While this distinction may not seem so different from the first group, what differentiates them is that they pursued archaeological studies based on an interest in learning about the past, with maritime and diving elements as afterthoughts rather than a career goal in themselves. It was during their studies in archaeology that the possibility of combining their previous dive training and interest in archaeology arose for both IP01 and IP11, whereas IP12 had as a teenager taken some introductory courses in maritime archaeology that influenced his decision to study archaeology.

Emphasizing the importance of gaining a solid basis in archaeology IP01 explained how her introduction to maritime archaeology in an academic setting influenced how she perceives the discipline today:

> My decision to study archaeology and to start at a university without a specialisation in that [maritime] field is understandable if you believe that maritime archaeology is only a technique or a method to get information out of the water and in general you are interested in archaeology, what has happened in former times, and it’s not a question of to do cool dives but to get the information out of the water. So, maybe that was also the attitude in that first [maritime] project I did, so maybe I learnt that from the beginning onward, that it’s totally important to put land archaeology and underwater archaeology together and to see it as one thing and not to separate them (IP01, 03:55).

**Individuals were archaeologists who later became interested in maritime subjects and took up diving as a way to access archaeology underwater** - IP07, IP09, IP14.

This group of individuals began their studies in archaeology and gradually found their way into working with maritime specialities. The reason this group are differentiated from group 2 is that they did not describe any affinity with the sea or how it was an interest of theirs from a young age.
IP07 was educated as a terrestrial archaeologist and worked on numerous terrestrial excavations before studying maritime archaeology at a graduate level. Similarly, IP09 studied archaeology with a strong maritime orientation while his excavation experiences during his studies were more focused on land. It was following his studies and a number of years working experience that he gained his commercial diving certification.

IP14 studied archaeology and took up diving as a way to be more employable since there were many qualified and experienced archaeologists looking for work while she was a student. Her interests then focused on maritime aspects and she specialised in it for her master’s studies. Following this she worked for a number of years on land excavations before working specifically with maritime archaeology.

Despite the maritime work that these individuals are currently involved with, they identify professionally as archaeologists. They described maritime aspects of archaeology as being an area in which they specialise rather than being a strong identity marker. While a number of other participants initially studied general archaeological degrees and others worked on terrestrial excavations, these two elements combined appear to be what influenced their professional identities and interests in the contract archaeological sector.

**Individuals who had a keen interest in maritime related subjects and who pursued maritime archaeology studies and diving education with the implicit goal of working with maritime archaeology - IP08, IP13, IP15.**

This group includes individuals who from early on decided to pursue a career in maritime archaeology, or related fields. This is most likely the kind of path to be followed by future maritime archaeologists due to the increased awareness among undergraduates of maritime archaeology as a speciality and also due to the increasing number of maritime archaeology masters courses available today. Two of the individuals studied for their undergraduate degrees in countries outside of Scandinavia which meant that different diving legislation meant that recreational diving certifications were sufficient for fieldwork. This enabled them to gain experience early on during their studies to conduct maritime archaeological fieldwork underwater. It should also be noted that all three individuals graduated from the same masters’ programme, and while this education may have shaped their subsequent views on the sector, their addition to this grouping is based on their career paths as a whole. The common interests of the individuals in this group is reflected in all three identifying as maritime archaeologists (section 2.2.1).

IP08 studied history for his undergraduate with the intention of continuing his education with a master’s degree in maritime archaeology. During IP13’s undergraduate studies in archaeology he also explored the possibility of pursuing maritime archaeology as a career. Having already had an interest in the subject he gained a recreational scuba diving licence. This enabled him to
participate in a field school that involved some underwater survey that encouraged him to specialise in maritime archaeology.

Similarly, IP15 received his BA education outside of the Scandinavia. In contrast to the first group, diving is seen as a method used to access maritime archaeology sites rather than an interest:

_I see it [diving] as work and not as pleasure. I know loads of people actually who are into maritime archaeology because of the diving, but I have a different approach to this life. I mean I like to stay on top of the sea a lot, on boats and stuff and maritime archaeology is nice and stuff but it’s like an environment I don’t belong to so that’s why. But I enjoy it anyway_ (IP15, 12:56).

**Discussion**

The interview participants were invited to elaborate on their answers to the previous section (2.2.1) to ensure that they were not simply responding with their official job titles, and in some cases it was commented on that while they may describe themselves as a maritime archaeologist, that their contracts stated general titles such as “curator” or “archaeologist”. The various interests that led the individuals to pursue careers in maritime archaeology, such as diving, maritime and nautical studies, mentors and employability, reflects a healthy diversity in opinions, experiences and specialities within the sector.

Those who had diving as a hobby or profession prior to studying archaeology tended to identify more as maritime archaeologists and saw a distinct separation between what they do to what colleagues on land do. Similarly, individuals who began their studies with the intention of working primarily with maritime archaeology shaped their careers to pursue paths different to terrestrial colleagues. The interest that these individuals shared in both maritime archaeology and diving could describe their positions more as callings than mere professions. The requirements for working in the Scandinavian contract maritime archaeology sector include professional diving qualifications as well as academic requirements. The emphasis on professional diving certifications differs among European countries, where in some instances professional diving certifications for scientific divers are awarded by authorised commercial diving schools or the military. To be eligible for employment often requires a considerable financial investment in commercial diving education, often paid for by individuals themselves, as well as experience of archaeological fieldwork underwater. Therefore, an interest and experience in diving is not only positive but also a considerable advantage in seeking employment.

One way in which many individuals explained how they got their first opportunities of working with maritime archaeology was through other established maritime archaeologists. These included mentors who familiarised
them in procedures (IP01) or senior academics who also had an interest in the topic (IP09, IP13), participants who were given opportunities to work on paid projects prior to graduation (IP02, IP03), or those who were afforded inroads into the discipline through contacts they had made (IP04, IP05, IP13). These examples are not particular to archaeology, and are even to be expected in smaller field such as maritime archaeology.

Many other specialist areas within archaeology require additional education, such as osteology or those that focus on specific time periods, yet collectively the professions are considered under the umbrella term of archaeology. The connection between maritime archaeology emerges as an identifying marker not only to describe the physical work that is done underwater, but as a means for the individuals to identify as working with something beyond archaeology.

2.2.3 Priorities
This theme assembles the various priorities that dictate the way in which participants plan and carry out maritime archaeology projects in contract settings.

The following results reveal how aspects of the system and structure of contract archaeology influence the priorities of the interview participants. Many of the excerpts and reflections are from responses to Question 4, where the participants were asked to rank in order of priorities a certain number of factors relating to contract maritime archaeology projects (table 3). The questions relating to prioritising were posed in order to learn how the individual interview participants understood the contract maritime archaeology system operated. Furthermore, the responses to the interview questions were analysed to investigate if and how the contract system of archaeology influenced the use of digital technologies or how digital data was produced.

IP08’s response to Question 4 is presented in its entirety as an example of how participants typically responded to being asked to both list factors in order of priority and to give an explanation for each:

I would have to put safety first, which I hope is a given. Second, I put documentation as our main priority, if we can't document whatever we have done or seen it doesn't matter. Then I've been cheeky and put efficiency/equipment because they are inherently intertwined. Then I have put the creation of new knowledge, which after all is the idea. Following that dissemination of knowledge, in a wider sense, I suppose because the documentation aspect and the creation aspect itself will necessarily mean some sort of dissemination, if
only at the legal minimum. So I've taken it at the broader sense and therefore put it further down the list.

And ultimately developing new methodologies and technology because we work mainly in a contractor financed sphere that we rarely have the luxury of going out on a tangent and seeing whether this works.

And finally, I'm afraid, longevity of data (IP08, 18:30 file 1).

As in the case of IP08, the factor that was identified as overwhelmingly important by individuals working in all regions was that of safety. This was seen as obvious in the context of a diving project, but also as an ingrained part of the legal framework defining the contract system. IP01 said that while safety was also important when working as an archaeologist on land, that the risks of fatalities was much greater with underwater operations, resulting in its high priority. A total of nine participants ranked it as the most important factor within a contract maritime archaeology project, with some suggesting that it should be regarded as an established fact.

Following safety, the overriding factor that influenced the ranking order of priorities was that of efficiency. One of the participants who ranked equipment as the number one priority (IP05) explained that determining the appropriate equipment to use for a certain archaeological project was his first consideration:

*Ah, equipment, first and foremost. What equipment do we need, is it enough with diving or should we have an ROV [Remotely Operated Vehicle], or, uhm, you know. I think that this is like a fundamental given, like how will we motivate it [the diving], who goes into the water* (IP05, 04:35).

While IP05 followed his ranking with safety and documentation, of interest is that in planning a project the process begins not with the consideration of the research questions posed, but rather equipment. As will be discussed in more detail in section 3.3.2, the possibilities for testing a number of methodologies or taking longer time than planned in the field are stated by many participants as not feasible within contract projects. In this sense the emphasis placed on efficiency dictates the priorities of the archaeological projects, placing emphasis on completing projects within a specific time and budgetary framework, rather than archaeological enquiry.

Operating within a competitive sector therefore requires strategies for ensuring efficiency. Decisions on methodologies and project goals are for some individuals seen as being decided by departments as a whole and also based on what the Swedish County Administrative Board dictate, rather than being driven by research questions or goals specific to individual projects:
we work in accordance to a sort of template in the department, one that we have all agreed to follow, we use these instruments and those methods that, like, are decided upon or that are accepted, but - I don’t know - what one could consider a little is the reuse, in particular regarding outreach. And it is the letter of enquiry from the County Administrative Board that serves as a guideline for that (IP03, 10:00).

IP04 reflected that the County Administrative Board would not approve a budget that allows for the detailed positioning and documentation of a wreck site by traditional means when a photo-mosaic could offer a more general visualisation of a site. In this sense the methodologies used are driven by the need to deliver results in the least amount of time possible, rather than by any research or archaeological priorities.

For some participants efficiency was singled out as a restrictive element of their project planning process:

And then there's efficiency, sadly to say, when we make the budgets we need to send them into to the Riksantikvaren [Norwegian Directorate of Cultural Heritage] for their approval and they always cut, and say that we have to do things faster, so we know that we have to think about this from the beginning, so we have to do it fast (IP14, 30:07).

Yet, efficiency was viewed by others as a positive outcome of their work, as opposed to profit-making. Having had experience and knowledge of both contract archaeology systems of Norway and Sweden IP11 explained:

Norway is a fantastic country to be an archaeologist in because the one thing that is so good is the part that it's not [about] companies trying to make a profit, I guess they're not allowed to make a profit but come on, it's what the incentive is. But here nobody makes money out of it and safety and efficiency and creating new knowledge is [sic] our priority (IP11, 31:48).

In discussing this line of enquiry with another participant who had work experience in both Denmark and Sweden, IP10 found minimal differences between the systems of heritage management. It was suggested that allocating maritime archaeology responsibilities to regional museums as having positive effects for both archaeologists and developers:
In one way there's no difference [between Danish and Swedish systems] because it's all time and money, but I think it's kind of clever to have the country divided into areas where there's a museum responsible for each area but the contractor is, I think, free to hire anyone to do the research. But since they know the museum is an expert in a certain area they will be the fastest way even if the bill looks kind of high (IP10, 35:55).

