Underwater cultural heritage management and public engagement

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Climate change impact assessment on shipwreck sites in Ireland

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Abstract: In Ireland, the CHERISH project has investigated the impacts of climate change on wreck sites exposed to different environmental conditions. Remote sensing and archaeological recording methodologies created substantive site records, baseline and monitoring datasets. Maritime archaeologists, geologists, divers, surveyors and geophysicists worked together, providing a range of expertise for data collection, analysis and appraisal. The incorporation of previous site records made it possible to assess change and site formation processes for periods longer than the six-year course of the project. The CHERISH project looked at a number of wrecks from three different locations and environments, including unidentified wooden intertidal wreck sites at North Bull Island, Dublin, which are being impacted and damaged by storm activity on an annual basis; the schooner *Sunbeam* located at Rossbeigh Strand, County Kerry, which has suffered severe damage due to storms in recent years; and SS *Manchester Merchant*, which is located a few kilometres offshore from the *Sunbeam* in Dingle Bay and has been reported by local divers as deteriorating due to storm damage. This chapter presents the gathered data, how data can help increase the understanding of these cultural heritage assets and how climate hazards associated with climate change are impacting the coastal and underwater cultural heritage resource.

Introduction

CHERISH (Climate, Heritage and Environments of Reefs, ISlands, and Headlands) investigated how changes to the physical climate of Wales and Ireland are impacting archaeological heritage along the coastal zone and underwater. This cross-nation multidisciplinary European-funded project (Ireland-Wales 2014–2020 Programme) was undertaken by four project partners: the Royal Commission on the Ancient and Historical Monuments of Wales; the Discovery Programme: Centre for Archaeology and Innovation Ireland; Aberystwyth University: Department of Geography and Earth Sciences; and the Geological Survey Ireland. The project ran for a period of six years from 2017 to 2023 and raised awareness of climate change for Irish Sea communities through outreach events such as talks and community excavations.

Anthropogenic climate change is accelerating and intensifying environmental impacts acting on the cultural heritage resource (Cassar 2005; Colette 2007; Jigyasu *et al.* 2013; Fatóric and Seekamp 2017; ICOMOS 2019; Dawson *et al.* 2020). Physical wreck-site change is caused by climate hazards such as coastal erosion and flooding, increased storminess, drought and seabed erosion, phenomena which are increasing in frequency and intensity due to climate change. CHERISH mapped, monitored and assessed potential climate change impacts on shipwreck sites by establishing new metrically accurate baseline and monitoring datasets. A number of the survey methods were able to be repeated during the course of the project, and the results were subsequently compared to the initial baseline or/and other pre-existing surveys to analyse degradation and change at the wreck sites. The research and survey work presented within this chapter produced important information on the overall archaeological context and impacts of climate change on shipwrecks.

The debilitating effects of sea-level rise include more extreme and frequent flooding events, increased impacts of storm surge and accelerated rates of coastal erosion. These are projected to alter the natural and built environments, and therefore, understanding the impacts to heritage is crucial (Curran *et al.* 2016: 23; Horowitz 2016: 40). The relationship between rising sea levels and flood events is clear; this means an uncertain future for heritage assets situated on the coast. Sea level rise is seen as a pressing issue, as coastal heritage and communities were dealt with in the subject matter of 23% of publications on climate impacts and cultural heritage in the five-year period 2015–2020 (Orr *et al.* 2021: 12). In Ireland, sea levels are forecast to increase for all coastal areas, with satellite observations indicating the sea level around Ireland has risen by approximately 2–3 millimetres per year since the early 1990s (Cámaro García and Dwyer 2021). Increasing wave heights have been observed over the last 70 years in the North Atlantic (Cámaro García and Dwyer 2021), and projected changes in sea level will magnify the impacts

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of changing storm surge. Alteration to storm patterns has the potential to impact wave strength and direction (see Woolf and Wolf 2013), potentially increasing seabed and coastal erosion, which in turn results in the degradation of underwater and coastal archaeological heritage. Erosion is one of the greatest threats to coastal archaeological resources, as wave and tide action cause the loss of invaluable and unrecoverable information (Westley *et al.* 2011: 352). Coastal erosion may destroy heritage sites gradually over decades or cause catastrophic loss during single events (Dawson *et al.* 2020, 2021).

The CHERISH project focussed on wreck sites located in three different locations and environments, including Dublin Bay, which is relatively enclosed and sheltered from the prevailing winds, and Dingle Bay, which is exposed to the full forces of Atlantic weather systems. The main aim was to monitor site condition and change, in order to understand how climatic changes are physically impacting wreck sites located in these exposed coastal and underwater environments. Overall sea-level rise for Dublin Bay is in line with expected trends, but higher rates of rise occurred in recent years (Shoari Nejad *et al.* 2022: 511). Higher sea levels amplify coastal flooding and erosion, which directly impacts the coastal archaeological resource of intertidal wreck sites at North Bull Island. The erosion of the dunes at Rossbeigh, Dingle Bay, where the wreck of the *Sunbeam* is located, has been of particular concern; erosion and flooding events in this area are predicted to intensify in the context of climate change, sea level rise and more intense and frequent storms (Tubridy *et al.* 2022: 7; also see Devoy 2015). SS *Manchester Merchant* is located in 15 m of water in Dingle Bay. Climate change will cause increased storminess for Ireland, which means more frequent storm surges. Seabed sediments are affected by storm surges; during storms, wave–current interaction may result in seabed damage (Zhang *et al.* 2015). From this, it can be ascertained such events may damage archaeological material located in impacted areas, whilst stronger currents will increase scouring around wreck sites during storm periods.

North Bull Island, Dublin Bay

In Dublin Bay, on the intertidal sand flats seaward of North Bull Island storms, shifting sand bars and channels occasionally expose shipwrecks and loose timbers. This island developed after the completion of the North Bull Wall, built to protect the entrance to Dublin Port in 1824 (Gilligan 1988: 89–95). The harbour wall blocked sand movement around the Bay, causing an area of sand dunes to grow to become the island known today as North Bull Island. Over 800 shipwrecking events in Dublin Bay are recorded in the Wreck Inventory of Ireland Database (WIID) held by the Underwater Archaeology Unit (UAU) of the National Monuments Service (NMS) (Brady 2008; WIID 2023). These are compiled from historical records, archaeological investigations by the NMS and development projects such as the Dublin Bay pipeline project in 2001 and 2002. The earliest documented record for a wrecking incident in the Bay dates to 1562, when the Vice-Treasurer of Ireland reported a ship with artillery and munitions wrecked on Dublin Bar. No doubt, many ships were lost in earlier times, and some evidence for this has emerged with keels from clinker-style vessels dating to the eleventh to thirteenth centuries recovered from the 2001 pipeline project (Brady 2008: 268, 322; Dunne 2008: 295–298).

Surveys over the last 30 years have found six wooden wrecks, recorded in the WIID, on North Bull Island strand, though there are approximately 150 historical wrecking events (Brady 2008). The number of vessels recorded as being wrecked on the North Bull, Dublin Bar and North Wall area every decade falls from 35 in the 1790s when the Great South Wall was built to only eight wrecks in the 1830s after the North Bull Wall was built. This not only highlights the effectiveness of the building of the seawalls, but it also suggests many shipwrecks found today could be from the late eighteenth century or earlier. Historical sources also record episodes of plundering wrecks lost on the North Bull; one such occurrence took place in 1745, when Lord Howth jailed tenants for looting recently wrecked ships (wreck no. W01071). This and other historical accounts of the protection of wrecks from plundering by various authorities may explain why the wrecks which are exposed on North Bull were not completely salvaged for their wood at the time of wrecking.

CHERISH undertook seasonal and post-storm site monitoring visits of intertidal shipwrecks, from September 2019 to February 2020 when, unfortunately, the Covid-19 pandemic prevented fieldwork. Fieldwork involved archaeological survey, beach profiles and magnetometer survey to ascertain if significant changes could be detected over time, particularly after storms. Earlier commercial and UAU surveys were incorporated into the site analysis to further the understanding of the archaeological context alongside rates and patterns of change at each wreck site. As well as the usual tidal and seasonal changes, a series of storm events occurred during CHERISH fieldwork in early 2020 which impacted the wrecks, including Storm Brendan (13 January 2020) and Storm Ciara (9 February 2020). Due to the dynamic tidal nature of the environment, weather conditions and the varying levels of wreck exposure, a variety of equipment and techniques were required to record the sites, including GPS (particularly Global Navigation Satellite System (GNSS)), beach profiling and magnetometry (using a Sensys MAGNETO MXPDA 5 sensor channel push-cart magnetometer). Three wrecks were monitored during the CHERISH surveys.

Prior to CHERISH, the UAU surveyed Wreck 1 (W01131 in the WIID) between 2004 and 2006; the vessel was recorded as exposed for 9.30 m by 3.35 m with clinker overlapping planks and 14 oak futtocks (Brady 2008: 236–237). Photographs showed a wreck on the sand flat in a pool larger than the extent of the exposed wooden futtocks. Further images from March 2015 held by the UAU show a wreck in a smaller pool, as there are three futtocks above

Figure 17.1. North Bull Island Wreck 1. Clockwise from top left: 2 September 2019; 8 January 2020; 20 January 2020 (after Storm Brendan, which occurred on 13 January 2020); and 11 March 2020. Photographs taken looking northeast. Copyright Discovery programme/CHERISH project.

water level in the pool on the surrounding sand ripples of the sand flat. The sand level must have been higher, as only two timbers were exposed on the northern side, as opposed to at least nine in the earlier survey. The largest extent during CHERISH surveys was 7.92 m with only one side of exposed futtocks visible. However, the magnetometer survey showed a magnetic disturbance around Wreck 1 of about 12 m long and 5 m wide. Wreck 1 (Figure 17.1) was recorded in September 2019 on the sand flat around 20–30 m seaward from the sloping beach which leads from the sand flats to the sand dunes. Ten timbers were recorded initially, although after the storms in January, this number had reduced to six, and by the last visit in March, there was only one timber visible. The beach profile from the sand cliff at the HWM across the sloping beach and over the wreck in January shows the wreck only 7 m from the sloping beach and the smoothing of the sloping profile of the beach. Wreck 1's length of around 12 m suggests a sloop- or yawl-sized vessel.

Wreck 2 (the Sutton Wreck) is a section of carvel planking covered by sea lettuce (*Ulva lactuca*) near the northern end of the sand flats. The archives at the UAU have photographs of this being recorded in October 2015. CHERISH recorded planking lying on a sand bar 3.49 m long, 0.27 m high and 0.60 m wide. The section consists of two layers of perpendicular planking joined by tree nails 4 cm in diameter. Compared to the 2015 photographs, the CHERISH surveys found the section to be covered more by carragheen (*Chondrus crispus*) and sea lettuce, though similarly surrounded by a shallow pool and sand ripples. This may be a part of the hull section of UAU wreck W01142 (also known as the Sutton Wreck), which is located about 750 m seaward of Wreck 2. A section of hull from the Sutton Wreck floated free and settled on the sand when discovered during archaeologically monitored dredging operations for a pipeline (Dunne 2008: 298). The pipeline route was diverted around the wreck, which was covered over by sandbags and sand and thought to be a trading vessel with a beam of 6.5 m and length of about 23 m.

Substrate changes resulted in Wreck 2 disappearing by January 2020 with a 30 m-wide intertidal drainage channel recorded in its location. GNSS measurements indicated a 3–4 cm drop in sand levels between September and January in the Wreck 2 position, indicating the wreck had not been buried, with the new channel up to 23 cm deeper. It is also possible two loose timbers (Timber 1 and 2) found in the northern area of the beach also came from the Sutton

Wreck. Ship timbers have been intermittently recorded as washing up on the beach (*e.g.* Brady 2002: 475; Dunne 2002: 474), and more recently in March 2021, five ship timbers were reported by the public to have washed onto the southwestern area of beach. Timber 1, recorded by CHERISH, was a plank broken at both ends, found on 8 January 2020 in a shallow drainage channel 350 m west–southwest. It was 3.41 m long, 0.35 m wide and 0.04 m thick, with traces of 21 dowel holes 38 mm in diameter. Timber 2, found 250 m north–northwest of Wreck 2 on 10 March 2020, was 1.5 m long and 0.2 m wide, with dowel holes and one unbroken end exposed.

The primary locus of the Sutton Wreck was inspected during a low spring tide in February 2020, but nothing was visible. A working hypothesis is that the bulk of the wreck remains buried; otherwise, if the wreck structure had been destroyed, larger quantities of timbers would likely have washed ashore since its 2001 discovery. However, Wreck 2 and the timbers found landward probably represent the concentration of wrecks recorded in the WIID around Sutton Creek mouth. Two wooden wrecks were found in the area of Sutton Creek, 150 m apart, during the course of dredging works for the Dublin Bay Pipeline Project (Brady 2008: 239–240). The WIID records 23 wrecked brigs and 10 schooners on the North Bull, some of which would be about the same size of vessel as those recorded around Sutton Creek. A couple of examples include *Lively* (W01025), a brig from London stranded 2 January 1788 on North Bull with cargo of sugar, tea and hops, and *Olive* (W01038), a 97-tonne schooner travelling from Liverpool to Cork wrecked on the North Bull, near Sutton, in a gale on 15 February 1828.

Wreck 3 was a previously unrecorded, *in situ* single timber on the sand flats whose height above the sand varied from 0.36 m to 0.59 m. It lay further seaward on the sand flats than Wreck 1. The single-angled timber is orientated northeast–southwest, reaching 0.41 m high above the sand, with a width of 0.13 m. The magnetometer survey over Wreck 3 indicated a wreck around 35 m long from a similar positive anomaly that same distance to the west–southwest. The angle of the timber in the sand suggested it may be the stern or bow of a vessel. Wreck 3 GNSS beach profiles showed a drop of 9 cm in the sand level over an area of about 3 m between September and January, indicating clear pooling around the single timber. There was a further 20 cm drop in sand height after Storm Ciara in February, which contrasts with the silting over of the more landward Wreck 1. The end of the timber was thinner at the end of the CHERISH surveys, compared to when it was first recorded, suggesting abrasion due to wave action. Similar to the wrecks around Sutton Creek, it could be the remains of a schooner or brig type vessel, due to the 35 m length suggested by the magnetometer data.

Tidal and wave forces continually affected these Bull Island wrecks over the monitoring period, causing changing sand ripples, scour pools, drainage channels and sand bars. The growth of sea lettuce, barnacles (*Semibalanus balanoides*) and carragheen (found only on Wreck 2) on the wooden wrecks contrasted with loose timbers which had no growth, suggesting the latter had been recently exposed above sand level. The colonisation of these wrecks with marine life indicates that wreck site exposure from the time of initial recording by CHERISH probably lasted years, though further biological studies need to be done to further determine the age. The carragheen growth on Wreck 2 suggested it had been exposed for the longest amount of time. The evidence from Bull Island shows seasonal environmental changes, but it also reveals the effects of storms with the silting of Wreck 1 closest to the HWM, attributed to redeposition of sand from an eroded sand cliff. The disappearance of Wreck 2 from wave action powerful enough to remove this section of timbers, and the exposure and deterioration of Wreck 3 from reduction of the height of the sand flats, shows the effects of further seaward and wave abrasion.

***Sunbeam*, Rossbeigh Beach, County Kerry**

The *Sunbeam*, a 99-tonne wooden schooner around 24 m long and 6 m wide, was built in Exmouth in 1860. Bought by Richard Kearon of Arklow, Wicklow in 1874, it had a regular run between Galway, Cork and the Bristol Channel. In January 1904, the schooner departed Kinvara, Galway in ballast for Cork to load timber for transport to the Bristol Channel. Soon after the ship left Galway Bay, the weather deteriorated, with storm conditions intensifying to a force 8–9 gale. The schooner's foresail ripped, and she took shelter in Dingle Bay. The second evening of the storm led to the vessel breaking anchor, and it was driven ashore. The crew walked away unscathed, whilst all salvageable material was shipped to Arklow (Dunne 2014; WIID). With no hope of refloating the largely intact vessel, it was subsequently abandoned on Rossbeigh Beach, County Kerry. It became a popular attraction, remaining as such as the vessel broke down and became partially buried over time. Its lower hull remained intact, and the wreck was a local landmark.

The eastern side of Dingle Bay is bounded by beach-dune barrier systems of the Inch and Rossbeigh Spits orientated approximately north–south (Devoy 2015: 141–142). These dune systems are special areas of conservation in their own right. Given the open and exposed nature of Dingle Bay, the dominant Atlantic southwest–west prevailing winds, swell waves and storm surges result in wave heights reaching 2.8 meters (Devoy 2015: 146). This continuous high-energy wave environment—high winds in tandem with the increased occurrence and intensity of storms—has resulted in the spit suffering significant erosion, with the dune system being breached in a number of areas.

Severe winter storms in 2013/2014 resulted in direct, damaging impact to the *Sunbeam*. The UAU responded to this by commissioning a local archaeological consultancy, Laurence Dunne Archaeology Ltd., to undertake rapid assessment, wreck remains defence works and rescue of over 50 ship timbers, including a large articulated section

of the bow (Dunne 2014). As a means to protect the impacted wreck remains on the beach, a temporary defence was put in place using large 1-tonne sandbags to form a protected structure around the articulated hull remains. Large disarticulated timbers recovered were placed within the hull remains, along with iron fixings, to ensure they too were protected. These defensive works were subsequently destroyed by further storms in February 2014, which also destroyed the stern of the vessel. The remaining coherent wreck was also lifted and moved 200 m along the beach, where it lodged up against the dune system, which had also been breached (Dunne 2014). The Google Earth historical images from 2003 to 2012 show the outline of the wreck of the *Sunbeam* orientated northwest to southeast and lying partially buried 16–19 m seaward of the sand dunes on Rossbeigh Beach. In order to preserve the remaining intact wreck structure after the 2014 storm events, it was reburied in this general area. The southern spit, Rossbeigh, was about 4 km long prior to its breaching and the erosion of its distal end by a storm surge in 2008. The satellite data shows a 661 m wide breach had appeared 3.4 km along the length of the spit by 2010.

CHERISH began monitoring the site of the *Sunbeam* from the outset of the project in 2017 in order to record seasonal and storm impacts on the wreck site. On 26 July 2017, a photographic and photogrammetric survey of the *Sunbeam* wreck (Figure 17.2) was carried out, resulting in a Structure for Motion (SfM) 3D model of the site and its immediate surroundings. At this point in time, the majority of the wreck site was buried with only its framing elements exposed. On 19 September 2017, a monitoring inspection of the site recorded the wreck and surrounding sand levels as relatively stable. Only the sides of the vessel remained above the sand, as most of the stern and bow sections had been destroyed in earlier storm events. During the autumn/winter period of 2017 into 2018, several storms hit Ireland, including Ophelia (16 October), Eleanor (2 January) and Fionn (16 January). Following these storms, the site was revisited in April 2018, but no remains of the wreck were located. A further visit on 26 June 2018 involved a snorkel survey; from the results of the survey, the site was presumed either to have been reburied or to have moved again.

A wider search on 10 October 2018, which involved a walkover survey of the entire extent of the spit, found a portion of the lower hull of the *Sunbeam* (Figure 17.3) at the northern tip of Rossbeigh Spit, at the entrance to Castlemaine Harbour. This is 2.4 km northeast of its last recorded position, and it had therefore moved farther north along the spit for at least 2 km and was washed about 700 m into the mouth of the channel. Not surprisingly, the wreck had been badly damaged and was now in poor condition, with only about 10 m of one side remaining and 2 m in height of hull structure surviving above the seabed. The full extent of this remaining part of the hull section could not be fully surveyed due to being submerged within the channel. It lay just beyond the low water mark in an area of sand with patches of pebbles. Marine growth

Figure 17.2. Image of wreck taken during recording works in 2017. Copyright Discovery programme/CHERISH project.

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Figure 17.3. CHERISH project staff recording *Sunbeam* in 2019. Copyright Discovery programme/CHERISH project.

(barnacles, mussels and sea lettuce) flourished on the wreck in its new location; this indicated the wreck was exposed near the low water mark for some time. Following another inspection in April 2019, marine growth on the ship timbers was observed to have decreased to mostly barnacles and sea lettuce, possibly indicating continuous levels of sand abrasion was limiting marine growth. The wreck had continued to deteriorate; copper alloy nails and wooden dowels which originally held the hull planks together were very exposed. A beach profile was carried out; this procedure was repeated in May 2022 when the substrate was found to be sandy again, probably indicating longshore drift and accretion of sand. Only five ribs remained above the water line, with six of the previously recorded ribs impacted and lowered to the remaining planking height. Sea lettuce growth had increased to cover the protruding ribs, along with bladder wrack on lower parts more permanently underwater. Beach profiling was undertaken at the northern end of Rossbeigh Spit in 2019 and 2022, revealing several metres of erosion of the island towards landward.

