Αρχιμήδη "Στομάχιον"

Ένα ενδιαφέρον ιστορικό ανάγνωσμα, που το είχε διανείμει πριν κάποια χρόνια ο Καθ. Παπασταυρίδης. Το βρήκα στα ξεχασμένα μου αρχεία και το παραδίδω.

Twenty-two hundred years ago, the great Greek mathematician Archimedes wrote a treatise called the Stomachion. Unlike his other writings, it soon fell into obscurity. Little of it survived, and no one knew what to make of it.

But now a historian of mathematics at Stanford, sifting through ancient parchment overwritten by monks and nearly ruined by mold,appears to have solved the mystery of what the treatise was about. In the process, he has opened a surprising new window on the work of the genius best remembered (perhaps apocryphally) for his cry of "Eureka!" when he discovered a clever way to determine whether a king's crown was pure gold.

The Stomachion, concludes the historian, Dr. Reviel Netz, was far ahead of its time: a treatise on combinatorics, a field that did not come into its own until the rise of computer science.

The goal of combinatorics is to determine how many ways a given problem can be solved. And finding the number of ways that the problem posed in the Stomachion (pronounced sto-MOCK-yon) can be solved is so difficult that when Dr. Netz asked a team of four combinatorics experts to do it, it took them six weeks.

While Dr. Netz acknowledges that his findings cannot be proved with absolute certainty, he has presented the work to other scholars, and they say they agree with his interpretation.

On a recent snowy Sunday morning at Princeton University, three dozen academics gathered to hear Dr. Netz speak, and then congratulated him, saying his arguments made sense. "I'm convinced," said Dr. Stephen Menn, a McGill University historian of ancient mathematics, in an interview at the end of the two-hour session.

Among all of Archimedes' works, the Stomachion has attracted the least attention, ignored or dismissed as unimportant or unintelligible. Only a tiny fragment of the introduction survived, and as far as anyone could tell, it seemed to be about an ancient children's puzzle - also known as the Stomachion - that involved putting strips of paper together in different ways to make different shapes. It made no sense for a man of Archimedes' stature to care about such a game. As a result, Dr. Netz said, "people said, `We don't know what it is about.' "

In fact, he has concluded, the prevailing wisdom was based on a misinterpretation. Archimedes was not trying to piece together strips of paper into different shapes; he was trying to see how many ways the 14 irregular strips could be put together to make a square.

The answer - 17,152 - required a careful and systematic counting of all possibilities. "It was hard," said Dr. Persi Diaconis, a Stanford statistician who worked on it along with a colleague, Dr. Susan Holmes, who is also his wife, and a second husband-and-wife team of combinatorial mathematicians, Dr. Ronald Graham and Dr. Fan Chung from the University of California, San Diego.

Independently, a computer scientist, Dr. William H. Cutler at Chicago Rawhide, a manufacturer of oil seals in Elgin, Ill., wrote a program that confirmed that the mathematicians' answer was correct.

Perhaps as remarkable as the discovery that Archimedes knew combinatorics is the story of a manuscript that dates to 975, written in Greek on parchment. It is one of three sets of copies of Archimedes' works that were available in the Middle Ages. (The others are lost, and neither contained the Stomachion.)

"For Archimedes, as for all others from antiquity, we don't have the original works," Dr. Netz said. "What we have are copies of copies of copies."

Investigators evaluate copies by asking whether they agree on the text they have in common, and by looking for unique passages, which lend them particular interest. By those measures, the manuscript was invaluable. But it was nearly lost.

In the 13th century, Dr. Netz explained, Christian monks, needing vellum for a prayer book, ripped the manuscript apart, washed it, folded its pages in half and covered it with religious text. After centuries of use, the prayer book - known as a palimpsest, because it contains text that is written over - ended up in a monastery in Constantinople.

Johan Ludvig Heiberg, a Danish scholar, found it in 1906, in the library of the Church of the Holy Sepulcher in Istanbul. He noticed faint tracings of mathematics under the prayers. Using a magnifying glass, he transcribed what he could and photographed about two-thirds of the pages. Then the document disappeared, lost along with other precious manuscripts in the strife between the Greeks and the Turks.

It reappeared in the 1970's, in the hands of a French family that had bought it in Istanbul in the early 20's and held it for five decades before trying to sell it. They had trouble finding a buyer, however, in part because there was some question of whether they legally owned it. But also, the manuscript looked terrible. It had been ravaged by mold in the years the family kept it, and it was ragged and ugly.

In 1998, an anonymous billionaire bought it for $2 million and lent it to the Walters Art Museum in Baltimore, where it still resides.

"I should emphasize how incredibly uncommon the situation is," Dr. Netz said.

With the manuscript in hand, a small group of scholars set out to reconstruct the original Greek text. It was not easy. "You look with the naked eye and you see nothing, absolutely nothing," Dr. Netz said.

Ultraviolet light revealed faint traces of writing, but it included both the prayers and the mathematics. "The major problem is the combination of the fact that many characters are hidden with the fact that many are so faint that they are invisible," Dr. Netz said. Then there are the gaps where the pages were ripped or eaten away by mold.