In response to being asked the final question in the interview (7), where participants were asked to imagine the opportunity to plan a project without budgetary or time restraints, one participant asked for more time to think over the question. While not against the system in place where project scope and costs are controlled, she did reflect that over time there were adverse consequences to operating within the sector. Maritime archaeologists were understood to be balancing the demands from heritage authorities with results that clients or society expected. Working within a framework where limitations are constantly shaping project planning and scope, risked shaping how one thought:

I think the way that we are forced to think: efficiency, and low budget or time, after some years it kind of destroys you in a way. Maybe it kills some of the creativeness (IP14, 56:19).

Since the author is linked to the Swedish contract sector, the participants working in Sweden discussed the role of the heritage authorities, in particular the County Administrative Board, in more detail than those working in Denmark or Norway. The issues discussed centred on the subject of quality across the whole of Sweden, in particular the lack of consistency that they encountered with regards to knowledge of maritime archaeology within County Administrative Boards. In addition to the emphasis on profit and keeping costs low it was further emphasised that this lack of consistency posed a problem with quality. Having had previous working experience of the Swedish heritage system, IP11 reflected on:

... how the Swedish archaeology is divided between the National Heritage Board as a watchdog, the Country Administrative Board as the people who order it and do the main thinking and prioritising of projects as well as the contractors and I think that it's good that it's been tested out somewhere but I saw there with the County Administrative Board, it's so different from region to region how well it works. Some regions it works very well, in others you find the lowest of the lowest (IP11, 43:31).
A number of participants cited the lack of an established or equal treatment of maritime archaeology among the various County Administrative Boards in Sweden. IP05 felt that the discipline was not yet fully accepted equally all over the country:

You notice that maritime archaeology is still not as accepted as land [archaeology] is, far from it. When will that happen? It’s a long way to go I think, like look at how many County Administrative Boards make decisions [relating to maritime archaeology] in the entire country, is it not many, and the majority of them, like, couldn’t give a crap (IP05, 28:53).

A further grievance expressed by participants working in all countries was the general survey nature of the work that they did, in comparison to the excavations that are carried out on land. Planning developments at sea are often easier to re-route in the event that archaeology is detected, and in the case of shipwreck or submerged settlement sites that would incur significant costs to not only excavate but also preserve, it is often the case that contract maritime projects do not proceed beyond initial surveys (Bergstrand, 2017).

Due to the large numbers of surveys and initial investigations carried out, the tasks most common for contract maritime archaeologists centre largely on providing the location of a site, its extent and in order to ascertain its eligibility as a heritage site, a confirmed date or age, as explained:

Research questions tend to be age and the locations of bow and stern [laughing]. It is very seldom, it is mostly surveys that occasionally leads to some investigations, anything more than that we do very rarely. It’s been years since we did an [underwater] excavation. I have done one once in eight years, that was four years ago. I think that we have had one excavation underwater in eight years (IP04, 25:52).

**Discussion**

That safety was an overriding priority among the interview participants is positive as it is not only a legal requirement for divers in a working environment, but also because lives should not be put at risk for the sake of archaeology. It does reflect, however, one of the many ways in which the working conditions for maritime archaeologists differ from those of their colleagues on terrestrial sites, primarily those that affect prioritising. It was also clear that to all the participants the drive of efficiency influenced their project
planning and fieldwork strategies more than any other factor, ranging from the choices of equipment used to the methodologies applied.

Reflecting on the general development of technologies and methodologies in contract projects, participants tended to prefer reliable methods that have been tried and tested. This ensures that projects are completed in time and that it is possible to deliver the requested results. Many of the methodologies cited have been designed to gather and deliver data for management purposes and do not reflect the changes in policy that now include communication as a goal. Budgetary and time pressures from the governing heritage authorities shape the priorities of archaeological projects. Some participants saw the achievement of efficiency as a marker of good work, while others saw it as a problem for the archaeological process. Despite their own reflections on the role that efficiency plays in contract maritime archaeology projects, all are expected to conform. Irrespective of whether participants are employed within a non-profit or market driven sector, the clients and developers who contract the archaeological projects drive the demand for efficiency in both cost and time.

Critique was aimed at the heritage authorities, most notably the Swedish County Administrative Board, where the recognition of maritime archaeology as a legitimate discipline of archaeology was stated as being at varying levels around the country. While development projects are not equally distributed and are generally centred on areas of greater economic activity, the suggestion that not all County Administrative Boards consider maritime archaeology as a factor in all development projects implies that opportunities for additional maritime projects are being missed. It was also recognised by the participants in all regions that the majority of projects that are carried out in the maritime sector are survey in nature, rather than excavation. There were exceptions where institutions that were located in areas of higher economic and development activity were involved in excavation rather than surveys, but these examples were suggested as being exceptions rather than the norm. The emphasis on surveying and delivering data primarily of use for planning authorities and developers is directly connected to the emphasis on efficiency.

In the case of digital technologies used, most commonly multi-image photogrammetry, the choice was most often based on speed rather than the goal of answering research questions or objectives. Dive times can be significantly reduced by filming or photographing a site and later creating a photo mosaic or digital model to measure from, than setting out tapes underwater and relaying back measurements to the surface or sketching a site underwater. Efficient data capture therefore suits the purposes of survey projects, where extensive excavation or a detailed examination of the archaeological sites are not required. Whether or not archaeologists working underwater are afforded the time to conduct detailed examinations of sites is largely dependent on the goals and objectives stated by the heritage authorities.
2.3 Digital and 3D technologies

2.3.1 Digital Motivations

This theme reflects the motivations expressed by the interview participants for their use of digital technologies in their work. The responses to this theme emerged primarily from answers to question 3 (table 3).

From diving to surveying, using digitised historical maps or GIS, maritime archaeologists are for the most part reliant on some form of technology in their work. As has been discussed above (Part 1) technology’s role and influence in the discipline has been questioned on a number of occasions. In the contract sector particularly equipment, tools and technology are a means to assist with completing tasks safely and efficiently.

The potential benefits of digital technologies realised by the individuals were focused on saving time underwater along with visualising archaeological sites and the work they do underwater. The most recognised marker of improving efficiency was the reduction of fieldwork time, which is also one of the main professional priorities that individuals identified in section 2.2.3.

Fieldwork costs can be significantly reduced if actions such as detailed measurements and interpretation can be conducted in an office environment. Further, fieldwork in contract settings often require a minimum of two archaeologists, whereas analysis or report writing costs can be reduced to a single individual.

*It helps for us to be economic. For example, we had to deal with a piece of a shipwreck that washed up on shore and we had one day. It was much easier to make a 3D model with the points so we can measure from it* (IP13, 31:32).

This aspect is especially important for projects conducted within the competitive contract sector in Sweden where the less field time equates with a lower costs for the client, as illustrated in the next example of a maritime investigation that included creating a photomosaic of a wreck site:

*But then we have begun to use it [3D] for surveys because it is fast and it is possible to film the wreck site and get the ship timbers recorded. We have used 3D often, we take 3D photogrammetry in plan so that it is georeferenced and possible to place directly into GIS and coordinate each individual ship timber. This is good when working for the County Administrative Board, we had a project in [location redacted] where we created a photomosaic of the wreck. There were timbers everywhere and it showed their positions within about a meters accuracy, and the*
filming took like half an hour, which isn’t possible if one were to measure in each individually (IP04, 21:56).

In addition to efficiency benefits in the recording process, the ability to use data from which to measure and interpret was also cited as a benefit of recording sites with multi-image photogrammetry:

*I think maybe photogrammetry is the biggest thing that has happened lately because if you're able to do a proper photogrammetry documentation and you have everything you need in there, you can take your measurements and do your drawings and reconstructions afterwards, so I think there will be a lot of emphasis on that* (IP10, 25:10).

Even when it is recognised that less time spent interacting with the archaeological material can result in failing to get a deeper understanding of the site, the benefits of speed and enhanced visualisation material were assumed to be a deciding factor for developers or the heritage authorities when faced with alternative budgets:

*If you can use my consideration and not my experience around it I would definitely say that in that case technology for a better visualisation and speed processes is definitely a combination the factors [of their use]. What would take you 14 days to make a lines drawing plan in 1:20 you can do in one and half day with cleaning and shooting a camera then there is no reason for the longer project plan. Unless of course, you get a better feeling and understanding of the whole thing if you take it slower and that's probably a bad argument to put forward to the developer* (IP07, 22:30).

In addition to being able to conduct further analysis post-fieldwork, an additional benefit of using multi-image photogrammetry was the ability to communicate a site in an interactive visualisation even if a limited glimpse was possible to present:

*Primarily it was from an outreach point of view, even if though we just provided a little peephole into the wreck and then the second [reason] is that when one is out on a survey and there is time pressure and one is stressed. It is to ensure that all the documentation is carried out so that once you are back inside you can then look at the site exactly or a feature you wondered about, like what distance is it between these two points.*
But it [3D model] was in fact a little bonus, often one plans for a sort of, what to say, a minimum level and then, if you have time, you add something [with regards to outreach] something, so, uhm, something like that (IP03, 10:56).

For a few individuals, the limitations of the technology, such as the inability to accurately georeference sites underwater, were cited as restrictions for the scientific community, but not for communication purposes:

Most of what we have done underwater is actually for the public because the ground control points are not good enough for the main documentation method.

We also, of course, have problems with visibility and light, which we are trying to solve now, but which are unfortunately a big problem on many of the sites we are on. We have very few sites that are open to both light and visibility.

Our main goal is to [eventually] use photogrammetry when our methodology is solid, to have as our main documentation method, underwater as well. So far we have mostly used it for presentation and not for analysis (IP12, 16:08).

A lack of dissemination channels to fully exploit the full potential of 3D data was also recognised as a current limitation, and it was observed that the data is primarily retained by professionals:

Use and re-use of data, well by the same token we haven't really got a way of disseminating the richness of the models that we create, for example. We're usually quite aware of that even though we collect a lot of very nice data and make some very nice models, in the end, it will end up as a lines drawing in a report and a nice colourful picture up on the website. So the wealth of the data is still unexploited and lies in our, albeit neat, service system away from everyone else. And so in that way use and reuse doesn't really occur because it's not really ever properly disseminated.

Of course, we have a desire to return to it at some point in a research capacity to kind of exploit the wealth that is hiding there. So far that hasn't really happened to the extent that it could. It's one of the appeals of doing something like photogrammetry, that we can really harvest a lot of data for later use, whenever that day arises (IP08, 12:02).
So, despite the awareness of the potential that 3D documentation for communication purposes, this potential has not yet been fully realised. The limited opportunities for evaluating methodologies within contract archaeology may constitute one reason for this:

Long term use of data, yes we save all kinds of data, the problem is that we seldom take the time required to evaluate methods, the use of instruments, and those kinds of things. Instead it's a bit like, you know going from the office to the coffee machine and wondering “was that good or bad, should we do things in another way next time?” (IP02, 24:25).

Discussion
The excerpts above represent the main motivations behind the use of digital technologies in their work, primarily for improving efficiency and communication. Factors that inhibited their potential were the technical obstacles of georeferencing underwater, the inability to display the wealth of data within digital models and the long term storage of data.

National repositories of archaeological data are currently based on GIS platforms (Geographic Information Systems), where information relating to various categories of archaeological sites, finds and research activities are accessible. All the databases are created with information that is primarily of relevance and use to heritage management professionals, yet their open availability online is also stated as being on the basis of public use and interest (Fornösö, 2017; Kulturminnesöök, 2011; Fund og Forntidsminde, 2010).

