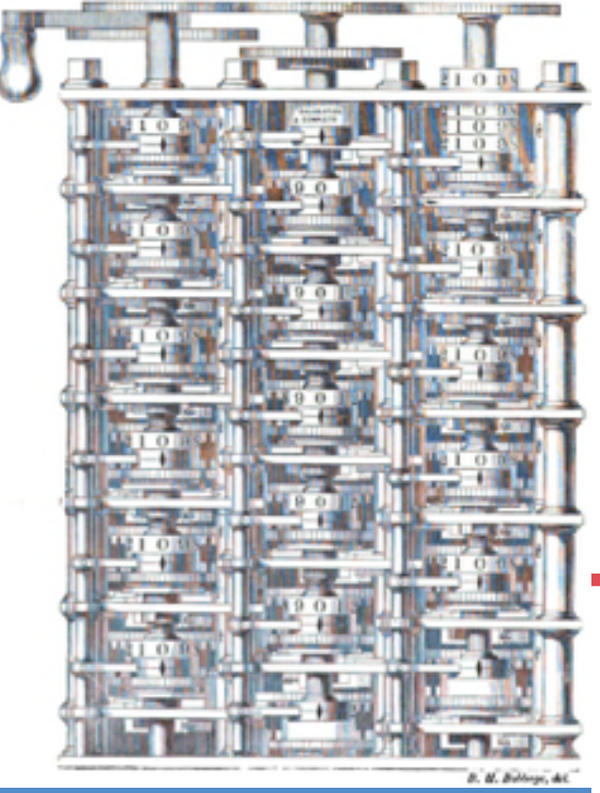
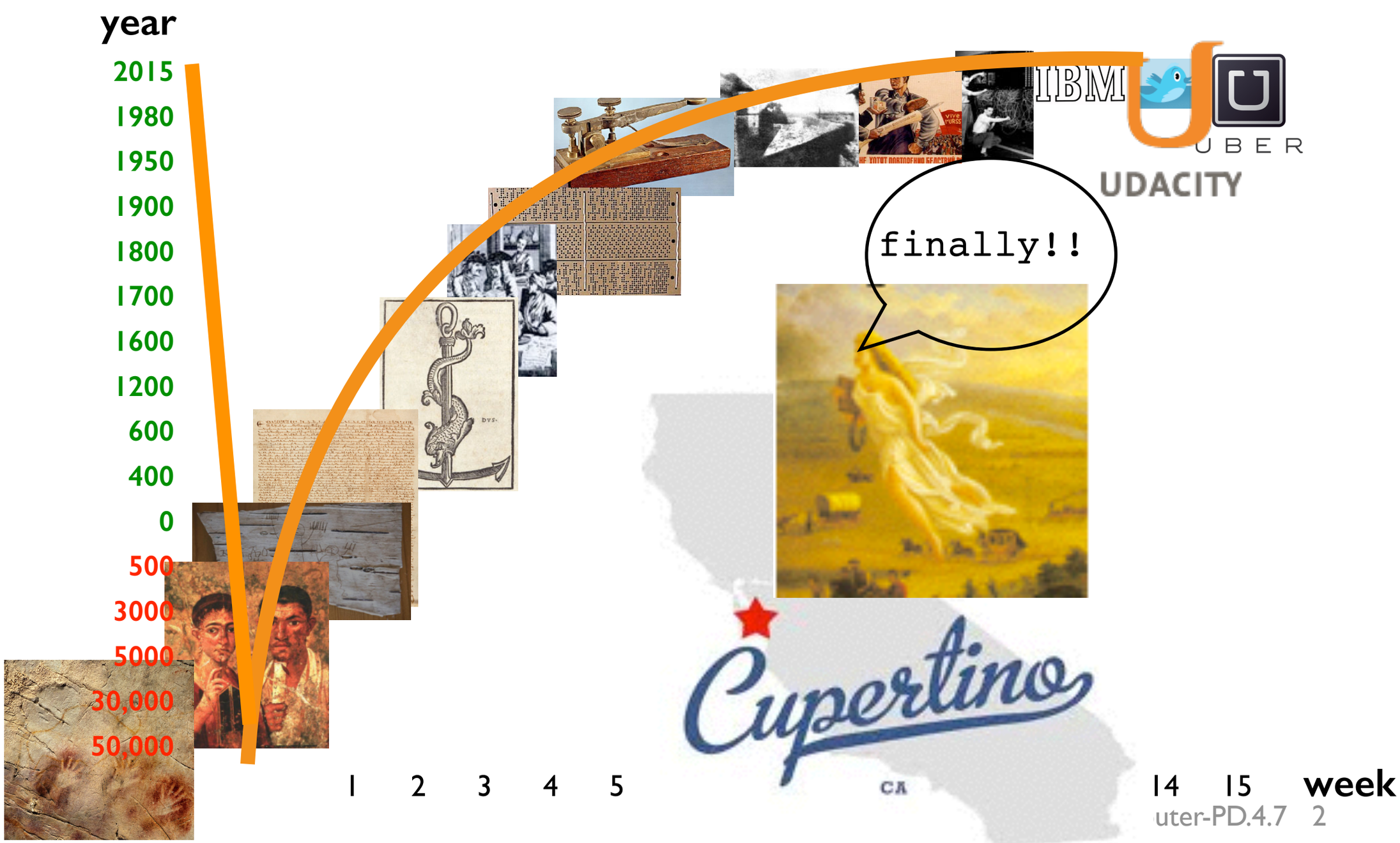


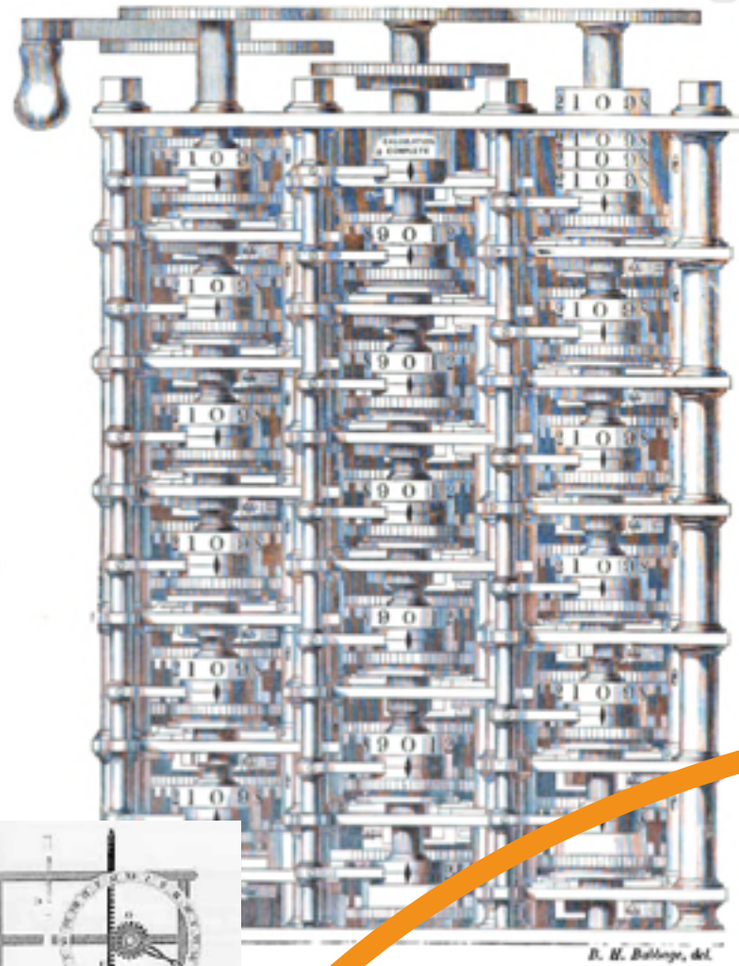
computer "revolution"

History of Information

April 7, 2015

where are we?

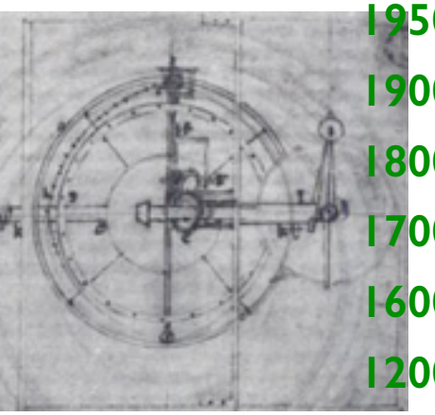

year
2015
1980
1950
1900
1800
1700
1600
1200
600
400
0
500
3000
5000
30,000
50,000
IBM
UBER
UDACITY
finally!!
Cupertino
CA
1
2
3
4
5
14
15
week

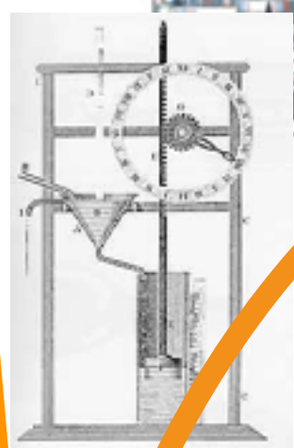


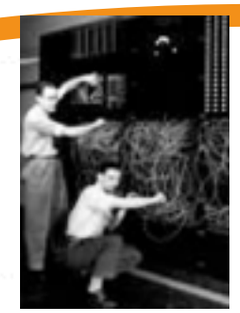
Impression from a woodcut of a small portion of Mr. Babbage's Difference Engine No. 1, the property of Government, at present deposited in the Museum at South Kensington.

It was commenced 1823.
This portion put together 1833.
The construction abandoned 1842.
This plate was printed June, 1853.
This portion was in the Exhibition 1862.

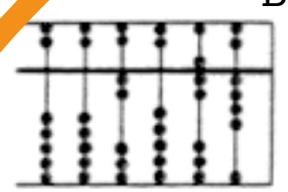
not so fast





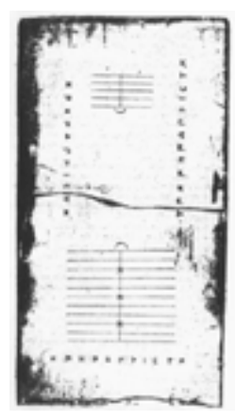


Babbage's dream



Suan Pan
c 1200

Salamis tablet c 300 bce

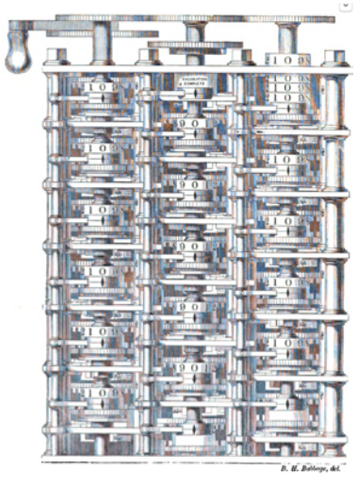


antikythera c 200 bce

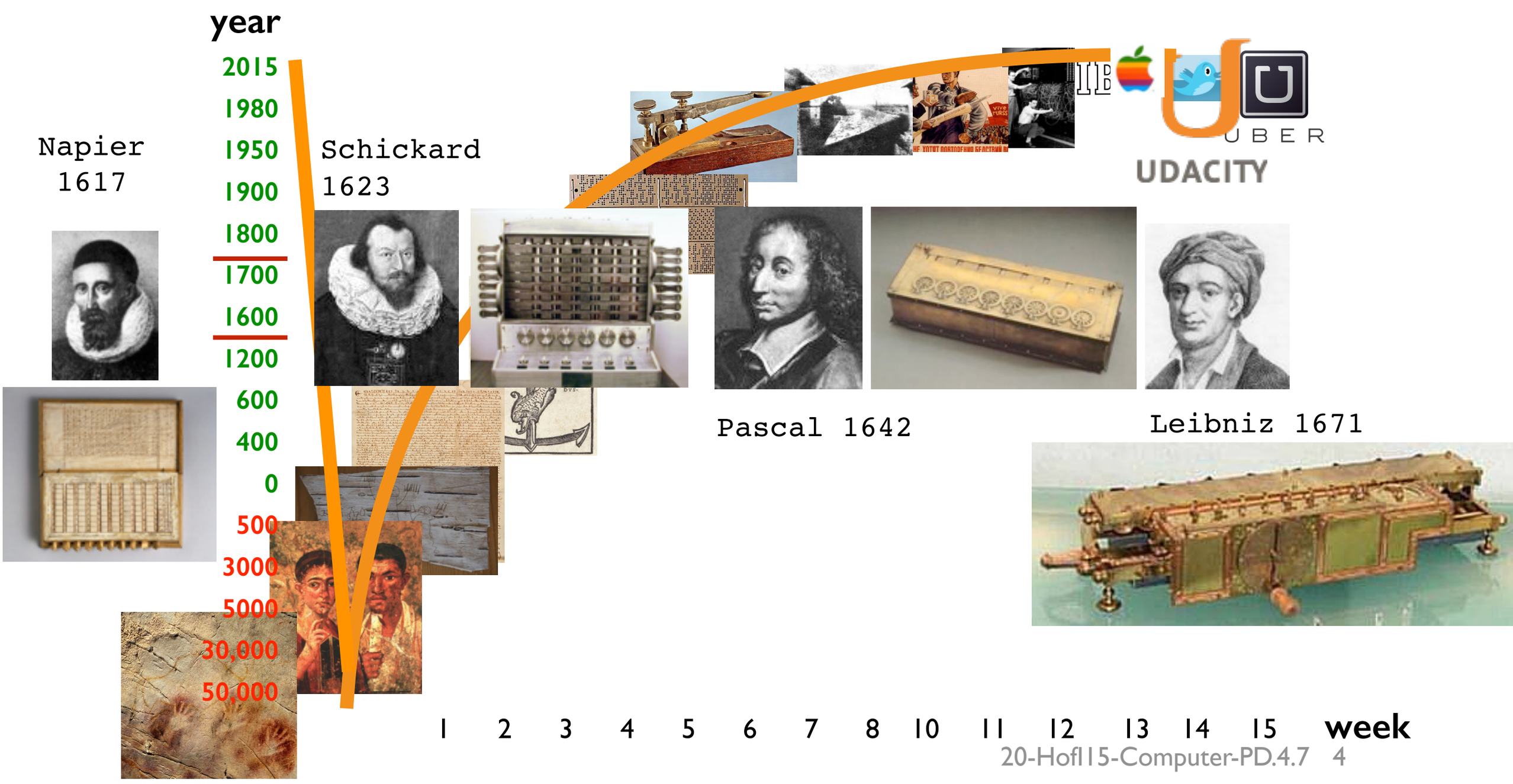
year

2015
1980
1950
1900
1800
1700
1600
1200
600
400
0
500
3000
5000
30,000
50,000

week 1 2 3 4 5 6 7 8 10 11 12 13 14 15 week



17c: rooting for "tech"



overview

changing perceptions

changing business

the demand side

inventions

"Its inventor did not take it up already imperfectly formed … not … gradually advanced"

—Lardner

invention to innovation

"The invention [of television] was no single event. ... a very complex interaction between new needs and new inventions ... military ... government ... corporate interests ... ."

