Archaeology and Engineering

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What is the use of the past?

Are we more than the sum of our experiences, than our past? Why so few people would throw away their family albums?
A friend of mine, Gary Momber, says that the past is a source of self-esteem.

Nashville, replica of the Parthenon, 1897.
Memories can be anchors that keep us balanced through the storms. Knowing that people walked the streets of your city for millennia before you gives you perspective. There is a soothing effect in the permanence of our habitats. History is like the soul of a landscape.
Plato said that the unexamined live is not worth living. Understanding the world is paramount… not the least to give us perspective and direction in the struggles that we choose to fight.
To understand the world we must represent it. A good way to look at history is to imagine that we would give our hand to our mother and she would give her hand to her father, and so on. It would not be a long line from now to the Roman Period.
Archaeologists’ questions are:

Who are we?
Where do we come from?
Where are we going?
What can we know?
Man, Animals, Plants, are we all part of the same clan?
Man and nature
Man and the spirits of nature
Man and the world within
Archaeologists try to reconstruct the past based on surviving physical remains.
Introduction: what archaeologists do

N. S. dos Mártires, 1606
Introduction: what archaeologists do
Introduction: what archaeologists do
Introduction: what archaeologists do

Over 2,000 artifacts dated to circa 1600.
Introduction: what archaeologists do

There was just one small portion of the hull preserved.
Introduction: what archaeologists do
Introduction: what archaeologists do
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Introduction: what archaeologists do

Cais do Sodré, c. 1500
Introduction: what archaeologists do

Found in April 1995; Excavated and recorded in the summer of that year; dismantled and transported to a warehouse in the same summer; handed to CNANS in 1996.
Introduction: what archaeologists do

A whipstaff indicated a large vessel with several decks.
Introduction: what archaeologists do

Because the archaeologist designated by the government (Ippar) was very ill, and it was obvious to the contractor that he could not do his work – he wasn’t present when the machines hit the site and the midship frame and maststep were lost forever – the management of the *Metro* and the contractor agreed to assign a total station and record the site, pack it, and hand it to Ippar.
Infighting, incompetence, irresponsibility, and ignorance from the Ippar management left the ship timbers abandoned an entire summer, during which they dried and warped.
Introduction: what archaeologists do

In 2000 and 2001 I was allowed to help recording the timbers, came with my A&M students, and recorded all the frames.
Introduction: what archaeologists do

I was not allowed back, and nobody recorded any other timbers.
Although struggling with his condition, in 2002 the archaeologist responsible for the project, Paulo Rodrigues, finished his masters at Sorbonne.
Introduction: what archaeologists do

In 2008, based on my notes, we made some attempts at understanding this shipwreck.
Introduction: what archaeologists do

In 2010-2011 a change in the management of IGESPAR allowed us to come back and try to make sense of this shipwreck. Paulo Rodrigues had died, and some of the data were lost, but the engineers’ drawings were still there.
Introduction: what archaeologists do

We used them to reconstruct the shape of the ship in situ.
Developed a new set of excavation drawings.
Introduction: what archaeologists do

And attempted to make sense of the warped frames, mounted on a straight keel.

Then we combined the drawings of the frames with the shape of the planking in situ.
In 2015 we tried again to study these timbers, which the DGPC wants to throw away, but we did not manage.
Introduction: what archaeologists do
Introduction: what archaeologists do
Gagliana grossa, 1583

The Gnalić ship was a large cargo ship built in Venice for the merchants Benedetto da Lezze, Piero Basadonna and Lazzaro Mocenigo.
Introduction: what archaeologists do

It was launched in 1569 and rated at 1,000 botti, a capacity equivalent to around 629 t, which corresponds to a length overall close to 40 m. Early in 1570, the Gnalić ship transported troops to Cyprus (which fell to the Ottomans in July).
In 1571 the Gnaći ship fell into Ottoman hands, captured by Uluç Ali. Uluç Ali captured the ship and imprisoned the captain, a 16-year old condottiero named Giovanni Tomaso Costanzo.

Giovanni Costanzo was held prisoner until 1574, when he was exchanged against Ottoman prisoners and given a captaincy of a fortress at Corfu.

He eventually asked to fight the Protestants in Belgium, with Alexander Farnese, where he died in battle, on September 21, 1581. He died in Valenciennes, 36Km from Tournai, at the age of 26.

A descendent of Costanzo sent us a collection of very important documents pertaining to his ancestor.
In 1581, the old Ottoman merchant ship, the former *Moceniga, Leze, & Basadonna* was sold in Constantinople to an Italian merchant named Odoardo da Gagliano.

Following a fire in the Topkapi Palace, early in 1583 Sultan Murad III (1574-1595), the powerful Ottoman ruler, son of Selim II, ordered a consignment of 5,000 round windowpanes from Venice, to rebuild a part of the harem quarters, damaged by the fire.
Loaded and carrying all the permits necessary for the voyage, *Gagliana grossa* left Venice for Constantinople in the last days of October 1583, a few weeks before the winter ban on sailing, which according to Venetian law started November 15 and ended on January 20.