Currently the Swedish National Heritage Board is running a program to increase availability of archaeological data for and improving efficiency. While the information relating to heritage management will also be available for public access, a main goal is to improve efficiency within the heritage sector (Larsson, 2017; DAP, 2017). In these instances the information pertaining to archaeological and heritage sites is provided by interfaces created by and familiar to heritage management professionals. Non-experts with an interest in heritage sites must therefore become familiar with and adjust to the expert-informed way of negotiating the information. Relating to the lack of channels available for the dissemination of 3D data, the national repositories do not as of yet provide for the hosting of the models created by the maritime archaeologists. They rely therefore on institutional websites, social media or commercial 3D hosting sites.

The time benefits of digital documentation methodologies such as multi-image photogrammetry are related to the data capture phase, that is, the phase that takes place in the field. The generation of models can be conducted post field-work, thereby saving time underwater when compared to traditional documentation methods. Reducing fieldwork time on this basis, however,
results in less interaction with the archaeological material, and in effect reduces the quality of interpretations.

By basing the decision to adopt digital recording technologies primarily on the basis of saving time illustrates the importance of fulfilling contractual obligations, with heritage authorities or clients, within the contract sector. This, however, diminishes the potential for adding to the archaeological knowledge base by enabling “computer-based visualisation authoritatively to contribute to the study, interpretation and management of cultural heritage assets” as one of the London Charter objectives states (London Charter, 2009).

In addition to striving for efficient methodologies within the contract sector, the motivations also reflects a tendency described as the “rush to latch on contemporary technologies within the sub-discipline” of maritime archaeology (Sperry, 2009:20). It has also been asserted that the enthusiasm to adopt technologies in maritime archaeology has functioned as a facilitator for the shift that has moved the sector from “a mostly excavation to a mostly survey culture” (2009: 32). What has been abandoned on the quest to develop, adapt and use technologies for survey work is the focus on what early concepts of the discipline were thought to focus on, people and society (Cederlund, 1997; Jasinski, 1999).

2.3.2 Research and development

This theme considers the research and development of methodologies of digital technologies within the contract maritime archaeology sector. The interview excerpts and answers are largely in response to Question 4 and discussion of the priority given to research and development of methodologies (table 3).

On the topic of the potential, or lack thereof, within the contract system for developing technologies and methodologies it emerged that it is not dependent on whether institutions operate within a competitive market or not. Participants working in Norway and Denmark commonly perceived the development of technologies and methodologies as something that was not possible to include as a billable aspect of contract projects. Rather, it was something that should be established prior to a conducting a project. Participants working in the Swedish sector for the most part also ranked the factor as a low or middle priority. While they acknowledged that it was usually not possible to achieve within the tight confines of a contract project they, more than participants from other regions, recognised it as important for the sector.

This makes the development of methodologies and technologies challenging within the contract sector. Examples were given of cases when museum institutions invested in the education and training of individuals for certain methodologies, for example, the use of multi-image photogrammetry or the use of the 3D measuring Faro arms (Jones, 2009) for ship timber documentation. In the second example the training and methodology had been developed by
another research institution. It was acknowledged that the earlier experience and knowledge developed was a key factor in deciding on the method, since the development of a new methodology would have been resource intensive.

In other cases the knowledge of a certain methodology is reliant on the expertise of certain individuals, for example, at one Danish institution where one member of staff is responsible for creating 3D models from data gathered in the field.

_We have a guy [laughing]. I kind of know how to do it, but we have a guy who has been working with it for several years so he or someone else takes the pictures and then he works the, uhm, software. We save all images like every photo is saved for, I don't know how long for but very very long (IP10, 12:02)._ 

When asked about considering the storage of data and safeguarding it for future use participants largely acknowledged that it was important but that either they as individuals or the institutions where they worked had not resolved the issue. IP08, for example, was aware of the potential future problems with data becoming obsolete and cited examples of choosing open source and non-proprietary software if possible, but concluded that it was as of yet an unresolved issue that required attention. IP11 and IP14 also acknowledged the importance of ensuring future access and re-use of digital data while admitting that a formal plan was lacking.

For others the issue of long term archival of data was seen as not being their responsibility (IP02) but rather of his employer. IP05 stated that because he did not have the relevant knowledge or digital skills that it was also not his responsibility. IP11 raised the point that many archaeologists are trained and skilled in a variety of digital methodologies, especially so in software and hardware particular to maritime archaeology. With time often being a factor in contract projects it could be that emphasis is placed primarily on gathering the required data and the archival questions left until a later date.

In cases where individuals have both the technical knowledge and desire to experiment with non-traditional uses for archaeological data, the lack of collaborators and resources are often a hindering factor:

_I tried to do that for fun for an excavation we did in [location redacted] where I tried to make some kind of walk-through game where you can go around the ship and I used Unity for doing that, and then with photogrammetry you could dive on the sites but now it's not online anymore. It's a pity but you need collaboration, I do this for fun and I like 3D modelling and I like fiddling around with game engines and so on but I'm not professional to do this, so I think that it's always_
important to collaborate with someone who knows better about these things. And this never happens, this collaboration between the museums and the game companies (IP15, 1:00:01).

**Discussion**

The lack of uniformity in relation to digital tools and data exhibited among the individuals and institutions is perhaps expected when certain methodologies are still being adapted to the underwater archaeology field. This is in stark contrast to how diving regulations in Scandinavia, which are stipulated by governmental authorities in each region, are to a large extent uniform in all institutions. As it stands today digital documentation of underwater sites is largely based on the individual competence and interest of those employed at each institution. As will be discussed later, the audiences in mind for the results of this documentation are also varied among the interview participants.

The nature of contract archaeology project planning does not often leave room for manoeuvring outside of the stated archaeological goals, regardless of whether companies operate in a competitive market or not. Offers or quotes to prospective clients state the time scale and cost of a project and except for weather difficulties or unforeseen obstructions, a major objective is to deliver results within the stated time. As was stated above archaeological projects are not occasions for the testing of methods or equipment, instead tried and tested methods are used to ensure the completion of projects. However, larger excavations, in Sweden at least, provide more opportunities for companies to motivate the investment in new technologies (Riksantikvarieämbetet, 2016: 37).

Efforts to develop methodologies are often based on the knowledge, interests and experiences of individuals, and this occurs outside of contract projects. One example (IP05) described was how the development of a methodology for digitally documenting shipwrecks excavated on a terrestrial site was a combined effort of a tech company in search of material. The interest of the participant in developing a digital documentation methodology for analysis purposes was the driving force rather than any strategic institutional or national program for the development of maritime archaeology. Rather than being an anecdote from the 2010s, it is instead reminiscent of Swedish archaeology in the 1950s and 1960s when “research development has largely rested on the initiative of the individual to lift to the forefront archaeological problems and questions that are evident in the comprehensive documentation” (Ambrosiani, 2012: 318). Development of digital recording methodologies among participants is largely driven by individuals, which are largely based on personal experiences rather than on established guidelines (e.g., London charter, 2014; Seville Principles, 2016).

The drive in Sweden to create a digital society has largely focused on the drive to digitalise (Statens Maritima Museer, 2015; Digisam, 2016b) and this motivation is evident in the contract archaeological process where data delivered to heritage authorities and reports are in digital formats. Future
implications of creating digital data, however, were not often considered by the interview participants. Whether or not a 3D model will be accessible or of use to future users is for some not their concern, and within the project format of working each project operates largely independently of other. When creating data that is to serve as an archaeological record and archive, the focus on the know-how and practical approaches to data collection alone will not suffice. A holistic approach must be taken that includes future responsibilities for data curation and longevity.

The tried and tested methods of maritime archaeology have largely come to the field today from larger research excavations that were conducted at a time before contract maritime archaeology was an established field. Many participants acknowledged the development of methodologies as an area given low priority within the contract system. In the cases where methodologies were developed, they were associated with museum institutions that had research as institutional goals, rather than contract units. In the case of Sweden where companies not attached to museum or research institutions can operate on the contract market it is possible, with sufficient resources that research and development efforts may occur, but this is not guaranteed.

Of the participants who used multi-image photogrammetry there was no common practice or standards being adhered to, apart from individual institutional workflows. While this may be expected during the early stages of adopting digital recording methodologies, it may also reflect the recognised lack of knowledge relating to these tools in archaeological training (Dell’Unto, 2018: 54). The goals and objectives for the re-use of resulting models were in general not considered beyond the parameters of contract projects. The question of long term archival of the data was one recognised but not solved. Overall, when the purpose is to record digital or 3D data for documentation purposes, communication objectives are not considered at the fieldwork stage.

2.3.3 Digital vision

This theme reflects the responses to question 7 (table 3) that asked the participants to suggest digital solutions for a hypothetical project with the goal of achieving societal benefit.

Three main categories of responses were noted. The majority (9) of respondents envisioned some form of digital visualisations of sites underwater to allow audiences the chance to experience and see what maritime archaeologists do underwater. Three respondents offered suggestions on how the research community could benefit from digital and/or visual methodologies. Finally, three respondents suggested that the imaginary unlimited resources should be applied to research areas they determined to be understudied.

Many individuals recognised the potential for archaeological documentation recorded in 3D and to then present the results in a virtual diving experience
where the public could see archaeological sites and the work done, often invisible, by maritime archaeologists:

Yes, with 3D, what one would want is to somehow have the possibility to take the public along, to go down under the surface through different digital technologies so that they can actually see the site, in part to see the work and the investigation of it, but also to, by themselves, investigate the site in its natural environment and so that one could in some way explore... go on their own exploration of the site. And those tools already exist to a large extent today but it is a question of money and resources and time (IP03, 45:38).

It was also suggested (IP01) that in addition to visualising the work being done underwater that representing those doing the work, the maritime archaeologists, was favourable to an empty or sterile archaeological site. IP10 envisioned taking people underwater, through a digital experience, allowing them to see the work that she does and perhaps go inside a shipwreck. IP06 elaborated on the importance of transmitting the emotional aspect of diving within a virtual tour of an underwater archaeological site. In particular feelings associated with the exclusive nature of being one of the first people to see a site in centuries.

In addition to experiencing the environment in which underwater archaeological sites are in, one respondent emphasised visualising the complex nature of the work that is involved with understanding sites like shipwrecks:

I think something I’d really like to do is Virtual Reality of the underwater, with a proper eh, to try and make it see [sic] what it’s like in the underwater environment in VR and I think like how we perceive the wreck and so on because the interest would be on the wreck site or the underwater site, to show through VR that, I’m not talking about the diving part, but the general idea of a wreck it’s the pirate ships with the sails still on underwater, that’s the general image, but instead to show how complicated and how fascinating a wreck is somehow. And also, thanks to VR to show from a wreck to the actual ship, or the idea of a possible reconstruction, just a simplified idea, to show that ok, this piece of boat isn’t just a piece, here’s how the ship looked, so yeah, that’s what I would like if I had the budget and time (IP15, 1:12:35).

For a number of participants the concept of unlimited resources was somewhat disorienting and instead they imagined that in the event of a project
without time or budget restrictions that they would likely use the resources to publish more articles, create more 3D models and share the knowledge via online mediums.

Discussion
The favoured idea among the interview participants of visualising the work that maritime archaeologists do underwater places emphasis on the tasks that are carried out, the environment in which the work takes place and the subject matter of the archaeological site. As a kind of archaeological practice that is largely unseen by the public, both because site visits would prove problematic and in some cases due to poor visibility, the urge to show non-professionals how the work is carried out could in one sense be seen as a wish for recognition, to highlight what is for the most part invisible. Furthermore, with an increasing emphasis on survey-based work in the discipline, there are less opportunities for large scale excavations or raise large ships for the public to see (Sperry, 2009: 23-25).