-- Williams, *Technology and Cultural Form*, 1973

eye witness account

"What constitutes an invention?--Few simple mechanical contrivances are new; and most combinations may be viewed as a species, and classed under genera ... [and] pronounced old or new according to the mechanical knowledge of the person who gives his opinion."

--Babbage, *On the Economy of Machinery*, ...1832

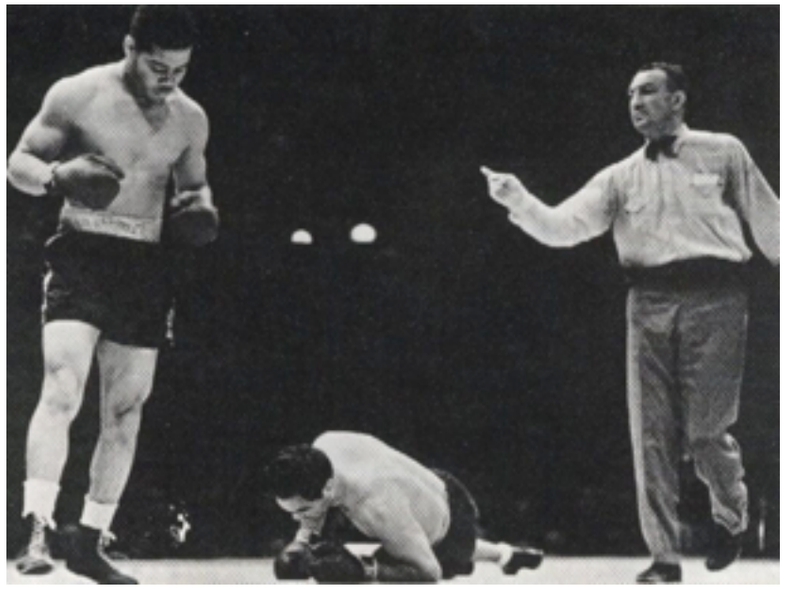
taking sides

what difference a semester makes

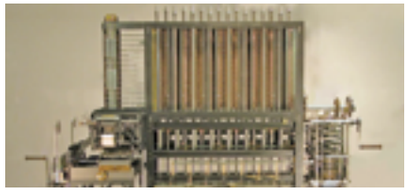
1/27

McLuhan -- it's the medium that does it 45%

Williams -- no it's not 48%



maybe; maybe not: -- 7%



"the first awareness that we had of the fact that computers and data processing had something in common with communications started in early '65"

—Bernard Strasberg, FCC, 1988.

Inventions	Technology	Applications	Media	Genres
clock	"computer" or "engine"	calculating	engines	logarithms
mill/store		registering	mainframe	ballistics
logarithm		sorting	desktop	accounting
loom		controlling	cars ...	registration
governors		...	laptop	logistics
...			the net	...
vacuum tube			the web	bbs
transistor			phones	email
chip			tablets	social networks
...			the cloud	
genes				

*
*
inventions

getting to (and beyond) the computer

"military ... government ... corporate interests"

individual inventors (and investors)

business / customers

government

military / intelligence

science / education

TECHNOLOGY

Silicon Valley Turns Its Eye to Education

By NATASHA SINGER JAN. 11, 2015

"Education is one of the last industries to be touched by Internet technology" —[CEO of EdSurge], 2015

Mirifici Logarithmorum Canonis Descriptio, **1614**

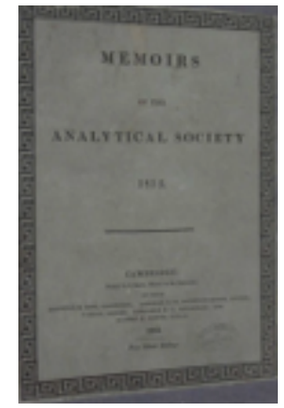
$10^x \cdot 10^y = 10^{(x+y)}$

$93.6 \times 37.7 =$

$10^{1.971} \times 10^{1.576}$

$= 10^{(1.971 + 1.576)} = 10^{3.547}$

$= 3{,}525.12$



Analytical Society, 1813

& the "dot-age"

$\ddot{y} \quad \rightarrow \quad \frac{d^2y}{dx^2}$

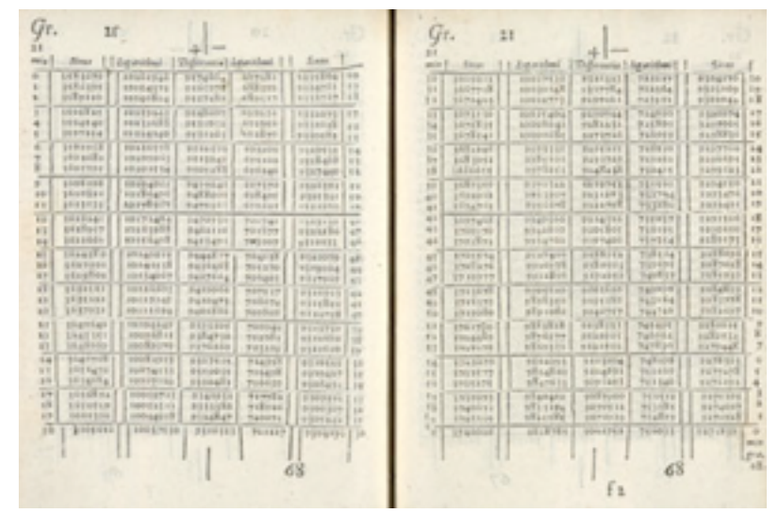
individual calculation

John Napier

Charles Babbage

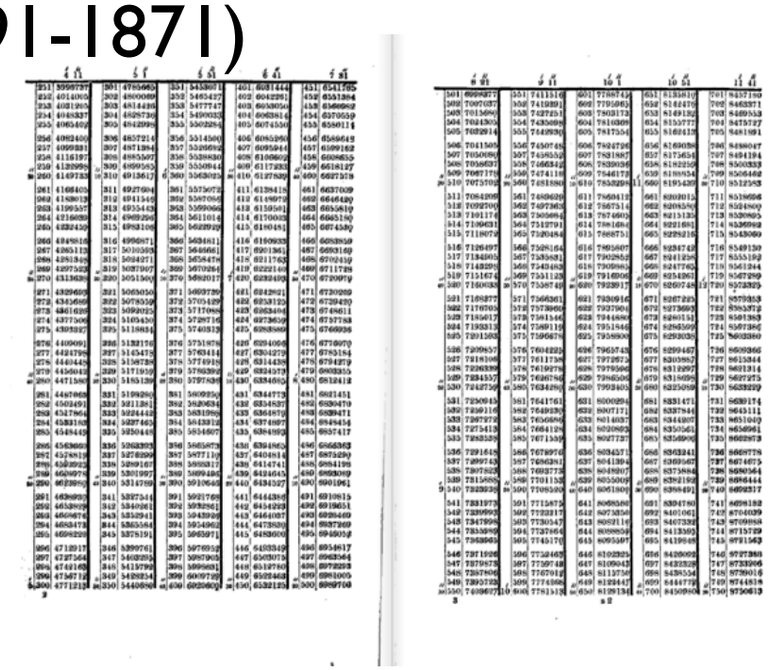
John Napier (1550-1617)

(a 'computer')



Charles Babbage, RS (1791-1871)

Table of Logarithms from 1 to 108000
1827

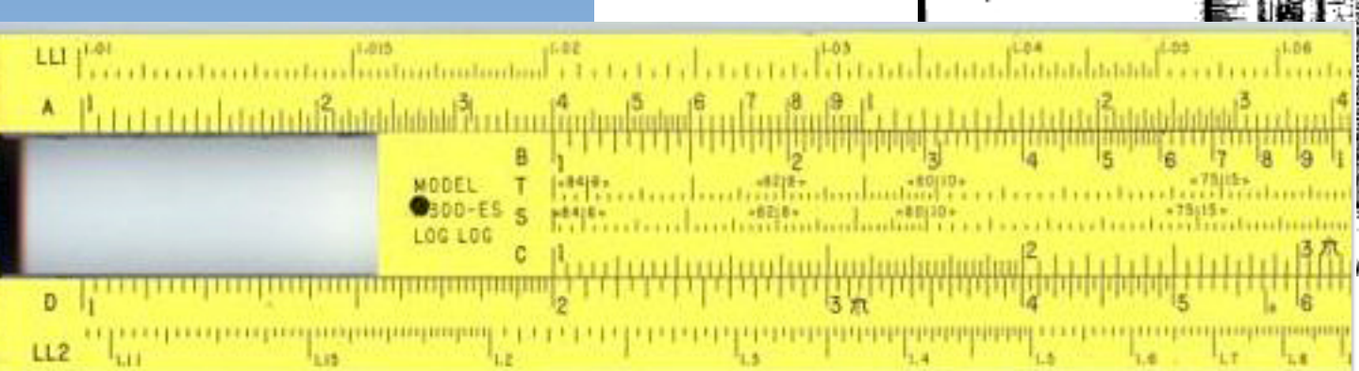


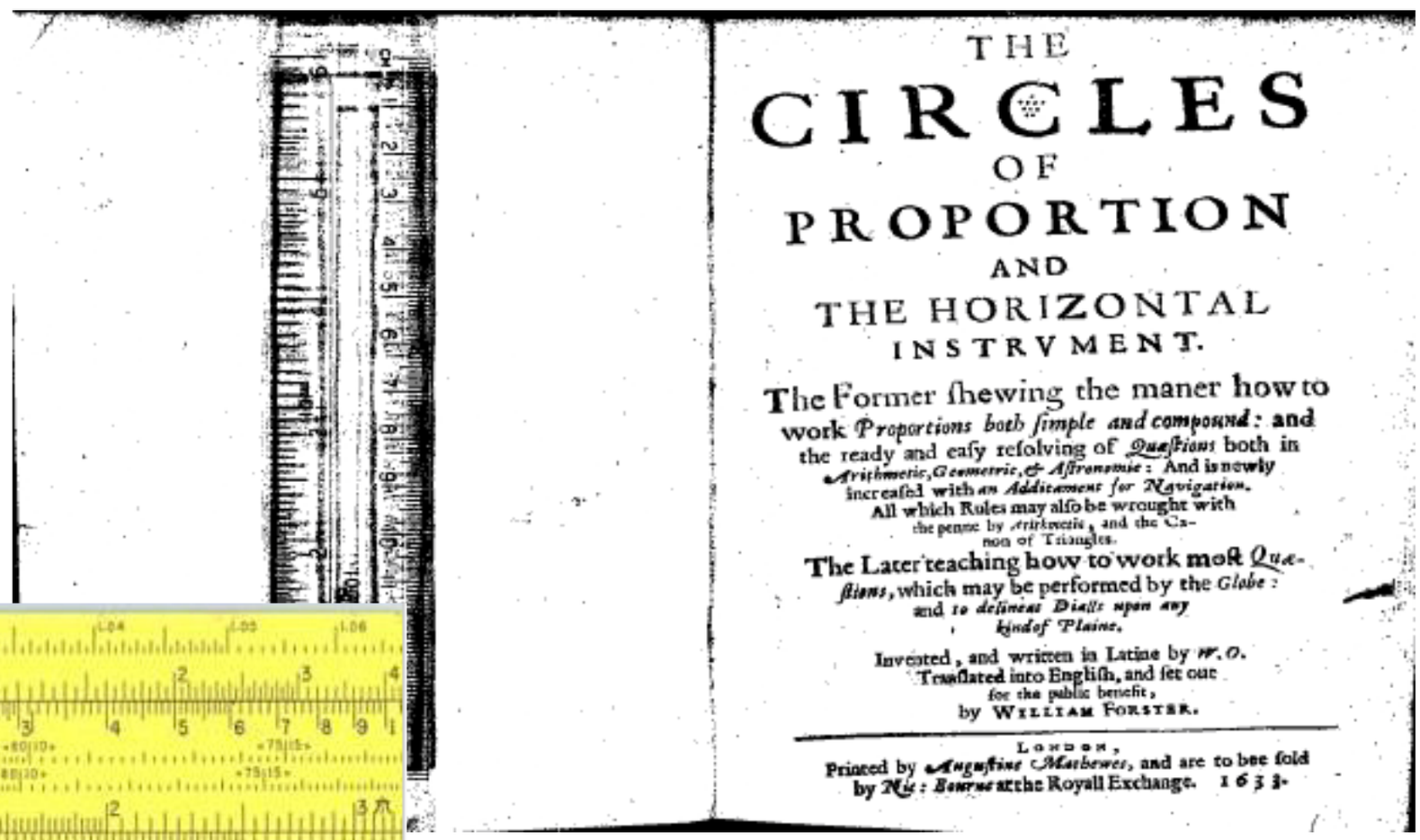
"I wish to God these calculations had been executed by steam" (1821)

let's not forget

William Oughtred (c1575-1660)

ideas to objects (and to Christopher Wren)





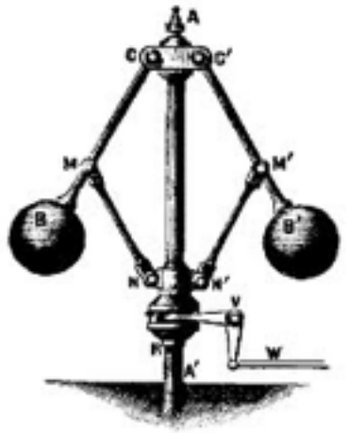
THE
CIRCLES
OF
PROPORTION
AND
THE HORIZONTAL
INSTRVMENT.

