

# THE MAKING OF THE ANTIKYTHERA MECHANISM

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*The largest fragment of the Mechanism, exhibited at the Greek National Archaeological Museum in Athens*

## WHEN AND WHERE WAS IT FOUND?

It was found in **1900** by sponge-fishers, in a **Roman shipwreck** near the Greek islet of Antikythera, hence the name of the device. It took two years for the 82 fragments to be identified as part of a complex mechanism!

## WHAT WAS OUR PROJECT ABOUT?

Our project is part of the UCL **Natural Sciences Innovation Lab**, a summer program aimed at keeping students engaged during this unusual summer 2020.

We took an interdisciplinary perspective to study the Mechanism. Our two main objectives were to produce:

- a **video series**, to explain concepts in the three disciplines we considered (History of Science, Astronomy, Engineering)
- a **replica**, to be displayed at UCL alongside a poster similar to this one.

## WHAT IS THE ANTIKYTHERA MECHANISM?

The Antikythera Mechanism is the **earliest** known mechanical device designed to display **astronomical information**. It's dated to about the 1<sup>st</sup> century BC, the **Hellenistic period** of Ancient Greece, when many advances in the arts, sciences and philosophy are made. As well, territorial expansion means different cultures' knowledge gets intertwined, which can be seen in the Antikythera Mechanism as it contains **influences** from the Babylonian and Egyptian astronomical and calendrical traditions.



*A replica at the Greek National Archaeological Museum— an attempt at understanding the original machine better*

## WHY IS IT INTERESTING?

This object is a fascinating materialization of the advanced **astronomical and technological knowledge** of the Ancient Greeks. Still, its purpose remains mysterious - a good reason to study the device.



*Our logo for the video series*

## HISTORY OF SCIENCE

One thing that can't be forgotten when studying ancient artefacts is the significance of religion to the culture they come from. **Astrology** often played in a significant role in understanding omens from the Gods, and the tradition of predicting phenomenon thanks to calendars may be why the Antikythera Mechanism was built. It has also been suggested that it was used to determine astronomical position of celestial bodies at the time of the **Olympic games**.



## ASTRONOMY

It is incredible what early astronomers discovered by looking at the sky with their naked eye. For instance, Thales understood that the positions of the Moon and of stars can be used to determine one's position – an observation extremely useful for **navigation**. The hypothesis that the Antikythera Mechanism was used for that purpose has been put forward by some historians of science.

## ENGINEERING

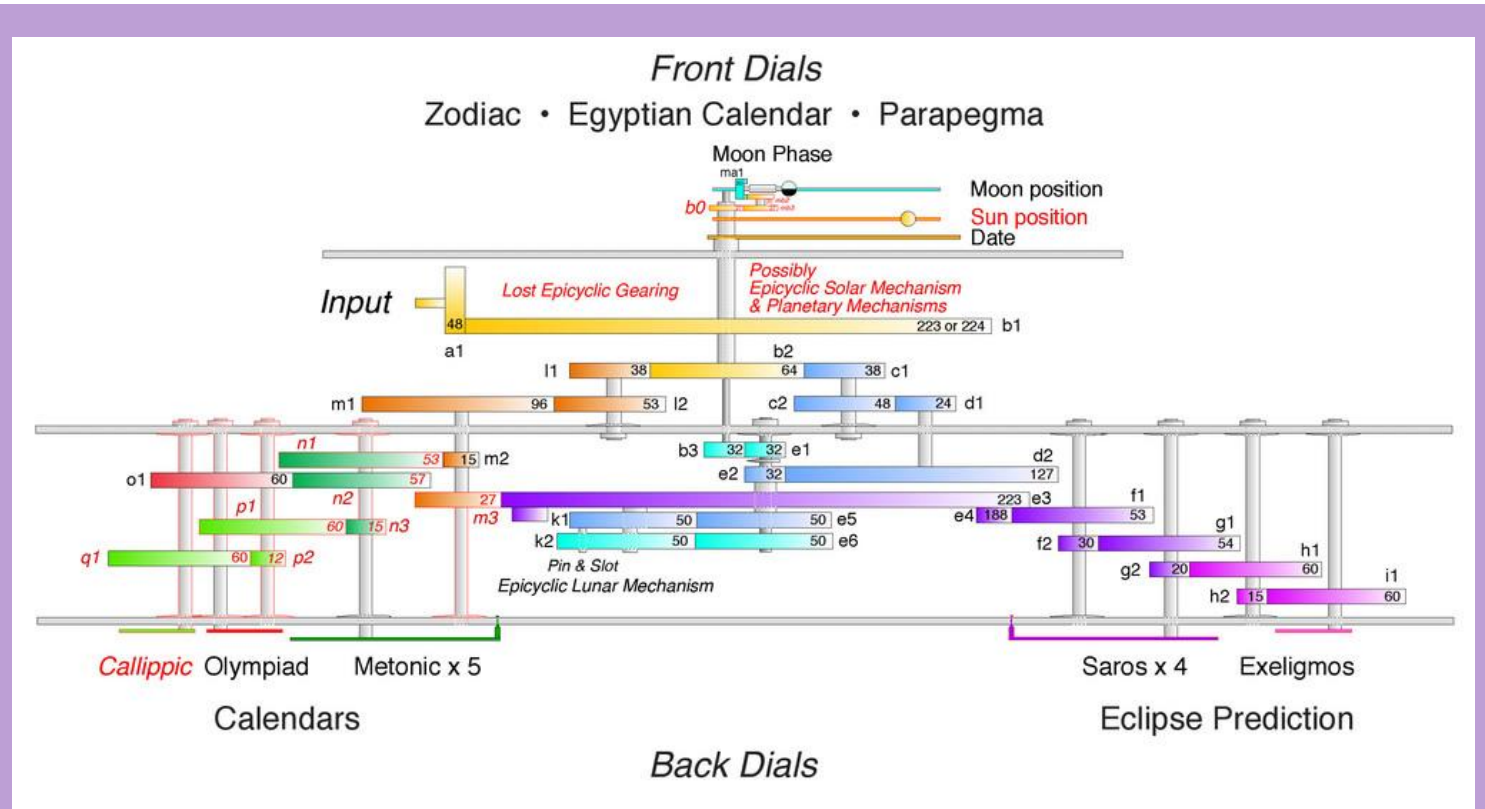
Machines are built for a specific purpose. The Antikythera Mechanism is often described as the world's first "analog computer", a device that uses changeable aspects of physical phenomena to **model the problem** being solved. Ancient Greek scientists were often also teachers – it could be that the device was used for **demonstrations** as a physical model of what's occurring in the sky, helping students to grasp astronomical prediction-making.