Furthermore, IP15’s suggested visualisation would strive to transmit the complicated contexts that sites like shipwrecks represent and the efforts involved in making sense of them. Presenting the archaeological process and the heritage sites underwater is therefore one suggested means of delivering knowledge to society, since this has thus far not been possible to achieve.

That few mentioned a hypothetical site reconstruction as part of a virtual visualisation is notable in that this is often the focus of research maritime archaeologists (e.g. Steffy, 1994). The lack of resources for extensive research within contract maritime archaeology may in part be responsible for suggestions of presenting the archaeological site rather than a proposed reconstruction. The typical projects described by the participants were that of surveys, the results of which provide information to heritage managers primarily used for planning decisions. The proposed digital visualisations of showing audiences sites underwater ignore the potential that digital data provides, for example, hypothesis testing of construction sequences or providing audiences with reconstructions of sites that allow for the exploration of space from various vantages.

Three participants suggested some form of reconstructions of sites, shipwrecks and submerged Stone Age landscapes, as a possible use of data that would be of benefit to society. The tradition in nautical archaeology (Steffy, 1994) of using reconstruction as an interpretative tool for researching shipwreck sites is long established and has continued to develop with the adoption of digital technology. The fewer instances of underwater excavations and the predominance of survey projects where data is predominantly created for management purposes within the contract sector may explain the lack of reconstructions proposed by the participants.
The visions suggested for achieving societal benefit reflect, to a large extent, the priorities of the contract maritime archaeology sector. Contract archaeology work underwater oftentimes involves the aim of seeing and reporting what is underwater, rather than that of excavation. Therefore, conceiving a digital visualisation that would allow people to see the archaeology that they find is a natural extension of their professional tasks. In some ways the suggestions can be interpreted as visual expressions of the same data delivered in contract archaeological reports, but with an emphasis on the emotional aspect of interacting with heritage.

Suggestions that would further research or knowledge production were in some instances related to the research interests and areas of the individuals. IP02’s vision of aggregating the large data sets that institutions hold could be interpreted as frustration from operating as one small part of the larger heritage sector yet not being afforded the opportunity to present results within a larger context. The suggestions offered to use unlimited resources for research reflect obvious frustrations with the lack of opportunities afforded in the contract system to focus on subjects that the individuals see as being of importance to maritime archaeology. In general, the visions that participants expressed reflect the frameworks of the contract sector, which is to show what underwater, detail the work that is done and offer suggestions for areas that are in need of further study.

As well as wanting to visualise the archaeological process that happens underwater, participants also suggested virtual diving could be a means to share what the archaeologists themselves experience, for instance the exclusivity of being one of the first to see a ship in 300 years as IP06 suggests. Indeed this ability to come close to history is one of the main attractions with recreational scuba and wreck diving in particular. Underwater archaeological data as currently presented in reports and more recently via online sharing platforms are lacking these emotional narratives, as are being explored in the EMOTIVE project (Emotive, 2016). Among the many suggestions for visualising underwater archaeological sites the goal of transmitting the feelings that individuals had were seen as an important element to transmit. Research on scuba diving professionals (Straughan, 2010) found that the act of diving is an embodied experience that can mobilise a particular complex of emotions. The feelings that diving in water mobilised were centred around feelings of well-being, calm and trust in their own abilities, meaning that diving is therefore a very personal experience. While it is becoming possible for certain senses to be transmitted by VR aides and technologies (Eve, 2017) it could be that the feeling of total immersion in a body of water may be what the individuals are hoping to transmit, rather than any information about the heritage site underwater. Diving has been used as a form of therapy (e.g. Deptherapy, 2017) and indeed it is a potential area where underwater heritage can be of societal benefit, but
more research is required in order to identify the particular elements of underwater heritage that affect people in positive ways.

2.4 Communication

2.4.1 Within the sector
This theme reflects how the participants view the communication of results from maritime archaeology contract projects. The topic of communication, in the form of project reports to various stakeholders, the dissemination of results to wider audiences, as well as communication directly from contract maritime archaeology projects was raised a number of times during the interviews, most notably in questions 4 and 5.

Question 4 asked participants where they ranked communication in order of project priorities. Question 5 asked participants specifically about the dissemination of results, whether or not it was a part of their job and the target groups that they included for dissemination. The responses to the yes or no question included a number of conditions. While twelve participants responded that they understood the dissemination of results to be their responsibility, one individual specified that it depended on the kind of project that was in question, and two responded that while their official job or task from the heritage authorities may not always specify dissemination that they communicated results to wider audiences anyway since it was an important thing to do or a duty of a maritime archaeologist. Of the three who responded that it was not their responsibility, two specified that it was the museum institution’s role rather than the contract maritime archaeology unit’s role to disseminate, whereas one responded that it was due to a lack of resources rather than any aversion to it.

Regional differences emerged in the attitudes towards communication. The individuals working in Sweden ranked dissemination from the 3rd highest to the least prioritised factor. Participants considered both archaeological reports as fulfilling communication responsibilities to the County Administrative Board or clients, along with Popular Summaries in the case of excavations (Populärvetenskaplig sammanfattning, 2016) as being official forms of communication. Writing blog and social media posts as well as giving presentations were considered to be more enjoyable forms of communication yet were at times conducted by the individuals outside the scope of project budgets, which is to say during their free time.

In the case of individuals working in Denmark, where communication costs are not always borne by developers/clients, but instead by museum institutions it was ranked relatively low. Participants reflected on how the legal requirements of reporting to the authorities was the responsibility of the contract archaeologists, whereas the museum had the responsibility of disseminating knowledge to wider audiences.
Participants working within the Norwegian contract system responded favourably to the concept but in some cases saw it as a focus of research funded projects rather than the goal of contract projects, or mainly associated with large scale contract excavations where provisions such as site tours could be planned early on in the project process.

Overall, the importance of communicating was acknowledged by all participants. However, two main opinions on how it is carried out within the context of contract projects emerged. Some participants understood dissemination of results as being one of the primary reasons for practising maritime archaeology despite budgetary restrictions. Others understood dissemination as being a task to be completed or considered strictly within the project frameworks as demanded by the heritage authorities.

**Personal interest**

The responses to questions relating to the communication of results to audiences beyond the sector of maritime archaeology were often accompanied by enthusiasm and a personal interest in telling others about their work. A number of participants added that while oftentimes popular outreach fell outside the scope of certain projects (IP03) or that it was not an official task of theirs (IP13), they nevertheless felt a duty to do so anyway:

> It's not part of my job description, but it's just natural to do it. We do have a [sic] people responsible for communication at the museum. Either we send photos with a little description to the person who will then write the story of what we are doing and where (IP13, 47:23).

IP05 noted that the County Administrative Boards were in more recent years becoming more aware of the importance of dissemination by allowing for budget posts solely for communication purposes. However, he acknowledged that his own personal interest in maritime archaeology and communicating was the main reason why he wrote blog posts and shared news on social media, doing so often outside of office hours. Indeed his interest in communicating was a central interest of his, citing it as one of the most important elements of his job:

> I think that it's fun to babble, telling people who do not know about what we find, because that is, I think, the whole point, so that it is not just a really nice technical report or “Oh, look how good I am” with fancy words in a report that sits there on the shelf that nobody ever reads. That's not the point with the damn thing, I think, that it’s like, it’s the outreach of the result that IS fun.
It’s not always easy though, if one is informing a client who might thing that we are being difficult, so perhaps we think that’s the whole job. That is one thing that I am damn good at I think, at talking (IP05, 06:28).

Fun was also an aspect of popular communication activities, namely writing articles, blog posts and posting about their work on social media, for instance as IP04 commented It is a fun area that one should really have some more time for (35:02). That these activities are seen outside the remit of official communication efforts, namely archaeological reports, may be a reason for downplaying popular communication efforts as light-hearted or fun and described as additional activities that take place if time allows.

In addition to communicating popular results to audiences beyond the sector, IP03 considered scientific publication to be one of the responsibilities of contract maritime archaeologists. While he also acknowledged the recent emphasis placed on communication by the heritage authorities, he had always viewed it as an important part of his role.

Yes, definitely. As contract archaeologists it is one of our responsibilities to conduct both scientific and popular mediation. And I guess I have, even if there has now been more emphasis placed on public mediation or popular scientific communication in more recent years, I think that that is something that we [museum institution] have always, or at least I have, always thought of as important. But then there is not always time in projects or channels either, for varying reasons. And not all contract projects that we do that are perhaps so interesting for the public either (IP03, 25:30).

Finally, the archaeological material and the personal opinions of the individual maritime archaeologists is also related to the lack of communication efforts. When a lack of communication infrastructure exists the responsibility rests with the individual and what they understand to be interesting or worthy of communication:

Also, we have very little in terms of communication, I must say, because actually it's not a priority at all, really. So if nothing presents itself then we won't do anything actively. If it's not exciting then I won't bother making it exciting (IP09, 29:55).
Professional responsibilities

Among the participants who viewed communication as part of their professional responsibilities the concept was seen in two main formats, official reporting and popular dissemination. As one explained:

*It's a part of my job. Usually we there are two levels, there is through mass media and we contact and give them information if we have some exciting new finds or if there is something that we think they should report to the public.*

*And if we have an excavation we try always to involve the local community in some way, like we take an afternoon having lectures at the city hall for example.*

*Of course, there is pressure from the museum now that we need to make a blog or give pictures to the museum that they can put on the website so they can get more people coming here and so on.*

*That's an increasing pressure* [laughing] (IP12, 25:28).

Similarly, while recognising the importance of reflecting on bigger questions such as who benefits from the work of contract maritime archaeology or who would like the information, IP08 explained that tasks and assigned roles were established within the organisation where he worked and that dissemination of the data created within contract projects to wider audiences was not his responsibility. His organisation was established along two areas, with “*a more politically governed side and a more publicly and people minded side of the business*” (IP08, 09:35 file 2).

Despite placing “*dissemination of knowledge*” last in Q4, IP01 acknowledged that communication and sharing results is important for a number of reasons; not only does tax money often pay for archaeological work but also because some think it is important for identity and that it is important for society to learn from the past. In this way communication is seen as important because of the money used to pay for the archaeology, and therefore communication efforts are a form of return on society’s investment. Connected to this is the awareness that archaeologists can only work because of this investment, despite one's own personal interests. Communication is both a way to create awareness of the discipline and a way to gain more support.

A number of institutions had communication strategies in place where maritime archaeologists supplied images or video, along with descriptions of their work to museum staff who then spread the information along official institution channels, such as websites and social media pages in a predetermined format. For this reason a number of participants (IP02, IP08) saw dissemination as not being their direct responsibility. This was seen as distinct to reporting to clients and heritage authorities of the work completed, but it was noted that for more “*scientific*” archaeology that occurs within research project (IP02) direct
social media posts would be acceptable. One participant responded that while he was aware of the importance of dissemination he acknowledged that it was one of his weaker attributes (IP07) but also since there was also a lack of formalised strategies at the institution where he worked there was little emphasis on actively disseminating project results.

The nature of the archaeological project was noted as a factor when communication was considered, where efforts made to communicate beyond archaeological reports needed to involve results that should be “interesting” (IP07). But who exactly is responsible or in the position to make a decision on what was considered interesting was not offered by any of the participants. Topics such as diving and the underwater nature of work was given as one area that the public are interested in, others listed knowledgeable and interested members of the public as being interested groups for results relating to shipwrecks. These responses, however, varied on an individual basis and no clear vision of what topics were of importance to communicate was identified, beyond showing how archaeological sites and work looked underwater.