The Former shewing the maner how to work *Proportions both simple and compound*: and the ready and easy resolving of *Questions* both in *Arithmetic, Geometric, & Astronomie*: And is newly increased with *an Addicement for Navigation*. All which Rules may also be wrought with the penne by *Arithmetic*, and the Canon of Triangles.

The Later teaching how to work most *Questions*, which may be performed by the *Globe*: and *to delineate Dialls upon any kind of Plaine*.

Invented, and written in Latine by *W. O.* Translated into English, and set out for the public benefit, by WILLIAM FORSTER.

LONDON,
Printed by *Augustine Mathewes*, and are to bee sold by *Nic: Bourne* at the Royall Exchange. 1633.



on the economy of machinery and manufactures

chapters

1: Sources of the Advantages Arising from Machinery

2: Accumulating Power

3: Regulating Power

"that beautiful contrivance, the steam governor…"

4: Increase and diminution of velocity

5: Extending the time of action of forces

"watches & clocks … automatons"

6: Saving time in natural operations

7: Exerting Forces too great for human power; and executing operations too delicate for human touch

8: Registering Operations

9: Economy of the materials employed

10: Of the identity of the work when it is of the same kind, and its accuracy when of different kinds

11: Of copying

12: On the method of observing manufacturies

…

19: On the division of labor

20 On the mental division of labour

J. Clerk Maxwell, "On Governors, RS, 1868

I. "On Governors." By J. Clerk Maxwell, M.A., F.R.SS.L. & E.
Received Feb. 20, 1868.

A Governor is a part of a machine by means of which the velocity of the machine is kept nearly uniform, notwithstanding variations in the driving-power or the resistance.

I shall call all such resistances, if approximately proportional to the velocity, by the name of "viscosity," whatever be their true origin.

In several contrivances a differential system of wheelwork is introduced between the machine and the governor, so that the driving-power acting on the governor is nearly constant.

I have pointed out that, under certain conditions, the sudden disturbances of the machine do not act through the differential system on the governor, or *vice versâ*. When these conditions are fulfilled, the equations of motion are not only simple, but the motion itself is not liable to disturbances depending on the mutual action of the machine and the governor.

Distinction between Moderators and Governors.

In regulators of the first kind, let P be the driving-power and R the resistance, both estimated as if applied to a given axis of the machine. Let V be the normal velocity, estimated for the same axis, and $\frac{dx}{dt}$ the actual velocity, and let M be the moment of inertia of the whole machine reduced to the given axis.

Let the governor be so arranged as to increase the resistance or diminish the driving-power by a quantity $F\left(\frac{dx}{dt}-V\right)$, then the equation of motion will be

$$\frac{d}{dt}\left(M\frac{dx}{dt}\right)=P-R-F\left(\frac{dx}{dt}-V\right). \quad . \quad . \quad . \quad . \quad . \quad (1)$$

When the machine has obtained its final rate the first term vanishes, and

$$\frac{dx}{dt}=V+\frac{P-R}{F}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Hence, if P is increased or R diminished, the velocity will be permanently increased. Regulators of this kind, as Mr. Siemens * has observed, should be called moderators rather than governors.

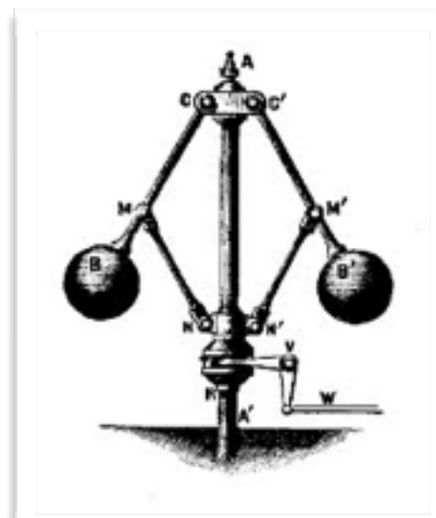
In the second kind of regulator, the force $F\left(\frac{dx}{dt}-V\right)$, instead of being applied directly to the machine, is applied to an independent moving piece, B, which continually increases the resistance, or diminishes the driving-power, by a quantity depending on the whole motion of B.

If y represents the whole motion of B, the equation of motion of B is

$$\frac{d}{dt}\left(B\frac{dy}{dt}\right)=F\left(\frac{dx}{dt}-V\right). \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

CYBERNETICS

OR CONTROL AND COMMUNICATION IN THE ANIMAL AND THE MACHINE



Norbert Wiener
PROFESSOR OF MATHEMATICS
THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

THE TECHNOLOGY PRESS
JOHN WILEY & SONS, INC., NEW YORK
HERMANN et CIE, PARIS

Norbert Wiener, *Cybernetics*, 1948

Adam Smith
1723-1890

Adam
Ferguson
1723-1816

divisions & combinations

the "hands"

manual division of labor
pin-making

—Smith, *Wealth of Nations,* 1776

the "head"

mental division of labor

"And thinking itself, in this age of separations, may become a peculiar craft."

— Ferguson, *An Essay on the History of Civil Society*, 1767

"the division of labour can be applied with equal success to mental as to mechanical operations"

Babbge, *On the Economy* …

the head and the hands

principals and agents

"Many mechanical arts require no capacity, they succeed best under a total suppression of sentiment and reason, and ignorance is the mother of industry as well as of superstition. Manufactures … prosper most when the mind is least consulted; and where the workshop may .. be considered an engine, the parts of which are men."

—Adam Ferguson, *Essay on the History of Civil Society*, 1767

"One great advantage which we may derive from machinery is from the check which it affords against the inattention, the idleness, or the dishonesty of human agents."

— Charles Babbage, *On the Economy of Machinery and Manufactures*, 1835

The Principles of Scientific Management, 1911.

the "efficiency men"

Frederick Winslow Taylor

March 20, 1856 - March 21, **1915**

1881 - time study ("time and motion")

"I can say, without the slightest hesitation … that the science of handling pig-iron is so great that the man who is … physically able to handle pig-iron and is sufficiently phlegmatic and stupid to choose this for his occupation is rarely able to comprehend the science of handling pig-iron."

—Congressional Testimony, 1912

Current Literature 1911

THE

BEGGAR'S COMPLAINT,

AGAINST

RACK-RENT LANDLORDS, CORN FACTORS, GREAT FARMERS, MONOPOLIZERS, PAPER MONEY MAKERS, AND WAR,

and many other

Oppressors and Oppressions.

ALSO,

SOME OBSERVATIONS

ON THE

CONDUCT OF THE LUDDITES,

In Reference to the

Destruction of Machinery,

&c. &c.

BY ONE WHO PITIES THE OPPRESSED.

" Nature and time destroy the vain opinions of the day,
But sooner or later confirm the dictates of wisdom. " CICERO.

THE SECOND EDITION GREATLY ENLARGED.

SHEFFIELD:

Printed for the Author by J. Crome,

1812

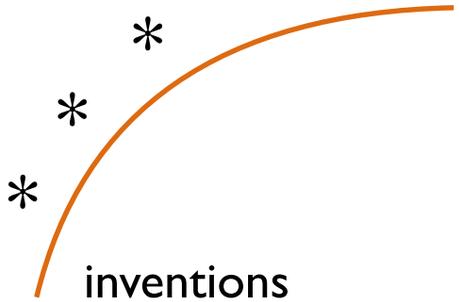
REFLECTIONS ON

LUDDISM.

IT will, no doubt, be gratifying to some Readers, to be made acquainted with the origin of *Luddism*. From the enquiries I made in Nottinghamshire, where Luddism originated, I learnt the following particulars, namely, That a good many years ago, there lived a poor man at Loughborough, in Leicestershire, about fifteen miles from Nottingham, whose name was *Edward Ludd*: This man was not one of the brightest cast, in regard to his intellects; and, as is commonly the case with such characters, was of an irritable temper. This *Edward Ludd*, called by his neighbours *Ned Ludd*, was by trade a *Frame Work Knitter*: or in plainer language, andwhich is all the same, a *Stocking Weaver*. This man, being irritated, either by his Employer, or his work, or both, took the desperate resolution of avenging himself, by breaking his *Stocking Frame*. As the value of a common Stocking Frame is considerable, being not much less than Forty Pounds, Ned's exploit was much more admired for its temerity than its utility.

However, the consequence of this affair was, a *Bon Mot*: for, whenever any Stocking Weaver was out of patience with his Employer or his Employment, he would say, speaking of his Frame, " I have good mind to *Ned Ludd* it :' meaning, *I have a good mind to break it, &c.*

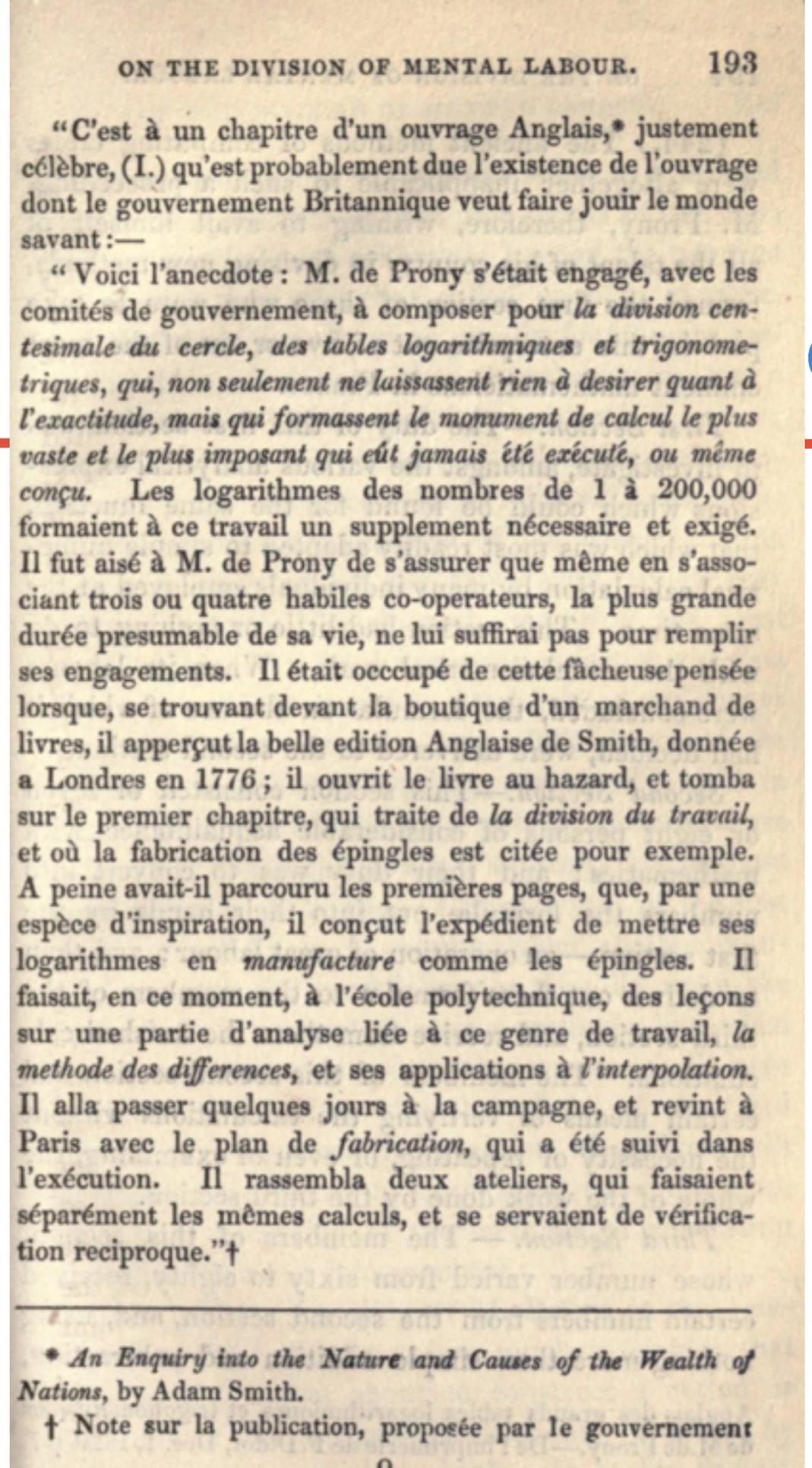
About the latter end of the year 1811, the Stocking and Lace Weavers of Nottingham, having been for a long time harrassed by abridged wages, and want of employment, in whole or in



vive les differences

Prony's tables, and the time that could have been saved … for longitude calculation