The *Sunbeam* illustrated the destructive and catastrophic nature of singular climatic episodes such as storm events on shipwreck sites. The work undertaken by the UAU, Laurence Dunne Archaeology and the CHERISH project created a timeline, mapped and monitored wreck site change and recorded the impact of storms. This site demonstrated how storm events can occur in tandem with each other, acting as a continual force against an archaeological resource leading to significant deterioration and loss which will eventually result in the complete breakdown and loss of the archaeological site. The reshaping and relocation of this wreck site does not solely result in the loss of the archaeological context and structural integrity of the site, for it also impacts local communities and visitors' sense of place, as the *Sunbeam* was a popular attraction and marker on the beach.

SS Manchester Merchant

SS *Manchester Merchant* was a 5600-gross tonne cargo vessel en route from New Orleans to Manchester. The vessel was 400 km off the southwest coast of Ireland when its cargo of cotton bales spontaneously ignited. The vessel sought refuge in Dingle Bay, Kerry on 15 January 1903, but after attempts to quench the fire failed, most of the crew took to the lifeboats, leaving the master and a handful of crew to scuttle the ship in shallow water with the hope of salvaging the vessel at a later stage. The wreck lies in approximately 12 m of water and is orientated northeast–southwest. The upper works of the steamer are largely

destroyed and have fallen onto the surrounding seabed, with the boilers and bow now forming the highest part of the wreck. Local divers have reported structural collapse and change to the wreck site in recent years; this was attributed to storm damage after the worsening condition of the wreck was correlated with storm events.

The CHERISH project aimed to identify physical change occurring at the wreck of the *Manchester Merchant*. Accordingly, a programme of work was initiated to produce individual and combined 3D models using point cloud data captured from methods such as multibeam echosounder (MBES) survey, remotely operated vehicle (ROV) and diver videography and photography, from which 3D SfM models are derived. This programme of work required elements of the survey operation to be repeated over the course of the project to create baseline, monitoring and comparison datasets. MBES data capture was undertaken as part of the CHERISH project in 2019. The acoustic wreck survey used a Kongsberg EM2040D single-swath multibeam echosounder operating at 400 kHz in tracking mode. Multiple survey lines were run at the lowest speed at which adequate control of the vessel and heading could be maintained, ensuring maximum along-track data density (generally 2–3 knots). A 10° overlap between swaths was maintained, and angular coverage of each swath varied between 30° and 70° to maintain coverage within a 10 cm grid over the wreck. The quality of the data was also checked in the field. Sound velocity profiles were taken before and after the wreck survey. The site has been mapped a number of times over the previous 15 years as part of the seabed mapping programme undertaken by Geological Survey Ireland and the Marine Institute (Irish National Seabed Survey (INSS), later Integrated Mapping for the sustainable development of Ireland's marine resource (INFOMAR)).

The image on the top left (Figure 17.4) shows the INFOMAR MBES survey from 2009. This data was compared to the CHERISH 2019 survey results using cloud compare software, and this showed degradation of the shipwreck site over a ten-year period. We can see particular changes in the condition of the wreck site at a number of areas, such as the bow, stern and amidships from this comparison dataset. This change is denoted by the colour green on the main image (Figure 17.4). A repeat survey of the wreck was undertaken in 2021 in conjunction with an ROV survey. It was conducted with a Kongsberg EM2040 D dual head multibeam echosounder using the same survey methodology as the 2019 survey. As MBES data provides structural information only to a certain level of accuracy, it was decided to supplement the MBES data with SfM data which would be captured through ROV and diver photogrammetric surveys. As it was not feasible to record the entirety of the wreck site in this manner due to time constraints, target areas were therefore identified

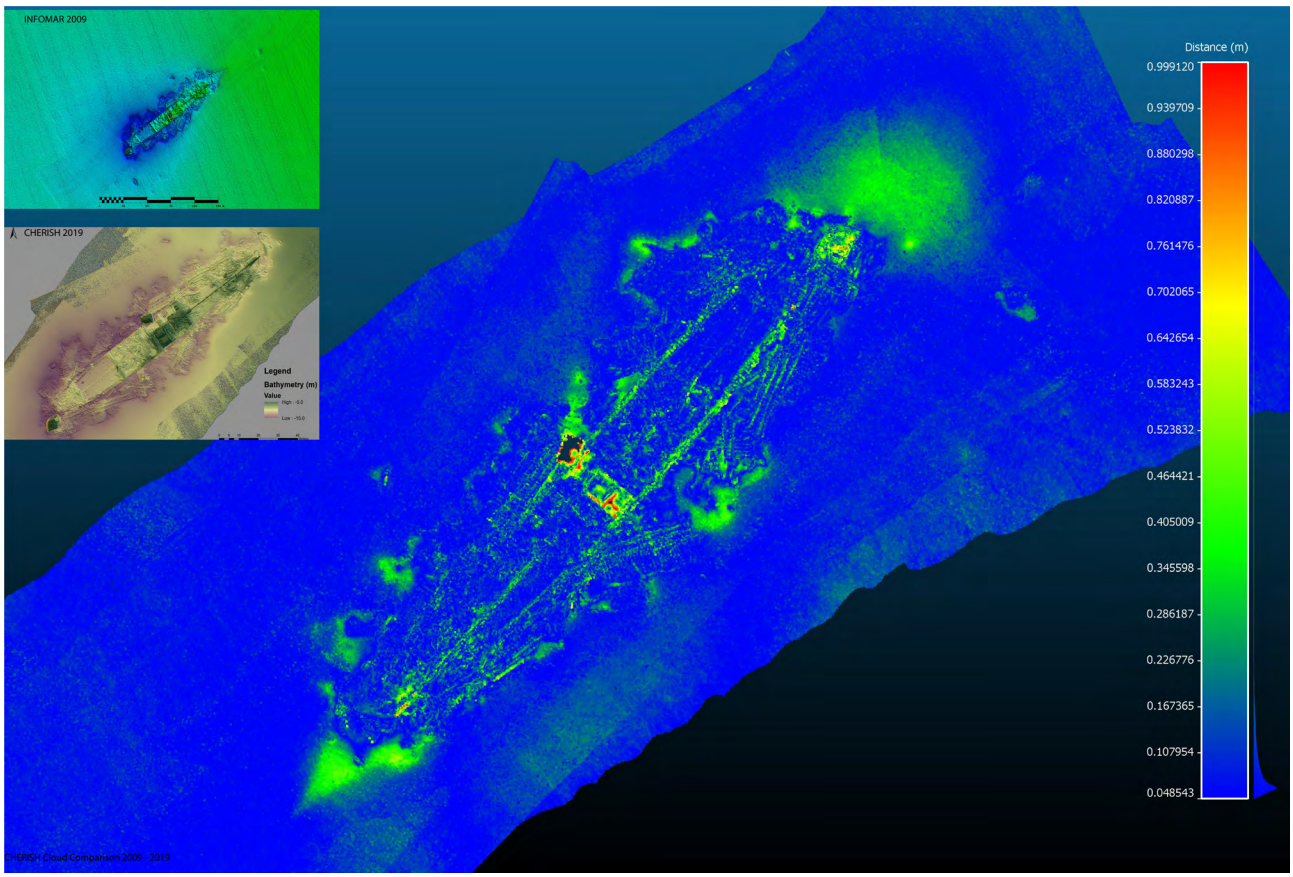

Figure 17.4. (a) INFOMAR 2009 survey (copyright INFOMAR, 2009). (b) CHERISH 2019 survey. (c) CloudCompare results; areas of structural change are denoted by green colouring. Copyright Geological Survey of Ireland/CHERISH project.

from the MBES comparison dataset. These areas were the ones observed to be suffering the most from structural collapse and change. CHERISH initiated the data capture and detailed visual survey of the wreck site with ROV and camera systems to augment the sonar data of the site captured; the MBES and ROV survey were undertaken over a two-day period during June 2021, aboard the RV *Keary*.

The ROV survey of the wreck was conducted by the Centre for Robotics and Intelligent Systems (CRIS), University of Limerick (UL) using the I-ROV system, an inspection-class ROV designed and built at CRIS, UL. It is a smart advanced system, not typically found in the commercial world, driven by a smart navigation and control suite known as OceanRINGS. This system moves away from manual piloting to automated piloting and control. To achieve a higher survey-grade platform, the IROV system facilitates an onboard inertial navigation system (INS), which is utilised by OceanRINGS to provide autonomous navigation and control. The INS is coupled with a doppler velocity log (DVL) for speed estimation, and a submersible GPS gives last known position prior to dive. The INS couples all sensor inputs, including 3-axis accelerometers and 3-axis fibre gyros, to provide a very accurate dead reckoning position over time from last known GPS. These platforms enable more accurate survey trajectories subsea, which can be critical in capturing close-quarter data.

The photogrammetry system utilises a camera system from SubC imaging, which is operated in a continuous shooting mode and triggers two onboard strobe LED lights when a picture is taken. The camera and strobes are positioned in such a way as to minimise backscatter. In terms of execution of the survey itself, the system utilises GPS positioning to manage the navigation of the ROV and ensure photos with overlaps of about 80% between camera frames are achieved. There are many operational issues on shipwreck sites, and it can be challenging to acquire high-quality photogrammetry datasets underwater. The conditions onsite were somewhat challenging, particularly in terms of strong tidal currents and poor visibility. The ROV system completed a number of surveys of target areas (Figure 17.5). The first area surveyed was the boiler section. The survey was designed to ensure good coverage and effective frame/path overlap, and a photogrammetric survey was completed with five passes on one axis and then seven passes on the second axis. The second target area surveyed was the bow section located to the southwest, one of the highest points on the wreck site. The ROV system undertook passes of this section in a less systematic manner. This was due to its height off the seabed and the entanglement hazards presented by this section of wreckage, which were even more prevalent due to the strength of the currents around the wreck site. A photogrammetric survey of this section of the wreckage was completed in roughly 15 minutes, which provided a consistent overlap and full coverage of the upper section of this part of the vessel.

The third survey area focussed on the propeller shaft, which runs half the length of the vessel, starting from the triple expansion engine just behind the boilers to the stern of the vessel. For this survey, three passes were completed along the length of the shaft, with additional data collected from passes made either side of the shaft. An inspection

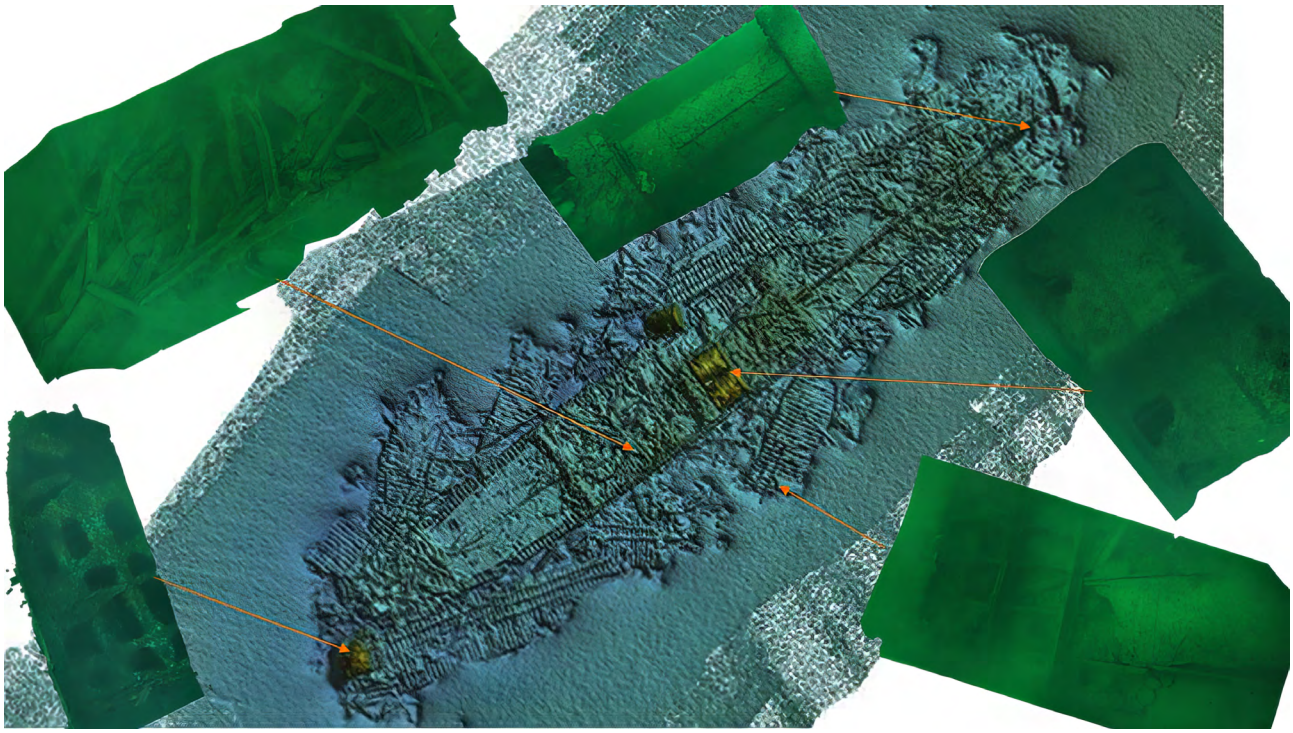

Figure 17.5. SS *Manchester Merchant* with ROV images from the targeted survey areas of the wreck site. Copyright Centre for Robotics and Intelligent Systems, UL/CHERISH project.

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survey of the final target area focussed on the stern of the vessel, where the rudder can be seen lying flat on the seabed. The diver surveys were undertaken in August 2022 by Indepth Technical Diving, whose crew collected photographic and video survey of the same areas targeted by the ROV survey. This ensured extensive datasets were gathered for the areas of wreck identified as suffering the most from structural degradation and wreck site change, and the imagery gathered was also used to produce 3D models (Figure 17.6).

The condition of the wreck was assessed through the collected data from the ROV and diver survey. Degradation of the structural integrity of the wreck was identified at all the target areas including the bow, stern and amidships around the boilers along with various other parts of the wreck. The hull plating has fallen away from the main body of the hull structure. This has led to the interior of the wreck being fully exposed and more susceptible to deterioration. The interior of the wreck is a collapsed jumble of various steel structural components, with sections of hull plating mixed with interior piping and other sections of wreckage, highlighting the structural collapse and decay which has occurred on the wreck site over the hundred plus years since its wrecking. SS *Manchester Merchant* is located in an area of strong tidal currents; increased storminess will mean increased current speeds acting on underwater wrecks, and greater potential for seabed damage due to storm related tidal, wave and current action, which inevitably results in damage to underwater cultural heritage located in impact areas. The addition of these forces to an already highly dynamic environment means that sites such as SS *Manchester Merchant* are significantly threatened with rates of deterioration fast-tracked by environmental impacts being intensified by climate change.

This work highlights the importance of mapping and monitoring change, and the importance and significant contribution of visual inspections by the diving community. The project has shown the capability of ROV survey for visual inspection of these important sites. The visibility posed a significant challenge for visual camera survey; however, this was mitigated to a large degree through the use of a smart ROV platform. The divers collected complementary datasets which enabled the production of high-quality 3D models and further material for wreck site condition assessment. The datasets are rich and supplement datasets acquired from ship-based sonar imagery. The SfM models provide dimensional information and data outputs, including point clouds and orthomosaics. These models can be overlain on the 2021 MBES data to provide higher-resolution data which complement the point clouds produced from the MBES survey. This survey established a high-quality baseline which can be utilised to continue to assess and map the deterioration of the wreck site in the future.

Discussion

Climate impacts on coastal and underwater heritage are relatively poorly understood (Gregory *et al.* 2022: 1396). Increases in intense storm events and rising sea level

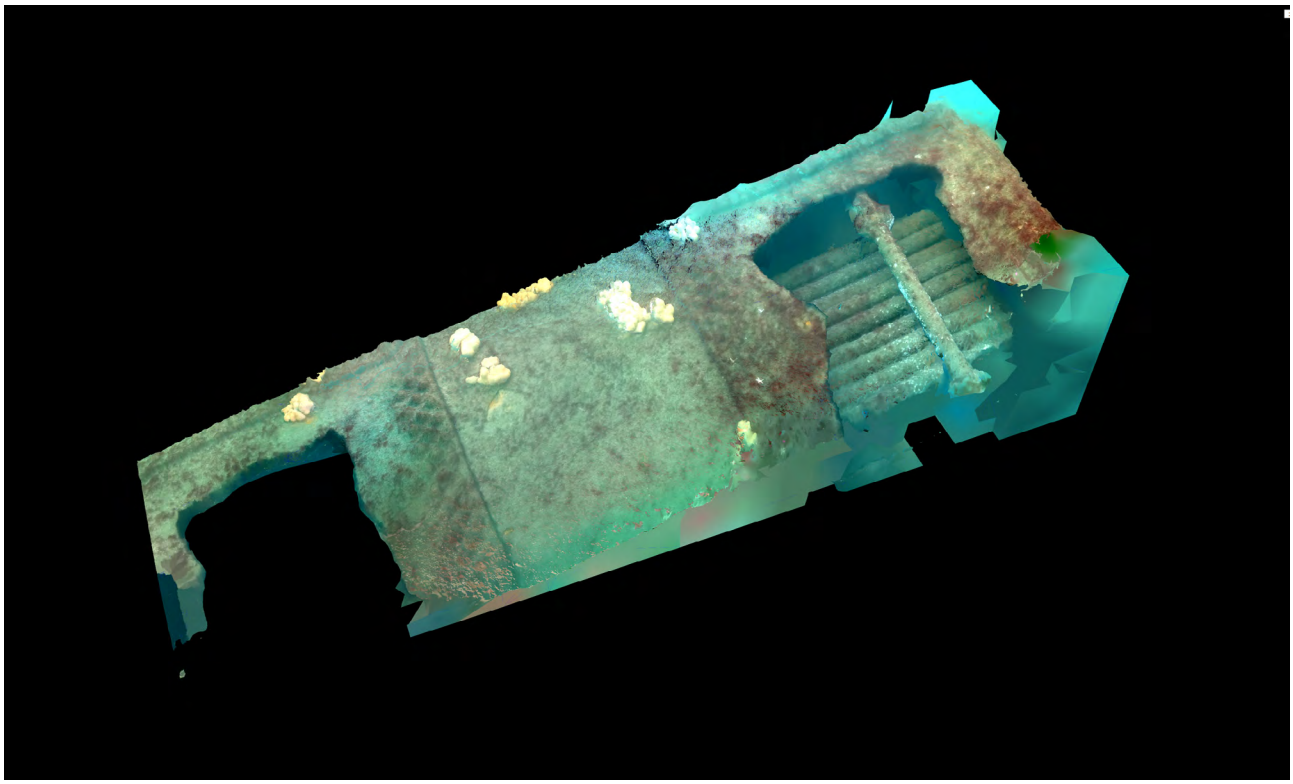

Figure 17.6. Photogrammetric model of the boiler, diver survey Go-Pro images. Copyright Discovery programme/CHERISH project.

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accelerate coastal erosion and flooding. As recorded on Bull Island and Rossbeigh, these factors are impacting intertidal archaeology in the form of uncovering, moving, breaking apart, redepositing and reburying sites and artefacts. At Bull Island, shifting sand is regularly revealing evidence in the form of shipwrecks, artefacts and loose timbers. Beach profiling shows the erosion at the HWM of the island during storms and sediment transfer to the sand flats. The environment is less active during calmer periods, resulting in formation of continuously moving sand bars separated by channels which expose and cover over wrecks and timbers. While these conditions are and have been ongoing events over time, climate change is resulting in heightened and increased impact. Beach profiling at Rossbeigh showed extensive erosion of the northern end of the island and sand spit where the *Sunbeam* came to rest following its initial impact during a series of extensive storm events. The dynamic nature of sediments outlines the extensive erosion occurring in the area of the wreck. This intertidal work has highlighted the need to undertake repeat intertidal surveys, not only around low spring tides but seasonally and following storms when sediment is most likely to be in flux. Many shipwrecks are in danger of being damaged and lost before confirming identification through available historical and artefactual evidence, and creating substantive site records.