The value of the Popular Summaries was brought into question by IP04 regarding its online publication within the Swedish National Heritage Board’s report database Samla (2013). As the site is primarily tailored for experts within the heritage sector it was questioned who apart from archaeologists would ever read the work that they created.

While the goal of creating new knowledge was ranked as an important aspect of their work, it was not stated by all participants to be a goal of the sector:

_As a commercial archaeologist it’s not your duty to create new knowledge but the idea is that someone else will after look at the data. Because then you need a research project, normally in commercial archaeology you don’t have the time to do research so the idea is to produce data that everybody can access, and then someone else in the future will look after that_ (IP15, 44:11).

The above excerpt is from a participant working in the Norwegian sector, where in general archaeological research is carried out by universities (Schenck, 2014: 17). His opinion illustrated that within this system contract archaeologists contributed to the communication process by providing data to research institutions for analysis and who would then disseminate results.

**Discussion**

There were opposing views to the concept of communication within organisations and within countries, despite all individuals working in accordance to the same frameworks that each of the countries heritage authorities have created for dissemination practises. The limited excavation
opportunities in contract maritime archaeology result in limited communication efforts as part of contract projects. This imbalance is often offset by efforts made by individual maritime archaeologists, either during their own personal time or by museum institutions. The subject matters being communicated are dictated by the individuals based on what they believe to be of interest or relevance to public or non-expert audiences.

For some participants, communication and dissemination efforts comprised of the reporting of projects to clients, heritage authorities and the archaeological community, and in the cases of larger projects with sufficient budgets additional efforts such as site tours could be planned for. In this sense the needs of the sector are prioritised above all others, and efforts for communication are designed with the needs of the main actors, as identified by the participants as the heritage authorities, the clients and the research community, rather than members of society.

Others noted the lack of opportunities within contract projects for communication in budgets and therefore carried out dissemination efforts, such as writing blog or social media posts, in their own time. While acknowledging that these acts fell outside the scope of projects they saw this more as a vocation or as a duty of being a maritime archaeologist, as well as it being an enjoyable process.

The topics or subjects communicated often reflected the interests and opinions of the individual archaeologists rather than communication being an ingrained element of the archaeological process, such as documenting or reporting. Furthermore, it was not discussed in detail the specific knowledge that was enjoyable to disseminate, for example, whether it focused on the archaeological or the diving processes, or whether historical events associated with sites were presented rather than the results of archaeological research. It is therefore not possible to know for sure whether the process of dissemination preferred by some individuals related more to their professional interests rather than topics of relevance to modern societal debate.

Recording methodologies that prioritise communication on the same level as documentation already exist within Swedish contract archaeology, for example, the Instant field Documentation system and Availability system (IDA, 2017) where the digital archaeological workflows are made available for communication purposes. Yet, the participants presented a distinct separation between official archaeological data for management purposes and summarised information for popular communication purposes. Further, delivering data and results of scientific quality for maritime archaeology research appears to be the main object of contract maritime archaeology projects, and communication to audiences outside of the sector seen as an added benefit if sufficient time or resources allowed.
2.4.2 Audiences

This theme reflects the various groups and audiences that the participants identified as being recipients of their communication efforts, in particular digital data. The interview excerpts and answers are largely in response to question 5 (table 3) when asked what audiences they considered for communication purposes.

The audiences and target groups identified by the interview participants included heritage authorities, the research community and other archaeologists, clients; special interest groups such as divers, local societies and boat builders, museum visitors, schools, local communities, those interested in marine history; “the public”, “society”, “everyday Swedes” (Sw. *vanliga Svenson*) and “anyone out there”.

When asked about target groups for the digital data produced in the line of contract projects, IP04 and IP06 identified heritage authorities as being the main audience for geodata, such as GIS positions from sites, as this is often the primary data sought after in the contract project, outlining a site’s location and extent. Because contract projects are commissioned by heritage authorities they were identified as the main target audience for this data, and not the public.

*Target groups, for digital geodata that is primarily for the County Administrative Board who want the shape files in SweRef [coordinate system].*

*Other target groups, like the public, of course they don’t want the geodata* (IP04, 14:58).

It could be that the current reporting structure and procedures of delivering geodata to heritage authorities for management purposes influences this point of view. IP13 noted that while they have made efforts to think of the public more, it is the clients or developers who commission contract projects who are the primary target audience of contract project data: *Of course on the surveying projects it's mostly the client* (IP13, 35:35).

In contrast to this view, IP03 considered the research community as the main target audience of the work he does, and the heritage authorities as more secondary. As he understood it, the heritage authorities required archaeological data mainly for making management decisions:

*Primarily I think that our main target group is the research community.*

*The work we do serves as a basis for County Administrative Board decisions but that is a little, for me that is somewhat secondary. That is the County Administrative Board’s problem, what we produce is first and foremost for the research community, I would say* (IP03, 26:55).
Despite an increasing pressure to communicate to broader audiences, IP15 admitted that in reality the main target group for the work he does is for other archaeologists. He suggested that not all responsibilities should be placed on the archaeologists, as it is impossible to be an expert in all aspects of cultural heritage, and he also recognised the limits of his own competence:

*I think that the first audience is always other archaeologists [laughing] most of the time we focus on them.*  
For public there is not that much publication, like you always publish the data from the excavation but there is never a public or like a popular [sic], unless it’s something exceptional.  
*I think it should also be part of the museums job to do that, not all on the archaeologists, there are other figures that should help us to do that, because we the archaeologists are not the experts in media or museologists either so, it’s a part of my job but there should be someone. Because what I notice nowadays is that there’s a lot of pressure on the archaeologists to be eclectic and be able to do everything [laughing]* (IP15, 1:07:42)

One reason that communicating to public audiences was cited as being of importance was for creating an interest and understanding for the work that maritime archaeologists do, yet the limited opportunities for this within contract projects was once again identified. A comparison was made by IP03 between the higher levels of interest that a maritime archaeology project can attract in comparison to larger scale contract projects undertaken on land:

*But I think that public outreach is equally important. In part to create interest in what we do and to create understanding for what we do, and to show that it is actually fun and interesting. When one talks about outreach in an archaeological context then it usually refers primarily to excavations. And it’s very seldom that we [maritime archaeologists] conduct large - or even smaller - excavations, we mainly do surveys and investigations. Then again we are somewhat fortunate in the sense that we deal with maritime archaeology which many think is interesting, so I think that many times [maritime archaeology] surveys and investigations have a larger public or general interest that what colleagues who work on land have. And I think that there are very few colleagues who work on land who meditate to the same extent from investigations and surveys as the maritime archaeologists in Sweden do* (IP03, 27:35).
Reflecting on the nature of digital data produced by IP08’s contract archaeology unit, the data is mostly kept within the unit rather than made with public audiences in mind, and this is in part because there is no obligation to publicise to wider audiences. Furthermore, they do not yet see a market or an audience actively asking for digital data associated with, for example, 3D models:

I'm absolutely sure, yeah, it's something that we keep for ourselves so that we can use it on a rainy day and the general public benefits from some nice models and some attractive fly-throughs but yeah I think the real worth of that is quite limited to be fair, beyond the gloss.

I guess there's also the target audiences as well, we have an obligation obviously to serve contractors and the official agencies but they are usually not very critical in terms of how we exploit our data and what they actually receive in terms of anything beyond the basic data.

And then we have a second outlet through Facebook for example, which is a larger, generally, lay audience which I think is attracted more by the stories and the process and the methodologies rather than the potential of whatever it is we actually present.

That means that there's not really an outcry for the rich products to be disseminated because there's no one saying “I would really like to see the raw data for this” for example, yet at least (IP08, 14:05).

The possibility to instantly share digital data was raised by a number of participants as being an important aspect of interacting with public groups (IP04, IP13), especially via social media. Furthermore, IP11 cited the potential for multi-image photogrammetry to include wider audiences due to the simplified nature of the resulting visual data. In addition to communicating knowledge about a particular site, the potential for visual data to appeal to wider audiences also means the possibility for heritage authorities to be more favourable to higher project costs. In this way the ability to justify the use or purchasing of costly equipment to the heritage authorities is easier by emphasising the larger public audiences that the digital data can appeal to.

Apart from references to the general public, a number of focus groups such as “a sort of knowledgeable interested general public” and a “maritime history interested public” (IP04) were also identified. A number of participants referred to having communicated with sports divers (IP04, IP05, IP06, IP11, IP13) in outreach programmes where maritime archaeologists taught divers how to properly engage with heritage underwater.
Discussion

The target groups identified for digital data, the heritage authorities, clients and the research community, represent the main actors within the contract archaeology system. This represents a small number of institutions and individuals and in one way form a closed loop. Contract units attached to museums have the opportunity to disseminate results of their work to the public via exhibitions, presentations and social media outlets, yet it is often large scale excavations or research projects that account for these efforts. The small projects that involve identifying the size, extent and age of a site result in technical archaeological data with heritage experts in mind. Certain groups in society, such as sports divers interested in historical wrecks, or historical archaeology enthusiasts, can also benefit from the information within archaeological reports, but as special interests groups they do not represent society as a whole.

When reflecting on the concept of outreach and dissemination of their work or archaeological results, the majority of participants are favourable to presenting results to wider groups in society, most commonly referred to as “the public”. When asked to comment on the target groups for the digital data produced in the line of their work the majority of respondents listed the heritage authorities, the clients and other researchers primarily, with a number reflecting on how new methods such as multi-image photogrammetry have the potential to include the public to the list.

In one way it could be said that by delivering results of contract archaeology projects to clients and the heritage authorities to assist with the development process the archaeologists are fulfilling their part of a social contract, whereby they document archaeology that is at risk of being destroyed in the course of development. By documenting the site and providing the data to heritage authorities and in some cases research institutes for further analysis, their role ends and they need not be concerned with how long the data will be available for or the various target groups that will access it. However, this reasoning is not in line with the respondents opinions on outreach, rather it would seem that within the contract maritime system the public is viewed as an important target group of the work that they do. That the majority failed to list the public as the recipients or target groups of their digital data is a symptom of the way in which non-expert communication or is not an ingrained part of data collection within the archaeological process, as well as the low priority afforded to dissemination in smaller scale projects by heritage authorities.

The understanding of audiences for both general information and digital data by the participants reflects the system of communication established within the contract sector. The hierarchical nature whereby heritage authorities and clients are acknowledged as the primary audience was followed by a general “public” audience that was assumed to be more interested in compelling stories rather than factual data. The description of audiences in general terms, such as “anyone
out there”, could reflect the identified tendency for professional development to take priority over outreach and communication within maritime archaeology education (Ransley, 2008: 57).

These specific public groups that were identified by participants groups share many of the same interests that were identified by participants as being what first sparked their own interests in the field of maritime archaeology. In this way communication of mutual interests may in part explain the positive attitude that participants expressed towards the more enjoyable aspects of dissemination. Similarly, the identification of academic and research audiences by some individuals may also reflect their own interests in maritime archaeology research. The autonomy that many participants had often resulted in their own interests dictating the knowledge communicated and the groups chosen for communication. This, coupled with the acknowledged limitations of education and knowledge pertaining to archaeological communication results in a narrow focus on a limited number of groups being served by communication efforts.