—Babbage



ON THE DIVISION OF MENTAL LABOUR. 193

"C'est à un chapitre d'un ouvrage Anglais,* justement célèbre, (I.) qu'est probablement due l'existence de l'ouvrage dont le gouvernement Britannique veut faire jouir le monde savant :—

"Voici l'anecdote : M. de Prony s'était engagé, avec les comités de gouvernement, à composer pour *la division centesimale du cercle, des tables logarithmiques et trigonometriques, qui, non seulement ne laissassent rien à desirer quant à l'exactitude, mais qui formassent le monument de calcul le plus vaste et le plus imposant qui eût jamais été exécuté, ou même conçu.* Les logarithmes des nombres de 1 à 200,000 formaient à ce travail un supplement nécessaire et exigé. Il fut aisé à M. de Prony de s'assurer que même en s'associant trois ou quatre habiles co-operateurs, la plus grande durée presumable de sa vie, ne lui suffirai pas pour remplir ses engagements. Il était occcupé de cette fâcheuse pensée lorsque, se trouvant devant la boutique d'un marchand de livres, il apperçut la belle edition Anglaise de Smith, donnée a Londres en 1776 ; il ouvrit le livre au hazard, et tomba sur le premier chapitre, qui traite de *la division du travail*, et où la fabrication des épingles est citée pour exemple. A peine avait-il parcouru les premières pages, que, par une espèce d'inspiration, il conçut l'expédient de mettre ses logarithmes en *manufacture* comme les épingles. Il faisait, en ce moment, à l'école polytechnique, des leçons sur une partie d'analyse liée à ce genre de travail, *la methode des differences*, et ses applications à *l'interpolation*. Il alla passer quelques jours à la campagne, et revint à Paris avec le plan de *fabrication*, qui a été suivi dans l'exécution. Il rassembla deux ateliers, qui faisaient séparément les mêmes calculs, et se servaient de vérification reciproque."†

* *An Enquiry into the Nature and Causes of the Wealth of Nations*, by Adam Smith.

† Note sur la publication, proposée par le gouvernement

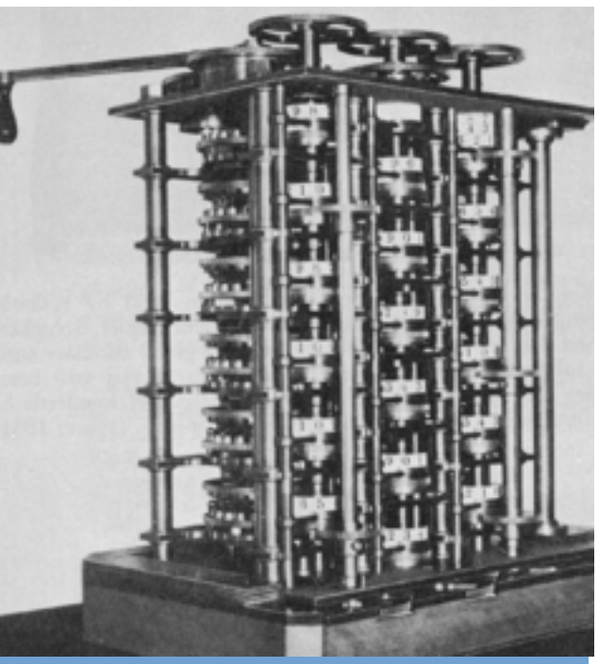
Adam Smith

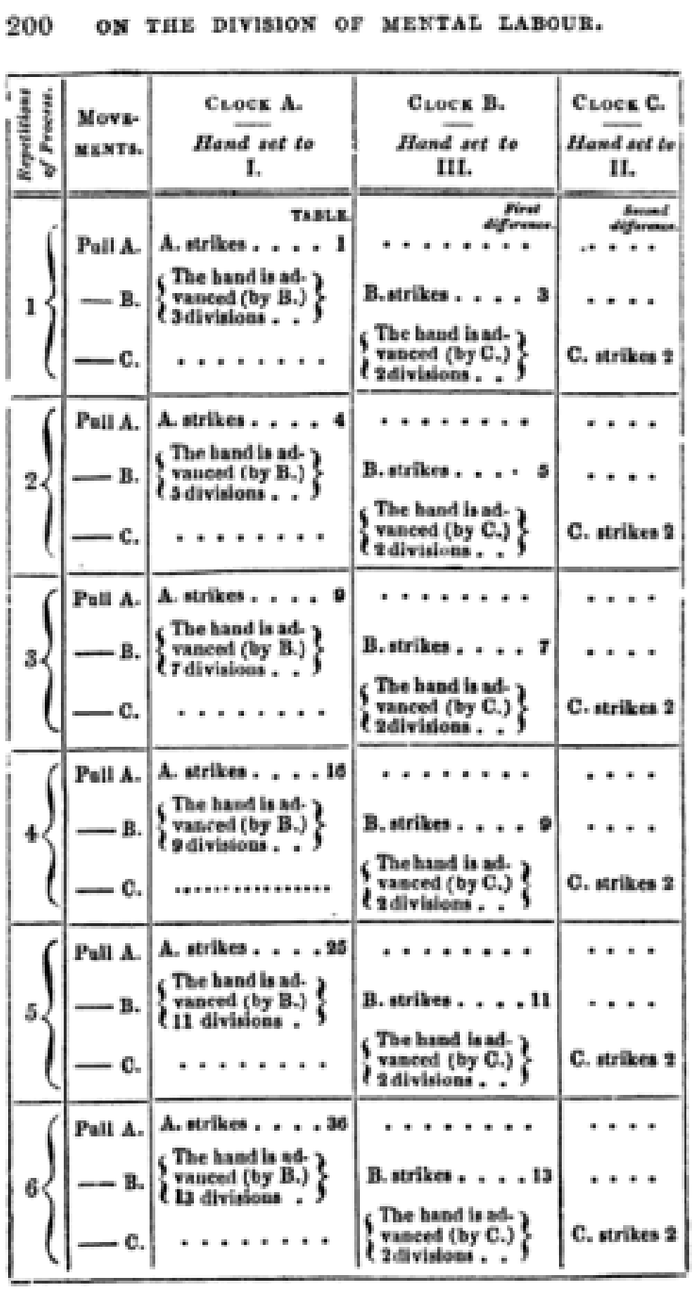
M. de Prony

Babbage

" by the aid of differences, … vast variety of equations .. may .. be solved … tables .. produced "

difference engine

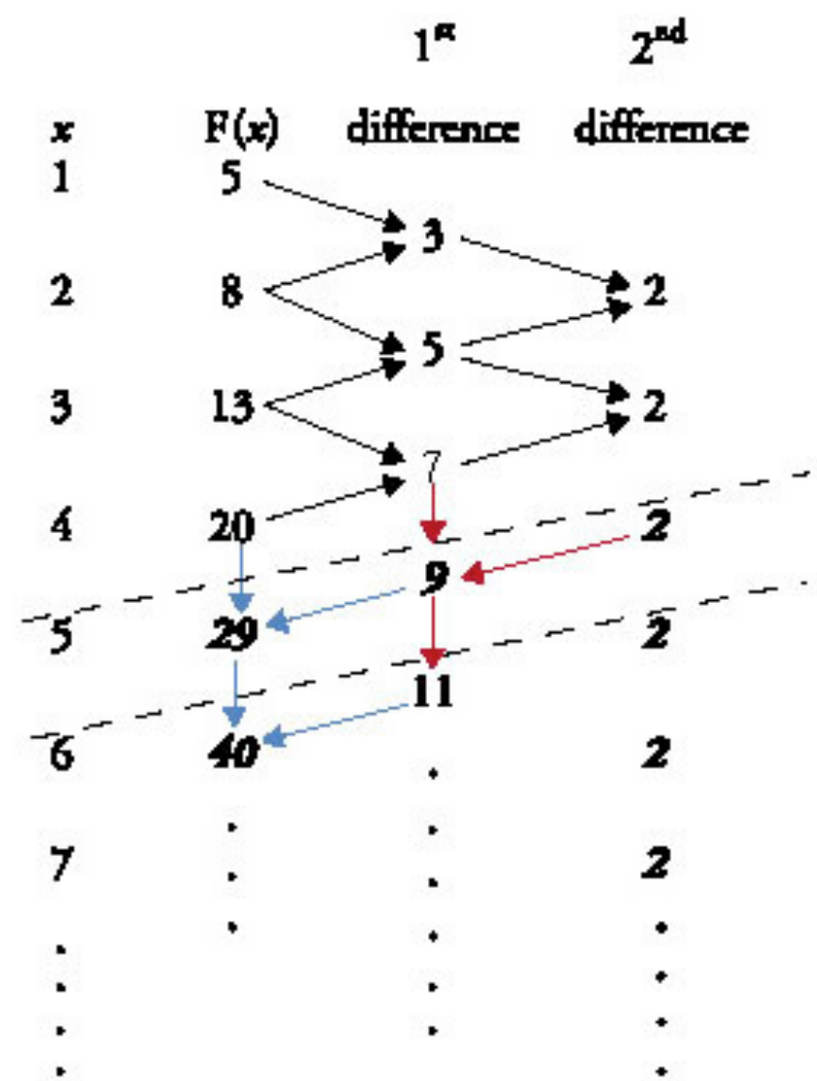




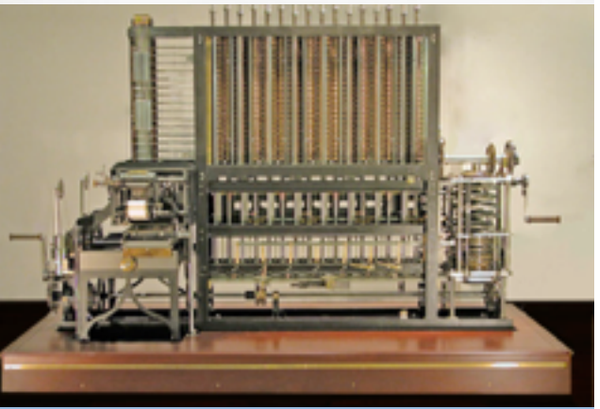
200 ON THE DIVISION OF MENTAL LABOUR.

Repetitions of Process.	Movements.	Clock A. Hand set to I.	Clock B. Hand set to III.	Clock C. Hand set to II.
		TABLE.	First difference.	Second difference.
1	Pull A.	A. strikes 1	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 3 divisions . .	B. strikes 3	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
2	Pull A.	A. strikes 4	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 5 divisions . .	B. strikes 5	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
3	Pull A.	A. strikes 9	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 7 divisions . .	B. strikes 7	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
4	Pull A.	A. strikes 16	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 9 divisions . .	B. strikes 9	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
5	Pull A.	A. strikes 25	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 11 divisions .	B. strikes 11	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
6	Pull A.	A. strikes 36	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 13 divisions .	B. strikes 13	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2

