Joys and virtues of obsolete technologies

Steven F. Bellenot

Department of Mathematics Florida State University

Math Tech, Valdosta State University, Valdosta, GA, Feb 23, 2007

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- No longer produced; out of date.
- Biology Less developed (formly or related species); rudimentary; vestigial.
 - I just bought a computer and now it is obsolete.
 - The dinosaurs disappeared from the historical record.
 - This antique is valuable because they stopped making them.
 - Vestigial organs like the appendix.

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Found as the problem of math riddles book in the 1960's Perhaps a Math Puzzle book by Martin Gardner Perhaps *The Unexpected Hanging and Other Mathematical Diversions* 1969.

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Log-Log Duplex Deci-Trig



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Slide Rule

- invented by Oughtred in 1622 just a few years after logarithms.
- Mannheim (1851) Modern slide rule with A, B, C and D scales.
- Made the trip to the moon with Apollo.
- essentually disappeared in 1970's when all the slide rule manufactors silently quit, perhaps in response to the HP 35.
- now a collectors item.
- variations in size, circular, with microscope.
- Over 40 million produced.

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- Develops analog reading abilities. (Gauges, dials)
- Parallel computing.
- Wonderfull applicaton of Logs. Intermediate value theorem.
- Intermediate results were stored.
- Stable design:

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When Napoleon set out to conquer the world in 1804, his artillery officers were using a simple form of slide rule to solve ballistics and support problems. Their aim was excellent

Slide Rule Scales

SAVARD SIMPLEX LOG-LOG SLIDE RULE COPYRIGHT 2003 JOHN J. G. SAVARD

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Napier's Bones 1617

- Doubled the life of astronomers.
- Great application of the laws of exponents.
- Linear interpolation
- Table lookup also used for trig, factors, integrals, Laplace transforms . . .
- Which is larger $\log \log \pi + \log e$ or $\log \log e + \log \pi$?

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- Which was the correct way to introduce elementary age children to arithmetic. (US education 1990's)
- Which is the correct way to do arithmetic. (Algorists vs Abacists, the 400 years war)

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Highlight: Florence 1299 forbid the use of the new numbers in financial procedures.

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- Arranged in decreasing size. (MCV and not CVM)
- Letters are repeated for missing values: III for 3, XX for 20, etc
- Sometimes shorthands: IV for 4, CM for 900.
- Other extensions.

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- Much harder to alter entries (try changing an id's XVIII to XXI)
- numeral vs number
- Look important? Use on clocks and movie copyright dates.

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Virtues of Abacus

- Counting table ancestor: some lines in the sand and some stones to count with. Indeed calculate comes from calculus which is latin for stone. Abacus comes from the greek abax, table covered with sand or fine dust
- positional representation. (1950's netherlands used them in education)
- paperless office (paper wasn't cheap in dark ages)
- add, subtract, multiply, divide

There is a on-line book on how to use the abacus http://www.tux.org/ bagleyd/takashikojima1.pdf

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- Counting table ancestor: some lines in the sand and some stones to count with. Indeed calculate comes from calculus which is latin for stone. Abacus comes from the greek abax, table covered with sand or fine dust
- positional representation. (1950's netherlands used them in education)
- paperless office (paper wasn't cheap in dark ages)
- add, subtract, multiply, divide

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- The Basel problem $S = \sum n^{-2} =$? was first done numerically.
- Euler knew $\pi = 3.141592653589793238...$
- Euler computed S = 1.6449340668482264364...
- Euler came up with an agruement that $S = \pi^2/6$ and the numbers above proved it. (It is better than the current experiments of quantum mechanics)
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- The Euler-MacClaurin formula.
- Accelerating series convergence, Euler transformation x = y/(1 y) maps y = 1/2 to x = 1.
- Is this like turing completeness? Namely the fastest computer can't do anything a turing machine can do, nor any faster mod polynomial time.

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Modern theory starts with Frobenius(1880). A good source is Hardy's book (1948) [Now printed by AMS (1992).]

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- Computed π to 200 digits
- Hired by Gauss (first person to buy computer time?) to factor the intergers from X to Y.

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Human Calculators – WW2

Calculator was a job title during World War II. Often female, she would do calculations for the military.



- Taught in Chemistry class. Along with scientific notation, the ideal gas laws and molarity calculations.
- Getting the decimal point correct. (Estimation.)
- Percentage error, significant digits.
- Low cost items, roughly \$3 (\$15-\$20 in current money)
- No S or T scales, so the technology wasn't used in Trigonometry class. (Most Trig students had already taken Chemistry.) Trigonometry classes used tables of trig and log functions.
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- (Numerically) Tables to replace using log/trig tables
- Verbally to replace what?
- Formulas to replace what?

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Programing Assignment #7



Steven F. Bellenot Joys and virtues of obsolete technologies

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- But they are for games, hence only single percision.
- Slide rules disappeared because they were a small and not very profitable part of scientific instruments.
- HP quit making graphing calculators briefly. The TI-89 hasn't improved mathematically since 1999 and the price as gone up.

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Victorian Internet



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$\alpha^\beta < \beta^\alpha \iff \beta \ln \alpha < \alpha \ln \beta \iff \frac{\ln \alpha}{\alpha} < \frac{\ln \beta}{\beta}$

Need to maximize $f(x) = \frac{\ln x}{x}$ which by calculus happens when $f'(x) = \frac{1 - \ln x}{x^2} = 0$ or $\ln x = 1$ or x = e So $\alpha^e < e^{\alpha}$ for all $\alpha \neq e$ including π .

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e^{π} Wins



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• The analog world had virtues.

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