Certain circumstances result in archaeologists being unable to publicise data, such as geo data pertaining to maritime archaeological site that may be at risk of looting. However, all geo data was understood by those who cited it as only being of interest to the heritage authorities. That the public are not seen as a target audience of this data runs contrary to efforts made by ongoing the Swedish National Heritage Board's Digital Archaeological Process project (DAP, 2017) and products such as IDA (2017), where interaction with GIS data by wider audiences is encouraged. This restricted view on geo data may be a result of working within the routine of the contract sector, but also illustrates how in many cases individual archaeologists decide what data or information is disseminated to the public.

The particular interest in maritime archaeology by public groups was identified by a number of participants. It could be questioned whether groups that make up “the public” necessarily differentiate so strictly between land and underwater, or it the explicit line between the two are constructs of the system of contract archaeology or archaeological education.

2.4.3 Subject matter

This theme considers the topics and subjects that participants identified as important to communicate from contract maritime archaeology projects. The interview excerpts and answers are also in response to question 5 (table 3) where participants were asked about their thoughts on the communication of archaeological project results.

Two contrasting views on what people are interested in arose throughout the interviews. On the one hand there were those, such as IP03, who were positive towards the enthusiasm that many members of the public had towards the discipline, for a many number of reasons such as childhood dreams of becoming
an archaeologist, being a hobby diver or having an interest in historical archaeology.

The other view on this interest was more pessimistic, in that it was lamented (IP02) that despite the archaeological finds uncovered during a project or whatever the research results, people were mostly only interested in the diving element of their work. Rather than understanding this interest as a benefit, it was cause for frustration where the interests of the maritime archaeologists were at odds with those of public audiences.

Beyond defined and commissioned communication requirements within projects, the participants identified other factors that justify communication efforts of maritime archaeology results. The examples that the interview participants suggested for communication all relate in some way or another to making underwater heritage accessible to others, either by allowing people to see and understand the work that maritime archaeologists do underwater, or to allow people to go underwater themselves virtual reality or visual experiences. Further, there were also suggestions that called for the work that they do to be related to a story rather than only the presentation of facts and figures.

Creating access to the maritime archaeology process was recognised by many of the participants. Particularly noted was how multi-image photogrammetry is a suitable means to visualise the work of maritime archaeologists to public and interested audiences. One benefit of how the methods speeds up the process of documenting was the potential it allowed to share digital models online almost immediately following fieldwork, in contrast to the longer process of presenting findings of research via archaeological reports or peer reviewed articles. The interactive nature of the medium was also noted as positive, allowing audiences to digitally move about a site or object that, being underwater, would otherwise be largely inaccessible to them. That multi-image photogrammetry allows the possibility to engage with the material by moving it from one side to another was seen as a vast improvement on what was before possible to achieve by presenting 2D plans of underwater sites. That the models do not contain the same level of archaeological data or interpreted results as a traditional report was not seen as a hindrance for communication.

In digital models shared to public audiences an effort is made to emphasise the aesthetic elements of sites underwater over high levels of detail or archaeological data. Rather than presenting public audiences with detailed knowledge of site information that would assist in archaeological interpretation IP15 therefore edits digital models to what he assumes is more appropriate data:

*The thing with photogrammetry is, I think it's better to record a site with the highest quality possible and then you can use the same data for both scientific purposes but you can easily use to send it for using public outreach and 3D models, and then you just scale down the data just to give an impression. You don’t need to*
have all the details, that’s not what the public I suppose would be interested to see, the treenail hole or the square nail hole, so that’s the thing, so that’s what I’ve been doing, I do it properly to achieve the highest quality possible, and then try to use the same data to produce different kinds of models (IP15, 27:48).

IP08 explained that when multi-image photogrammetry was used as a recording method the models were made with documentation as the primary goal, but more recently they have been creating 3D models with dissemination purposes because of their appeal to wider audiences:

*it can produce some very appealing data as well that can be awesome for dissemination, by its very nature people tend to get attracted to the nice models and we can make that* (IP08, 09:55 file 1).

IP05 suggested that what an ordinary member of the public is interested in is more general information relating to the finds themselves, rather than the detailed results of analysis or the facts that are prevalent in archaeological reports. From personal experience he found that sharing detailed analysis with journalists, such as measurements of ship elements that would be of more relevance to an archaeologist, did not result in any media communication.

Sport divers were identified as the one group or audience who would benefit from more detailed information, in particular relating to the appropriate means of engaging with maritime heritage underwater and consequences of removing objects from their archaeological context. The belief is that these efforts generates more respect for underwater heritage that in turn benefits the conservation and preservation of sites.

One positive aspect of immediate communication online and via social media outlets identified was the ability to engage directly with audiences. IP06 reflected on the difference between weekly blogs and social media posts, where the former might contain more concrete information relating to the significance of a project the latter was identified as creating an active dialogue between maritime archaeologists and those interested in learning more. Using social media sites was also seen as an easier way for the individuals to communicate, whereas a blog post required more intensive writing of text and editing of images.

Apart from visualising the archaeological process, a number of participants cited the importance of creating a narrative relating to or resulting from the analysis of archaeological data. In discussing communication to various audiences, IP12 referred to the American nautical archaeologist, James Delgado, noted for his work on the Titanic expeditions. The point Delgado made
was that it is not enough to present data to the public, rather a narrative is needed.

*Yes, I went to talk once by James Delgado, the American archaeologist who was in charge of the Titanic survey and so on, and he said that we always need to get back with a story for the public, that's the most important thing! Not to come back with only data and data and data, come back with a story!* (IP12, 45:02).

While many participants identified the importance of storytelling and narratives not all believed that it was always feasible for contract maritime archaeologists to deliver this. Furthermore, IP06 raised the interest in many younger shipwrecks that are not afforded heritage status but that may have accessible and interesting stories attached to them. In this sense, heritage laws shape the kinds of narratives that maritime archaeologists can create within the context of contract projects.

For one participant, work that maritime archaeologists carry out consisting of gathering data and that focuses largely on fieldwork activities, rather than research, which can result in interesting stories or narratives for public audiences:

*What we communicate to the client and the authorities falls back on the value for money, on the technicalities of things, which is rarely in my opinion what the public, capital P, wants to know about. They want the stories, they want the analysis, and they want the results of it rather than the grunt work, which usually is contract archaeology (IP08, 05:18 file 2).*

Similarly, IP14 while reflecting on the text outlining the Faro convention felt that current museum formats and exhibits did not present material with the interests or needs of public audiences in mind:

*So what it says is that it's a very democratic way of understanding the past and asking who is it for. Well, I think the traditional way of thinking of museum exhibitions is not very like this, it's kind of an old way of thinking of how to involve people in the past so I can understand why this is a better idea. The question is how to actually solve it in a practical way, within the limits of the museum, where should this happen or how to make it happen.*
But I think if we go on presenting the past within the limits of the museum we will not be doing this for so much longer [laughing] that’s my personal opinion. I think it demands some kind of involvement, to make it interesting and relevant for others (IP14, 47:45).

The tendency for mass media to categorise maritime archaeology as entertainment was criticised by one participant, IP02, who felt that instead the narratives should remain focused on the heritage site or archaeological results. Rather than relying on the old media formats that place maritime archaeology within a predetermined genre, it is suggested that by taking advantage of new media maritime archaeologists no longer need to conform to stereotypes.

I am damn tired of being categorised as entertainment, like if there is news on the TV it [maritime archaeology] is always shown before the weather [laughing] and that is not where we want to be. And if we are to play, ah, if we are to be included in social discourse we should not participate as entertainment. We should be the collective memory, of why we should not gas people to death, like. We are living in a time of changes in that sense too, the old press and TV almost no longer exist, you are your own media (IP02, 52:14).

Discussion
From those participants who recognised the public interest in maritime archaeology and underwater heritage, a number of suggestions on how to create access to sites that only a few heritage experts get to experience were offered. A particular emphasis was placed on the benefit of immediate communication, especially via social media. Also suggested were ways by which parallels could be made between past situations and those happening today, for example, economic crises and how people react to difficult situations; informing the public of what sites are underwater, regardless of age or heritage status; telling people a story; allowing the public to understand the archaeological process underwater, giving the public an impression or an idea of heritage rather than too many details.

New media, as mentioned by participants to include blogs and social media posts, are changing the nature of communication that maritime archaeologists have with interest groups, such as avocational maritime archaeologists, divers and people interested in historical archaeology. Most notable in this change is the speed by which publishing takes place. Earlier communication channels, such as newsletters or society magazines allowed time for a certain amount of research and referencing, even when preliminary results were being presented.
While new media prioritises the immediacy of publishing direct from the field, it often means that the accompanying narratives are less concrete or not based on archaeological analyses. This was not seen as an issue, however, when communicating with groups who were already knowledgeable or interested in diving or maritime archaeology. Engagement with sports divers as an interest group was cited by individuals working in all three countries, and indeed they are an important group to whom underwater cultural heritage is an important resource. Divers, however, do not represent a majority or a large portion of the public in Sweden, Denmark or Norway. Virtual diving may therefore present a pragmatic opportunity in allowing more groups in society to experience maritime heritage.

Virtual experiences of heritage underwater prioritise the viewpoint of the diver (Reunanen, Díaz and Horttana, 2015; Eric Nordevall, 2012) diving on a site as it is today, on the seabed or in a river or lake. Some visualisations present how the site came to be, showing a site formation process from a sunken ship to a broken up wreck, with details such as water depth and targeted information points highlighted to encourage interaction with specific areas.

These elements direct the user’s attention to elements of maritime archaeology that professionals prioritise, rather than allowing the user to navigate a space of their own accord. Aspects of a “dive” that are of importance to archaeologists, for example, the depth of water is used to calculate diving tables that control how much exposure time a diver can safely stay underwater, do not necessarily need to be of consequence to someone standing on land. Is it important that virtual divers are exposed to the same risks as maritime archaeologists? Or do the risks enhance the experience and thereby make underwater heritage more valuable because of the lengths involved to access it?

By directing users to areas of a site, either because there is information to share about the finds or the areas were important for the archaeologists to research, suggests that virtual divers are allowed to experience underwater heritage in a limited and specific way, the same way that a maritime archaeologist would.

The current efforts at presenting underwater cultural heritage is influenced by expert ways of knowing and experiencing, and this is especially so with digital underwater heritage environments. Rather than digitally recreating heritage sites to allow users to interact with a functioning site, such as a ship or a boat on the water as it had once done, the focus remains on the material that archaeologists find, often a jumble of disjointed timbers. Expert knowledge is required to access meaning and to interpret the archaeological or historical significance of heritage sites like these. The act of presenting and communicating digital visualisations of this kind is often equated as successful outreach due to the technological advances in digital visualisation.
Part 3

3.1 Conclusion and outlook

This part presents a summary of the analysis in light of the research aim of the licentiate. This will be followed by a discussion of identified knowledge gaps suggested for future research.

3.1.1 Summary

This thesis considers the use of digital visualisations for knowledge production and communication of maritime heritage located underwater. The aim is to understand the use of digital visualisation for knowledge production and communication of maritime archaeology located underwater.

The case study used for the research is the contract maritime archaeology sector in Scandinavia. The empirical data used stems from 15 semi-structured interviews conducted with maritime archaeologists active within the sector in Scandinavia. To broaden the scope the case study included the countries of Denmark and Norway, as well as Sweden, where the research is based.

