Ancient Computers: Part I. Rediscovery by Stephen Kent Stephenson

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In this short monograph—the main text of 40 pages or so is supplemented by a collection of appendices—the author seeks to reconstruct ancient calculation techniques using counting boards. This is a very under-researched and poorly understood area with very little high-quality evidence, either textual or archaeological, so a certain amount of speculation is inevitable.

While a few examples of the small, Roman hand-abacus with constrained beads in columns are known, there are no extant Roman examples of the posited larger counting boards that presumably utilized scratches on boards and pebbles or similar small objects as counters.

In the absence of Roman evidence, the author turns to the Greek remains, specifically, to the Salamis Tablet, an object of considerable speculation since its discovery in 1846. This large marble slab (roughly 1.5m x 0.75m) now housed in Athens has been variously interpreted as a counting board or as a gaming board. The author follows Lang's contention that it was a counting board without addressing alternative theories. In fact, he sees it as an exemplar of the Roman counting board: 'Let us assume the obvious, that the Roman counting board abacus was The Salamis Tablet' [6]. Further, he writes:

> The Romans were borrowers. They borrowed The Salamis Tablet from the Greeks, but the Greeks borrowed it in turn from the Babylonians. [11]

This arc of transmission is adduced in the following way. The author compares the symbols on the slots of the hand-abacus with the line-markings on the Salamis Tablet, finding that 'the mapping is perfect' [7]. However, this mapping forces an 'engineering compromise'

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whereby the Roman adaptation of the Greek counting board forces them to use a 'less preferred structure for one of the base-12 digits' [7]. Furthermore, this mapping leaves the 'dashed lines unused', a fact that the author uses to argue for the sexagesimal and, hence, Babylonian origin of the Salamis Tablet. Thus, the Tablet can be used for base-10, base-12 and base-60 calculations, although only the sexagesimal ones use the full power of the counting board.

The author offers a detailed account of his reconstruction of how the Tablet was used as a counting board; and, on the laudable grounds that a visual lesson makes the algorithms much clearer, he has posted a series of accompanying videos on YouTube[1] illustrating the various arithmetic operations. He also makes two points that deserve wider dissemination. The first is that he sees the central dividing line of the Salamis Tablet as allowing an additive side and a subtractive side. A pebble or counter on one side of the 10's column would represent 10, while a counter on the other side of the units column would subtract from the total, or represent -1. Thus $9 = 10 - 1$ could be represented with just two tokens. The concept would be familiar to Romans. The author describes a full-blown additive and subtractive regime and notes that this approach, 'reduces the number of pebbles needed tremendously' [7]. It also makes many calculations easier. One cannot argue with his claims of increased efficiency and this point deserves further investigation. One cannot help think, though, that a single pebble placed on the subtractive side of an empty board should have led to the idea of negative numbers.

The author's second substantive point is that in attempting to understand ancient mathematics, historians need to pay more attention to the available tools, technology, notation, and terminology to see how particular algorithms may have been performed. He gives an example of multiplying two five-digit sexagesimal numbers *via* the formula, showing that this requires 178 separate operations [22]. The author has a video of himself computing the square root of 2 using a set of Salamis Tablets following Heron's method. It takes him 25 minutes. His argument is that using only tables and writing intermediate results on clay would take a lot longer. He issues a challenge:

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[1] See http://www.youtube.com/view_play_list?p=545ABCC6BA8D6F44.

> The Historians should record their own performance video and post it to YouTube.com so we can compare its length to Stephenson's. [24]

There have been some very careful studies done of calculation techniques but there is plainly more to be done.

By and large, the professional literature is accessible only to professionals. The internet has allowed wide access to information (thus *Aestimatio*) but of varying quality and with unpredictable results. In an aside on the origins of the sexagesimal system and the seven-day week, the author includes this quote, which he footnotes as 'Wilson, 2001':

> The Sumerians had a better reason for their septimalism. They worshipped seven gods whom they could see in the sky. Reverently, they named the days of their week for these seven heavenly bodies.

It turns out that the source of this bizarre claim is a one-page unsigned article in the Christmas Special edition of *The Economist* in 2001. The A. Wilson whom Stephenson cites seems to be the author of the website where he found the link to the *Economist article*. The *Economist* article has no references and I have been unable to trace this further back. However, in the vast echo chamber of the internet, it is widely, and perhaps ineradicably, cited. There is, however, no evidence for a seven-day week in third millennium Mesopotamia. Moving on to the sexagesimal system, Stephenson cites another website where the claim is made that it originates in the fact that 60 is the least common multiple of 12 and 30, the periods of Jupiter and Saturn. The sexagesimal system has its origin in the proto-cuneiform system used to count discrete items in alternate multiplies of 10 and 6. It has nothing to do with astronomy.

Publishing is undergoing a period of extremely rapid change and, in closing, I offer a few comments on accessibility and media. The author has published his monograph in epub format through Barnes and Noble for the Nook Reader (a Kindle edition is also available). Anyone with internet access and a Nook Reader can download a copy and start reading. I do not have a Nook Reader. Barnes and Noble will allow you to download software to read epub books on your computer. But you have to have an account. Given that I had once bought something from them, Barnes and Noble would not

allow me to create a new account: nor could they establish an old one. Nor would the Reader recognize a book that I had not downloaded myself (the review copy). None of this is the author's fault, but it does illustrate to those thinking of testing out the brave new world of electronic publishing some of the teething troubles potential readers may have. Eventually I gave up and got a browser plug-in. Elapsed time from preparing to open the book to actually being able to read it: about one hour.