$f(x) = x^2 + 4$



"by the word operation, we mean any process which alters the mutual relation of two or more things … include all subjects in the universe. …A new, a vast, and a powerful language … to wield its truths" —Lovelace



analytical engine

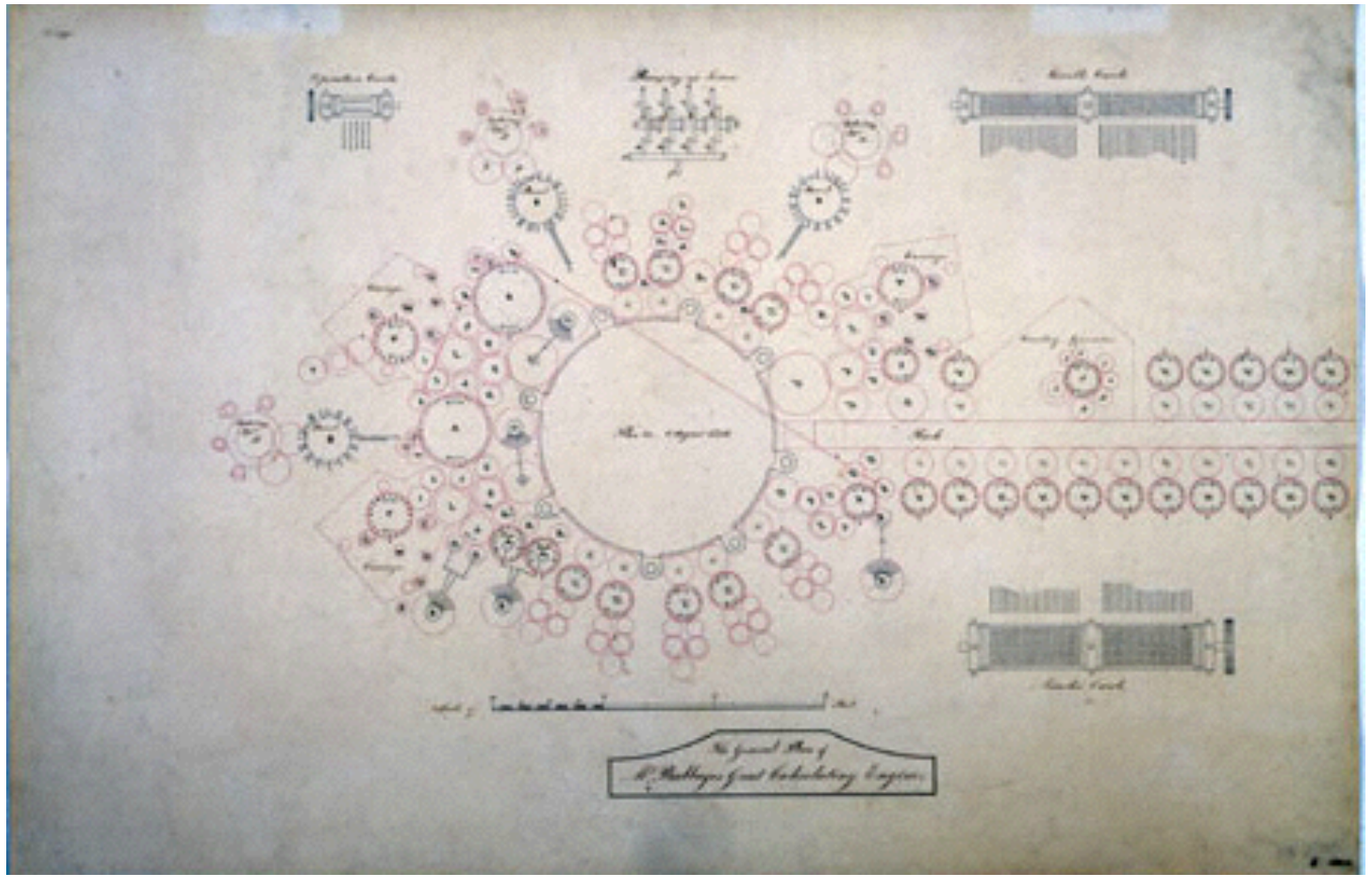
general purpose machine

programmable

storing

looping

branching



"the solution … from Jacquard's apparatus"

— Babbage

Ada Byron/Lovelace

Ada Lovelace
1815-1852

"a machine that not only would have foresight, but could act on that foresight"

"I want to put in something about Bernoulli's Number, in one of my notes, as an example of how an explicit function, may be worked out by the engine, without having been worked out by human head and hands first"

--Lovelace to Babbage, 1843

"Analytical Engine weaves algebraical patterns just as the Jacquard loom weaves flowers and leaves"

—Taylor, *Scientific Memoirs*, 1843

inventions

also 1815

```
#!/bin/sh
var=false
if [ $var ];then
   echo $var
else
   echo "false"
fi
```

boolean binary operators on numbers
< <= >= >
boolean binary operators on anything
= /=
boolean binary operators on booleans
or and
boolean unary operator on booleans
not
string/list/record binary operator on strings/lists/records
& (concatenation)

George Boole
1815-1864

"Boolean logic is the basis for the design of all modern computers since the ultimate components of these devices were capable of storing just two values (equated with true and false) and their circuitry calculates the basic Boolean operators over these two values."

"who can foresee the consequences of such an invention?"

—Lardner

Thamus reborn?

Ada Lovelace
1815–1852

[people tend to]

"first, overrate what we find to be … remarkable, and secondly, by a sort of natural reaction, to undervalue the true state of the case ... The Analytical Engine has no pretension whatever to originate anything"

--Ada Lovelace,

Taylor's *Scientific Memoirs*, 1843

overview

changing perceptions

changing business

the demand side

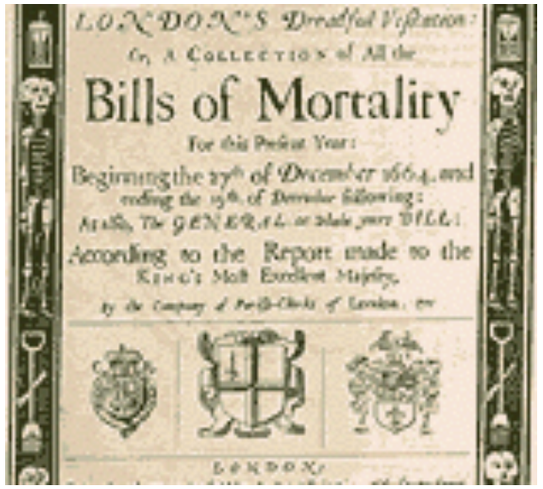
inventions

on the demand side

who might want these machines?

why?

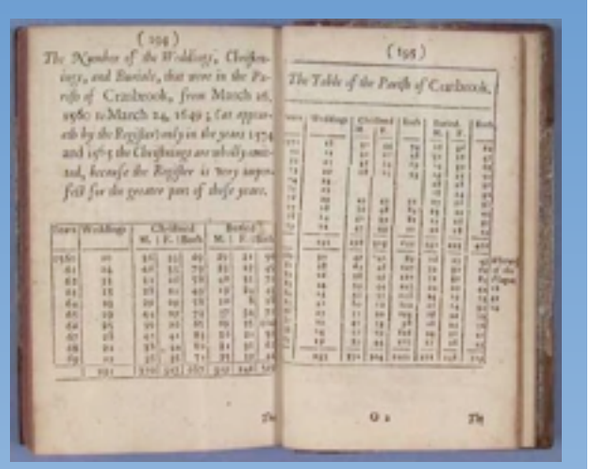
what would they want?



"inextricably linked with our understandings of state and government"

--John Agar, *The Government Machine*, 2003

government



registration

- property
- bills of mortality
- births & marriages
- parish members
- population
- taxpayers
- military eligible

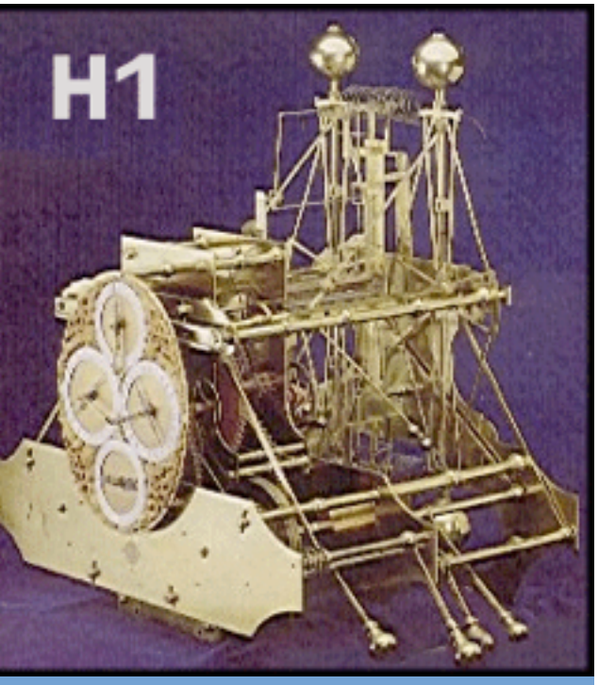
- aliens
- racial groups
- the poor
- professions
- midwives
- prostitutes
- cars
- 'National Insurance'
- social security

John Harrison
1693-1776

"calculating longitude tables … by difference … Prony's tables, and the time that could have been saved

—Babbage

fixing longitude



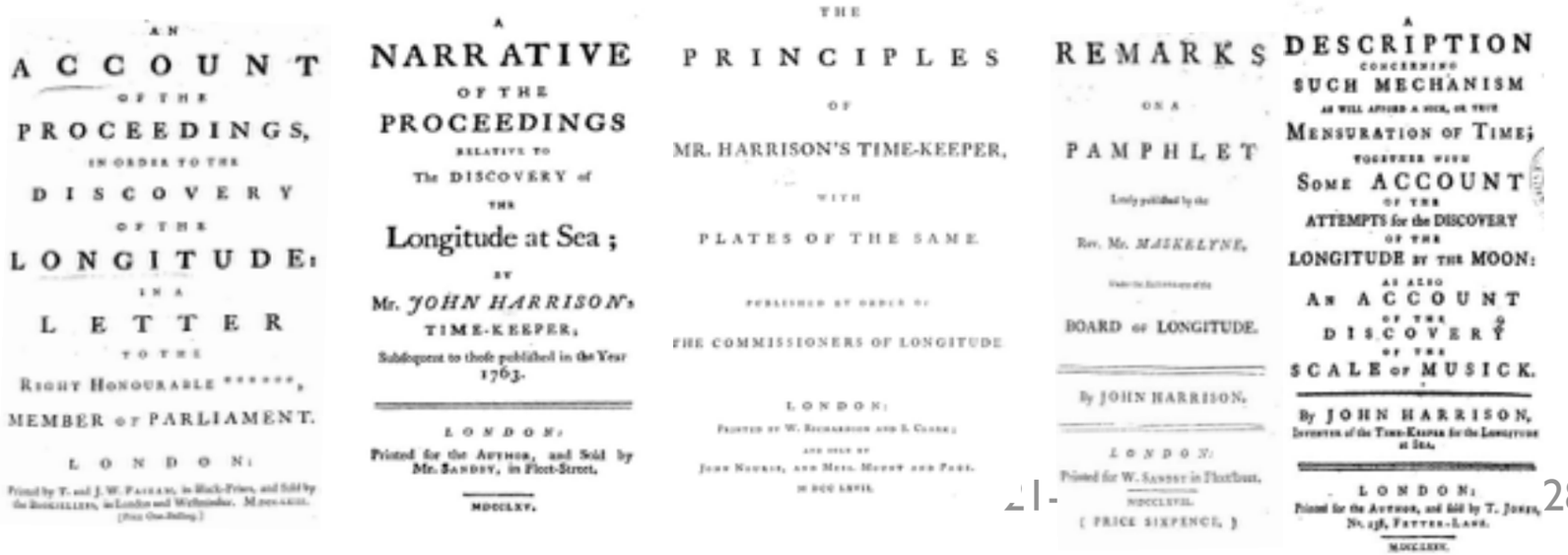
Harrison vs Men of Science

H1 - Lisbon Trial, 1736

awarded prize, 1773

"meridian … of a country whose interests are so inseparably connected as ours are with … navigation"

—Lardner


AN ACCOUNT OF THE PROCEEDINGS, IN ORDER TO THE DISCOVERY OF THE LONGITUDE: IN A LETTER TO THE RIGHT HONOURABLE ******, MEMBER OF PARLIAMENT. LONDON:

A NARRATIVE OF THE PROCEEDINGS RELATIVE TO The DISCOVERY of THE Longitude at Sea; BY Mr. JOHN HARRISON'S TIME-KEEPER, Subsequent to those published in the Year 1763. LONDON: Printed for the AUTHOR, and Sold by Mr. SANDBY, in Fleet-Street. MDCCLXV.

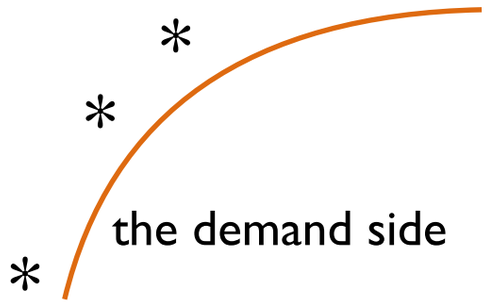
THE PRINCIPLES OF MR. HARRISON'S TIME-KEEPER, WITH PLATES OF THE SAME. PUBLISHED BY ORDER OF THE COMMISSIONERS OF LONGITUDE. LONDON:

REMARKS ON A PAMPHLET Lately published by the Rev. Mr. MASKELYNE, BOARD OF LONGITUDE. By JOHN HARRISON. LONDON: Printed for W. SANDBY in Fleet-Street. MDCCLXVII. [PRICE SIXPENCE.]

A DESCRIPTION CONCERNING SUCH MECHANISM AS WILL AFFORD A SICK, OR BLIND MENSURATION OF TIME; TOGETHER WITH SOME ACCOUNT OF THE ATTEMPTS for the DISCOVERY OF THE LONGITUDE BY THE MOON: AS ALSO AN ACCOUNT OF THE DISCOVERY OF THE SCALE OF MUSICK. By JOHN HARRISON, Inventor of the Time-Keeper for the Longitude at Sea. LONDON: Printed for the AUTHOR, and Sold by T. JONES, No. 238, FETTER-LANE. MDCCLXXIV.

"Statistics should reveal the quantum of happiness in a population [and] the means of further improvement."