Remote sensing techniques such as magnetometry have proven successful in identifying potential archaeological anomalies, alongside locating and determining the extent of wreck sites. This enables archaeologists to be prepared for the uncovering of high-potential areas after storms, seasonal changes or the continual movement of sand bars and channels. The results gained at Bull Island from surveys in areas immediately surrounding exposed timbers are promising, and this method needs to be expanded to assess the full length of the beach to test its value further. This is logistically challenging as the tidal window at low water can be limited, and other techniques would be required to cover larger areas quickly. The geophysical data provided an indication of approximate size of the buried remains of the wrecks, but it would be useful to confirm these results with test excavation or probing. The site records and information created for Bull Island and Rossbeigh are useful as a baseline study for any future surveys which can provide further information of the nature and cause of deterioration, stability, new processes and biological factors affecting the wreck.

Over the past decade or so, equipment and methodological advances have resulted in MBES surveys presenting strong capabilities for identifying and mapping condition change on wreck sites. The results obtained through comparing datasets of the SS *Manchester Merchant* allowed the identification of changes in the condition of the wreck site over a 10-year period, and across smaller timeframes such as two years. This allowed the collection of data in target areas where the wreck site suffered the most change, such as the bow, stern and amidships. The ROV survey showcased the ability of such systems to undertake the visual inspection of these important sites and produce high-resolution 3D models, even under adverse survey conditions. The ROV and diver datasets are rich and can supplement datasets acquired from ship-based MBES imagery with higher-resolution models. The datasets can be utilised to estimate the degradation of the sites over time, given the results of this survey as an established baseline.

It is also worth noting that through the invaluable input of diver engagement with underwater cultural heritage, verbal and visual records of change are produced, and these were critical to the development of this study. This work can be used to further the understanding of and feed into wider studies on the impacts of climate change on Irish underwater cultural heritage. This work also informs the use of efficient and state-of-the-art underwater cultural heritage monitoring and recording methodologies. The collection of rich, metrically accurate datasets allows for the development of strong visualisations and representations of underwater cultural heritage. Mapping this change and visualising it are hugely beneficial in bringing this underwater resource into the public domain. The outputs of the work by CHERISH, such as 3D models, can be used as a tool to communicate change to the wider public, who normally do not have the opportunity to engage directly with underwater resources.

The understanding of natural systems is pivotal for assessing the sites at greatest risk from climate change, and allow for informed decisions concerning future risks faced at sites, the understanding of past processes and the sustainability and timescale of preservation actions (Howard 2013: 654). The identification of climate hazards which are known to be intensified and accelerated by climate change provided information on how Irish wreck sites are being and will continue to be impacted due to climate change. The development of such studies provides insights on other at-risk sites and enables the assessment of future impacts for sites. In nearly all instances, the breakdown and deterioration of the wreck was recorded, with instances of extreme loss recorded. Episodes of loss have the ability to negatively impact the value and significance of an archaeological site. Future projections due to the currently observed impacts and in consideration of climate projections suggest significant loss is occurring and will continue to occur to shipwrecks. The *Sunbeam* provided thought-provoking and surprising insights on the application of preservation measures, such as the building of defensive structures and the reburying of sites. The work described in this chapter presents the adaptation measure of management of loss through the creation of the archaeological record. In the face of climate change, this adaptation measure is likely to become the most commonly employed method in the management and implementation of adaptation strategies for at-risk coastal and underwater heritage, assisting in the preservation of these resources for future generations through the creation of site records.

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18

Blending WW2 history with the present in an interactive virtual heritage experience

Eike Falk Anderson and Thomas Cousins

Abstract: We have developed 'Exercise Smash', a virtual heritage experience which allows audiences to take part in a 1944 military exercise originally held in preparation of the D-Day landings in Normandy. Several participating amphibious tanks sank during the exercise, and our experience allows audiences to explore the present-day tank wrecks in a virtual dive to the seafloor.

The interpretation and presentation of archaeological artefacts frequently revolves around the two fundamental questions: 'what happened here?', and 'who did it happen to?'. Addressing these, we propose a mode of cultural heritage presentation using an interactive virtual environment, our 'Snapshot in History' time-travel paradigm for Virtual Heritage, which provides an innovative synthesis of tangible and intangible cultural heritage.

Audiences engage in a two-step interactive virtual experience which is ideally suited for the public presentation and dissemination of maritime archaeology, *e.g*. as an interactive museum exhibit. First, they experience the snapshot in history, taking part in the historical event which resulted in the submerged archaeology. The underlying story is conveyed through an interactive narrative, after which the audience are given the opportunity to explore the present-day archaeological site in an extension of the virtual dive trail concept.

'Exercise Smash' proves our concept, engaging audiences with this WW2 heritage. The audience first experience the story, then they are tasked with landing one of the swimming tanks on the beach without sinking it, and finally they explore the present-day wrecks within a detailed virtual environment populated with simulations of local marine life, which in the real world would be accessible only to divers.

Introduction

The public presentation of archaeology is a complex issue (Moshenka 2017) and of increasing importance, not the least because engagement with the public plays a major role in the dissemination of the results of research findings. With the rise of digital media over the past three decades, in recent years Virtual Heritage approaches—the use of interactive virtual environments for the presentation of cultural heritage—have become a popular medium for engaging the public.

The presentation of archaeology can involve different types of cultural heritage. Obvious among these is the 'tangible cultural heritage' which consist of archaeological finds and remains or their reconstructions; these tend to be (more or less) visible, and approaches to their presentation—after preservation—can be straightforwards, *e.g*. in museums. Requiring a much more complex approach for public presentation is the far less obvious and often invisible 'intangible cultural heritage' (UNESCO 2003), which encompasses oral traditions, performing arts, rituals and social practices but can also include personal stories such as memories of war (Jansen-Verbeke and George 2012) or memories by witnesses or survivors of a—potentially traumatic—historical event. Intangible cultural heritage frequently requires a means for interaction of the audience with dynamic objects in the virtual environment and sometimes also with virtual characters.

Our proposed approach towards the public presentation of archaeology aims to combine both tangible and intangible heritage to create a more holistic virtual heritage experience with the intention of improving audience engagement with the archaeology.

Related work

There exist many different types of Virtual Heritage applications for the presentation of cultural heritage, each providing their own sets of challenges. They are often concerned with the interactive visualisation of heritage sites which provide a means for exploration of digital reconstruction of lost or decayed objects and places, sometimes in museums (Deggim *et al*. 2017), requiring the provision of necessary infrastructure or hardware, or online (Firth *et al*. 2019), which can limit the extent of user interaction with the heritage artefacts. Sometimes

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these Virtual Heritage applications employ VR (virtual reality) to immerse users in the heritage sites (Duer *et al*. 2020), or they are enhanced with additional informative or educational content and more extensive user interaction. The latter can include serious games for cultural heritage (Anderson *et al*. 2010; Champion 2015). These can take the form of exploration games which take place in historical settings, such as 'Roma Nova' (Panzoli *et al*. 2010), or games set among the archaeological remains of historical settings, such as the virtual 'Priory Undercroft' game (Petridis *et al*. 2013).

The 3D reconstruction of archaeological or historical sites is often accompanied by the notion of time travel as a means to experience the past. This can take the shape of the virtual and interactive exploration of historical settlements as they existed in the past, such as the previously mentioned 'Roma Nova' (Panzoli *et al*. 2010) or 'Virtual Segeberg 1600' (Deggim *et al*. 2017). Sometimes they take the shape of a simulation which shows how an archaeological site or a historical building evolves and changes over time (El-Hakim *et al*. 2006, Laycock *et al*. 2008), although this type of visualisation is usually non-interactive, merely presenting the changes to a passive audience. One reason for this non-interactivity is the potential problem of role-playing 'time travel' in interactive scenarios, which could affect history in ways which could result in an alternative, counterfactual history (Champion 2015). The challenge which arises from this is to prevent the time-travelling user from making changes to the past without obviously restricting the user's interaction with the virtual world.

Public outreach in maritime archaeology

In recent years, the utilisation of interactive computer graphics, such as those employed by digital games, has become a frequently chosen approach for engaging the public with maritime archaeology (Beavis *et al*. 2021), utilising modern home computer technology to create new avenues for communicating archaeological finds to existing audiences and reaching out to new ones. There are now so-called 'Virtual Dive Trails' (James 2018), which allow for the exploration of submerged archaeology, such as protected wreck sites, either by members of the public who cannot dive, or in cases where sites are inaccessible to scuba divers. While originally in the form of labelled but static 3D models within an interactive viewer application, more recently such dive trails have also been implemented within fully interactive virtual environments (Bruno *et al*. 2017) or as VR experiences (Liarokapis *et al*. 2017), which can provide comprehensive virtual tours of maritime archaeology which can incorporate immersive diving experiences (Bruno *et al*. 2019) or which can be integrated with kiosk-style exhibits in museums (Sundén *et al*. 2017). Perez-Reverte *et al*. (2021) noted the development of virtual heritage experiences based on the 'virtual dive trail' concept can also be achieved by the use of 360 (panoramic) video, providing an alternative to employing a fully computer-generated virtual environment.

Lately, these fully computer-generated virtual dives have also included the simulation of marine life, including both marine fauna and flora, such as plants on the sea-bed or fish moving around the virtual environment. This can increase the perceived realism of the virtual environments (Stone *et al*. 2009; Kouřil 2017; Liarokapis *et al*. 2017), as was demonstrated by Costa *et al*. (2020) in an immersive VR virtual dive experience which allowed users to explore the wrecks of transport ships which had carried Sicilian marble blocks. In support of the creation of such immersive VR virtual dive tours, Plecher *et al*. (2022) explored the user interaction elements which are required to convey a diving experience in VR which is perceived as realistic, resulting in a modular conceptual framework which simplifies the adaptation of the VR diving experience to different maritime archaeology sites, speeding up the creation of virtual dive trails in VR. VR has been shown to be suitable not just for the public presentation of maritime archaeology, but also for the presentation of maritime history. An example of the latter is the VR simulation of the restored four-masted barque 'Peking' (Kersten *et al*. 2020).

One approach to engaging the public which has been popular in recent years is the development of so-called 'serious games' for promoting underwater cultural heritage. Serious games are computer games which not only provide entertainment but have a secondary purpose (Zyda 2005) such as education or public information. Cozza *et al*. (2021) explain the design and development of a serious game, 'Dive in the Past', for promoting underwater cultural heritage in the Mediterranean Sea. 'Dive in the Past' allows users to dive virtually to and then virtually explore underwater archaeological sites. Cozza *et al*. (2021) provide a detailed rationale for the design decisions they made during the development of their game.

Yamafune *et al*. (2017) detail the process of recording and processing underwater archaeology for use in virtual heritage experiences for public outreach, and they describe a methodology for recording and reconstructing maritime archaeological sites. Similarly, Tousant and Fai (2019) developed a detailed workflow for digitally recording (scanning) underwater archaeology and preparing the resulting 3D information for deployment in interactive virtual environments. Such digital recording and processing of underwater archaeology provides the basis for creating VR diving experiences, for which the integration of such processed maritime archaeology into interactive, immersive virtual environments has been comprehensively explained and demonstrated by Plecher *et al*. (2022).

The enhancement of virtual heritage experiences with a narrative, conveyed through interactive digital storytelling and facilitated by the integration of live-action recordings of real actors who provide information about the depicted heritage to users of VR heritage experiences, was explored by Škola *et al*. (2020). These authors created

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a virtual dive trail of a submerged Roman villa which allows users to visit a scenario in the past, during which they can tour the reconstructed villa at a time when it was above the surface and inhabited, where they can then interact with its inhabitants. The effectiveness of the user experience created by this approach in terms of user 'engagement', 'presence' and 'immersion', all of which feed into the perception of realism, was verified not only by employing a user questionnaire but also by recording neurophysiological brain activity as an objective measure. Related to the notion of perceived realism and immersion, it should be noted any type of virtual heritage experience depicting submerged archaeology must try to overcome the various issues identified by McAllister (2021), particularly in regards to the perceived realism of scanned 3D objects placed in an underwater virtual environment. To address issues of realism, McAllister provides a comprehensive set of guidelines for planning and executing photogrammetric surveys, the subsequent processing and evaluation of the resulting 3D data and the final dissemination of results.

A snapshot in history

One difference between many land-based archaeological finds and those discovered through maritime archaeology is that in the latter, the remains are often the result of a single identifiable event in history (*e.g.* such as a ship sinking in a storm). In some cases, there are official reports or recorded eyewitness accounts of the event, and in other cases—for example, among coastal communities—there are stories about these incidents which have been passed down through the generations, being memorialised and becoming intangible heritage (Kempe 2006).

Such instances of intangible cultural heritage which have resulted in tangible cultural heritage are not usually shown in virtual reconstructions of archaeological or culturally relevant sites. These omissions occur despite the potential for a virtual reconstruction within interactive virtual environments to provide the necessary infrastructure to create a view of a snapshot in time of an archaeological site which would allow audiences to experience the event creating the archaeological site, as well as the archaeological remains as they exist today.

One attempt at providing such a link between the past and the present is the 'HMS *Falmouth* dive trail' (Firth *et al*. 2019), which superimposes an annotated photogrammetric scan of the original shipbuilder's model over a recent and annotated 3D survey of the wreck on the seabed, allowing a direct comparison of the wreck site with how the ship would have looked when it was new. We propose to take this link between the past and present much further by splitting the presentation of the archaeological finds into two distinct parts. First, we emphasise the notion of time travel, which allows audiences to experience a snapshot in history depicting the specific event creating the archaeological remains being presented to the public, while simultaneously allowing the public to take part in history interactively without changing it. Second, we allow the audience to explore the archaeological site—which has been fully annotated with information derived from the archaeological investigation—as it exists today.

Our proposed approach is not limited to maritime archaeology but could also be used to depict archaeological sites which are the result of a single cataclysmic event (*e.g*. a battle or a natural catastrophe such as the eruption of Vesuvius which destroyed the Roman towns Pompeii and Herculaneum; Cooley and Cooley 2013).

Using this paradigm for the public presentation of archaeology and the results of archaeological evaluation, we have created 'Exercise Smash' as a proof of concept, providing audiences with an engaging virtual experience which allows the interactive exploration of the archaeological remains of the 1944 'Exercise Smash I' military training exercise by diving to the wrecks of the amphibious tanks. Our virtual heritage experience also presents the archaeological artefacts in their historical context in form of a serious game which allows the audience to take part in the military training exercise (Figure 18.1), using a screen-based virtual environment to immerse the 'visitors' to the past within the event in a similar manner to the immersive VR exhibit by Duer *et al*. (2020), who demonstrated that simple presence within a virtual representation of the past can facilitate the illusion of 'walking in the footsteps of others'.

Historical background

Lessons learnt from other amphibious operations such as Gallipoli in World War One and Dieppe in 1942 highlighted the need for armoured support when assaulting fortified positions. The allied solution was to establish the 79th Armoured Divisions, who developed a series of specialised fighting and support vehicles now commonly known as 'Hobart's funnies'. One of these vehicles was the Duplex Drive or DD Tank.

Originally Valentine, but later Sherman tanks were fitted with a watertight canvas skirt which displaced enough water to allow the vehicle to float. The drive of the tank was also modified so it could power a propeller at the stern of the vehicle, allowing them to sail under their own steam. The tanks could then be launched at sea to land on the beaches without risk to the landing craft, where the skirt would be dropped and the vehicle would operate as any other land tank of its class (Fletcher and Bryan 2006).

A series of live-fire rehearsals were held by allied forces in preparation for the D-Day landings in Normandy. One of these, 'Smash I', took place on 4 April 1944 in Studland Bay, Dorset (South West England, UK), where it was observed by VIPs from a specially built bunker—National Heritage List entry 1411809 (Historic England 2012). Although the beach and hinterland were not ideal in terms of geography, the site was relatively isolated for the South

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Figure 18.1. Top: landing craft approaching Studland Bay during the Exercise Smash virtual experience; bottom: Swimming Valentine DD tanks trying to reach the beach. Image created by the Exercise Smash Development Team.

Coast of England, and it was therefore chosen to practise a full-scale multi-service beach assault.

The exercise plan was for the initial assault to be led by two squadrons of 4th/7th Dragoon Guards in their Valentine DD tanks. These were to launch 5,000 yards out from the beach, landing five minutes before the infantry. However, for reasons unknown, the tanks seem to have been launched in the wrong place and in unsuitable conditions, leading to the loss of six tanks and the deaths of six members of the crew. A seventh tank was also wrecked within Poole Bay; it was long thought to have been scuttled after the exercise, having run aground and drifted off at the next tide (Cousins *et al*. 2020), but new research is shedding doubt on this. In 1944, to avoid drawing attention to what was then a secret weapon, no efforts were made to recover the sunk tanks, and they remain on the seabed today.

In the post-war years, with the advent of scuba diving, the tanks soon became a popular and interesting dive site, and the majority of the non-ferrous metals and loose artefacts were salvaged by sports divers. The latter often included HE (High Explosive) ammunition, which were regularly left on Poole Quay. As a result, the MoD (Ministry of Defence) made the decision to render the wrecks 'safe' by blowing up the submerged tanks in 1987 (Philpott 2015). Two tanks were missed in this endeavour, but one was hit by a trawler in the 1980s, and the other was vandalised by unknown agents in 2022, leaving no complete tanks on the seabed today.

Poole's D-Day heritage–maritime archaeology

Without accurate navigation systems, the actual positions of most of the tanks were lost over time. In 2014, Bournemouth University's Maritime Archaeology department began a student project to locate and survey the remains of these vessels (Manousos 2014).

The first step for this project was to gather all of the reported positions for each tank (40 in total; BU Maritime Archaeology 2014) and input these into a geographic information system (GIS) for correlation with an accurate map of the seabed by the UKHO (UK Hydrology Office). This would enable an assessment of the known obstructions in the area, with the goal of reducing the number of potential targets.

Once a list of targets was produced, divers were sent down to survey the seabed and locate the obstructions, and for any found to be tanks, new confirmed positions were marked along with a basic record of the remains (MAST 2014).

The project resulted in the rediscovery of all of the tank wrecks (Cousins *et al*. 2020), and in 2018, during routine monitoring of the various wreck sites in Poole Bay, it was decided to create rapid photogrammetric models of the sites to act as a baseline for future surveys. As the sunk Duplex Drive tanks are among these heritage assets, Bournemouth University maritime archaeologists also returned to the tank wrecks and created photogrammetric models of the tanks (http://bumaritime.org/projects/duplex-drive-tanks/archaeology-of-dd-tanks/; also see Figure 18.2).

On 31 May 2019, Historic England—England's agency for the management and protection of historic sites, buildings and monuments—placed the sunk 'Valentine Tank Assemblage' (*i.e*. the remains of the Valentine tanks) on the National Heritage List for England as a scheduled monument (Historic England 2019), granting them protection by the state. Unfortunately, though, since the initial surveys in 2018, significant damage occurred to 'Tank 7' in 2019 and 'Tank 1' in 2022. This means the photogrammetric surveys from 2018 are now the most complete record of the sites which exist. As McAllister (2021) notes, an accurate photogrammetric record of an archaeological site can provide a valuable backup in cases where the original site has changed or been destroyed.

Exercise Smash virtual experience

We wanted to make these data available to audiences in a manner which improves on the traditional 'virtual dive trail' by employing our 'Snapshot in History' paradigm. Accordingly, in 2019, we initiated a student project (Anderson and Sloan 2020) to create the virtual heritage experience 'Exercise Smash'. This is organised as two scenarios presented to the audience/players. Implemented using the game engine Unreal Engine 4 (https://www.unrealengine.com), in the first scenario, the virtual heritage experience places audiences at the centre of the action of Exercise Smash I, challenging 'players' to launch a Valentine DD tank from a landing craft into Studland Bay and then 'swim' the tank to the beach, literally stepping into the shoes of the participants of the training exercise. In the second scenario, an immersive 3D virtual dive trail, audiences dive to the tank wrecks, where they can then explore the archaeological remains on the seabed. This is intangible-heritage-in-place (Kaufman 2013), which links places to intangible heritage such as memories of an event or oral histories. In the case of our virtual heritage experience, these are Studland Bay with the sites of the tank wrecks (place) and the story of the events of Exercise Smash (intangible heritage).