A few weeks later news of its loss reached Venice. It sunk near the little Islet of Gnalić, not far from Zara Vecchia, today Biograd na Moru.

A party of salvagers was sent in December, under the direction of a certain Manolo ‘Fregata’ originally from Crete.
The site was discovered by sport divers in the early 1960s, lying at a depth of between 25 to 32 meters.

The site was reported to the authorities by sponge divers in 1967 and was the object of several archaeological interventions since then.
Introduction: what archaeologists do

A large collection of artifacts was recovered from the Gnalić site over the years, and although some of the artifacts have been salvaged by sport divers, a large collection remains, its interest tied to the amazing story of this ship.
Introduction: what archaeologists do
Introduction: what archaeologists do

The ShipLAB was involved in excavation of this site only from 2012 to 2014.

Kotaro Yamafune
Introduction: what archaeologists do

Kotaro Yamafune:

http://vimeo.com/101804979
Santiago de Galicia, 1597

This warship was built in Napoli by a Ragusan merchant for the king of Spain, Felipe II.
Introduction: what archaeologists do

It sunk on the mouth of the Eo River, which makes the frontier between Galicia and Asturias.
It is being excavated by an international team, under Dr. Miguel San Claudio, since 2015.
Introduction: what archaeologists do

With a low budget and no conservation facility, this excavation is progressing slow.
Introduction: what archaeologists do
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Introduction: what archaeologists do
To study and preserve the past we must know what we have:

• Inventory
• Diagnostics
• Prognostics
Archaeology needs Engineers
Three main subjects:

1. Surveys;
2. Excavations;
3. Cultural Heritage Management.

a) Methodology;
b) Recording and data acquisition;
c) Organization and curation of information;
d) Data sharing;
e) Longevity of digital data.
Surveys

Expensive, limited, not planed within a plan to inventory and manage the Portuguese underwater cultural heritage (uch).
The Portuguese inventory is incomplete and there is no plan for the study and preservation of the underwater cultural heritage (UCH).
There are no means in the state agency to develop and much less to implement a plan.
Nobody knows the exact position of the majority of the submerged sites.
There is only anecdotal information on the state of many known sites.
Excavations

Inexistent: only emergency interventions are carried out, and only when constructions destroy cultural heritage sites.
Some private companies work with competent technicians, others don’t.

ERA seems to be a good-sized company with means to excavate, study and share. Some companies see the general public as their client, others still focus on the government and the corporations.
Some contract archaeology companies have realized that although their clients are the contractors that must hire them by law, their constituency is the public in general, and have started sharing their reports online.

Problems

Santos: Shipyard
In Portugal, the alleged cost of ‘delaying’ works – there are only delays if there is no serious planning – put an excessive pressure on companies and archaeologists.
The state is averse to conserving waterlogged timbers and politicians are constantly trying to de-access archaeological materials.

Remains of the Cais do Sodré Ship, abandoned by the state and still in risk of being destroyed before being studied.
UCH Management

The underwater cultural heritage database is incomplete, and many sites are unverified.
The underwater cultural heritage database has the historical references to shipwrecks mixed with the underwater sites.

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Problems
Many sites are not georeferenced.
There is no strategy to share or publish the data;
There is no strategy to collaborate with the stakeholders: the population, the diving clubs, universities, museums, municipalities, the Navy, etc.
Surveys

To setup a national database (GIS). Australia has the best database online, with the permits, the reports, and the status of each site.
To identify the vulnerable sites and inventory the ones that must be monitored;

Remains of a ship that could be part of a 17th century shipwreck carrying silver…
To implement a survey strategy and create synergies, by collaborating with other agencies and organizations;
To define protocols for the storage and curation of digital data;

Excavations

To develop mapping and recording methods;
To develop protocols for the inventory of timber remains;
To develop protocols for the inventory of artifacts;

Rodrigo Torres and Kotaro Yamafune
To develop protocols for the inventory of primary data;
UCH Management

1. Database of underwater archaeological sites in Portuguese waters;
2. Database of historical references to shipwrecks in Portuguese waters;
3. Database of underwater archaeological sites in outside Portuguese waters;
4. Database of historical references to shipwrecks outside Portuguese waters.
To develop a monitoring plan for vulnerable sites in Portuguese waters;
Solutions

To develop a collaboration plan to involve the public and stakeholders.

Sesimbra dive club that organizes dives in a 16th century shipwreck.
The Nautical Archaeology Digital Library
Ideas for Projects

Transforming 2D ship lines drawings into 3D wire frames

This is a time-consuming technique that would benefit from at least partial automation.