## WHAT IF THE ANCIENT GREEKS BUILT THE MECHANISM USING TODAY'S TECHNOLOGY AND MATERIALS?

We set out to design and build a **21<sup>st</sup> century 1:1 replica** of the Antikythera Mechanism. By displaying it at UCL, we wish to introduce students and a larger public to the device in an **interactive** way: notably, they will be able to drive the Mechanism with the **handle**, as in the original machine. It will also give them an insight to some of the **research** that takes place the UCL Engineering, Science and Technology Studies and Natural Sciences departments.

Researchers have used X-rays and other analysis methods on the fragments to be able to reverse engineer a theoretical model. We used the CAD software Catia V5 to transform these drawings into a **visualization** of a 3D object. In the building of the tangible replica we will use a variety of **methods**, including but not limited to 3D printing and laser cutting, as well as modern **materials** such as a casing of transparent acrylic sheets, so that the public can see the **inner workings** of the gearbox.



*The theoretical model by Freeth and Jones, 2012, which forms the basis for our replica.*

*Gears labelled in black are derived from the fragments while gears labelled in red are assumptions to make the mechanism functional.*



*Technologies for building such temples were available, but what about metallurgy?*

## PROBLEMS WE FACED

Covid-19 also disrupted this project: we couldn't manufacture our replica yet, and UCL workshops will remain closed for the first term. We hope to complete production and display before the **end of the academic year!**



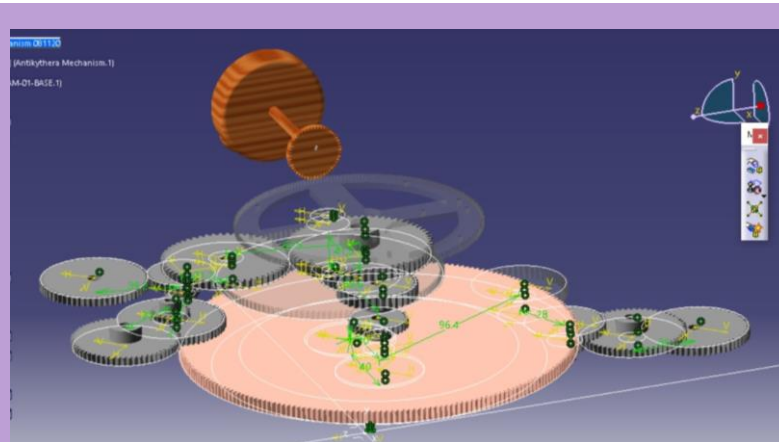
*A diver inspecting amphorae at the wreck*

*Credit: Brett Seymour, EUA, WHOI, ARGO*

## OUR CONCLUSIONS

In our reproduction of the Mechanism, we were able to use precise contemporary tools. There is yet much to be learned about the **engineering abilities** of the ancient Greek. As well, with our interdisciplinary perspective, we showed that there are many plausible explanations for the **purpose** of the device.

The Antikythera Mechanism could be **one of many** complex machineries that they were able to create, modelling different phenomena from the Natural Sciences. On the other hand, it may well be that the device was **never fully functional** because of its complexity.



*An extract from the design plans for our replica, which we intend to “put into practice” once the workshops re-open*

## POTENTIAL FOR FUTURE RESEARCH

100 years after its discovery, the Antikythera shipwreck keeps yielding new treasures – a few years ago, a well-preserved **Roman body** was found, buried under layers of pottery. This might give us more information about the people on board of the ship and the context in which the Greek Mechanism was transported.

Unfortunately, the recent illegal private removal of objects from the seabed can pose a **threat** to further archaeological research.