—John Sinclair

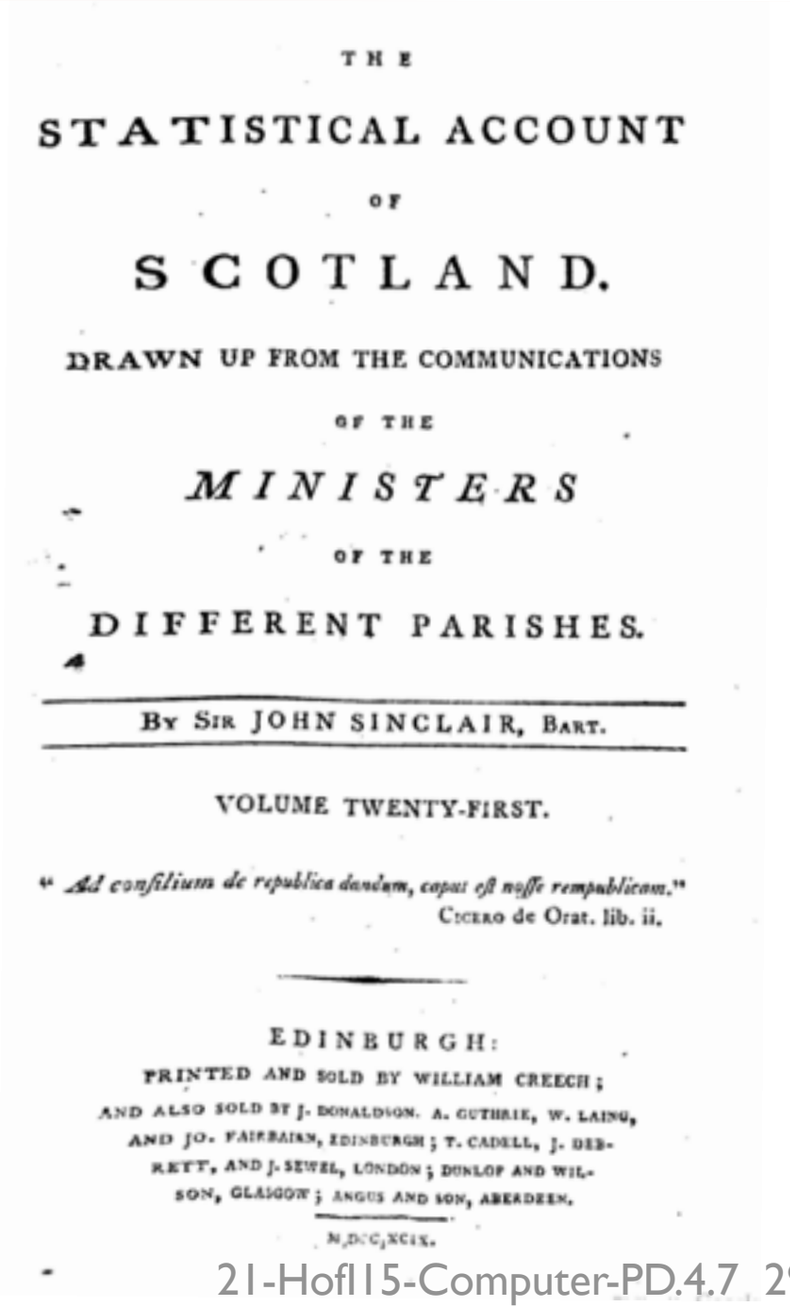


big data

"*Statistics*: a word lately introduced to express a view or survey of any kingdom, country, or parish"

Encyclopaedia Britannica, 1797

John Sinclair
1754–1835



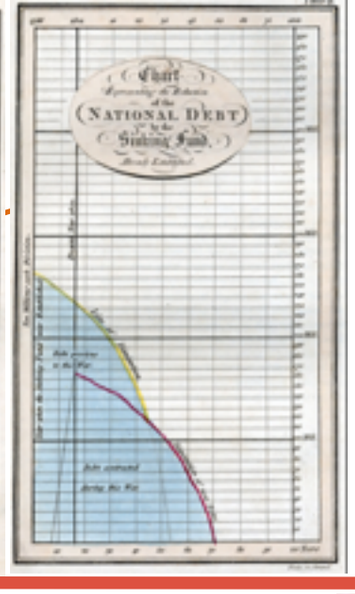
THE
STATISTICAL ACCOUNT
OF
SCOTLAND.
DRAWN UP FROM THE COMMUNICATIONS
OF THE
MINISTERS
OF THE
DIFFERENT PARISHES.

BY SIR JOHN SINCLAIR, BART.

VOLUME TWENTY-FIRST.

"*Ad consilium de republica dandum, capax est nosse rempublicam.*"
CICERO de Orat. lib. ii.

EDINBURGH:
PRINTED AND SOLD BY WILLIAM CREECH;
AND ALSO SOLD BY J. DONALDSON. A. GUTHRIE, W. LAING,
AND JO. FAIRBAIRN, EDINBURGH; T. CADELL, J. DEBRETT, AND J. SEWEL, LONDON; DUNLOP AND WILSON, GLASGOW; ANGUS AND SON, ABERDEEN.
M.DCC.XCIX.



Scots & statistics

THE

STATISTICAL BREVIARY;

SHEWING,

ON A PRINCIPLE ENTIRELY NEW,

THE RESOURCES

OF EVERY

STATE AND KINGDOM IN EUROPE;

ILLUSTRATED WITH

STAINED COPPER-PLATE CHARTS,

REPRESENTING THE

PHYSICAL POWERS OF EACH DISTINCT NATION WITH EASE AND PERSPICUITY.

By WILLIAM PLAYFAIR.

TO WHICH IS ADDED,

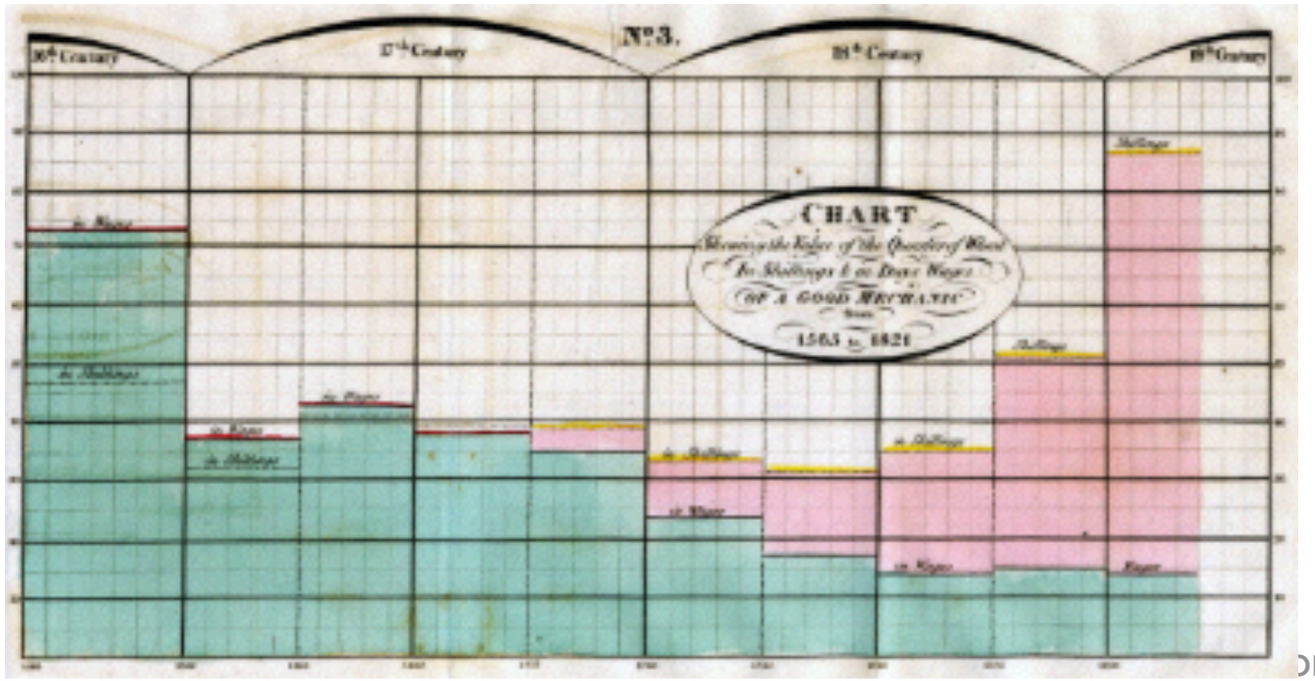
A SIMILAR EXHIBITION OF THE RULING POWERS OF HINDOOSTAN.

LONDON:

Printed by T. Bensley, Bolt Court, Fleet Street,

For J. Wallis, 46, Paternoster Row; Carpenter and Co. Bond Street; Egerton, Whitehall; Vernor and Hood, Poultry; Black and Parry, Leadenhall Street; and Tiffey and Didier, St. James's Street.

1801.



THE

COMMERCIAL AND POLITICAL

ATLAS,

Representing, by Means of

STAINED COPPER-PLATE CHARTS,

THE

PROGRESS OF THE COMMERCE, REVENUES, EXPENDITURE, AND DEBTS OF ENGLAND,

DURING THE WHOLE OF THE

EIGHTEENTH CENTURY.

THE THIRD EDITION,

Corrected and brought down to the End of last Year.

By WILLIAM PLAYFAIR.

London

Printed by T. Burton, Little Queen-Street, Lincoln's-Inn Fields,

FOR J. WALLIS, NO. 46, PATERNOSTER-ROW; CARPENTER AND CO. BOND-STREET; EGERTON, WHITEHALL; VERNOR AND HOOD, POULTRY; BLACK AND PARRY, LEADENHALL-STREET.

1801.

business interests

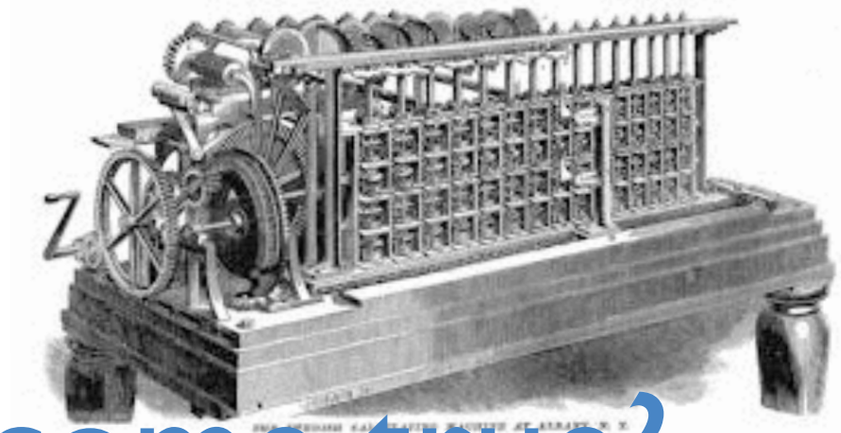
sorting operation: the clearing house

"In a large room in Lombard-street, about thirty clerks from the several London bankers take their stations ... at desks placed around the room. ... From time to time other clerks from every house enter the room, and passing along, drop into the box the checks due by that firm to the house from which this distributor is sent. ... The whole of these payments are made by a double system of balance, a very small amount of bank notes passing from hand to hand.

--Babbage, *On the Economy*, 1835

"[1839] £954 million was cleared--$250 billion in today's money."

--Campbell-Kelly & Aspray



dream come true?

Georg Scheutz
1785–1873

Edvard Scheutz
1822–1881

spreading the word

Scheutz Difference Engine, with printer c 1853

stepping westward

Dudley Observatory, Schenectady

lifelong calculations

British Government, actuarial calculations
"English Life Table" 1864

Of this maritime chief of police, the ship's corporals, so called, were the immediate subordinates, and compliant ones; and this, as is to be noted in some business departments ashore, almost to a degree inconsistent with entire moral volition" —Melville, "Billy Budd, Sailor," [1891]

* the demand side

information

clerks & copyists (UK)

1871: 262,100

1891: 534,622

1911: 918,186

female clerks

1891: 17,859

1911: 117,057

1921, women 46% of all clerks

typewriter girls

1931, 212,296 female typists

5,155 male typists

PUTNAM'S MONTHLY.

A Magazine of Literature, Science, and Art.

VOL. II.—NOVEMBER 1853.—NO. XI.

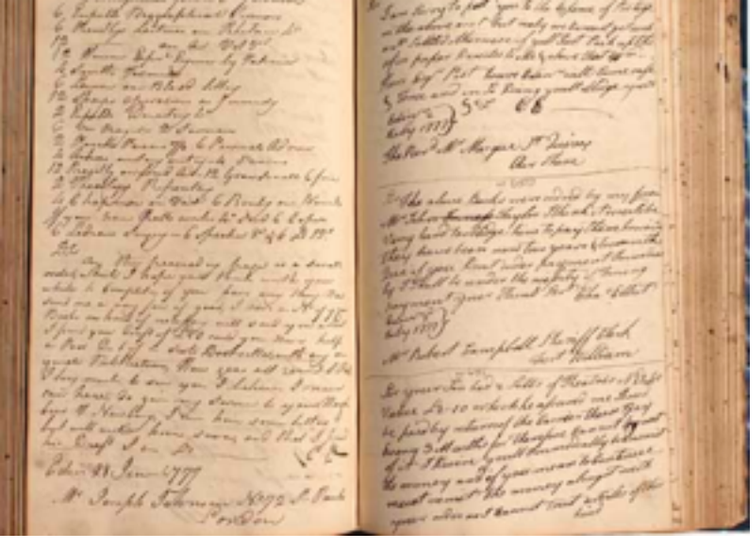
BARTLEBY, THE SCRIVENER.