First scenario–a snapshot of 1944

As stated above, in the first scenario, 'players' taking part in the virtual experience find themselves in control of a Valentine DD tank on a landing craft in Studland Bay off Studland Beach, taking on the role of a soldier participating in Exercise Smash I. Their tasks are to launch the tank off the landing craft without damaging the canvas which keeps the tank afloat (DD tanks risked tearing their canvas if they hit the sides of the landing craft during launch) and then steer the tank towards the beach without it being swamped by waves and sinking (Figure 18.1).

Figure 18.2. Underwater Photogrammetry of the complete (before the damage that occurred during 2022) 'Tank 1' (Valentine MK-IX DD) at the bottom of Studland Bay (3D model of 3.3 million vertices in 6.6 million triangles). Without a fixed survey grid on the tanks, the 'rapid fire technique' developed by Daniel Pascoe (Pascoe Archaeology Services) and Bournemouth University was used, employing a goPro6 camera with a 105 degree fisheye lens. Four one-meter scale bars were placed around the site, and then with the goPro's time-lapse function, photos were automatically taken every second, with the diver slowly swimming over the site. The resulting photos were colour corrected using Adobe Photoshop and loaded into Agisoft Metashape where the images were further processed to mask out any undesirable features, such as the water column and fish, and to calibrate the lens to compensate for the wide angle which can cause issues with alignment. After processing and filtering with Metashape, the original photos were then used to create the texture-map. Finally, the model was scaled using the bars placed around the site during image acquisition before it was exported as a 3D object. Image created by the Exercise Smash Development Team.

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Success or failure are not pre-determined, and depend on the interaction between the swimming tank, which a player controls, and the simulated waves of Studland Bay. Around the players, other tanks are being launched from landing craft and trying to make their way to the beach, with some of them sinking within the players' view; above them, fighter planes fly past, providing air cover for the exercise. The players see what the participants of Exercise Smash I would have seen; they experience what many participants of Exercise Smash I would have experienced, and, immersed in the scenario through this virtually shared experience, they gain an awareness of what happened back then and who this happened to.

To reconstruct the exercise as faithfully as possible, the construction of the scenario was guided by accounts of eyewitnesses to and participants of Exercise Smash, including oral histories, some of which have been previously reported (Cousins *et al*. 2020). The Valentine tank was modelled after reference drawings, blueprints and period photographs (Fletcher and Bryan 2006), as well as recent photographs of the only surviving Valentine DD in working condition (Figure 18.3), from which engine sounds were also recorded. The integration of the engine noise of a real Valentine DD tank facilitates a more authentic experience, one that is not just limited to 'sight' but which also includes 'sound' for greater immersion in the virtual scenario. Information about the landing craft involved in Exercise Smash—especially the tank transports—was taken from contemporary official documentation (ONI 1944).

For the creation of the interactive virtual environment, Studland Bay itself was modelled after maps, nautical charts and from visual references. The sea was added in-engine by applying an ocean shader which implements 'Gerstner Waves' (Williams 2017), allowing fine control over the roughness of the waves. For the interaction of the swimming tanks with the sea—*e.g*. splashes, as well as water breaching a tank's canvas and flooding the tank—a position-based fluid simulation (Macklin and Müller 2013) was used to pre-calculate cached animation sequences which are interpreted in-engine as geometry caches. These are instantiated in the scene, relative to the user-controlled tank, by triggers placed around the perimeter of the tank's canvas which detect collision with the ocean.

Second scenario–a virtual dive to the Valentine DD wrecks

In the second part of the virtual experience, users take a dive boat out into Studland Bay to dive to the tank wrecks, which they can then investigate (Figure 18.4). The navigation of the virtual underwater environment is not restricted, and players can freely explore it at their own pace. The wrecks are annotated with information about the archaeological remains, as well as historical facts about the use of DD tanks; this information is displayed to the user when an object in the virtual environment is selected. For this, the photogrammetric scans of the tank wrecks made in 2018 (Figure 18.2), as were mentioned in the section on 'Poole's D-Day heritage' above, were integrated into the virtual environment.

The photogrammetric scans of the tank models were of an extremely high resolution, so in order to integrate the archaeology into the virtual heritage experience, the 3D scans needed to be reduced to a more manageable topology for use in the virtual environment. To preserve visual fidelity, detail from the high-resolution tank models was baked into normal maps for in-engine use with these lower-resolution tank models. Distance field blending was used to create a smooth and unnoticeable transition between the scanned seafloor area around the tank wrecks

Figure 18.3. Top left: the last complete and working Valentine DD tank on Studland Beach in April 2019; top right: Valentine tank model (without canvas skirt); bottom right: Valentine DD model with deployed and fully raised canvas skirt. Image created by the Exercise Smash Development Team.

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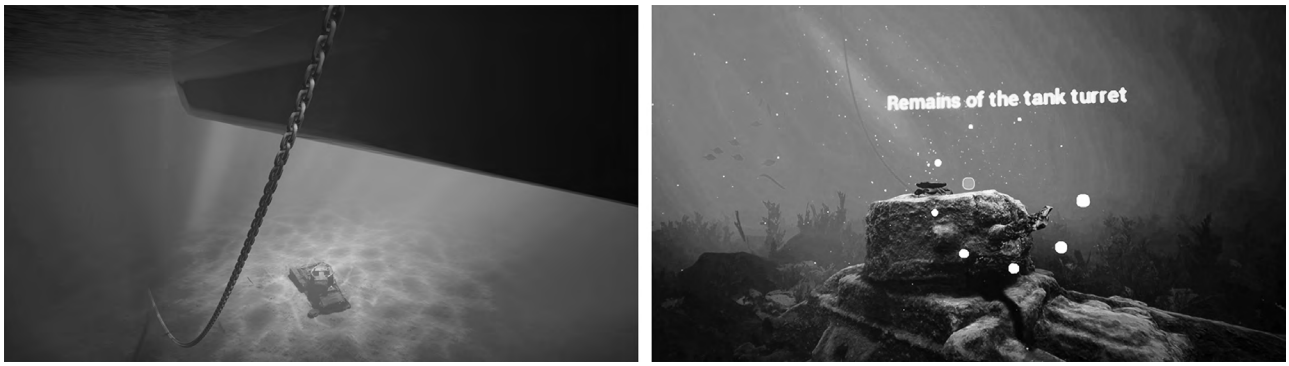

Figure 18.4. Left: view from the diving boat with the tank at on the sea floor below; right: investigating the wreck on the sea floor. Image created by the Exercise Smash Development Team.

and the remainder of the virtual seabed, where rocks and seaweed were placed to add realism to the environment using a simple procedural method based on pseudo-random number generation.

As the sea around the sunk tanks is rich in marine life and many of the species found in the neighbouring Poole Rocks Marine Conservation Zone (DEFRA 2019) are found around the tank wrecks, many of the marine species which inhabit the area around the tank wrecks were identified and modelled to provide a realistic impression of the virtual dive trail to players (Poole Rocks 2017). This made them a major feature of the underwater environment in the dive-trail scenario of our virtual heritage experience (Figure 18.5). To implement schools of these fish, similar to Liarokapis *et al*. (2017), we employed a Boids-style flocking algorithm (Reynolds 1987), with which we extended the Unreal Engine. Within the flocking system, fish models are animated as a looped swim-cycle using a motion path with a spine rig, with the fish models deforming by following this curve.

Discussion

While the project exists as a fully working prototype, it should be considered work in progress, as there are still a number of open questions and unresolved issues. The 'Exercise Smash' proof of concept was built without a specific means of deployment in mind, and with different possibilities kept open for future consideration, which use of the Unreal Engine 4 allows. This could be as a standalone computer game or even a VR experience—possibly set up as a kiosk-style system in a museum (Bruno *et al*. 2017, Deggim *et al*. 2017)—and deployment through a website, either as an online museum or as a virtual dive trail, is a distinct possibility. The virtual experience—especially the second part concerned with the virtual dive to the tank wrecks—was designed and built to present audiences with a rich and detailed virtual environment. This tends to require a fairly large display area, so typical screen size alone—not even taking into account the required GPU capabilities—would most likely be unsuitable for deployment of Exercise Smash as a mobile app for smartphones and tablet computers. The best mode of deployment may be determined by a future user study. Finally, since the development of our initial prototype, the more capable Unreal Engine 5 has been released, and porting the project to the newer engine might result in greater visual fidelity.

One benefit of choosing Exercise Smash as the content for our proof-of-concept prototype was the wealth of

Figure 18.5. Left: some of the distinctive marine animals that populate the sea around the tank wrecks: a) Black seabream (one of the most important species in the region), b) pouting fish / bib (found shoaling in large groups in the area), c) cuckoo wrasse, d) Dover sole, e) Baillon's wrasse, f) brown crab; right: several schools of fish, populating the virtual dive environment. Image created by the Exercise Smash Development Team.

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information and documentation available on Valentine DD tanks, as technical drawings, photographs and moving images of Valentine DD tanks are available. Various military museums house intact Valentine tanks, and there even exists a Valentine DD tank in working condition (Figure 18.3), and some of the developers were able to take reference photographs of it, so there were no issues of reconstruction uncertainty when the submerged wrecks were reconstructed for the first part of the experience, presenting the snapshot in history. This circumstance was a luxury, when compared to many archaeological surveys such as marine excavations of unknown vessels which are hundreds of years old.

The choice of scenario was also fortuitous, as the subsequent damage to the wrecks in 2019/2020 and 2022 resulted in the photogrammetric surveys which were used as the basis for our virtual heritage experience. These provide the most complete archaeological record of the site, and they also now provide the only means for the public to experience the site in its original state—albeit virtually.

We presented the prototype of the 'Exercise Smash' virtual heritage experience at 'Tankfest 2019', a three-day event held at the Tank Museum (https://www.tankmuseum.org) in Bovington (Dorset, UK), where it was demonstrated to a large audience of museum visitors. The prototype generated a lot of interest among these visitors, especially the children, who were particularly fascinated by the first scenario (landing the tank on the beach). The positive reception the prototype received, along with the evident enjoyment of the people who engaged the virtual experience, was encouraging and inspiring for the development team. A further opportunity to demonstrate our prototype virtual heritage experience was the CAA-UK symposium (Anderson and Cousins 2019), where our prototype was experienced by other archaeologists.

The public demonstration was very useful, as—apart from the bugs which were discovered by the audience—it highlighted a number of issues for future consideration. For example, we quickly noticed the playtime was far too long for use in a public installation, as several children who were determined to drive the tank to the beach and `win the game' had to be convinced by their parents to leave before their tank reached the beach. The younger audience were particularly helpful in discovering bugs and game-play issues which should be addressed before the virtual heritage experience is finalised, such as player actions which had not been anticipated during development. For example, a bug which occurred when players tried to turn a tank on the landing craft before it had cast off the landing ramp was discovered by multiple children who tried out the prototype.

To provide an immersive experience of time travel, we believe, it is important to avoid mechanisms which obviously restrict the user's actions. This meant predetermined events had to be reduced to a minimum or their nature hidden. To achieve this in Exercise Smash, the determination of whether a user-controlled tank sinks or reaches the beach depends solely on the simulation of the sea in its interplay with the user's steering actions. By not specifying which historical tank is being controlled (*i.e*. a tank which sank or a tank which succeeded in reaching the beach), the problem of possibly altering history, as mentioned above, is avoided.

Conclusions and future work

We have proposed what we believe to be a novel mode of cultural heritage presentation using an interactive virtual environment which creates a strong synthesis of tangible and intangible cultural heritage, combining stories about and memories of a historical event with archaeological finds which are directly linked to the event. To prove the concept, we created 'Exercise Smash', providing audiences with the experience of taking part in the virtual recreation of the historical Exercise Smash I, a Second World War landing exercise with amphibious tanks, several of which sank during the exercise. The experience of actively participating in the (virtual) exercise keeps the memories of the event 'alive' by immersing audiences in it; they do not just passively witness it, but literally 'live' through it, thus virtually sharing the experiences of the soldiers who were there. The site of the present-day archaeological remains resulting from this event can then be virtually visited and explored during a virtual dive. As these archaeological remains have been damaged since the 3D data we used were recorded, the significance of our virtual heritage experience has increased, as it is based on data which provide the most complete record of the site.

Our approach extends beyond existing 'time travel' paradigms and has the potential to immerse audiences not only in history but in the resulting archaeology itself, creating a much richer virtual heritage experience. This type of 'Snapshot in History' makes use of and combines existing Virtual Heritage approaches in a similar manner to Duer *et al*. (2020), facilitating the experience of intangible-heritage-in-place (Kaufman 2013). Audiences are immersed in the past to convey the intangible heritage of a historical event, and in the present, they virtually explore a fully interactive related location, such as an archaeological site. We believe this approach can create new avenues for the public presentation, as well as dissemination of archaeology, and should be particularly suitable for maritime archaeology. Through this, we believe our 'Snapshot in History' paradigm can provide opportunities for advancing the field of maritime archaeology by explicitly linking the tangible heritage of the archaeological finds with intangible heritage of the history which created them. By experiencing the intangible heritage first hand—literally 'living' it—and actively engaging with the historical event, public audiences are given the opportunity to gain a better understanding of the history and the resulting archaeology, which, by extension, should lead to a better understanding of human life.

Future work on the 'Exercise Smash' project will, in its first step, consist of improvements to the virtual heritage

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experience by fixing the bugs and addressing the gameplay issues identified during the presentation of our prototype at 'Tankfest 2019'. For instance, during the public presentation of the virtual heritage experience, we noticed some interesting user behaviours when players engaged in the diving scenario, which suggested some form of disorientation, possibly due to the accurately simulated low-visibility underwater and a lack of kinaesthesia in terms of the viewer's position and orientation in the virtual environment. This warrants further investigation, as it has implications for scenarios dealing with virtual maritime archaeology, and might require a reduction of the simulated realism, sacrificing visual fidelity for the sake of 'playability' of the scenario. After this first step has been completed, we plan to conduct a set of focussed user studies to help decide the best possible form of deployment of our virtual heritage experience for public engagement, and to determine the efficacy of our 'Snapshot in History' approach on the public presentation of archaeology.

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19

Blue Growth meets Maritime and Underwater Cultural Heritage (MCH / UCH): overview of the situation of preventive archaeology in France

Nicolas Bigourdan

Abstract: This chapter presents an overview of how France has managed the protection of Maritime and Underwater Cultural Heritage (MCH / UCH) over the last three decades, in relation to the Marine Spatial Planning (MSP) and Blue Growth programmes, through developments in the field of maritime preventive archaeology.

In 2001, the National Assembly adopted a legal framework which defined the application of preventive archaeology on land and under water throughout the French territories. Initial cases were few, isolated and relatively unstructured; but some 10 years later, complex processes had been set in place, and the first official preventive maritime archaeology operation had been launched.

The implementation of MCH and UCH protection in a MSP and Blue Growth context has benefited from the contributions of operational teams, fieldwork means, procedures, technological advances and experience. Effective support of the mission of MCH and UCH protection in a MSP and Blue Growth context is a central objective of the programme in France, but increasing the cooperation, organisation, consideration and interaction among stakeholders is also crucial.

Introduction

The European Union (EU) defines Marine Spatial Planning (MSP) as *'*a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives which are usually specified through a political process*'* (Ehler and Douvere 2007: 13). This definition has created the framework within which Maritime Cultural Heritage (MCH) has developed its relationship with MSP. In this context, this chapter provides an overview of the path taken nationally by France over the last 30 years to develop the link between MSP and MCH through its preventive archaeology system and capabilities (within the maritime environment), which is also known as rescue archaeology or development-led archaeology.

The origin and definition of 'Blue Growth'

The term *'*Blue Growth*'* has never had an agreed-upon definition, despite its extensive use, because it has gathered a large and diverse set of meanings and approaches which vary according to context (Eikeset *et al.* 2018: 177). However, the origin of the concept is related to the idea of sustainable development which emerged internationally in the 1960s (Eikeset *et al.* 2018: 177). Following a series of major international conferences centred around this idea since the 1970s, in 2012 after the development of the concept of Green Growth, a similar term focussing on the ocean (Blue Growth) emerged. This term (which was derived from the larger concept of Blue Economy, an umbrella term for economic activities involving ocean resources) was initially used in Europe as part of the Europe 2020 strategy. The Blue Growth initiative began in 2014 when a directive from the European Parliament and the Council of the European Union established a framework which emphasized the importance of marine areas for innovation and growth in specific sectors and increased the focus on MSP and coastal protection (Legat *et al.* 2015: 13).

General context and limitation

In order to contextualise the activities under consideration, the European Commission identifies five main maritime sectors within the realm of Blue Economy or Blue Growth. These five sectors are renewable energy, mineral resources, aquaculture, tourism and biotechnology.

Unfortunately, from a heritage perspective, these large categories, as defined, make very little-to-no direct reference to the role and contribution of MCH to European Blue Growth (Firth 2015: 10). Indeed, in associating heritage with tourism, the European Commission has not positioned it with sufficient strategic importance. However, the diversity, nature and level of relationship between marine industries and MCH long predates the Blue Growth concept, and accordingly, it has been the subject of multiple mitigation strategies in many EU countries. This includes France, which has created a dense and centralised network with multiple diverse layers of stakeholders. Further, these

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relationships currently continue to evolve as part of the United Nations (UN) Decade for Ocean Science (2021–2030) initiative, which emphasises the importance of ocean science in sustainable development. As part of this multidisciplinary approach, archaeologists can take advantage of a larger and more influential engagement through the wider ocean scientific community in addressing more complex issues.

From global to national, and from terrestrial to maritime

On a global scale, the impact of development on cultural heritage has increased noticeably, and as a result, it started to be taken into account more actively in the 1980s. Within many European countries, regardless of the approach and pace chosen, rescue or development-led archaeology initially focussed on terrestrial cultural heritage, before adapting the terrestrial approach to MCH. In France, a strong legal turning point was provided by the 2001 inclusion of a detailed section on preventive archaeology within the Heritage Codex. Nonetheless, enforcement of the protection of MCH impacted by maritime development has generally been slower, compared to its terrestrial counterpart. The reason for this is simple: beyond the observable impact of maritime development on MCH, such industrial projects have offered and are offering within their geographical context new opportunities to access archaeological contexts, fund fieldwork operations, and make interesting discoveries. In addition to the 2001 legal evolution, the administrative processes surrounding this aspect of the archaeological discipline in France has been considerably strengthened since 2019/2020, allowing the system to function in a more satisfying manner. In addition, from an employment perspective, a steady growth has been observed in the number of professional archaeologists working in maritime preventive archaeology in both the public and private sectors.

The specificities of a French paradigm

General principles

In order to understand how France has tackled the necessary development of preventive archaeology, it is essential to emphasise that the French system for protecting cultural heritage from developmental impacts has been framed by two guiding principles. The first is the *'*polluter pays principle*'*, which is largely derived from environmental law. It was adopted by countries from the Organisation for Economic Co-operation and Development (OECD) at the first UN conference on sustainable development in 1972, and ratified by the EU in 1986 through the signing of the European Unique Act. France later introduced this concept into national law by including it in the 1997 Environment Codex. France adapted this notion to preventive archaeology, in order to make the party responsible for damaging the historic environment additionally responsible for paying for the damage done.

The second principle which has guided the development of the French legislative and administrative framework of preventive archaeology is the idea that as a discipline, it is fundamentally anchored to the economic life of the country. Despite multiple concerns and debates around the idea of including preventive archaeology into the realm of MSP, its inclusion was a real breakthrough because it permits archaeologist to participate actively in development projects without slowing them down. Consequently, this system allows archaeologists to study and safeguard cultural heritage as an active step of the economic development and growth. Linking preventive archaeology with the MSP process has provided archaeologists with extensive access to vast areas of investigation, affording the possibility of safeguarding numerous archaeological sites and artefacts for the public and future generations.

Critical juncture

Beyond the principles shaping the foundations of preventive archaeology in France, several additional factors have contributed towards the emergence of a new paradigm in the past several decades, resulting within the French Heritage Codes in the structure and framework of this discipline. These can be listed as follow:

- First, there was a need to end the legal uncertainties associated with the 1941 French law on *'*rescue archaeology*'*. These uncertainties were creating conflict between stakeholders, weakening the entire system of safeguarding cultural heritage and not allowing sufficient opportunities for analysing archaeological results derived from rescue archaeology operations.
- Second, there was an obligation to ensure the stability, compatibility and transformation of the amateur rescue archaeology operational institution entitled Association Française pour l'Archéologie Nationale (AFAN). Since 1973, this organisation has been solely focussed on the implementation of rescue excavations.
- Third, France had the opportunity in 1992 to sign the European convention on the protection of archaeological heritage in order to build upon an agreed set of regulations. This convention was ultimately ratified by the EU in 1995 in Malta.
- Finally, the Competition Council and the Ministry of Culture both published studies on preventive archaeology in 1998. These studies highlighted an unnecessary and unhelpful monopoly situation, as well as the need to improve global heritage protection, public service and scientific objectives.