The methodological approach taken for the case study (Part 2) draws from approaches developed in the fields of discourse analysis and thematic analysis. Studies approaching heritage discourses with or inspired by critical discourse analysis methodologies provided starting points for this case study (Smith, 2006; Waterton, 2009, Högberg, 2012; Taylor & Gibson, 2017). The concept of the authorised heritage discourse (Smith, 2006) provided a framework for analysing discourse relating to the use of digital technologies in the contract sector. Thematic analysis of transcript material informed the method of coding.
the data into categories and themes. Relating to the research questions the themes concerned: the maritime contract sector; how the nature of the sector defines the roles of the individuals or research goals; digital technology with an emphasis on those producing visualisations; and concepts of communication.

The research questions that provided the means by which I could accomplish the research aim were:

- What are the primary professional priorities, identities and interests that prevail in the Scandinavian contract maritime archaeology sector, and what influence do they have on visualisations and communication of archaeological sites underwater?
- What are the primary motivations for adopting digital documentation technologies in the contract maritime archaeology sector?
- How is communication understood by contract maritime archaeologists working in the Scandinavian sector?

3.1.2 Results

By investigating the primary professional priorities, identities and interests among participants active in the contract maritime archaeology sector, I have created a deeper understanding of how digital recording technologies are understood in the sector. The results show that elements of an authorised heritage discourse are evident in the motivations for the use of technologies and the digital visualisations created.

Knowledge production within the context of contract projects was found to be predominantly concerned with the efficient creation and reporting of archaeological data to serve as a basis for planning and development decisions. Following safety, which is of paramount concern within the context of diving, the study shows that efficiency is a fundamental goal at all stages of contract maritime archaeology projects. In both competitive and non-competitive systems of contract archaeology, the emphasis on efficiency is associated with the governing authorities responsible for supervising contract projects and the timelines of development activities. Despite the stated goal of creating new knowledge in the contract archaeological sector, the results of maritime projects primarily report the existence of unknown sites or are used to assist planning and development efforts. Using digital documentation methodologies with knowledge production as an explicit goal is not widely considered in the sector. Current workflows are adopted based on outcomes such as efficiency and visuality rather than enhancing interpretation.

Degrees of knowledge production are contingent on the type of project, with different methodologies used such as surveys, investigations or excavations. The high number of surveys and investigation projects, along with the fundamental questions they aim to answer, result in data on site locations, their
dimensions/areas, typologies and age. The infrequent occurrences of excavations presents limited opportunities for research on underwater sites. Digital visualisation technologies for maritime archaeological surveys are primarily used for locating and identifying the presence of archaeological sites underwater. Images resulting from these technologies serve as aids for experts in the field, are presented in archaeological reports and are used to illustrate the maritime archaeological process. Multi-image photogrammetry methods and resulting 3D models of underwater sites are utilised mainly for maritime archaeological investigations or surveys in order to effectively document underwater sites. The resulting visualisations are not primarily created with communication as a goal but are nonetheless used for outreach purposes.

In general, knowledge production in the form of research and analysis of data from contract projects is understood to be the responsibility of academic institutions. The contract sector is seen as one link in the chain of knowledge production, charged with the task of gathering data. However, the low priority given to ensuring the longevity and future reuse of the data produced, such as appropriate file formats and archival procedures to ensure that others will have access to the data, contradicted this understanding.

The contribution to knowledge production by the sector is defined by maritime expertise. Participants predominantly acknowledged the importance of defining their maritime specialty as part of their professional identity, rather than archaeologists or contract archaeology specialists. The distinction made between maritime archaeology and terrestrial archaeology further emphasises maritime expertise and a sense of operating separately from other sector companies or units.

Professional maritime identities are related to the interests that participants had prior to following their maritime archaeology careers. Scuba diving, shipwrecks and historical archaeology were common interests for participants who later pursued careers based on these. A broader education in archaeology and later specialising in maritime subjects and diving education resulted in participants viewing diving as a method by which they could access the archaeological site. Despite these different interests, all participants share similar understandings on what information and data from underwater sites that are of relevance, which are answering the research aims of contract projects and concerned the mapping, collation and management of sites.

The use of digital visualisation technology is primarily in order to increase efficiency by enabling archaeological documentation to be carried out in more visual detail and in less time than traditional, hand-drawn methods. The impetus for applying new methodologies is to deliver data to heritage management bodies in a timely and cost-efficient manner, while the potential to present this data visually is understood to fulfil contract archaeology’s responsibility to conduct communication and outreach activities. With efficiency as the main basis for using digital documentation technologies and with planning and
development priorities informing the data collected, it can be concluded that digital visualisations of underwater archaeological sites resulting from contract archaeology projects and communicated to all audiences, are primarily informed by these goals.

The content or subject matter which is considered to be of most importance to communicate to audiences, and also understood to be of most interest or relevance, is the process of archaeological work underwater and how sites appear underwater. The analysis shows how the specialist maritime identities influence visual communication efforts with wider audiences that the participants described, where emphasis placed on the underwater environment in which the sites are situated and on the specialist methods required to work there. This limited and defined means by which maritime archaeology sites are presented reflects an authorised heritage discourse where the legitimised means of understanding is that of the expert view and knowledge.

Communication of archaeological sites underwater is understood to be greatly improved by the ability to visualise them in 3D, further enhancing non-expert understanding of both the archaeological process underwater and maritime sites themselves. The immersive qualities of virtual technologies are also identified as having potential to communicate the feelings associated with archaeology underwater, centred around diving underwater and discovery of archaeological sites. While the pedagogical potential of 3D visualisations is acknowledged, those resulting from contract projects are by-products of efficient documentation, and not produced with outreach or communication as a primary recording objective.

The intended audiences and target groups for communication efforts were described by participants using a range of vocabulary. In order to present these results clearly the responses were grouped according to categories. For example, groups such as society and everyone were categorised as The public; sport divers and history enthusiasts were categorized as Special interest groups. Figure 3 presents these categories, comprising of audiences or target groups identified for communication efforts of contract maritime archaeology work. In descending order of how frequency these are cited: special interest groups (6), consumers of mass media - both digital and print (5), heritage authorities (4), colleagues (4), the public (4), project clients (2), museum visitors (3), local communities (1), schools (1), all project stakeholders (1). Even if archaeological reports could serve all these recognised audiences, it is generally felt that they are not widely read by those without special interests in archaeology or involved with contract projects. Communication to public audiences is generally recognised as an important part of the contract archaeological process, involving outreach and dissemination activities. The degree to which communication activities are carried is often are based on the willingness and interest of individuals to do so or as defined by project parameters.
Online communication of the maritime archaeology working process and environment are understood as more democratic and inclusive communication topics than those contained in archaeological reports. Images taken in the field and uploaded to either institutional or individual personal social media accounts is recognised as a suitable means of outreach for contract survey or investigation projects with minimal communication budgets. A common understanding among participants is that the real-time posting of content and engagement with the maritime archaeologists is of more interest to public audiences than analysis results. This is understood as especially important in areas where members of the public may not be aware of the presence of maritime archaeological sites.

Despite few participants identifying professionally as being part of the contract sector and the recognition that archaeological reports represent an unsuitable outreach format, the typical content communicated to wider groups reflects much of the same information that contract maritime archaeologists deliver to heritage agencies and clients. This generally consists of presentations of archaeological data and visualisations, similar to that contained in archaeological reports. Information concerning site location, dimensions or area, state of preservation, a date of the site and construction sequence/tradition, along with details explaining how this information was obtained are commonly presented to all audiences. For heritage authorities this information assists with decisions on development plans and also fulfil the requirements for heritage registration. When communicated to wider audiences the outreach of this information via online channels is favoured over inaccessible technical reports, and is done so intending to of being of relevance to all of society.
3.1.3 Outlook

It has been ten years since Joe Flatman summed up maritime archaeology education as partly being “at heart ‘avocational’, a self-sustaining ‘hobby shop’ in which one bunch of people teach another bunch of people some stuff, everyone seems pretty happy, but nothing much changes” (Flatman, 2008: 121). While the contract sector is by no means avocational, the latter part of his observation resonates. The latest “stuff” adopted by the field, that is digital and 3D technologies, do appear to make many people happy, but have they really contributed to a fundamental change in the way that contract maritime archaeology operates?

Throughout the interview process and review of maritime archaeology literature the presence of a particular tradition was evident. This maritime archaeology tradition honours the early work of the discipline’s pioneers who have striven over the past 60 or so years to raise the profile of underwater archaeological work within mainstream archaeology and to legitimize it as a serious practice. It is a tradition that creates a sense of pride among those who carry out this kind of work that so few chose, or have the opportunity, to do. It is also a tradition that is open and acceptant of both adapting and incorporating new and emergent technologies into the maritime archaeological workflow, testing boundaries in attempting to move the discipline forward. This tradition is predominantly masculinist, not only in the sense that the majority of those employed in the sector today are male (table 1), but is masculinist in the fundamental objectives that steer the discipline.

Referring back to the discussion of the authorised heritage discourse (section 1.5.1) this tradition legitimizes particular gendered identities and cultural values (Smith, 2008) where masculine identities and values are overly represented in maritime archaeological research (Flatman, 2003; Ransley, 2005, 2008; Ransley & Satchell, 2014). In addition, a number of methodologically oriented traditions dominate disciplinary practices (Flatman 2003, 2007a, 2007b; Harpster, 2013). This is evident in the high priority given to visual representations of monumental and aesthetically pleasing sites underwater, and that are understood as being preserved for future generations through digitisation. By emphasising importance on the material and monumental maritime remains, the “particularly masculine values from the elite social classes” (Smith, 2008: 160) of the heritage sector are strengthened. Belief in the importance of this work is justified on the basis of risks that these underwater sites face, either from development, looters or environmental factors. This belief is bolstered by notions of nationalism and patrimony, where maritime archaeologists ensure the protection of underwater monuments and pass along their knowledge to public audiences. The resulting sense of patrimony is ever
present in this tradition and this transfers to the communication of heritage sites by expressing to the cultural experiences of a certain social group.

Technology is one of the fundamental ways through which gender is expressed in society (Bray, 2007). Feminist critique of GIS methods, for example, argue that the objectifying male gaze enabled by the technology creates a disembodied and masculinist vision (Kwan, 2002: 648-650). The ability to have vast overviews of landscapes and sites is both assumed and normalised in archaeological practice. A quantitative and seemingly neutral tool for visualising archaeological data may not be obviously reinforcing patriarchal power, but because many masculinist privileges in society are institutionalised and pervasive, so too are many technologies and their intended use. Translation algorithms, as a more obvious illustration, have been shown to work according to pervasive gender bias in favouring male over female when faced with gender-neutral pronouns, and to pair certain genders with particular professions or values, for example, nurse, nanny and lazy are linked with female, whereas soldier, doctor and hard working with male (Quartz, 2017). Seemingly innocuous emoji on certain platforms are also shown to follow this pattern, and this has been identified as stemming from biases inherent in the predominantly male tech industry (Forbes, 2018).