A STORY OF WALL-STREET.

I AM a rather elderly man. The nature of my avocations for the last thirty years has brought me into more than ordinary contact with what would seem an interesting and somewhat singular set of men, of whom as yet nothing that I know of has ever been written:—I mean the law-copyists or scriveners. I have known very many of them, professionally and privately, and if I pleased, could relate divers histories, at which good-natured gentlemen might smile, and sentimental souls might weep. But I waive the biographies of all other scriveners for a few passages in the life of Bartleby, who was a scrivener the strangest I ever saw or heard of. While of other law-copyists I might write the complete life, of Bartleby nothing of that sort can be done. I believe that no materials exist for a full and satisfactory biography of this man. It is an irreparable loss to literature. Bartleby was one of those beings of whom nothing is ascertainable, except from the original sources, and in his case those are very small. What my own astonished eyes saw of Bartleby, *that* is all I know of him, except, indeed, one vague report which will appear in the sequel.

Ere introducing the scrivener, as he first appeared to me, it is fit I make some mention of myself, my *employées*, my business, my chambers, and general surroundings; because some such description is indispensable to an adequate understanding of the chief character about to be presented.

Imprimis: I am a man who, from his youth upwards, has been filled with a profound conviction that the easiest way of life is the best. Hence, though I belong to a profession proverbially energetic and nervous, even to turbulence, at times, yet nothing of that sort have I ever suffered to invade my peace. I am one of those unambitious lawyers who never addresses a jury, or in any way draws down public applause; but in the cool tranquillity of a snug retreat, do a snug business among



revolutionary tech

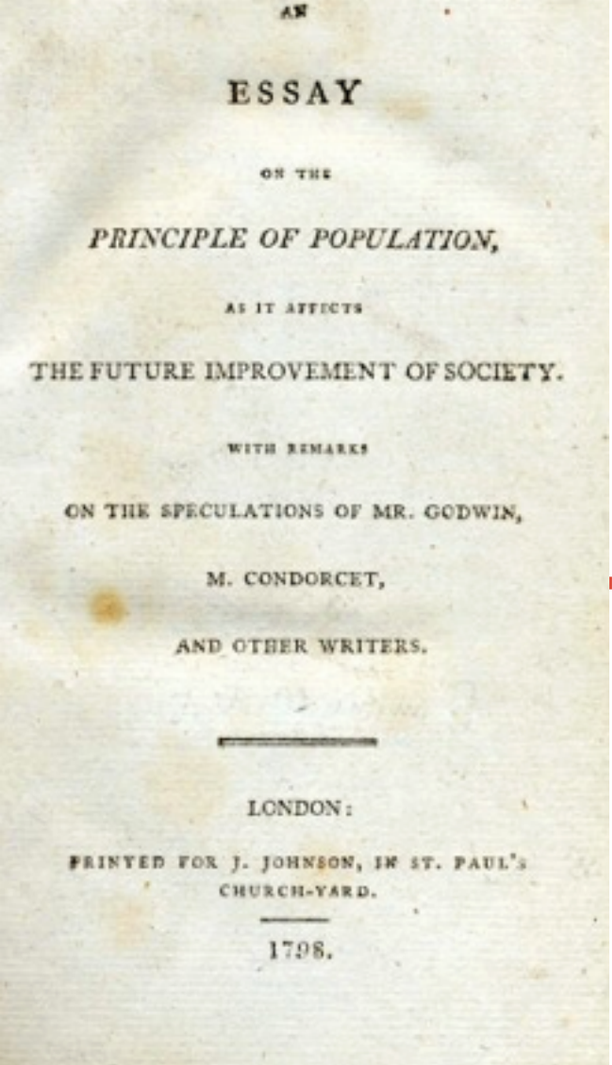
carbon paper
Wedgewood, 1806

typewriter
Remington, 1874

calculator
Burroughs,1892

cash *register*
mechanical register, 1884

"the check which it affords against … the dishonesty of human agents." — Babbage



AN

ESSAY

ON THE

PRINCIPLE OF POPULATION,

AS IT AFFECTS

THE FUTURE IMPROVEMENT OF SOCIETY.

WITH REMARKS

ON THE SPECULATIONS OF MR. GODWIN,

M. CONDORCET,

AND OTHER WRITERS.

LONDON:

PRINTED FOR J. JOHNSON, IN ST. PAUL'S CHURCH-YARD.

1798.

Spain:	1787
US:	1790
UK:	1801

"[An] Enumeration shall be made within three Years after the first Meeting of the Congress of the United States, and within every subsequent Term of ten Years, in such Manner as they shall by Law direct."

enumerating

Year	Population	Gain		Clerks
1900	76,212,168	13,232,402	21.0	
1890	62,979,766	12,790,557	25.5	
1880	50,189,209	11,630,838	30.2	2000
1870	38,558,371	7,115,050	22.6	1495
1860	31,443,321	8,251,445	35.6	483
1850	23,191,876	6,128,523	35.9	
1840	17,063,353	4,202,651	32.7	28
1830	12,860,702	3,222,249	33.4	
1820	9,638,453	2,298,572	33.1	
1810	7,239,881	1,931,398	36.4	
1800	5,308,483	1,379,269	35.1	
1790	3,929,214	-	-	

tabulating

Herman Hollerith
1860–1929

Hollerith

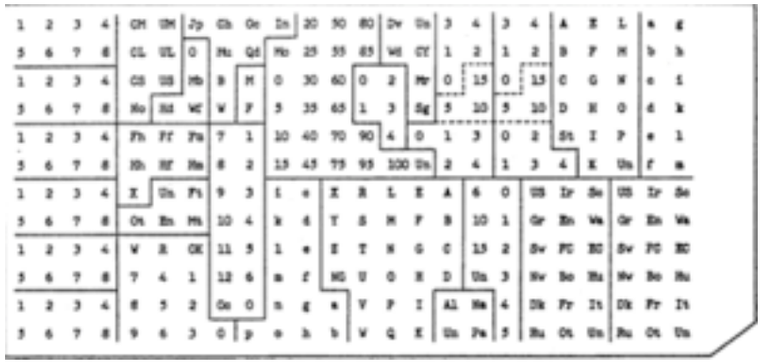
Electronic Tabulating Machine

1890 Census

"This apparatus works unerringly as the mills of the gods, but beats them hollow as to speed."

—*The Electrical Engineer*, 11 Nov 1891

the punch card

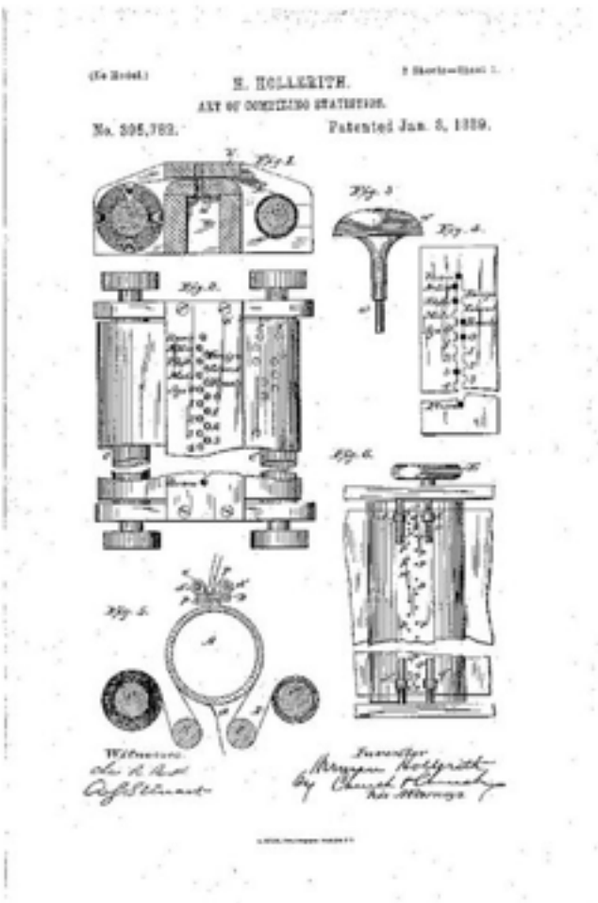


"Hollerith, then IBM, managed to maintain a near monopoly by periodically filing for new key patents or by acquiring those of unsuccessful rivals."

-- Mounier-Kuhn,2012

*
*
*
the demand side

government & business



Hollerith

Tabulating Machine Company

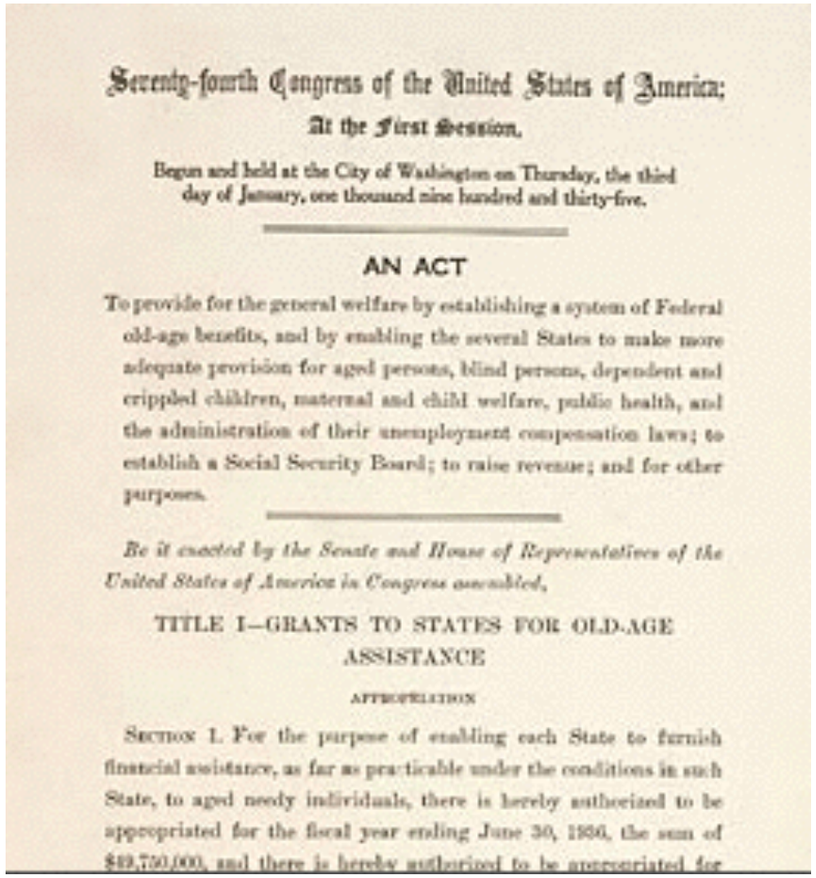
CTR:
Computing-Tabulating-Recording Company

Thomas Watson
NCR to CTR to ...

a whole new deal

Social Security Act, 1935

"the world's largest bookkeeping job"



Seventy-fourth Congress of the United States of America;
At the First Session,

Begun and held at the City of Washington on Thursday, the third day of January, one thousand nine hundred and thirty-five.

AN ACT

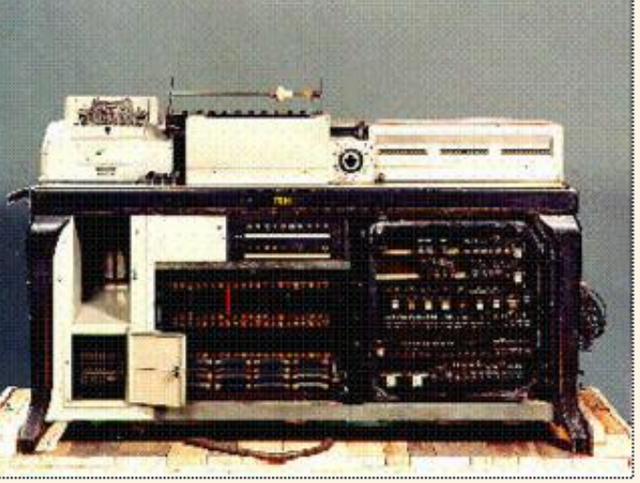
To provide for the general welfare by establishing a system of Federal old-age benefits, and by enabling the several States to make more adequate provision for aged persons, blind persons, dependent and crippled children, maternal and child welfare, public health, and the administration of their unemployment compensation laws; to establish a Social Security Board; to raise revenue; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—GRANTS TO STATES FOR OLD-AGE ASSISTANCE

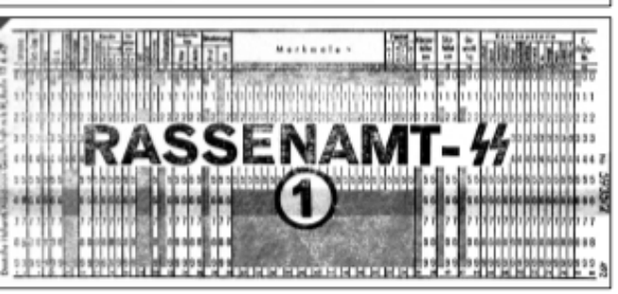
APPROPRIATION

SECTION 1. For the purpose of enabling each State to furnish financial assistance, as far as practicable under the conditions in such State, to aged needy individuals, there is hereby authorized to be appropriated for the fiscal year ending June 30, 1936, the sum of $49,750,000, and there is hereby authorized to be appropriated for



Hollerith-Maschine Dehomag D11, die 1933 in Deutschland

controlling numbers



... controlling people

The Nazi Census --Aly & Roth, 2004

IBM D11

Census, 1933, 1939

Labor Book, 1935

Health Pedigree book, 1936

Registry of the Populace, 1939

Blood (high, average, acceptable, inferior), 1940

Personal Identification Number, 1944

still registering

Ruth Fremson/The New York Times

igrant farm worker peers into an iris scanner in New Delhi in the first effort to officially record each Indian's identity as an individual.

