The Antikythera Mechanism: An Ancient Computing Machine

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The Antikythera Mechanism was first discovered by sponge divers in 1900 from a shipwreck off the coast of Antikythera, Greece. The initial discovery was followed by a ten-month exploratory mission by the Greek Navy and the National Archaeological Museum. Multiple fragmented pieces were found and pieced together, revealing a complex and intricate bronze device that measures around 30 by 17 centimeters. It is dated back to 100 B.C. and is comprised of more than 30 finely crafted gears, dials, and inscriptions. Its outer casing features a bronze face adorned with various dials and pointers, each meticulously marked with Greek inscriptions. The inner workings consist of nested gears, interconnected in a complex system. Here is a detailed description of the device:

> It was box-shaped, with its bronze front and back dial faces about 17 cm wide and 32 cm tall; the front-to-back depth is uncertain but was surely not fewer than 10 cm. The sides, top, and bottom are believed to have been wooden, with the right side perforated so that some sort of drive, probably a knob or crank, could impart motion to the gearwork. The front face had a single large dial, with two concentric ring-shaped scales respectively divided into the 12 signs and 360 degrees of the zodiac circle, and into the 12 months and 365 days of the ancient Egyptian calendar. (The calendar dial could be manually taken off and replaced in any orientation relative to the zodiac since the Egyptian year, lacking leap days, gradually shifted relative to the natural year.) Pointers embellished with small spheres indicated the zodiacal longitudes of the sun, moon, and (probably) the five planets known in antiquity, and a small parti-colored ball displayed the moon's phases. Above and below the dial was the "Parapegma Inscription," a list of annually repeating phenomena relating to the sun, zodiacal signs, fixed stars, and constellations. Turning the input drive clockwise would simulate going forward in time, at a rate of roughly 78 days per turn, and the gearwork would cause the pointers and the lunar phase ball to revolve with motions appropriate for the heavenly bodies that they represented. (Jones 2018, 266).

Early research revealed the primary purpose of the Antikythera Mechanism as a navigational instrument or a tool for deciphering astrological events, such as predicting celestial events including the positions of the Sun, Moon, and planets, as well as eclipse occurrences. It was able to calculate solar and lunar calendars and incorporate important astronomical cycles which were widely used in ancient Greek astronomy. "The bronze device contains dozens of

small gears with teeth about a millimeter long that were used to predict the positions of the sun, moon, and planets at any chosen time." (Freeth 2022). Ancient Greek society placed great importance on celestial phenomena, associating them with divine or mystical significance. Predicting eclipses and celestial positions allowed for the coordination of religious festivals, agricultural activities, and navigation. Therefore, this device would be of great use and/or importance in a society that placed such great emphasis on the workings of the stars, planets, and galaxy.

For many years, researchers had to rely on photographs and seeing the device firsthand to make predictions on its function and uses. But as technological advancement marched on, so did the tools at the disposal of researchers.

> But from the 1970s on, technological advances such as X-rays, gamma-ray radiography, linear and computed tomography (CT), and reflectance transformation imaging (RTI) permitted investigators to see inside the Mechanism. With the aid of these advances and in collaboration with the National Archaeological Museum in Athens, the AMRP began in 2005–6 to re-examine the Mechanism's eighty-two fragments and to work on various reconstructions. (Henderson 2018, 1).

The primary use of the device was then determined to be suitable for “basic astronomical instruction for philosophy students and educated laymen, rather than for professional astronomers.” (Henderson 2018, 1).

This device is a testament to the remarkable technological expertise of the ancient Greeks. It’s intricate gear system showcases a level of mechanical precision and engineering not seen for another 1,000 years. “The device has no known precursor and is more complicated than any surviving mechanism from the following millennium.” (David 2017, 1).

What’s most intriguing about this technology is the absence of any known references or detailed descriptions of similar devices in ancient texts. This has perplexed historians. It suggests that the technology behind the Antikythera Mechanism may have been a closely guarded secret

or lost to history. The mechanism's discovery raises questions about the extent of knowledge and technological achievements that may have been lost. It is also believed that this device was much too advanced to not have any other similar technologies leading up to its creation. However, no other items that could have been precursors to the development of the Antikythera Mechanism have been found to date. New excavations at the site began in 2014 by the Hellenic Ephorate of Underwater Antiquities and the Woods Hole Oceanographic Institution in search of new fragments or other potential devices. The excavation did produce new artifacts, but no astronomical devices. "Fragile materials, including a human skull, and a similar range of artifacts have been recovered, including jewelry and glass, though as yet no sculptures, nor any fragments of astronomical instruments." (David 2017, 2).

The primary rationale behind the Antikythera Mechanism's creation was the understanding, harnessing and prediction of celestial events. It represents the legacy of Greek innovation and intellectual curiosity. It exemplifies the Greeks' commitment to understanding the natural world and their determination in developing sophisticated tools to explore it. Its creation also reflects the desire to advance knowledge and technological capabilities. One can't help but wonder what might have been had this device not been lost to history and the technology continually built upon from its first inception. The Antikythera Mechanism, with its remarkable technological sophistication and the absence of any known references to similar devices in ancient texts, poses intriguing questions about the preservation and dissemination of knowledge in antiquity. Its existence hints at the possibility of lost technological advancements and challenges our understanding of the depth of ancient expertise. While the search for potential precursors and new fragments continues, one thing is for certain: the Antikythera Mechanism is a unique historical find. It is far more advanced than anything else of its age. Whether the

Antikythera Mechanism was created for use by professional astronomers or as an educational device, it has earned its place as one of the first computational devices in history.

Bibliography

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The Antikythera Mechanism is an ancient and intricate device that dates back to around 100 BCE, discovered in 1901 from a shipwreck off the coast of the Greek island of Antikythera. Often referred to as the world's oldest analog computer, this remarkable artifact consists of a complex system of gears and dials. It was designed to track and predict astronomical positions, such as the positions of the Sun, Moon, and planets, as well as predict lunar and solar eclipses. The engineering used in the design and creation of the device is far ahead of its time. Nothing near as technologically sophisticated was produced for another 1,000 years.