Legal and financial framework

Combined with the guiding principles mentioned above, these factors allowed for the formalisation of a section in the French Heritage Codex dedicated to creating a legal and administrative framework for preventive archaeology. Upon its adoption in 2001, this framework has shaped French law on preventive archaeology (Delestre 2021), through the creation of Section Five in the Heritage Codex.

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Preventive archaeology is described in the Heritage Codex as a public service mission on land and under water which aims at detecting and preserving or safeguarding by study the elements of the archaeological heritage affected or likely to be affected by public or private development. Preventive archaeology also aims at ensuring the interpretation and dissemination of results obtained and their public release for the benefit and understanding of general audiences.

As a consequence, from a marine environment point of view, the French Ministry of Culture bears scientific responsibility for the study and conservation of MCH sites and artefacts preserved on nearly 18,000 km of coastline and the millions of square kilometres of open ocean (or sea) associated with mainland France and the French overseas territories. In the French maritime space, from coast to abyss, the Département des Recherches Archéologiques Subaquatiques et Sous-Marines (DRASSM) is the service which monitors submerged heritage on behalf of the State.

However, the initial application of the law was beset by several limitations and difficulties, including a high volume of activity, low financial support and insufficient interactions between stakeholders. Accordingly, the law had to be amended to address these issues. An updated version was signed in 2003, and it included the following necessary elements:

- an organisational structure which further detailed the State's role and control
- a financial structure which established adapted fees and support funds
- a monopoly status of the preventive archaeology operational institution modified to bring it into conformance with EU competition laws

Developing maritime preventive archaeology in France

2001–2003: A new era and new roles

As previously mentioned, the period 2001–2003 marked a crucial and essential turning point in protecting archaeological and cultural heritage impacted by terrestrial and maritime development across the French territories. Despite slow enforcement (especially in the maritime environment), these new rules have represented a positive development because they take into consideration the constraints and obligations of all stakeholders, including the State, local authorities, developers and archaeologists. Moreover, a network of archaeological scientific commissions (both national and regional) has become unavoidable, as the commissions provide essential expertise, advice and decisions at the heart of the French archaeological system, encompassing both planned and preventive archaeological initiatives as two faces of the same coin. In this context, preventive archaeology also has the mission of reconciling the requirements of scientific archaeological research and heritage preservation, without impacting economic growth or terrestrial, coastal or offshore development.

In France, DRASSM is the heart and soul of maritime archaeology. DRASSM was created in 1966 by the writer and intellectual André Malraux, who at the time was the French Minister of Culture. Since 1966, DRASSM has been responsible for archaeological scientific research and administration across the whole of the French maritime territory. This role includes the inventory, study, protection and conservation of all maritime heritage sites and artefacts throughout the world's second largest (after the United States of America) maritime space, an area which measures approximatively 11 million km2. As a consequence of the new framework created in the Heritage Codex, in 2001 the DRASSM formally assumed the new role of ensuring the implementation and execution of its legal obligations in preventive archaeology across the entire French maritime space. This new role implies that DRASSM administratively manages files related to development projects, investigates and analyses associated data and plans, implements scientific and technical control of archaeological operations (and to a certain extent, the conduct of some operations) and oversees the treatment of artefacts, materials and documentations collected.

2011–2021: New start for maritime preventive archaeology

Despite the official inclusion of maritime preventive archaeology within the new legal framework in place since 2001, the reality is that little activity occurred in this sector during the first 10 years. The main reason for this situation was the lack of human and technical resources dedicated to maritime preventive archaeology. However, the 2010 decade would prove to be very different. This was the result of strong structural changes which can be listed as follows:

- **2011:** Although a few development projects implying maritime preventive archaeological investigations have taken place in France since the period 2001–2003, one of the first truly important maritime development projects to receive substantial preventive archaeological attention began in 2011. This project consisted of a coastal road built partly over water in La Réunion, an island in the Indian Ocean, which is a French overseas territory. The size of the project raised sufficient concerns from local and national authorities that the decision was made to implement and closely follow the preventive archaeology framework for both the terrestrial and maritime components of the project.
- **2011:** The Institut National de la Recherche en Archéologie Préventive (INRAP), as the national operator, created a section for subaquatic operations. Within the context of the framework established by the 2001 Heritage Codex, this initiative provided a new, sustainable human resource dedicated to maritime preventive archaeology operations, which was the first of its kind to be stood up in France.

- **2012:** The DRASSM launched a new, large-scale (36 m) operation vessel, named the *André Malraux*, to respond to maritime operational needs for both planned and preventive archaeology. The *André Malraux* assumed the mission of a previous asset, the old and long-abandoned *Achéonaute*. In conjunction with this new asset, the DRASSM also created an active underwater robotics branch to develop new research and development (R&D) and innovative capabilities with the goal of reaching even deeper sites (ones well beyond the limits of human diving) with remotely operated vehicles (ROV) (Figure 19.1). Combined with appropriate geophysical tools, the *André Malraux* and the ROVs have provided DRASSM archaeologists with extended abilities in support of diverse endeavours, including preventive archaeology. My colleague Denis Dégez provides up-to-date details of these advances in a chapter in this volume.
- **2012–2014:** The initial launch and development of the Offshore Wind Farms (OWF) programme in France led to necessary changes within the Heritage Codex. Wind farms, as large-scale industrial projects, were recognised as having the potential to threaten the financial equilibrium of the maritime archaeology preventive system. Accordingly, in 2014, the DRASSM created and tested a new operational option, a more adaptable and flexible type of investigation called *'*evaluations*'*.
- **2014–2019:** A steady but constant increase in the volume of development projects being assessed archaeologically was observed as part of the maritime preventive archaeology framework. In 2019, INRAP, as an operator of diagnostics, initiated internal structural changes in the organisation of its subaquatic section, giving it renewed human resources and capabilities in order to respond to both the increased volume of activity and projected future challenges.
- **2021:** Following the *André Malraux* in 2012 and the 15 m *Triton* in 2015, the fleet welcomed a new 46 m vessel named the *Alfred Merlin*. The *Alfred Merlin* has the capability to travel to French overseas territories, as well as deploy ROVs to depths of more than 2000 m.

The operational procedures

To fulfil the obligations specified by the Heritage Codex, the French maritime preventive archaeology system offers three different types of procedures, which respond to various preventive archaeological scenarios. In general, these procedures allow either conservation by study or ensure that remains preserved in situ are avoided during development:

- **Diagnostics:** Established in 2001, diagnostics are generally put into place as part of the permit approval process as each new development project is authorised. When implemented, diagnostic procedures have the goal of detecting, identifying and characterising the presence of potential archaeological remains before any development take place. In the maritime environment, diagnostics are exclusively entrusted to INRAP, the national preventive archaeology operator, but they fall under the administrative and scientific control of DRASSM, the organisation responsible for prescribing diagnostic operations for the detection of archaeological heritage within the planned and expected footprint of a development project. Their implementation, which is similar to diagnostics applied in a terrestrial context, must follow predefined stages, including investigation, intervention proposal, operation and report. In a maritime context, these projects can concern port developments (as for example, the extension of Port-la-Nouvelle along the coast of the Mediterranean Sea), energy production and transport, telecommunications (such as the *'*Amitié cable*'* which lands on the coast near the Bordeaux region) and marine aggregate extraction.
- **Excavation ('Fouille'):** Also established in 2001, preventive excavation can be prescribed immediately or following the results of a diagnostic. To date (as of 2022), preventive excavations in the maritime environment have been prescribed but not implemented. However, they have been actively pursued since 2017, first in conjunction with a port development project in Corsica, followed by another port development project in Gironde near Bordeaux in 2021, and more recently with another port development project in Martinique (a French overseas territory in the Caribbean). Identical in structure to the terrestrial version, an excavation has the objective of collecting and analysing data about the site under investigation. Excavations are open to competition between public and private operators, and they may be conducted by INRAP, a commercial company or even a local public service as approved by the Ministry of Culture. They involve a strict step-by-step procedure including investigation, call for tender, operation and report.
- **Assessment ('Evaluation'):** Established in 2014, assessment is a procedure exclusive to the maritime environment. It is equivalent to a diagnostic as defined in the Heritage Codex, allowing the developer, when possible, to anticipate the formal procedure. Conducting an assessment is also equivalent to an *'*impact study*'* on cultural heritage according to the Environment Codex. Assessments concern only projects which cover an area beyond or crossing the first nautical mile zone (wind farm, energy cable, extraction, *etc.)* and which have, by their size, the potential to jeopardise the financial equilibrium of the system. This procedure is negotiated on a case-by-case basis by the DRASSM, and approved projects fall under its responsibility. Assessments combine the collection, study and analysis of geophysical survey data with in-situ expertise conducted either by ROV and/or divers. Assessments highlight and characterise the elements of the archaeological heritage potentially impacted by development, as well as define avoidance zones around the archaeological remains to preserve them from the

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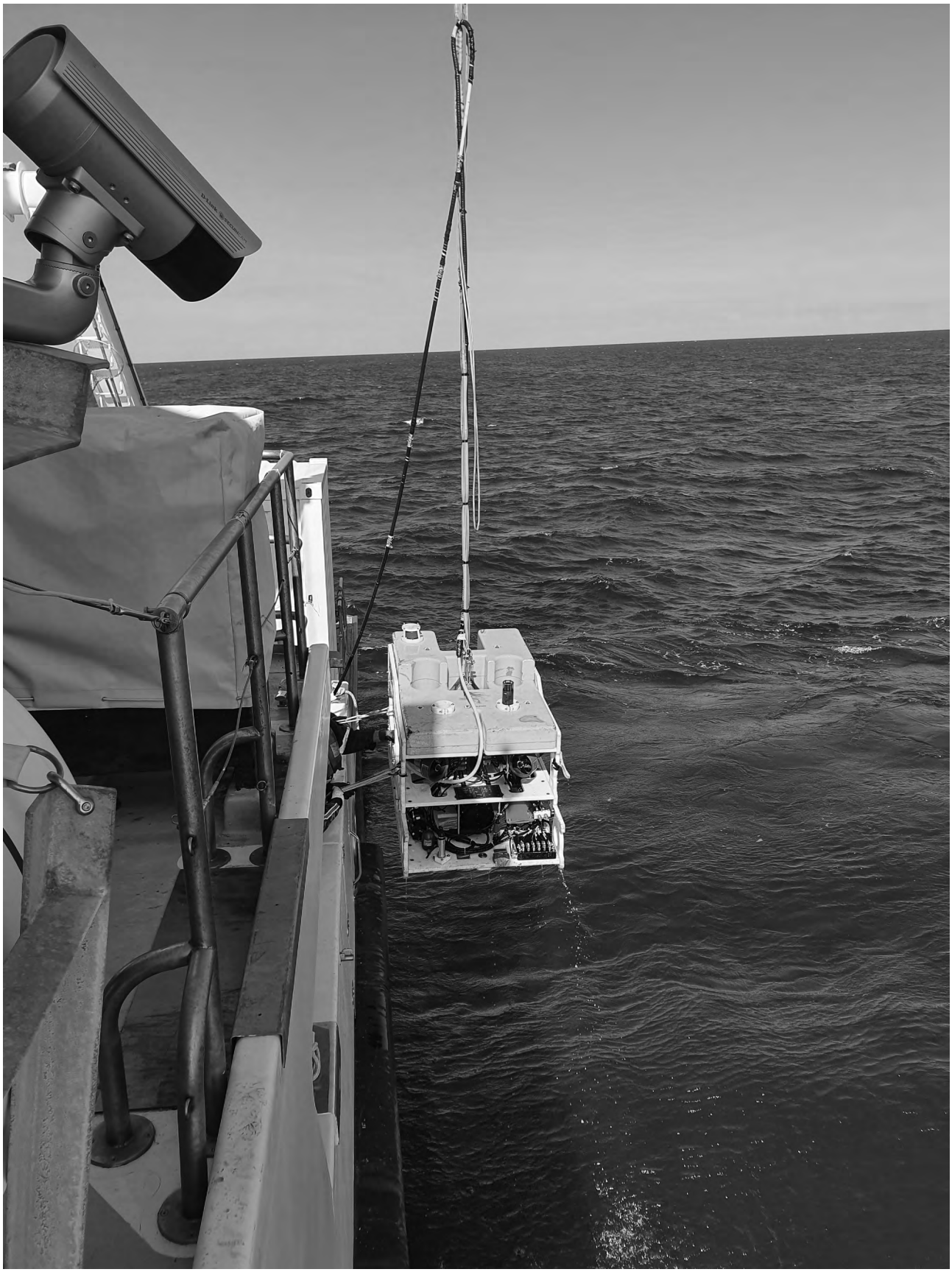

Figure 19.1. ROV being launched from the DRASSM ship *André Malraux* off the coast of Brittany in 2021. Image by N. Bigourdan, copyright DRASSM.

impact of development. For example, for the right-of-way of cables and wind turbines, the offshore project known as Île d'Yeu and Noirmoutier, off Saint-Nazaire (Figure 19.2), combined detection and verification of identified anomalies. Similar projects included the Courseulles wind farm in Normandy and a power cable in Corsica. Results are presented in a public report.

Projects and evolutions

Ports / wind farms / cables / aggregates

Given the many development projects along the country's coastline and maritime zone which are potentially subject to the implementation of the French maritime preventive archaeology system, the DRASSM has faced a diversity of challenges based on the different nature of each industrial infrastructure, which can be listed as follow:

- **Ports and coastal developments:** These projects tend to encompass a large diversity of infrastructure and activity types, including jetties, dredging, pontoons, moorings, *etc.* They also happen to have been the first type of maritime development taken into account within the context of the maritime preventive archaeology system, and as such, they have been subject to much attention over the last two decades. One of the earliest examples is the project of Le Havre Port 2000 in Normandy. Another, more recent example is the extension work of Port la Nouvelle near the city of Narbonne along the Mediterranean coast. Due to their location close to the coast, this type of project always and only falls under the diagnostic procedure, with the possibility of expanding efforts to a preventive excavation when the results of the diagnostic indicate the need for further investigation.
- **Offshore wind farms:** By their nature, location and size, these large-scale projects have precipitated the need to create a viable process which initiated the procedure of evaluations. Since 2022, new and similar projects have entered a new era, one characterised by higher volume. While the last decade saw tenders for only five projects, another five were recently announced, and there are more to come with a national scheme which aims to achieve energy independence within the next couple of decades. Among the first examples of OWF to have been launched are the ones near Saint-Brieuc (Brittany) and Noirmoutier (Vendée). As previously mentioned, because of their location and size, these projects are assessed archaeologically within a preventive context only through investigations undertaken as part of an evaluation.
- **Energy and telecom cables:** This new breed of maritime industrial project appeared on the scene of French maritime preventive archaeology in late 2019 as part of a new initiative to renew submarine telecom cables. Even if energy cables are slightly different (because of some legal exemptions), the challenge for

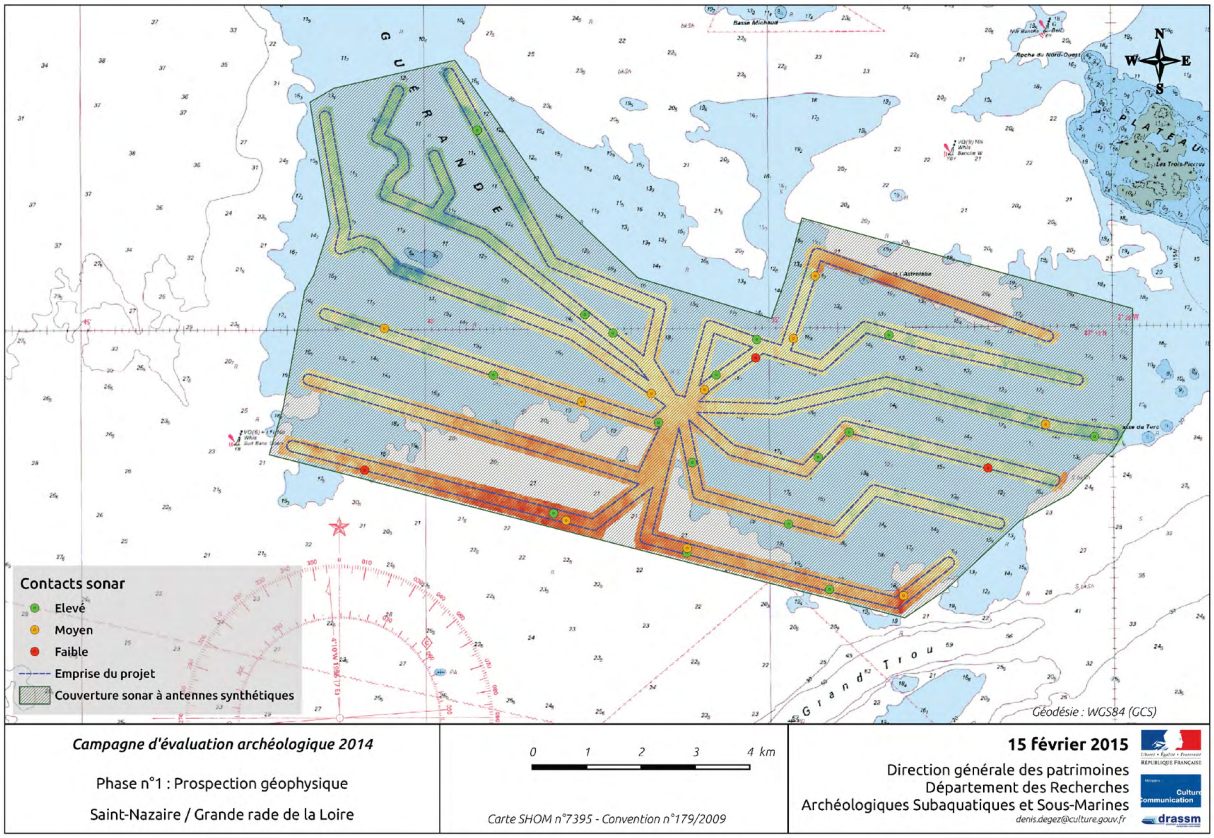

Figure 19.2. Map made in 2015 showing the location of geophysical anomalies over the area of a future offshore wind farm near the city of Saint-Nazaire. Image by D. Dégez, copyright DRASSM.

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these projects emerges from the political weight and financial oversight of these international ventures, a circumstance which necessitates various levels of negotiation, as well as raising the awareness of the need for heritage protection among developers. The first example brought to DRASSM's attention was the 'Amitié' cable landing near Bordeaux. A more recent telecom example is the 2Africa cable system project in Marseille. Here again, because of the nature of this type of development project, the evaluation procedure is often the best option, even if circumstances and schedules sometimes allow only a diagnostic to be considered as an option.

- **Marine aggregates:** Marine aggregate projects are occurring where sand and gravel deposits are found on the inner continental shelf. Projects falling under this definition are appearing more often along the Atlantic and Channel coastlines. From its inception, this type of development has strongly resisted the idea of collaborating with scientific stakeholders of the maritime preventive archaeology system in France. The financial constraints claimed to be applied towards these ventures have often been brought forwards in order to gain wide political support for completing these projects, while at the same time avoiding interactions at all levels with the organisations which protect maritime heritage. Because of the lobbies, few archaeological investigations have been conducted. So far, no preventive archaeological responses have been implemented or even accepted by developers. There is a significant and pressing need to develop new ways of communicating and raising awareness of the value of MCH among marine aggregate developers. These mechanisms could help renew the dialogue and mutual understanding between stakeholders.