In maritime archaeology methods and technologies have been developed for and by a predominantly masculinist discipline. Looking ahead in the quest to provide visualisations and knowledge of maritime archaeology to public audiences it is no longer feasible to consider 3D and digital methodologies as being objective and providing universal visual results. While the connection of gender with topics like public audiences, interpretation and the sector were in general absent in the case study interviews, more subtle biases were noted such as repeated references to ships as female objects. Looking at archaeology in general, a large proportion of full-time employed and established names in the discipline are male. This alone has been shown (Surface-Evans, Jackson & Jackson, 2012) to lead to fewer opportunities for women to excel and remain in the field. Since the completion of the interviews a widespread dialogue on gender/power relations has resulted from the Me Too Movement, which has thus far been concerned with equality in the workplace (e.g. DN, 2017 relating to Sweden). To continue this dialogue so that it can evolve to tackle both explicit and subtle consequences of gender inequality, a sector-wide engagement with feminist theory is required. Donna Haraway (1988) identified the need to bring together multiple voices and points of view relating to situated knowledges in the quest for more “objective” viewpoints. For Haraway feminist objectivity is not about whitewashing the past of all male references or interpretations, but instead includes experiences and perspectives that are not traditionally privileged (Haraway, 1988). If the wish to answer the objectives of democratic heritage management, that is to allow citizens equal participation, access to and authorization in heritage discourses (Guttormsen & Swensen, 2016: 2), then the
knowledge gap of how to go about acknowledging and communicating to multiple and diverse groups in society is one that needs closing.

As stated in the results above, the use of 3D interactive visualisations for communicating information from maritime archaeological sites is widely understood to be accessible by and of benefit to all audiences. Yet, it has also been established that the information communicated in these visualisations are heavily informed by development-led heritage management goals and professional priorities of their creators. The assumption that when archaeological information is presented visually that it becomes automatically and universally accessible, reveals a knowledge gap relating to the importance and understanding of communication with diverse public audiences. This places emphasis on merely one way to interact with and engage with heritage sites, one that privileges the expert need for accurate quantitative data over any forms. The recognised target groups and their associated priorities are illustrative of just one misconception relating to heritage communication. It could be hypothesized that this lack of understanding is not recognized since many participants actively engage with enthusiastic citizens via online platforms. However, since those who follow maritime archaeology interest blogs and social media pages are more likely to have prior knowledge or interest in the topic, this engagement may skew perceptions. For audiences that lack knowledge or understanding of diving, shipwreck construction or maritime history, there exists the likelihood that archaeologically informed visualisations may be alienating or of little significance.

Knowledge pertaining to digital archaeological practice varies within the sector, which is to say that in some instances the potential for enhancing archaeological analysis in a sector that is primarily engaged with limited survey projects is acknowledged by some. For others, the understanding of using 3D digital data to facilitate new ways of interacting with and interpreting archaeological data is largely unknown, thus revealing a second but related knowledge gap of digital archaeological theory and practice. As discussed above (section 1.5.2), 3D and digital technologies can allow for holistic understanding of sites, new interpretations, and reflexive engagement with archaeology (Berggren et al., 2015; Dell’Unto et al., 2015; Petersson, 2018). Basing the use of digital tools on their efficiency advantages should not result in survey or investigation projects becoming shorter, on the contrary, the time that is saved should allow for additional archaeological fieldwork, analysis or research.

These two knowledge gaps may be related to what was recognised in this research as an understanding that data collection and communication of data represent two separate stages of the archaeological workflow, independent of one another. For communication to be considered seriously as a legitimate outcome, rather than a potential benefit, new workflows and approaches to contract maritime archaeology are required. This will first require a sector-wide
understanding that interpretation is of importance and relevance to both archaeologists and non-experts. As Sara Perry (2018) argues, the incorporation of interpretation processes into the digital archaeological workflow has the potential to lead to imaginative acts of envisioning multiple worlds that could expand current interpretations of the maritime past, work to re-humanise the past and allow for the democratizing of the interpretative process. In a similar vein, William Caraher’s (2016) call for a slower, more reflexive archaeology highlights the risk of less importance being placed on archaeologist’s interpretative skills unless digital tools are carefully considered. Addressing these areas could uncover new ways of knowing and also work toward dismantling certain authorised elements of the current maritime archaeology discourse.

The knowledge gap of digital archaeological theory also concerns the longevity and potential re-use of digital archaeological data in the future. Since 3D documentation methodologies are still under development, standards and formats have yet to be established for their archival, a truth acknowledged by maritime archaeologists and the Swedish National Heritage Board (Riksantikvarieämbetet, 2018). Yet, this did not raise many reservations about whether or not current 3D documentation could considered as archaeological documentation, in the sense of it being archived according to national standards and available for future research.

The results of this research show that analytical, communicative and archival potentials are misunderstood or largely ignored by many within the contract maritime archaeology sector in Scandinavia. So, in one sense it could be like Flatman proposed, that nothing much really has changed. This outlook and the elements of current practices that it highlights may read as unnecessarily bleak, yet I feel that at this time it is required. Literature expounding the myriad of benefits that digital and 3D technologies offer to maritime archaeology is generally lacking in critical evaluations of new methodologies. This thesis offers a counter to the prevailing blind techno-optimism that has followed the discipline to this day. It also echoes Caraher’s (2016) slow archaeology sentiment that does not call for a rejection of digital technologies or new techniques, but proposes a critical assessment of their design to ensure a reflexive archaeological process.

Thankfully, traditions need not necessarily keep up rooted to the past. If change is indeed desired, research on archaeology, heritage and digital technologies in contemporary society can aid in navigating toward a maritime archaeology 2.0. While the legitimized and official operations of the heritage sector are influenced by some older values and understanding of heritage, new perspectives are also present. In addition, a range of external social and political influences affect the individual maritime archaeologists and their perceptions of the world. If, as Holtorf suggests, the significance of heritage sites in contemporary society is more related to their meanings in the present than on
events that took place in the past (Holtorf, 2005: 158), then so too are the understandings of maritime archaeologists. Far from existing in a vacuum they too are influenced by changes in society and the upheaval of norms. A maritime archaeology 2.0 may see a desire to change the role of maritime archaeologists from primarily responsible for the “grunt work” (IP08, file 2 05:32) of the sector to include providing new ways to meaningfully engage with archaeology underwater.

The identified knowledge gaps discussed in the previous section form the basis from which the second stage of this PhD research will advance. These knowledge gaps relate to diversity in maritime archaeological practice and research in the contract sector. A second knowledge gap is the relating to the communication of maritime archaeological knowledge to various audiences. The third knowledge gap concerns digital archaeological theory and methodology to allow for knowledge production and communication possibilities, as well as the longevity of data for re-use. Future research on these areas will inform workflows for the documentation of archaeological sites underwater that the overall PhD project will provide. The results of the overall project will work toward providing possibilities for extending the market of contract maritime archaeology.
Swedish summary (sammanfattning på svenska)

Denna licentiatavhandling behandlar användningen av digital visualisering av maritima lämningar under vatten. Avhandlingen fokuserar på arkeologiska undersökningar som genomförs inför markexploatering, så kallad uppdragsarkeologi. Syftet är att förstå användningen av digital visualisering för kunskapsproduktion och kommunikation av maritim arkeologi.


Utgångspunkten för denna undersökning är att problematisera den maritima uppdragsarkeologiska disciplinens antagande att digitala visualiseringar i sig är ett gynnsamt sätt att kommunicera med icke-expert. Mot den bakgrunden styrs studien av följande forskningsfrågor:

- Vilka är de främsta professionella prioriteringarna, identiteterna och intresseområdena inom den skandinaviska maritima uppdragsarkeologiska sektorn, och vilken påverkan har de på visualiseringar och kommunikation av arkeologiska lämningar under vattnet?
- Vilka är de främsta motiven för att använda digital dokumentationsteknik i den maritima uppdragsarkeologiska sektorn?
- Hur uppfattas fenomenet kommunikation av de uppdragsarkeologer som är verksamma inom den skandinaviska sektorn?

I målen för svensk uppdragsarkeologi läggs tonvikt på att, å samhällets vägnar, skapa dokumentation av den arkeologiska processen. Vidare framhålls
kunskapsproduktion och säkerställande av tillgängliga resultat som viktiga delar av arbetet (Högberg & Fahlander, 2017:15). Praktiska och administrativa aspekter av uppdragsarkeologi i Skandinavien innefattar undersökning, utgrävning och tolkning av arkeologiska lämningar. Det framhålls emellertid att resultaten från detta arbete ska överstiga sitt egenvärde genom att tillgängliggöra och demokratisera kulturarvet och därigenom vara till nytta för samhället (e.g. Faro Convention, 2005).


Ett antal kritiska röster från forskningsfältet ”digital arkeologi” har börjat ifrågasätta tillämpningen av digitala tekniker och metoder utan en full förståelse för de konsekvenser detta har för den arkeologiska processen, tillika effekten på arkeologerna som själva är en del av processen. Fokus för forskningsproblemet är den existerande klyftan mellan dokumentations- och kommunikationsprocesser. Det har framlagts att kommunikation bör beaktas i början av processen (Pettersson, 2018, Börjesson et al., 2016: 12). I lic-avhandlingen undersöks ett vida utbrett antagande att digitala visualiseringar i
sig är ett gynnsamt sätt att kommunicera maritim arkeologi med icke-expertgrupper.

En teoretisk utgångspunkt för diskussionen i del 1 är att den västerländska kulturarvssektorn domineras av vad Laurajane Smith kallar “the authorized heritage discourse”. Denna diskurs prioriterar kulturarvsexperternas roll, förstärker könsstereotyper i samband med kulturav och definierar sätt på vilka människor ska engagera sig i kulturav (Smith, 2006). Efter detta presenteras ny forskning om digital visualisering med betoning på datainsamling och visualisering av resultat. Slutligen presenteras ett antal tvärvetenskapliga förhållningssätt till maritim arkeologisk forskning. Förhållningssätten ämnar fungera inkluderande och demokratiserande gällande synen på vårt maritima förflutna. Detta arbetssätt ser bortom den traditionella analysen av fysiska lämningar och strävar efter att ställa nya frågor, såsom utredningar som fokuserar på det sociala livet ombord på fartyg liksom genupspektriv.


Nuvarande arbetsflöden baseras på effektivitet och visualisering snarare än förbättring av tolkningar av arkeologin.


Eventuellt bidrag till kunskapsproduktion bestäms av maritim praktik. Majoriteten av deltagarna i intervjustudien definierade sin yrkesidentitet primärt som maritima specialister, snarare än som arkeologer eller uppdragsspecialister. En uppdelning av utrycket ofta mellan maritim arkeologi och terrestrisk arkeologi vilket ytterligare betonade maritims speciality och en känsla av att fungera åtskilt från andra branschföretag eller enheter. Ofta är professionell maritim identitet relaterad till de intressen som deltagarna hade innan de inleddes sina karriärer som maritima arkeologer. Trots olika bakgrundssintressen delade alla intervjudtagare likadant förståelse för vilken data från undervattens-platser som är relevant för uppdragssändt. Datan från uppdragsarkeologiska projekt ska primärt besvara förutbestämda frågeställningar, dessa handlar i stor utsträckning om kartläggning, sortering och hantering av fornlämningar.

Ett annat resultat av intervjustudien är att de ämnen som anses vara av största vikt och relevans att kommunicera till allmänheten är processen för det arkeologiska arbetet under vattnet och hur lämningar ser ut under vattnen. Detta begränsades sätt på vilket maritima arkeologiska lämningar presenteras återspeglar en “authorized heritage discourse” som fokuserar på expertens synsätt och kunskap. De intervjuade anser att kommunicering av arkeologiska platser under vattnen förbättras avsevärt genom förmågan att visualisera dem i 3D. Den förstärker icke-expertens förståelse för både den arkeologiska processen under vattnet och för maritima lämningar. I vilken utsträckning kommunicering bedrivs bygger ofta på de enskilda arkeologernas vilja och intresse att göra det. Onlinekommunicering av arbetsprocessen och miljön i maritim arkeologi förstås som mer demokratisk och inkluderande kommunicering än den som ingår i arkeologiska rapporter.
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