1. Culip VI (c. 1300)
2. Almere Wijk (c. 1430)
3. Mary Rose (c. 1545)
4. San Juan (c. 1565)
5. Matthew Baker (c. 1570)
6. B&W 4 boat (1587)
7. Oost Flevoland B 71 boat (c. 1600)
Ideas for Projects

8. Pepper Wreck Indiaman (1606)

9. Fernandez caravel (1616)

10. B&W 5 flute (1625)

10. Vasa (1625)

11. Flute Zeehaen (1639)

12. Jacht Heemskerck (1639)
Ideas for Projects

1. Corpo Santo (c. 1400)

2. Avareiro (c. 1450)

3. Cais do Sodré (c. 1500)

4. Bom Jesus (c. 1533)

5. Belinho (c. 1580)

6. Pepper Wreck (1618)
Ideas for Projects

Model the ships of Manoel Fernandez…

…and put them online for kids to print.
Ideas for Projects

Building 3D meshes from truncated data

Often times all we have from archaeological sites that have disappeared are slides or paper pictures that were taken to produce a photographic mosaic, but provide only partial coverage or with limited overlap.
Ideas for Projects

A very important shipwreck, which was destroyed by treasure hunters, was photographed with a certain amount of overlapping, but the pictures were cropped. And the originals are lost.
Ideas for Projects

3D EyeWitness 9.0
Draw any crime, fire and accident scene quickly, easily and exactly!

or

PHOTOMODELER TECHNOLOGIES

The 3D view shows the textured surface, the black solved camera stations, and the green spheres indicating the GPS positions.
Two 3D models of a reconstructed Portuguese Indiaman are available for VR development, one of the ship’s structure in Rhinoceros, and one of the interiors and the cargo, in Maya.

Audrey Wells & Fred Parke- VizLab
Ideas for Projects

**Audrey Wells** (MA 2006-2008, Visualization Sciences Department, Texas A&M University)
Committee Chair: **Frederic Parke**
*Virtual Reconstruction of a Seventeenth-Century Portuguese Nau.*

**MAYA**
3D computer animation, modeling, simulation, and rendering software
Ideas for Projects
Ideas for Projects

Audrey Wells
Ideas for Projects
Ideas for Projects
Ideas for Projects

Audrey Wells
Ideas for Projects

Audrey Wells
Ideas for Projects
Ideas for Projects

Audrey Wells
Tracking the paths of the cultural heritage

Yue Yan (MA 2014-2016) - *Global Keyword Tracking in Archaeology*
Committee Chair: Richard Furuta
Ideas for Projects

Automating and generating shapes

Matt Suarez (MS 2014-2016) - A Procedural Approach to Computer-aided Modeling in Nautical Archaeology
Committee: Frederick Parke and Andre Thomas
Ideas for Projects

Ships on Paintings

*Iconography of Early Modern Ships and Boats*

**Austin Griffin** (Independent Study CSCE 491)

Advisor: Richard Furuta
GroPlan


LSIS - Laboratoire des Sciences de l’Information et des Systèmes - CNRS 7296

Grant (720,942.88 €) from the French Agence Nationale de la Recherche

The ShipLAB is a partner to this project.

Xlendi Phoenician Shipwreck, 7th century BC.
Ultimately, the main goal of a collaboration between marine robotics and archaeology would be the acquisition of accurate data.

Computer Science: Pierre Drap (CNRS) and the c. 700 BC Xlendi shipwreck, Malta.
iMARECULTURE (2016-present), dir. Dimitrius Skarlatos, “Advanced VR, iMmersive serious games and Augmented REality as tools to raise awareness and access to European underwater CULTURal heritage.”

Cyprus University of Technology. EU: Horizon 2020.
If marine robots can do archaeology, they can do anything.

Marine archaeology can be a good testbed for marine robotics:

1. Shipwrecks frequently occur in places with currents and waves;
2. Often deep;
3. Often in places with low visibility and suspended sediment;
4. Marine archaeology requires surgical precision;
5. It generates large amounts of data that need to be synchronized, stored, migrated, classified, and analyzed, in order to allow for interpretations of the sites and reconstructions of the past.
The Nautical Archaeology Digital Library
Most of the problems we have at NADL, are related to the representation of data.
A website like NADL, that purports to be a hub for information maritime archaeology, needs to:

a) develop tools to allow the community members to upload all sorts of data;
b) Curate the data;
c) Present the data in a user-friendly way.
Because the research on maritime archaeology entails the curation of collections of artifacts, descriptions of shipwrecks, videos, GIS databases, and data that changes in time and from place to place, we need to develop user-friendly graphic tools.
Creative navigating tools based on figures.
Easy to manage simple online databases of artifacts would be extremely useful.

Classic Warship Rams Database

Egadi 1 Ram, Italy, 241 BCE

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Found on:

Etc.
In sum, there is no maritime archaeology without engineers!
One million years ago we could learn all the skills we needed to live a good live. Now we must rely on the community: the world is too complex. Nobody alive knows how to make a computer mouse.

Matt Ridley TED Talk *When ideas have sex*
Thank you!!