Geophysics / robotics / vessels

In order for DRASSM to fulfil its mission objectives, some of the operational challenges generated by the maritime preventive archaeology system have required the widening of an already diverse set of field implementations, including:

- **Geophysical capabilities** (Figure 19.3) were initiated over 20 years ago. However, they were firmly established for use as a part of preventive archaeology only in 2012, and they were later included as part of the evaluation process. The available technological resources (*e. g.* Side-scan Sonar, magnetometers,

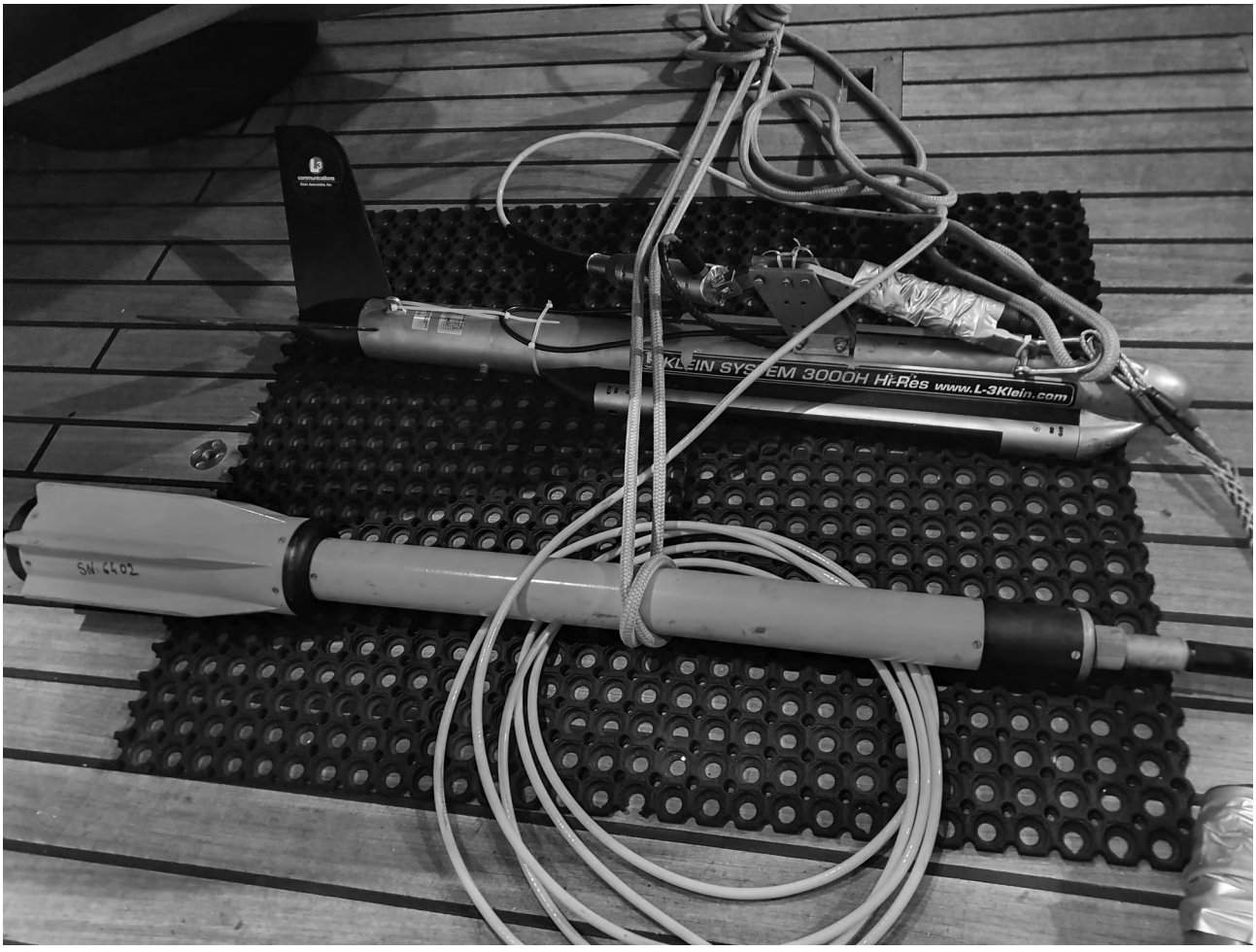

Figure 19.3. DRASSM's Side-scan Sonar and magnetometer on the rear deck of the *André Malraux* in 2022. Image by N. Bigourdan, copyright DRASSM.

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Multibeam Echo Sounder) have been growing gradually but steadily, and the initially limited human resources were recently doubled. In term of remote sensing, developments include the recent addition of drones for survey, detection and photogrammetry along shallow waters.

- **Robotic capabilities** are a central component of a larger strategy initiated in 2006 which had the objective of increasing human abilities beyond their physiological limits. Through the collaborative efforts of several robotics university laboratories from France (*e. g.* LIRMM of Montpellier) and abroad (*e. g.* Stanford University), ROV and robots (including humanoid robots which provide their human pilots with haptic feedback, like OceanOne) have been created or are being developed. These assets are also being used regularly for the purposes of preventive archaeology. Recent technological advances have included an ROV with the ability to operate at greater depth.
- **The fleet of ships** are the heart of operations. The current fleet is the result of multiple, sustained efforts to secure the financial support necessary for building and operating three floating platforms. The launch of these three vessels has multiplied the capabilities of interventions throughout France, and they will soon support deployments to French overseas territories. Over the past 10 years or so, these vessels have met the challenges and strengthened the operational capacities of research conducted under the purview of the Ministry of Culture. Two deep-sea vessels, the *André Malraux* and *Alfred Merli*n (Figure 19.4), together with the small unit *Triton*, have been designed to support the prerogatives and goals of the State in terms of cultural heritage, particularly in the case of infrastructure installations and the exploitation of natural resources.

Results and perspectives

Avoidance and discoveries

Because the mitigation strategy aims to protect MCH while supporting industrial development, the easiest and often preferred option is implementing an avoidance zone around a site of archaeological interest discovered as part of a preventive investigation. But this is less true for the diagnostics process, where in-depth analyses tend to occur more often, than the evaluations process, where a sense of urgency may lead investigations towards simple characterisations.

Figure 19.4. The DRASSM ship *Alfred Merlin* entering the port of Marseille in 2021. Image by N. Bigourdan, copyright DRASSM.

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However, during approximately 15 years of diagnostics and eight years of evaluations, almost 100 preventive archaeology operations have been implemented within a maritime context, of which more than 60% occurred in the last five years (Bigourdan and Leroy 2022: 250). This recent linear intensification of the volume of activity is accompanied by an increase in the number of finds and discoveries (Figure 19.5), including both sites and isolated objects, despite a slowly improving ratio between the areas investigated and discoveries. This point is explained by the intrinsic nature of this type of investigation, which does not target areas of archaeological interest but is rather orientated by the locations of the industrial projects.

Future developments, horizons of improvements and cooperation

This branch of preventive archaeology is dedicated to evaluating and mitigating the impact of development on heritage in the maritime environment. It is gaining momentum, mainly through structuring and the relations between actors in the sector (*e. g.* instructors, prescribers, operators, developers). However, it remains in a state of significant flux in striving to be able to respond effectively to all the identified challenges.

Figure 19.5. Stone anchor found during an evaluation operation off the island of Noirmoutier, photographed in 2019. Image by C. Lima, copyright DRASSM.

The forecast for future maritime developments in France shows a continuous increase in the number of planned OWF and submarine cable projects, as well as an increase in the diversity of project types with new technologies such as wave, tidal and current energy-collecting turbines. This trend will continue to increase the need for preventive archaeology to be implemented and maritime heritage to be protected over the next few years or even decades.

With an increase in the number and diversity of preventive archaeology projects, several complex cases have tested the limits of the system, and have also pushed DRASSM to find new solutions and analyse and learn from its past performance. One new horizon of improvement among others, already underway, is focussed on further developing the identification of paleo-environments as part of preventive archaeology investigations, through an increased inclusion of geotechnical and sub-bottom profiler data, and better collaboration with the marine aggregate industry.

Beyond the evolving field of French maritime preventive archaeology, the DRASSM's mission is and also remains to protect the maritime cultural heritage and to support the scientific aspects of these investigations. In this context, DRASSM also aims to promote and support archaeological research in a multidisciplinary way and with continuity between land and sea, as well as all the actors involved in the marine environment.

Conclusion

To conclude, it is important to remind the reader that the regulations relating to preventive maritime archaeology are binding on all developers, even if there are specific exemptions for fishing operations and the laying of communication cables. Funding for assessments, like excavations, is provided by the developers. Shipwrecks and coastal sites have been identified, and preventive excavations are looming. For the time being, project modifications or the avoidance of characterised anomalies have made it possible to preserve cultural heritage as it currently exists, without harming it, and thus preserve archaeological resources for the future.

Detecting, studying, documenting, preserving and promoting cultural heritage remains an ongoing challenge which takes on its fullest meaning in the context of regional planning and major consumers of non-renewable heritage (Garcia 2021). It is therefore no longer a question of a scientifically thematic choice, but of the application of a public research policy in the general interest. By small touches which are almost pointillism, cultural heritage is revealed in context. History thus resurfaces from the soil, between sea and land.

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I would like to thank Hanna Hagmark, executive director of the Åland Islands Maritime Museum, whose words (posted at the entrance of the museum's main exhibition) inspired me to remember why I do what I do. I would like to quote what she said:

> 'We are the people of the sea; The sea is our way; We live with, off and on the sea; We know that the sea gives and takes, isolates and connect; The sea is in our past and in our future; The sea is here and now.'

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In the beginning was muteness: approaching an anonymous shipwreck via poetry

Katariina Vuori

Abstract: In this chapter, I present a poetic approach to examining meanings and verbalising affections in maritime cultural heritage. As an example, I explain the conduct of 'From wreck to poetry' workshops organised at the IKUWA7 Congress and how the poems and poetry can be analysed through a three-stage metaphor analysis and free association. My motivation was to explore how a structured-poetry exercise works when the subject of the poem is an old wreck. What would be the response to a mix of archaeology and poetry, and would a creative approach stimulate, inspire or change the descriptive vocabulary regarding a wreck? Can we use poetry to add meaningfulness to the extended biography of an archaeological object?

Workshop participants included experts of maritime and underwater cultural heritage management, maritime historians and underwater archaeologists. They found the method to be easy, useful and fun, and a great tool for bringing new insights on how the material culture can be approached and interpreted beyond the objective, academic tradition. A word analysis of the poems demonstrated that creativity increases the diversity of descriptive vocabulary and that metaphors allow the viewer to venture beyond the obvious materiality. This study suggests the structured-poetry method could facilitate a multilevel cultural heritage discourse among different stakeholders.

Introduction

My research object is a seventeenth-century shipwreck, the Hahtiperä wreck, discovered in Oulu, Northern Finland in August 2019. It is the oldest surviving wreck discovered in Northern Finland so far. Traditionally, the biography and storification of wrecks from a historical period are based on archaeological and multidisciplinary research and written sources. These processes sum up as a narrative, which can be told to other researchers and to the general public in a storytelling format. Such narratives traditionally justify the value, or lack thereof, of a relic.

The usual sources in wreck research for identifying and building up the biography of a vessel from a historical era include the physical remains and their context, typology, written documents such as customs declarations and interdisciplinary research such as dendrochronology for dating, as well as provenance and ethnography. Sometimes the wreck site includes artefacts or human and/or animal remains, which open up a whole range of interdisciplinary research methods (Muckelroy 1978; Rönnby 2014). A well-detailed, vivid and in some cases exciting background of a wreck profits the scientific field, adds to the object's value and helps in capturing the curiosity of the audience.

The Hahtiperä wreck is a mute, 'paperless' and anonymous passenger from the past. No cargo or written documents are related to it. In my research, I study whether creative methods can add substance to the extended object biography of the wreck, transfer knowledge and engage different stakeholders to express their subjective views on cultural heritage through personal encounters with the relic. In this chapter, my focus is on structured poetry generated through the image of this particular wreck, and on the literal or metaphorical meanings the workshop participants used to describe the wreck.

The combination of arts and creativity is an emerging transdisciplinary practice of experimental heritage work and museum pedagogy (*e.g.* Renfrew 2003; Van Dyke and Bernbeck 2015; Bailey 2017; Kavanagh 2019; Bailey *et al.* 2020; Petersson and Burke 2020). When I took on my dissertation work on the wreck of Hahtiperä in 2022, I wished to contribute to the 'afterlife'—the post-excavation period of the wreck's object biography—by engaging the general public in the creation of the wreck's narrative, its life story. I also hoped I could give the general public a chance to see authentic pieces of the wreck, interact with them through slow, sensory archaeology and add to the multivocality when assessing the values and meanings attached to the wreck.

'Slow archaeology' is a method for archaeological object observation (*e.g.* Caraher 2016; Mol 2021). The origin of the term is unknown, but the concept has emerged alongside a broader 'slow movement'—a cultural shift towards slowing down life's pace—and 'slow science', which is a counterreaction to the increasing requirement to produce scientific information faster (Caraher 2016: 422). Caraher calls for slowing down in archaeology, stating that modern digital appliances have changed how archaeologists document and explore excavation sites (Caraher 2016: 421).

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Slow science is thought to have roots in Asian and especially Japanese way of focussing on objects (Mol 2021: 80). In my research, the concept of slow, sensory archaeology means prolonged lingering with authentic cultural heritage, using all senses and non-curated approaches.

Creativity enables nonintrusive exploitation of cultural heritage and creates a common, equal arena for the consumers of archaeology—experts and non-experts—to share their views of cultural heritage, values and signification. In my work, the ethical thinking is guided by UNESCO's Faro convention, also ratified by Finland. Article 4 states that 'everyone, alone or collectively, has the right to benefit from the cultural heritage and to contribute towards its enrichment', and the public should be allowed to approach the cultural heritage work in a versatile manner (Council of Europe 2005).

In this chapter, I first look at the object through traditional disciplinary lenses, and then I take a glimpse at the academic discourse around arts, creativity and archaeology. After that, I explain the conduct of structured-poetry exercise used in the IKUWA7 Congress and give an example of how we can process poetry through a word analysis. I end with a discussion of the broader implementation of the poetry exercise and how we can use poems to approach past societies.

Background and research environment

Paperless from the past

The wreck of Hahtiperä (Figure 20.1) was discovered in the city centre area of Oulu, Northern Finland during a hotel renovation in August 2019. The hotel had been built in the beginning of the 1970s. Part of the renovation plan was the renewal of heating and sewerage pipes. The construction area was the backyard of the Radisson Blu hotel, situated at the street address Rantakatu 1 in Oulu. In the vicinity are the main library of Oulu, the city theatre for performing arts and the market place.

Due to previous archaeological excavations (Kallio and Lipponen 2005; Pesonen *et al.* 2015) conducted nearby, it was expected that remains of old piers and waterfront storerooms might be found. In the spring of 2019, before the hotel renovation, the Finnish Heritage Agency carried out test excavations at the construction site. Older cultural strata and log structures of old piers were indeed detected (Riutankoski 2019: 2). Therefore, two archaeologists from the Finnish Heritage Agency were tasked to observe the construction project from its very beginning. On the second day of the project, pier planking was revealed, and carved and curved timbers emerged underneath. The digging was interrupted once the timbers were identified as a ship's hull.

Based on the location, depth of the items discovered and technical features of the wreck such as the use of wooden pegs and clenched iron nails to fasten the timbers, the wreck was estimated to date from the seventeenth to the eighteenth centuries. The shape and width of the hull structure, along with the thickness of the planks, provided preliminary indications of the type of vessel. The vessel was classified as a barge, a type of a cargo ship. The cultural heritage authorities of the Finnish Heritage Agency subsequently issued a protection decision for the wreck (Riutankoski 2019: 14).

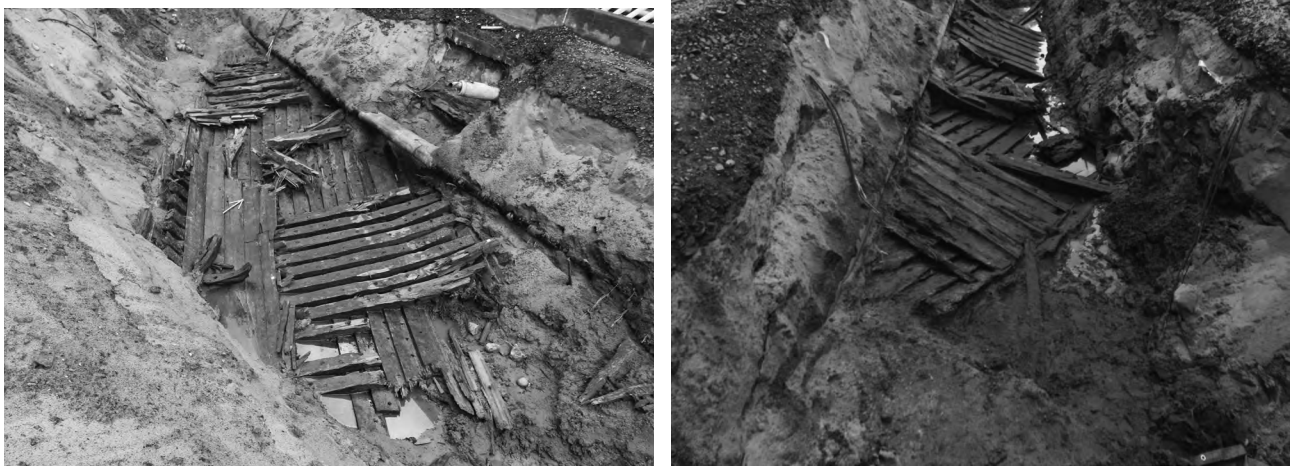

Figure 20.1. The Hahtiperä wreck (two views) was discovered from Rantakatu 1, downtown of Oulu. The excavation took place in the backyard of the Radisson Blu hotel. The wreck was embedded in an ancient seabed of an old harbour, the Hahtiperä harbour. Photos by: Matleena Riutankoski, Finnish Heritage Agency.

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The wreck was embedded in an ancient seabed of an old harbour, the 'Hahtiperä harbour'. The port was already in use by the time the city of Oulu was founded in 1605, and until 1724, it was the main port of Oulu and the main logistic centre of tar export in Northern Finland (Lithovius 1878: 2; Murman 1914; Hautala 1975: 7). Over the decades, the harbour shallowed due to land uplift and sediment which was carried to the harbour basin along the river Oulujoki and other minor waterways. In the nineteenth century, the harbour area was landscaped to be a recreational park (Hautala 1975: 64; Hautala 1976: 286). Due to the post submerging processes, the excavation of the wreck could be carried out by using land archaeology methods.

During the two weeks of fieldwork, a 10.5 metres-long and 4.4 metres-wide section was excavated and documented (Riutankoski 2019: 7). No mast, mastfoot or rigging was detected. The only artefacts found during the excavation were two pieces of chalk pipe, but it is unclear whether they were related to the wreck. Samples of the wreck were sawn at the site for dendrochronological analyses. The date of construction of the wreck was specified as after 1684. The trees used to build the ship were identified as pines. Based on the annual tree ring chronology, their provenance is Northern Finland, possibly Ostrobothnia or Northern Ostrobothnia more specifically (Aakala and Wallenius 2019: 3).

After excavations, all visible parts of the wreck were removed from the site. A so-called 'block piece', which displays the complete, remaining structure of four arched beams, the hull planking, keelson and bilge, is currently undergoing conservation process at the Finnish Heritage Agency's Conservation and Collection Centre in Vantaa (Riutankoski 2019: 16). The block piece will be set on a display in the museum of Northern Ostrobothnia in Oulu in 2026. The rest of the wreck pieces, numbering over a hundred, are not preserved and are not intended to be displayed.

The wreck of Hahtiperä is an anonymous wreck, 'paperless from the past': no artefacts have been identified to the wreck's context, and no written sources have been connected to the wreck. Its pre-excavation biography can only be narrated by reflecting on the general knowledge of the seventeenth and eighteenth centuries' Nordic clinker vessel building and seafaring history (see *e.g.* Kaila 1931; Greenhill 1976; Litwin 1991; Adams 2003; Eriksson 2010), together with information derived through archaeological and interdisciplinary research methods of the wreck's structure and building methods. In addition to on-site documentation, the wreck has undergone a thorough photographic, photogrammetry and scanning documentation and interdisciplinary research. Additional dendrochronological samples are to be taken to define the construction time more precisely. Additional information regarding the building techniques is expected to emerge through research lead by maritime archaeologist Minna Koivikko at the Finnish Heritage Agency.

Value-setting and narrative

What value does an anonymous, cargoless, mastless and humble barge hold in comparison to the 'treasure ships' and grand ships with interesting, well-detailed biographies? Traditionally, the value of an archaeological object largely depends on how well its history is known and whatever larger context it can be placed in. In wreck research and popularisation, the emphasis is frequently on large war or merchant ships with known historical background and/or valuable cargo. The most featured wreck in Finland—both in research articles and popular publications—is *Vrouw Maria* (Ilves and Marila 2021).