Computer imaging helped. Dr. Roger Easton of the Rochester Institute of Technology, Dr. Keith Knox of the Boeing Corporation and Dr. William Christens-Barry of Johns Hopkins University managed to write programs to pick out writing from the "noise"

around it, and in many places the Greek letters fairly pop off the computer screen.
"The product of the software is incredible," Dr. Netz said. But it too has limitations, especially near the tattered edges of the pages.
To reconstruct the writings, Dr. Netz and Dr. Nigel Wilson, a classics professor at Oxford University, are using every tool available: ultraviolet light, the computer images, Mr. Heiberg's photographs and their own intimate knowledge of ancient Greek texts.
Still, in some areas, "the text is likely to remain a conjecture," Dr. Netz said.
It was chance that led Dr. Netz to his first insight into the nature of the Stomachion. Last August, he says, just as he was about to start transcribing one of the manuscript pages, he got a gift in the mail, a blue cut-glass model of a Stomachion puzzle. It was made by a retired businessman from California who found Dr. Netz on the Internet as a renowned Archimedes scholar. Looking at the model, Dr. Netz realized that a diagram on the page he was transcribing was actually a rearrangement of the pieces of the Stomachion puzzle.
Suddenly, he understood what Archimedes was getting at. The diagram involved 14 pieces, and the word "multitude" seemed to be associated with it. Mr. Heiberg and those who followed him thought this meant that you could get many figures by rearranging the pieces.
"This is part of the reason people didn't see what it was about," Dr. Netz said. But the old interpretation seemed trivial, hardly worth Archimedes' time. As he examined the manuscript pages, piecing together their text, he realized that what Archimedes was really asking seemed to be, "How many ways can you put the pieces together to make a square?" That question, Dr. Netz said, "has mathematical meaning."
"People assumed there wasn't any combinatorics in antiquity," he went on. "So it didn't trigger the observation when Archimedes says there are many arrangements and he will calculate them. But that's what Archimedes did; his introductions are always to the point."
But did Archimedes solve the problem? "I am sure he solved it or he would not have stated it," Dr. Netz said. "I do not know if he solved it correctly."
As for the name, derived from the Greek word for stomach, mathematicians are uncertain. But Dr. Diaconis has a hunch.
"It comes from `stomach turner,' " he said. "If you get involved with it, that's what happens."

Το "Στομάχιον" του Αρχιμήδη
« **εστάλη:** Ιανουάριος 17th, 2004, 4:48pm »

Με έμφαση Τροποποίηση

Το "**Στομάχιον**" του Αρχιμήδη ήταν πάντα εκείνο το έργο που προσείλκυε το μικρότερο ενδιαφέρον για τους ερευνητές. Τόσο γιατί μας έλειπαν οι σχετικές πληροφορίες, όσο και γιατί είχε θεωρηθεί (με βάση τις φτωχές διαθέσιμες αναφορές) κάτι σαν παιδικό παιχνίδι, ένα αρχαίο παζλ, μάλλον ανάξιο της φήμης του μεγάλου μαθηματικού.

Τον περασμένο μήνα στις ΗΠΑ νέο φως χύθηκε στην υπόθεση αυτή, καθώς ανακοινώθηκε ότι το παλίμψηστο χειρόγραφο του 975 μ.Χ. που είχε αγοράσει κάποιος δισεκατομμυριούχος για 2,2 εκ. δολάρια, έδωσε τις πληροφορίες που χρειαζόμασταν.

Στοιχεία διαφορικού και ολοκληρωτικού λογισμού(!) και ένας συνδιασμός μαθηματικών και φυσικής επιστήμης που εξακολουθεί ακόμη και σήμερα να μην έχει κατανοηθεί πλήρως!!!

Το συμπέρασμα για το "**Στομάχιον**" είναι ότι επρόκειτο για πρόβλημα συνδιαστικής: Χωρίζοντας ένα τετράγωνο σε 14 μέρη διαφορετικών επίπεδων σχημάτων, αναζητούσε το πλήθος των τρόπων με

τους οποίους αναδιατεταγμένα θα ξανασυνέθεταν το ίδιο τετράγωνο. Το σύνολοο αυτών των τρόπων είναι 17.152 και για να βρεθούν δούλεψαν 4 μαθηματικοί επί 6 εβδομάδες!!!

Ο Ιστορικός των Μαθηματικών Ρέβιελ Νετζ του Πανεπιστημίου Στάνφορντ, που παρουσίασε το χειρόγραφο, είναι βέβαιος ότι ο Αρχιμήδης είχε λύσει το πρόβλημα - αλλιώς δεν θα το έθετε - αλλά δεν μπορεί να γνωριζει αν ειχε βρει όλους τους συνδιασμούς, καθότι είναι πρόβλημα τεράστιας δυσκολίας, πολύ μπροστά όχι μόνο για την εποχ΄η του αλλά και από κάθε εποχή προ υπολογιστών και στατιστικής!

Κάνει πάντως εντύπωση η αφέλεια των "ειδικών" με την οποία προσέγγιζαν μέχρι τώρα το "**Στομάχιον**"...μα είναι δυνατόν ένα πνευματικό ανάστημα σαν τον Αρχιμήδη να καταγίνονταν με ...ελέφαντες και παπάκια φτειαγμένα από τρίγωνα και τετράπλευρα;;;