Many maritime related cultural resources are important to individuals or communities simply because of their existence (Claesson 2011: 68). Thus, maritime archaeological sites, shipwrecks, historic waterfronts, cultural landscapes and coastal and submerged prehistoric archaeological sites provide knowledge and understanding of socioeconomic and intercultural structures and processes. They also provide insights into the relationships between humans and the marine environment, to forest exploitation, trade, communication and shipbuilding techniques, as well as to relations between people and societies (Muckelroy 1978; Rönnby 2014; Lehtimäki *et al.* 2018).

Historic ships can be associated with symbolic significance and as embodiments of many of the qualities which modern societies want to project, such as entrepreneurship, inventiveness, technological knowhow, courage and globality. Nationally, maritime heritage can magnify the historical importance of a nation or a community (Wickler 2019: 435; Hickman 2020: 401–402, 411).

Economic value of cultural heritage can be counted in money: are there valuable metals or other goods involved? What is the economic value of cultural heritage when represented in a museum (Claesson 2011: 63)? Cultural heritage can also be valued through rarity, identity, its pedagogical possibilities or information produced by the object. Research can alter the nature of cultural heritage and its value classification, by either increasing or decreasing the value (Enqvist and Niukkanen 2007: 11–12; Mason 2008: 102, 104–105).

Cultural heritage can represent intangible, sentimental and long-term social and economic welfare benefits, as well as metaphorical and subjective values, interpretations and meanings. I attended the two-week excavation of the Hahtiperä wreck. For me the most memorable and striking feature of the wreck was the smell: the thick and smoky scent of tar oozing from the timbers. I thought I caught up something extraordinary from the past—namely, the very same scent experienced by those who applied the black gold some 300 years earlier.

Cultural resources retain a great deal of 'intrinsic historic, artistic, social, spiritual, and symbolic qualities valued

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by society, which are not readily observed in markets' (Claesson 2011: 63). Nonmarket values can be determined in large part by consultation with stakeholders (Claesson 2011: 67). In regards to ownership, cultural resources may be seen as public goods (Navrud and Ready 2002). This shared ownership of different interest groups—experts, general public and the cultural heritage object—can require some balancing when defining, interpreting, valuing and dictating cultural resources and cultural heritage. In the centre of the debate is the question as to what extent the experts alone should decide the museum parameters (Whitcomb 2003; L. Smith 2006; Simon 2007).

One solution to softening the boundaries between experts and lay communities is acknowledging there might be different interpretations—multiple ways of seeing, valuing and consuming cultural heritage (Scott-Ireton 2007: 20–21; Friel 2014: 9). By integrating creative and scientific visions to museum narratives, we can create an inspiring environment to express cultural pluralism (Wickler 2019: 437).

The function and essence of cultural resources should be non-exclusion, meaning the general public and communities should not be excluded or prevented from receiving benefits provided by a cultural resource (Claesson 2011: 64). Combining traditional value-setting and inclusive processes, both top-down (expert values) and bottom-up (public's values), adds transparency to decision-making regarding common cultural heritage (Claesson 2011: 74).

Anthropologist Janet Hoskins suggests the 'life story'—the way an object's biography is narrated which can even be partially fictional—can increase the object's value (Hoskins 2006: 81). Minna Koivikko examined wreck biography and related perspectives in her dissertation. She suggests the life story of a ship or wreck can continue in diverse manners, even after its 'death', and the discovery of a shipwreck can open up a whole new chapter (Koivikko 2017: 37).

Over hundred pieces of the Hahtiperä wreck will not be preserved or curated in a museum. Claesson (2011: 67) states that 'maritime cultural resources have few direct or extractive uses'. I suggest that non-intrusive, creative and public-engaging methods could be an ethical conduct to enrich the extended object biography, especially in the case of non-curated, perishable, organic and waterlogged timber, which will not last for future generations. Giving the public and community a chance to mingle with authentic products from the past could give them a sense of a personal interaction with past peoples and societies.

Poetry and creativity in archaeological narrativisation

Minna Koivikko's (2017: 37) notion of a 'wreck's afterlife' and how its post-excavational events can enrich its biography gave me the impetus to study the Hahtiperä wreck with the aid of creativity and, in this chapter more specifically, through structured poetry. Here, poetry and creativity have a dual role, first, as a facilitator and a form of expression when narrating cultural heritage, and second, as an output—narrative—for different stakeholders' thoughts and affects regarding cultural heritage, in this case, a nameless wreck.

It is impossible to benchmark the starting point of artists' getting inspiration from archaeology or when creative methods were used for the first time either in archaeologists' own research processes or as a bridge between the general public and cultural heritage. Stories have acted for thousands of years as vehicles for knowledge and beliefs, morality and both individual and collective identity (Kavanagh and Chodzinski 2004: 8).

Through art—in this case, word art—it is possible to strengthen and produce information which falls outside the traditional scientific discourse (Lehtimäki *et al.* 2018: 12). In poems and lyrical representations, we can express qualities of affect and complicated emotional experiences which are otherwise difficult or impossible to represent (Jones 2006: 789; Aitken 2014: 14, 21). In word art, the text is saturated through the life story of the writer. Poetics is a process of sensing 'who we are and where' (Rothenberg 1976: 10).

The functions and impacts of literature and writing—prose, poems, biographies, *etc.*—are related to selfhood, human and environmental relationships, consideration of ethical issues and the integration of previously learnt and experienced to new perceptions (Ihanus 2009: 20). Expressive writing and narrating help to process information that we receive through our senses. In words and sentences, we express our worldviews and compare our own perspectives to the perspectives of other people and society. When writing takes place in a group, the shared texts open up a platform for dialogue and a comparison of subjective experiences (Bamberg 2006; Ihanus 2009: 23, 25).

Archaeological research is often creative and has similarities with fictional narration: in the beginning, there is a mute object. Block by block, through research, a story starts to emerge. As archaeologist Rosemary A. Joyce (2008: 4) noted, 'Archaeology at its best is like storytelling'. Over the past decades, storytelling has gained awareness, especially in learning and education (Kavanagh and Chodzinski 2004: 8).

Collaboration and interchange between artists and archaeologists have proliferated from the beginning of the twenty-first century (Bailey 2017: 246–247, 249; see also Renfrew 2003; Van Dyke and Bernbeck 2015; Kavanagh 2019; Bailey *et al.* 2020; Petersson and Burke 2020). Bailey suggests that archaeologists themselves should also venture in their work past the discipline's boundaries, 'let-go beyond […] to find new places (both physical and conceptual) in which to work that were beyond the traditional limits, boundaries and discourses

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of archaeology but also of art. That other space has been poorly peopled' (Bailey 2017: 249).

Bailey encourages the use of archaeological artefacts appropriated from museums or other cultural heritage institutions as the raw material for artistic processes such as exhibitions, performances and publications which take place in non-academic locations (Bailey 2017: 255). Already, the wreck of Hahtiperä has experienced an extraordinary post-excavation life. Non-curated pieces of the wreck were lent to Oulu-based Flow productions and repurposed in an immersive performance 'HYLKY' in 2020. This kind of artistic use of cultural heritage is unusual in Finland, and it was made possible with the courageous and venturesome attitude of the Finnish Heritage Agency, and especially, the aforementioned Hahtiperä wreck's research project manager, Minna Koivikko.

The wreck of Hahtiperä has also given inspiration to two other artistic ventures: '20×26' Twitter artwork (Vuori 2019–2020; see also Vuori 2024) and artist Susanna Sivonen's paintings for the Radisson Blu Oulu hotel, in whose backyard the wreck was discovered. '20×26' Twitter artwork was implemented as a collaboration between the Oulu Writers' Association and Oulu2026 European Capital of Culture Foundation. Artist Susanna Sivonen's 'Osa sesonkia' (2020) painting for the Presidential Suite of the Radisson Blu hotel and digitalised prints of her paintings 'Radisson Bloom' (2020), 'Radisson Aurora' (2020), 'Radisson Huurre' (2020) and 'Radisson Cold' for the standard hotel rooms all include visual elements inspired by the wreck.

Alternative representations such as storytelling, visual arts and drama are all used to support traditional archaeological methods in conveying information to the non-specialist public (Van Dyke and Bernbeck 2015: 2). Memory, individual and collective, shapes the frames of an arena for cultural participation (Brockmeier 2002: 23). By adding creativity to the process of explaining or interpreting the past, we could have a bigger impact on contemporary communities and audiences (Bailey *et al.* 2020: 5).

When experts utilise experimental narrative methods in their own work, they challenge the traditional academic demand for the pursuit of objectivity. With the parallel use of creativity, they can find new answers to questions and ways of thinking—and notice, perhaps, there might be more than one story which fits the archaeological evidence (Praetzellis and Praetzellis 2015; Van Dyke and Bernbeck 2015: 3–4).

Sherry-Ann Brown (2015: 1) writes that poetry improves 'critical skills in imagery, metaphor, analogy, analysis, observation, attentiveness, and clear communication', and she points out these skills also aid in learning, problem-solving, processing observations and making assumptions. For generations, there have been rhymes and versed stories for the intention to transfer knowledge. Dante's 'La Divina Commedia' (1320) is a masterpiece of prose poem, but it is also flirtation between poetry and science: the afterlife described by Dante's verses is a representation of the Mediaeval worldview, the state of science in Dante's era.

The roots of scientific poetry are far reaching: the poems of the Roman philosopher Lucretius gravitate around the nature of the universe, and in the Romantic and Victorian eras, scientists frequently expressed scientific—also archaeological—observations in poetic form (see *e.g.* Midgley 2001; Jackson 2008; D. Brown 2013). In the twenty-first century, one can find poems on human anatomy, chemistry, astronomy or Earth science on the web (see *e.g.* Mr R.'s World of Science).

Poetry has been and is being used as a method—both in the research process and as an output: an abstract or an entire report can be formulated in the form of a poem (*e.g.* Langer and Furman 2004; Faulkner 2005; Neilsen 2008; Faulkner 2009; Illingworth 2016). In education and social work, poems have been used, for example, to express the emotions of a dead child (Jones 2006) or describe bicultural experiences (W.N. Smith 2002).

There are several neuroscience studies on the effects of poems in the brain (see Hough and Hough 2012; Vaughan-Evans *et al.* 2016). These studies reveal that poetry and the drama of poems not only benefit health, learning and personal growth, but also stimulate the right brain's area linked to autobiographical memory. Through poems, readers or listeners are able to reflect on their own experiences when reconstructing the knowledge gained from the poem.

Poetry workshops in IKUWA7

I organised five 'From wreck to poetry' workshops at the IKUWA7 International Congress for Underwater Archaeology. There were approximately 150 participants in the Congress, of whom 24 participated in the workshops (as discussed below). The workshops were part of the official congress schedule. Three of the workshops were organised in time slots between the main seminar programme, and two after the seminar sessions at the end of the day. The workshops were advertised in billboards of the venue site and in social media. The purpose of the workshops was to have a test run of the structured poetry method, to find out how it works when the focus is on a wreck, and how experts adapt to the poetic approach.

My professional background is in writing, poetry therapy and expressive arts, and I was therefore interested in exploring whether the combination of an anonymous wreck, creativity and expressive arts could open up new approaches and new ways to verbalise individual meanings and affects regarding the wreck. I think this is one way of preserving cultural heritage; 'verbal conservation'. In creative writing and poetry therapy, one of the goals is to verbalise feelings, life occurrences and life narratives, and reflect on the world around us. Writing is always a

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personal output, a valuable subjective work. When people write, they document life. In expressive arts—unlike the fine arts—the outcome is not subjected to artistic critique. The 'beauty' of the outcome is not what matters; more important are the process and the meaning of the outcome, and the types of ideas and interpretations, both individual and shared, the text brings up.

I wanted to opt for a creative writing method which would be best suited for the repeatable workshop purpose and for stakeholder groups of various backgrounds and ages. Fictional narrative texts (*e.g.* short stories) more or less based on historical facts seemed too heterogenous and too time consuming. Such texts would also have been too demanding as a tool for use by small children or people with no experience in writing fiction. I therefore decided to use the structured-poetry exercise. It is a relatively quick method and suitable for comparative research, since all the poems are created within the same parameters. Structured poetry is also easy: the youngest participants I have used it with were two years old. (Naturally, an adult wrote down the children's words.)

The interest in structured poetry lies in the words which describe the object of the poem. The object can be the writer himself or herself, another person, landscape, *etc.* In this case, the object is the Hahtiperä wreck. The poetic result can be words with literal and semantic meanings ('it is a wreck'), figurative parables ('it is sleeping') or metaphors ('she is autumn'). Figurative and metaphorical verbalisation is especially useful when we study, express or deal with abstract and emotional matters (Glucksberg 2008: 69; Lakoff 2008: 33).

To ensure the participants were familiar with and focussed upon the poem's object, the wreck of Hahtiperä, a four-

Verbal instructions:

The poem focuses on the wreck of Hahtiperä. The exercise starts with blank papers.

Writers are instructed to leave ca 10 cm marginal to the left side of the paper.

"I ask you to write down words that describe the wreck. Write down the first word that comes to your mind."

1. First line: write down **A NOUN** that describes the wreck.
2. Second line: Describe the wreck with **THREE ADJECTIVES**. Do not use a colour.
3. Third line: What does the wreck do? Write **TWO VERBS** with an -ing ending.
4. Fourth line: Write down **A COLOUR** that describes the wreck and **AN ANIMAL** it resembles.
5. Fifth line: Write down your **FAVOURITE SEASON** and your **FAVOURITE PLACE**.

When the five lines are ready, the participants are instructed to write **SHE/HE/IT IS** to the 10 cm blank marginal in the left side of the paper and **IN/ON/AT** on the fifth line between season and place.

(10 cm marginal)

Line 1 (she/he/it IS)	A NOUN		
Line 2 (she/he/it IS)	1. ADJECTIVE	2. ADJECTIVE	3. ADJECTIVE
Line 3 (she/he/it IS)	1. VERB+ING	2. VERB+ING	
Line 4 (she/he/it IS)	1. COLOUR	2. ANIMAL	
Line 5 (she/he/it IS)	1. SEASON	**(IN/ON/AT)**	2. PLACE

Figure 20.2. Structured poetry exercise conducted in IKUWA7 Congress. Created by Katariina Vuori.

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minute slideshow with details of the wreck and its discovery was shown at the beginning of the workshop. A timelapse video of the removal of the wreck (shot by Mika Friman from Museum and Science Centre Luuppi of Oulu) was part of the slideshow. This clip nicely showed the excavation site, as well as size, structure and condition of the wreck. To add a sensory dimension, the workshop room contained three authentic pieces of the wreck's planking with wooden pegs attached to them, as well as a bag with pitch and moss caulking from the wreck. Indeed, the pitchy caulking brought to the venue the scent of tar as was experienced in the excavation.

After the slideshow, the participants had a moment to study and interact with the authentic pieces of the wreck and smell the caulking before they were seated for the structured-poetry exercise. 'Privacy notice for scientific research' and 'Research participant consent' forms were distributed. The participants were instructed verbally through the exercise process.

There are many different structural-poem methods. The one I chose for this venue is a very simple one, in which words describing the wreck are written on lines. The last line is a personal one, adding a subjective dimension to the poem. When all the words have been written on the lines, a reference to the wreck ('she is', 'he is' or 'it is', depending on the participant's choice) is added to the beginning of each line. This addition changes the position of the object to the subject of the poem.

A total of 24 persons attended the workshop. Seventeen participants gave permission for their poems to be documented by photographing. The instructions were given in English. Six participants chose to write the poem in their native non-English language. When the poems were ready, the participants had the option of reading their poems aloud. Five declined to read. One participant asked me to video his performance of reading his poem aloud.

Analysing the poems

The poems are narrative data, which can be analysed and studied in diverse manners (Bengtsson 2016; Baranik *et al.* 2018; Bhatia 2020). Here, I will analyse the selected poems with two methods. First, I will focus on two poems and on one verse in each of them, and I will run them through Sam Glucksberg's metaphor analysis. Second, I will use free association on a selection of 17 poems. These methods are described below in greater detail.

The words the participants chose to describe the wreck could be analysed and processed further in various manners. In longer workshops, for example, the process could include discussion of the poems and the words, and their significance, themes and metaphors. A technique called

Figure 20.3. Three authentic plank pieces of Hahtiperä wreck and caulking material added a sensory dimension to the poetry workshop. Photos by Katariina Vuori.

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Figure 20.4. Participants in the 'From wreck to poetry' workshop in IKUWA7. Twenty-four people attended the workshop. Photo by Katariina Vuori.

looping could also be included. In the looping technique, the written text is used as a material for successive texts. The writer could, for example, choose one verse from his or her poem, and then use it as a starting line for a new poem, short story, autobiography or even a novel.

Glucksberg's three-stage analysis

Since the process and sense of structured poems lie in the chosen words and what they represent or tell about the subject, I chose to analyse the poems with a three-stage word analysis formulated by Sam Glucksberg, a pioneer of psycholinguistics (Glucksberg 2008: 67–68). The three stages are: first, derive the literal meaning of the utterance; second, assess the interpretability of that meaning in the utterance context; and third, if the literal meaning does not make sense in context, search for a nonliteral meaning which does.

The following verses of two poems were used in this analysis:

Poem 1:

It is an assembly
It is waterlogged and fibrous
It is aging, floating, breathing
It is ocker [light brown] water dragon

Poem 2:

It is the sky
It is intense and profundo [deep]
It is sailing, swimming, living
It is a blue-green octopus

Let us focus on the first line of Poem 1: 'It is an assembly'. In the first stage (= derive the literal meaning of the utterance) of Glucksberg's three-stage analysis, we can agree the wreck is an assembly of carved timbers, planks, wooden pegs, wrought iron nails and caulking material. In the bigger picture, the wreck is an archaeological find, submerged in an old harbour, in the vicinity of the city centre of Oulu, situated in the shores of the Gulf of Bothnia.

We can go further and move towards a more holistic interpretation, even at a metaphorical level: the wreck could also be an assembly of knowledge, motivation and the knowhow of past humans, an assembly of cultural interaction, an assembly of old wood and modern archaeological interpretations, a manifestation of dreams, hopes and dormition, disappearance and forgetting.

When the words do not make literal sense, we can approach their meaning through a nominal metaphor survey (Glucksberg 2008: 68). We will focus on similes,

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and run the words through a comparative test. If we pick up the verse 'it is a green-blue octopus' and run it through Glucksberg's three-stage analysis, we can see the comparison is not true in a semantic sense. The subject of the poem is a barge type, clinker-built vessel, not an octopus. We can then open up a dialogue: what does the writer mean when she or he calls the wreck an octopus?

We know that octopuses are ocean creatures. They have eight limbs, a bulbous head and three hearts. They tend to hide and camouflage. They are predators. They are a little bit shy and mysterious. They have the intelligence of a four-year-old. We could discuss the possible similarities between a wreck and an octopus. Is it the head, the hiding or the camouflaging to the ground? Octopuses squirt black ink—could that be an allegory of the smoky tar applied on the ship's timber? How about the eight limbs? Could this detail lead to a dialogue about the complicated webs of seafaring, trade, forest exploitation, technology, shipbuilding knowhow, motivation, everyday life and the people behind this chipped, carved, joined, clinkered, tarred sea creature which once floated in the harbour of Oulu?

Free-association analysis

Next, I will go through some selected poems using the free-association analysis. I will focus on word choice and general feeling or ambiance, looking for differences and similarities. I will focus on lines 1–4, leaving out the last stanza where the author connects the essence of the wreck to the author's own favourite place and time of year.

The participants were asked to choose which personal pronoun (he, she, it) they wanted to use for the wreck. The most commonly chosen were 'it' (6) and the feminine 'she' (6), the neutral and genderless Finnish word 'hän' (3) and the masculine 'he' (2).

Instead of or in addition to the metaphor analysis, poems can be processed through free association of the thoughts evoked by words and their combinations, both spontaneously and affectively. The poems can be thought of having been born through the metapoetic reflection described by Gaston Bachelard (1993): the object of the description—in this case the wreck of Hahtiperä—is the base, principal element from which the mental images are created. The text has picked up ideas not only from

She is a dream
she is gentle and deep
she is gazing, thinking, rising
she is blue lion
she is Spring in a Greek island

It is a plank
it is thick and squared
it is sailing, running, floating
it is brown oak
it is Spring on a rocky beach

She is a sail
She is bold and old
She is missing, singing, sleeping
She is green blackbird
She is November in archipelago

She is timber
She is broken and musty
She is disintegrating, wallowing, hiding
She is a brown wombat
She is Summer in Cyprus

She is wood
She is soft and old
She is hiding, sleeping, waiting
She is a brown cat
She is Summer under the water

It is a plank
It is rotten, decayed
It is lying, resting and analyzing
It is brownish fungus
It is Autumn at coast

It is a jigsaw
It is anticipating and hopeful
It is leaping up, embracing nervously
It is an orange crocodile
It is Autumn inside chessgame

She is swamp moss
She is slick, smooth
She is gliding, glistening, sihhing
She is rusty orange goose
She is Summer in pool.

Figure 20.5. Examples of IKUWA7 poems. Copyright by the authors.

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the wreck, but also from the author. The words have been filtered through sight, experience, knowledge, olfactory senses, cultural meanings and the author's personality. In exactly the same way, the gaze, touch, experience, knowledge and purpose of the ship's builders have been recorded on the form of the wreck: its shape, material, purpose and the traces of work visible on the surface of the wood, both successes and failures.

In free-association analysis, words can still be interpreted concretely or, for example, intertextually and symbolically. In free association, the outcome is the reader's own; there is no right or wrong. Next, I will go through a selection of poems verse by verse using free-association analysis.

Verse 1: The noun that describes the wreck, an idea of what the object is

The nouns used in the poems are varied by nature. Some words have concrete meanings and arise from matter or form (log, plank, timber, wood, assembly). Others are more abstract, metaphorical or symbolic words (sky, dream). The wreck is described as 'a puzzle', 'a city', 'swampmoss', 'a tree', 'a barn', 'a surprise', 'a teacher', 'a collection', 'a bed', 'a cobblestone' or 'a rattan chair'. None of the nouns refer to the essence of the subject (wreck) as a mode of transport (for example, 'ship', 'boat' or 'barge').

With the exception of four words (sleep, sky, surprise, teacher), all the nouns used were descriptions of matter, many of which were very strong and sturdy (wood, barn, cobblestone, log, plank). Puzzle, barn, rattan chair, city and collection have an air of complexity, and they consist of multiple parts. In one verse, '*he is a teacher*', a professional title is attached to the wreck, and the wreck is given the role of an information distributor and a pedagogue. Thinking more deeply, 'teacher' can also embody a life guide, a guardian of sorts: the wreck knows something more than the watcher, the archaeologist or the audience does. In viewing the wreck as a teacher, there is something that is meant to be shared: perhaps new knowledge, wisdom, experience or awakening?

The poem 'He is a teacher' continues:

'He is friendly and fresh
He is breathing, diving and relaxing
He is a light yellow snake'

When the words friendly and fresh, breathing, diving and relaxing are considered together with 'teacher', the wreck takes the character of a calm guide and mentor, with positive pedagogy and a sense of newness.

Nine of the nouns used in the first verse refer to material. In terms of material, the wreck is compared to wood, rattan, stone, sedge, swamp moss. Viewed through Glucksberg's (2008) metaphor analysis, log, wood and plank are true in a literal meaning, as they are concrete terms and describe the realistic manufacturing material of a wreck. 'Swampmoss' could be connected to the visuality of the wreck: the planks in the water containers are covered with fine, furlike fluff. The moss may also be traced back to the caulking which was seen and smelled in the poetry room.

'Stone' creates a static, stationary and strong stamp on the wreck. A stone does not float, but it sinks. Cobblestone also refers to walking: cobblestones are used to pave roads, and in the city where the wreck was found, Oulu, there are many cobblestone streets, including near the discovery site. Cobblestones have a practical meaning in walking, or perhaps they might pave the passage from present to past.

The Finnish word 'lätty' can refer to a pancake-like fried product, or also to flatness. When the lätty poem is examined for the second and third stanzas, its connection to the form is strengthened:

'He's a pancake
He is flat and moist
He hangs out, waits, has time
He's a cloudy flounder'

'He's flat' and 'He's a cloudy flounder' give the idea of a flat, platform-like shape. This form also came out in the video about the wreck: the wreck has decayed, and it lost the shape of a pod-like or an oblique vase-like ship. Just like the flounder, the wreck also lies flat in the bottom of the excavation site, cloudy and covered with sand. Lätty, flat and flounder make the wreck passive and perhaps also lazy. Lätty can also refer to something which has gone wrong: the ship is no longer doing its job, but has sunk.

Among the nouns, 'city' opens up many options for interpretation: is the wreck a complex, functional and scenic, logistical and multi-functional centre? Administrative region? Or can the 'city' be the cause and consequence of the wreck's activity: the wreck was discovered at a waterfront town, and it was built approximately a hundred years after the founding of the city of Oulu (1605). Proximity to the sea gave birth to the city, maintained it, helped it grow, created movement away from the city and into the city. As an idea, 'the wreck is a city' makes the wreck a public, functional, dynamic and changing urban manifestation. It connects the city to the shore and the continent, the state and its various functions: the economy, technology, knowledge and skill, the polyphony of society and numerous different levels, language and culture, structures, laws, people and the environment.

'Sleep' and 'sky' are essentially light and floating, limitless, self-determined, changing, but still permanent. Their materiality is difficult to touch, smell or taste. As a metaphor, the sky can refer to, for example, freedom, infinity, death and the afterlife, eternity, the condition of life through the air we breathe, permanence, gliding, flying and possibilities ('the sky is the limit').

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'Sleep' is the opposite of waking. Before being discovered, the wreck was in a dark, dreamlike, lightless state. A dream is made by images, it is movie-like and produced by the subconscious. Often, we cannot remember it, or it returns to the mind only in fragments. A dream has its own mind and will. Sleep is nocturnal, and opposite to wakefulness. It cannot go on forever, unless sleep is used as a metaphor for death ('eternal sleep'). A dream is a state which is not real. A dream emanates from the one who 'sees' it, the dreamer. Dream is associated with visuality, inaccessibility and a kind of innocence. Dream is spoken of as an omen, but it can also be a repetition of things which have already happened. As a nightmare, it is distressing, persecution and fear.

'He is a surprise'. 'Surprise' as a noun describes the wreck as something dynamic, and positive rather than negative. Experiencing surprise requires an event, and the 'surprised', an outsider who experiences surprise. Or perhaps the wreck is the one which is surprised: it had slept, dreamed, lain flat for 300 years, but all of a sudden, there is light, the roaming of machines, the noise of people talking, touching, ripping it apart.

Maybe 'surprise' refers to the unexpected archaeological discovery, revelation from within the soil. The wreck's existence was not known until the earth had been sufficiently excavated. The surprise of the wreck takes the reader's thoughts to the enigmatic nature of the poem's subject and also the object. The wreck can be a phenomenon, as long as there is someone to experience the phenomenon. The encounter between the author of the poem and the wreck as a surprise could indicate a birth of a new idea.

This poem continues:

'He is a surprise
He is fragmentary and sympathetic
He is inspiring, disturbing, educating
He is a light blue Baobab'

Here the wreck has many faces: an object, a phenomenon and, as a surprise revealed from under the ground, the wreck also seems to have dimensions of human existence and humanity: he is 'fragmentary and sympathetic'. The sympathy attached to the wreck may be related to its appearance, which none of the participants describe as magnificent, ship-like, frigate or other words referring to large warships and merchant ships. As a sympathetic ship has hardly travelled at sea with war-like intentions, it is not offensive.

Verse 2: Describe the wreck with three adjectives

The adjectives in the second line of the poems move ambivalently between the concrete and the abstract. The wreck gets character traits and temperament (gentle, inspiring, bold, friendly). As in the first line, the writers do not describe the wreck as wicked or evil. Does gentleness and friendliness come from anonymity? Or from the fact the wreck is quite robust, very ordinary? Easy to relate to? But the wreck is not only sunken and failed: she is also 'bold'; she is still in one piece, heavy and sturdy.

'It is anticipating and hopeful.' What could an old wreck anticipate or hope for? That it will be fixed, that it will float, sail, swing and voyage again? Could this verse be interpreted through the allegory of the human being as a wreck? When we are hurt or broken or failed, we can be wrecked. When the healing starts, we are anticipating, slowly getting hopeful: it will be alright.

In the concrete allegory, the teeth of time gnaw the old wreck, just as has happened or is happening to it in real life: it is 'rotten and decayed', 'soft and old', 'waterlogged and fibrous', 'broken and musty', 'collapsed and heavy'. These lines describe the state of the wreck, its physical condition, perhaps its transience, organic weakness.

Verse 3: What does the wreck do?

Thus far, we have written and read aloud words up to the third verse. We have travelled through a city, planks, sleep, decay and inspiration. In the third verse, the wreck is resting, dreaming, lingering, decaying, hiding. The vessel's life has ended, the movement has ceased. The lack of urgency of the wreck is reflected in the verbs: it is no longer going anywhere, nor is it coming from anywhere. In one of the poems, it is diving; in another, sailing. In these two poems, it is associated with its own element, water. Water is one of the oldest cultural symbols, and water is tied to the flowing passage of time, rites, philosophy and world origin myths. Water is found in religions and in ethical and aesthetical allegories (Strang 2004; Lehtimäki *et al.* 2018).

Matt Edgeworth (2012) has pondered the idea of rhythm in archaeology, both as it relates to the archaeologist's working rhythm at an excavation, as well as the rhythm of the archaeological findings. Edgeworth argues that instead of tying archaeological interpretation too tightly to external theories, greater value should be 'accorded to interpretations made on the basis of engagements with archaeological evidence' (Edgeworth 2012: 91). In the third verse of the poems, the wreck of Hahtiperä gets its rhythm.

One of the poems—in which the wreck is also a city—presents the wreck as exceptionally active, highlighting the wreck's role in its past times:

'She is a city
She is strong and hard
She is transporting, connecting, travelling.'

In the poem, the themes of shipping and movement are connected to the wreck: transporting, connecting, travelling. It is seen as a vessel, not yet and no longer a wreck. It is part of the combination of land and sea,

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logistics, a cultural enterprise. In the poem, it still fulfils the mission for which it was once built. It is a city, it is strong and resilient, it is mobile and carries something. This poem combines many elements which encapsulate the meaning of the wreck, the reason for its existence. On the other hand, maybe she transports knowledge, connects us to the past, takes us on a voyage through times?

Verse Four: choose a colour and an animal that represent the wreck

At the colour level, we move in broken tones, shades of brown and orange. Sea and water are present in shades of blue, teal and green. The strong prevalence of earthly colours—brown and orange—could originate from the colour of the planks in the water cisterns: they are brownish-red in tone due to the corrosion of the rusted iron nails. The general colour of the wreck is brown. Blue and green locate the subject of the poems to the marine and watery element.

The sea—and more generally, water—has a great symbolic, metaphorical and also very realistic position on the scale of the entire planet. Water is not only a geographical and physical element, it has also always influenced and continues to influence cultural processes, social contexts and the environment. Water has social and cultural dimensions built of meanings and values given to water, and to water's ability to connect various things (Lehtimäki *et al.* 2018: 10). Water is a medium for similes, metaphors and allegories (Lehtimäki *et al*. 2018: 11).

Five of the animals in the fourth verse are water animals: water dragon, flounder, burbot, octopus and crocodile. It is interesting to note the last four of these—flounder, burbot, octopus and crocodile—move in a squirmy manner, staying fairly close to the ground, trying to be unnoticed. Water dragon throws us to a mythical world, to the era of maps in which the cartographer used more imagination than observations of reality. As a water dragon, the wreck has an air of something unknown, mysterious and mythical. It lives in tales.

Of the animals living on land, snake, bear, goose, lion, blackbird, wombat and cat are chosen for the poems. Snakes and wombats are slow, the bear and the lion are strong. Cat is fast, agile and gracious. Blackbird and goose have the ability to fly, a goose has a bit of plumpness in its looks and webbed feet. In literature, a blackbird symbolises something common, easy to ignore. The same could be true with barges in the wreck world: they are easily overlooked and forgotten in comparison to merchant and war ships. The blackbird and its symbolic meaning could stand as a starting point to the discourse of value setting.

Structured poetry as an experience

By observation, the result of the poem was a surprise to many of the participants. One of the joys of structured poems is that the poetry 'is born' when (in this case) 'she/he/it is' is added in front of the lines, and thus, the verses suddenly make sense. The participants were curious to hear what kind of poems the others had written. The chosen adjectives, nouns and verbs prompted vivid discussion of the variety and oddity of attributes or metaphors which people connected to the same wreck. The atmosphere was relaxed and somewhat hilarious. Many commented that writing a poem was not so terrible after all!

Table 20.1. Feedback keywords and their occurrence per 10.

Keywords	Occurrence of keywords per ten feedbacks
Fun	8
Easy	4
Surprising, unexpected result	5
Will try at own work	2
Relaxing	2
Suitable for non-specialists	3
Fascinating	3
Inspiring, new thoughts emerged	3

At the end of the workshops, I asked the participants to provide feedback. There were no structured questions for this. I received 10 written feedbacks, which are analysed by keywords in Table 1.

Two participants who did not leave written feedback said they planned to use the exercise in cultural heritage in their work with children. If there had been more time, a structured or semi-structured feedback form would have provided the opportunity to elicit more detailed answers to whether this kind of creative exercise can bring new ideas regarding the subject. Three participants thought the poems brought new ways to look at cultural heritage, inspired to new approaches and showed how varied were the perceptions of experts.

The organisers of the congress had a very positive attitude about adding the poetry workshop to the event. The archaeologists and conservators of the Finnish Heritage Agency chose suitable pieces of the wreck and transported them to the event. The organisers also aided in advertising and inviting people to participate the event. Organisers said the workshop and the poems created there were featured in the participants' social media during the Congress.

Discussion and further implementations of creative approaches

In 'Figuring it out' Colin Renfrew (2003: 7) writes: 'I have come to feel that the visual arts of today offer a liberation for the student of the past who is seeking to understand the processes that have made us what we are now.' I think that in addition to visual arts, all creative methods can add a new dimension to dealing with the relationship between a human being, nature, past and present, science and cultural perceptions. Fiction and symbolic, metaphorical language

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convey unconscious feelings and experiences through which we can explore what is in between subjectivity and the objectivity of science.

Creativity and poetry workshops can be used both for experts and in engaging general public in cultural heritage work and interpretation. Creativity offers ways to exploit non-curated material culture in an ethical, nonintrusive, fun and respectful manner. The Hahtiperä wreck is perishable, organic material and the non-preserved pieces will rot—fast. Soon the beautifully carved timbers will only remain in stories told by the ones who were lucky enough to see them. Utilisation of non-curated artefacts could also add accessibility: people with visual impairment, for example, can also take part in cultural heritage work by means of other senses.

Through slow and lingering creative workshops, I believe we can bring meaningfulness to the extended biography of an object, add ethical appreciation to both the afterlife of the object and the general public's right to participate in the cultural management discourse, and to feel cultural pride when included in value-setting. I think it is not only interesting, but also audience-friendly, to give general public a chance to mingle with non-curated cultural heritage. In museums, all the artefacts are labelled, 'pre-chewed'. When interacting with non-curated heritage material, people gain the experience the archaeologists get in the excavation: What is this? Where does this scent come from? The public have the freedom to work with their material imagination, come up with virgin interpretations, maybe get surprised.

Different kind of approaches, especially creative ones, can make people aware of their relation to cultural heritage. In combination with a wreck, creative methods can help people find their maritime 'identity-niches' (Dicks 2003: 28–29). Through creative activities, the general public is given a chance to explore subjective interpretations and verbalise their thoughts. In heritage management discourse, the focus is on objectivity. Maybe the dialogue between these two stakeholder groups could be facilitated by a joint creative poetry workshop: could the poems act as a mirror for meanings and hopes, narrow the discourse gap between general public and the experts?

As a writer, writing teacher and poetry therapist, I believe by adding creative, engaging activities, the afterlife of cultural heritage can be more meaningful to both cultural heritage and consumers. Creative methods not only allow people to experience the cultural heritage slowly, at a personal level and from various viewpoints, but they also facilitate the verbalisation of meanings, thoughts and affects towards cultural heritage, thereby giving everyone a voice in cultural pluralism. In this process, cultural heritage becomes part of people's own personal lifestory. Involvement and inclusion in the cultural heritage discourse can also add cultural pride and benefit to society.

What about them? Past people in a poetic mirror

... hand holding the tar brush
a blacksmith blowing his ember
an old woman plaiting a coarse rope
arms grabbing the pitch barrels
a sad wife longing for her seaman
a bourgeoise fond of Tellicherry Black pepper
a pretty young man addicted to Arabic coffee
an ugly lady petting Coromandel cotton
a snotty nosed girl begging for a penny in the harbor
a mouth chewing the salty dried pike
a priest who blessed them all to eternal sleep.
Me, when I think of you
all the time.

(An excerpt from the Poem biography of the wreck of Hahtiperä, section II: 'The ones who touched/were touched by her'; Vuori 2022.)

How can we approach the long-gone people who had carved, sewed, hammered, shaped or clipped the material remains that archaeologists use to understand and to interpret the past human behaviour? Instead of trying to look for these people by their names, occupations and home addresses, maybe we can try to approach them by thinking of the rhythm, the bodily movements they used to create the objects and how peoples' lives, near and far, were affected by the object, in this context ships of various status.

Speculative fictional narrative is criticised for making up things, being misleading (van Helden and Witcher 2021: 6). Many times, fictional novels and short stories of historical or prehistorical era include details we do no not know to be factually correct: sex, age, background, diet, personality, marital status, voice, *etc.* of a character. To use Bernbeck's (2015: 261) words, in fictional narratives the past people's right to speak for themselves is denied. I posit the language of poetry is more subtle. When we use poetry, we avoid the problems of speculative fiction. We can get closer to past people and yet not steal their own voice.

I repeated the IKUWA7 structured-poetry exercise with an archaeology graduate student at the University of Oulu. In this exercise, the focus was on the historical people who might have been in contact with the wreck of Hahtiperä before its demise. To orientate the student to the barge, I showed her the slideshow of the IKUWA7 poetry workshop. To mimic the authentic pieces, we examined photos of the timbers. When she observed the carving marks, she noted a certain level of closeness with the putative carpenter. She assumed that with the original logs, such a feeling of intimacy could have been stronger, the carpenter becoming more of an individual.

Having authentic archaeological objects in a creative workshop could lead to an even more profound 'from human to human' dimension. Through authenticity, public

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can conceptualise cultural heritage as a product of a human action. By letting the public get into a leisurely interaction with the objects, they can pay attention to the tool marks, whether skilful or rudimentary, aesthetic or ugly. This interaction can help people not only to see objects, but to see the past populated.

I instructed the student to 'focus on the people who built the barge'. The lines were the same as in the structured-poetry exercise described in this article (Fig. 1.), with one change: I replaced the fifth line ('your favourite season and your favourite place') with 'describe what they or he or she sensed'. The structured poem came out like this:

He is a book
He is strong and sweaty
He is sawing, pushing, dreaming
He is a brown woodpecker
He is hearing the forest.

After finishing the exercise, we talked about the thought associations which arise from the poem. The student said she focussed on a person who had gone to the forest to cut down the trees needed to build the vessel. She had some hesitation to use the noun 'he'. She would have rather used the Finnish gender-neutral 'hän', given the possibility that a woman or person of non-binary identity could have carried out the tree-felling task.

She sensed solitude and calmness when thinking of the person. A book which describes everyday chores, tragedies, joys, a lifetime was associated with the story. To be able to fell a tree and work on it, the person needed to be strong. Here, the writer pointed out, there were probably additional people involved, as the work was likely too much for just one person.

He is sweating, panting, grasping air. The movement of arm is 'pushing and then pulling' as he saws the tree. He dreams of a better life, getting nourished, returning from a wintery forest to a warm home. The allegory of a woodpecker leads to the sound: the clasping of an axe, the rhythmical echoing in the forest. In the verse 'he hears the forest', we can think of all the sensory elements of the surroundings: birds, breath, the crack of a tree branch, the crumbling voice of snow and even the deep silence when the work ceases.

With the combination of slow archaeology and poetry, I believe we can approach the people behind the objects sensitively. The language of poetry allows the expert or the public to cast out ideas about historical people, to draw a verbal picture in order to make them alive and vivid. We could even go further, go to the forest and include bodily writing to the poetry exercise by mimicking all the movements required to build the barge: pull, push, lift, peel, chip, chop, apply tar. Take off your shoes, smell, hear, feel and taste the forest. Write down everything you feel in your body, feel the ancient heartbeat in your chest. We are not that different, after all—are we?

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