LYDIA POLGREEN
lished: September 1, 2011

"sailors ... trace their family .. .names upon the wrist ... If it were possible for such a practice to become universal ... Who are you? ... no room for prevarication in the answer ... men were thus held as it were by an invisible chain."

-- Jeremy Bentham,
Principles of Penal Law [1843]

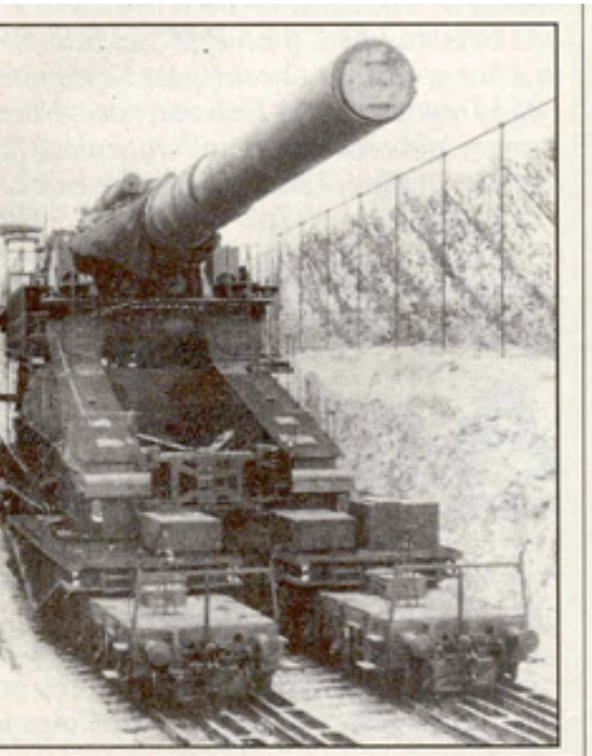
CYBERNETICS

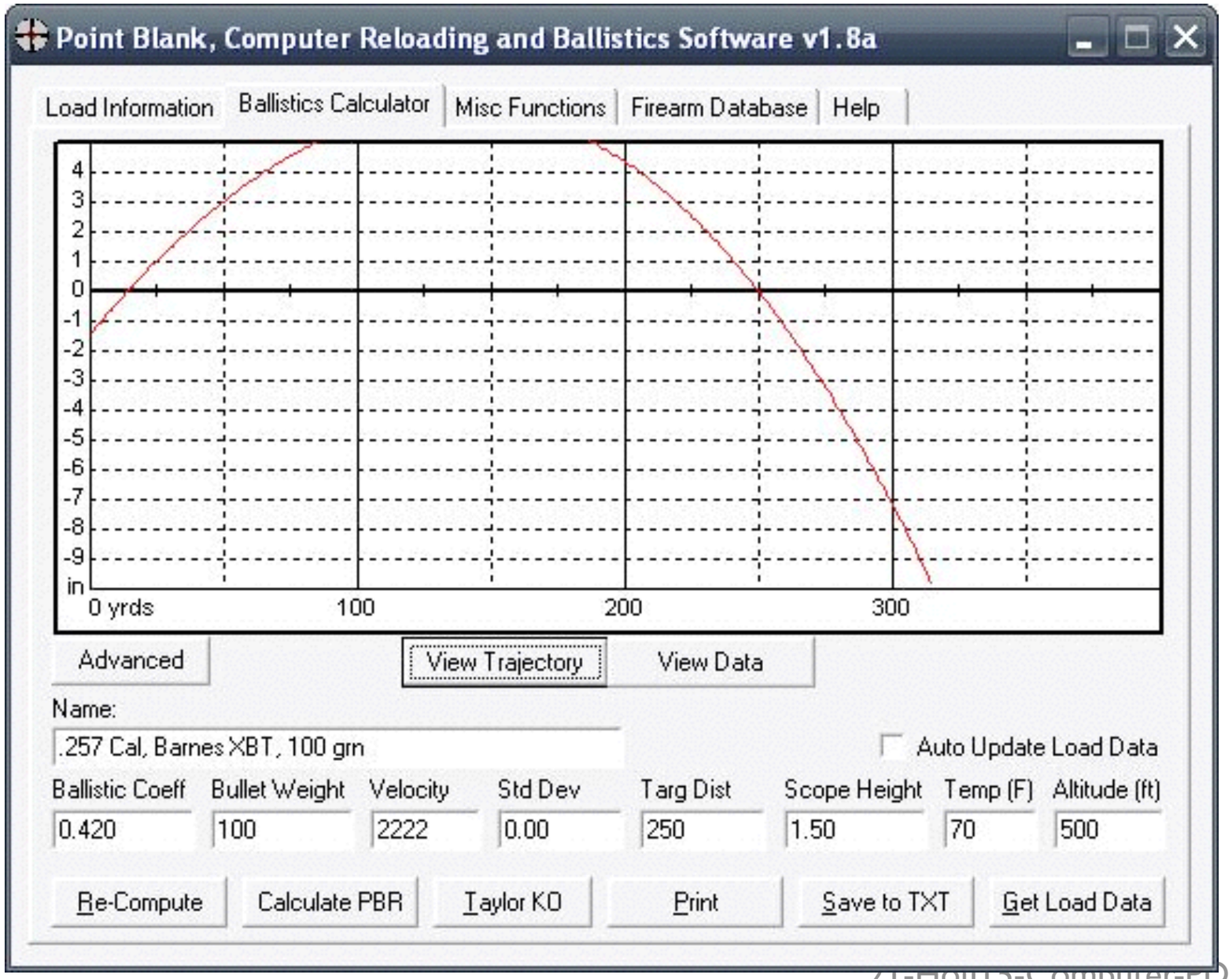
OR CONTROL AND COMMUNICATION IN THE ANIMAL AND THE MACHINE

Norbert Wiener
PROFESSOR OF MATHEMATICS
THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

THE TECHNOLOGY PRESS
JOHN WILEY & SONS, INC., NEW YORK
HERMANN et CIE, PARIS

military takeover





military processing

ballistics "firing tables"

Vannevar Bush, 1935,

Differential Analyzer

analytical work

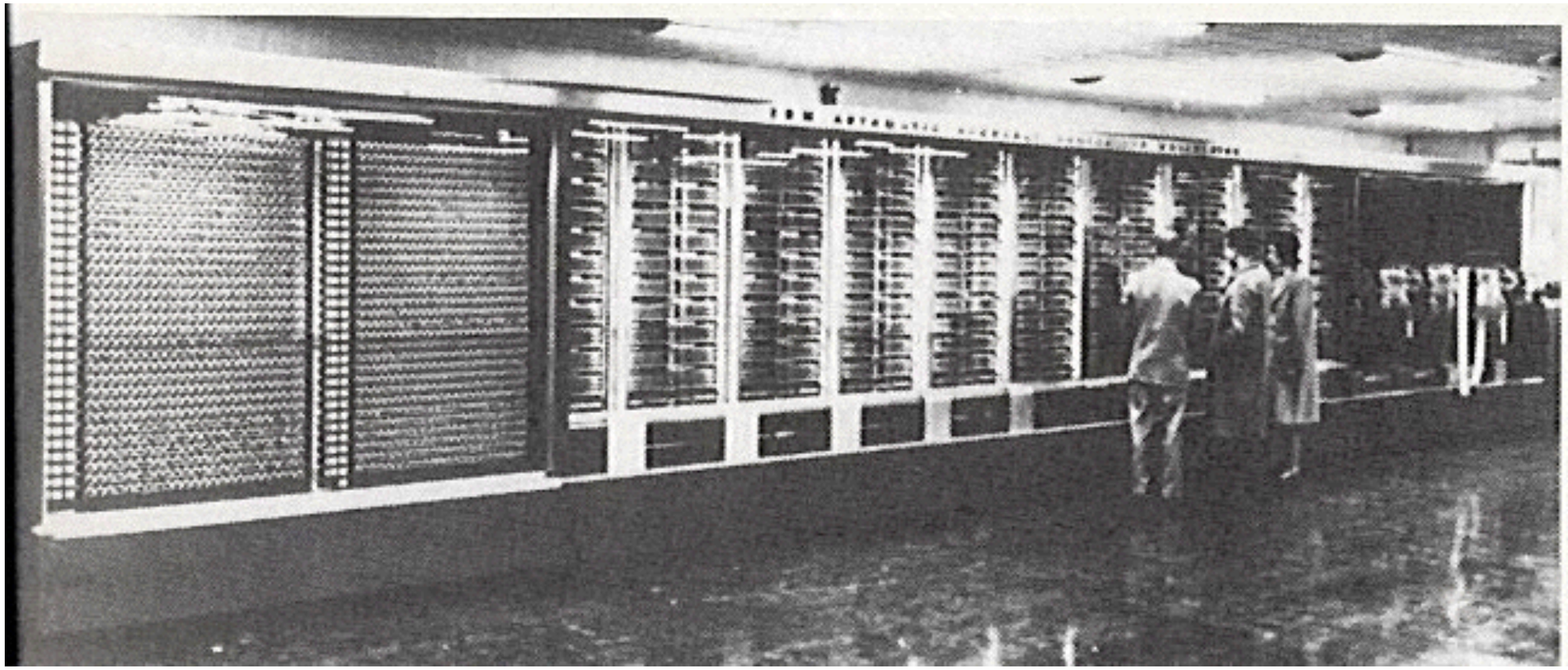
(Babbage)

Bush

Shannon, "A Symbolic Analysis of Relay and Switching Circuits," 1937

Harvard mark I

aka **IBM Automatic Sequence Controlled Calculator,** 1944

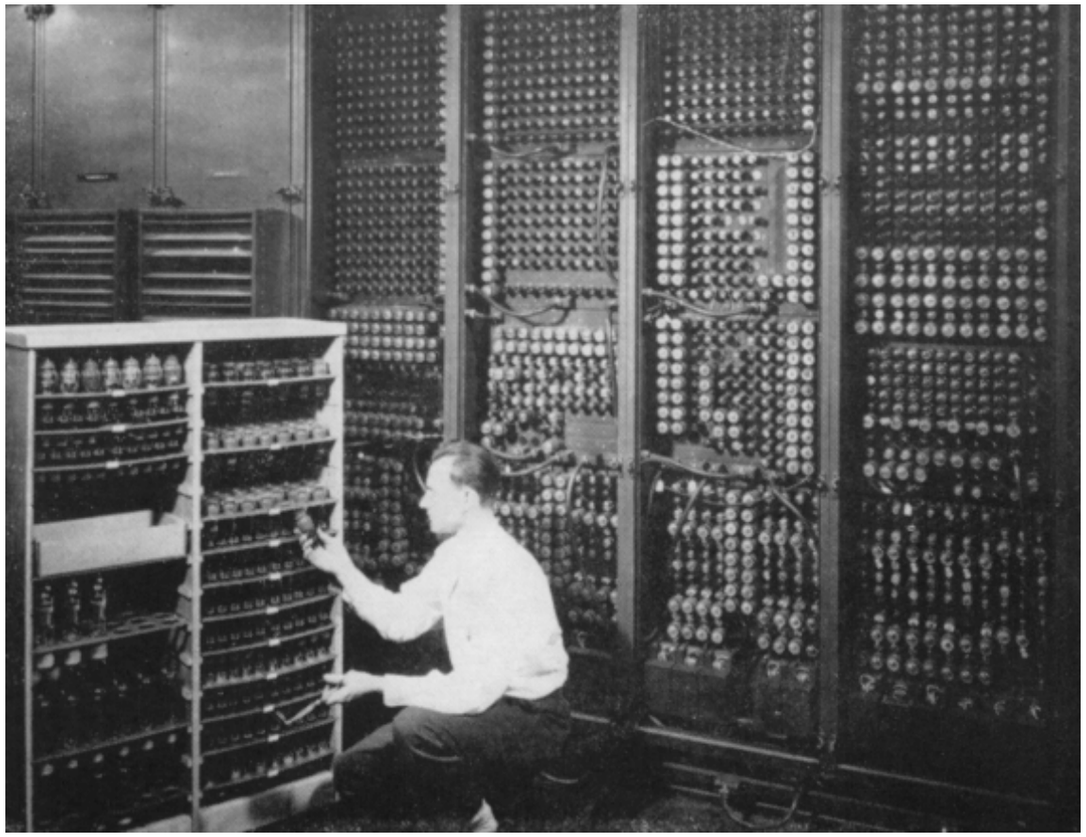


John von Neumann
1903–1957

military processing

Moore School

Aberdeen Proving Ground



Eckert & Mauchly

1945, ENIAC

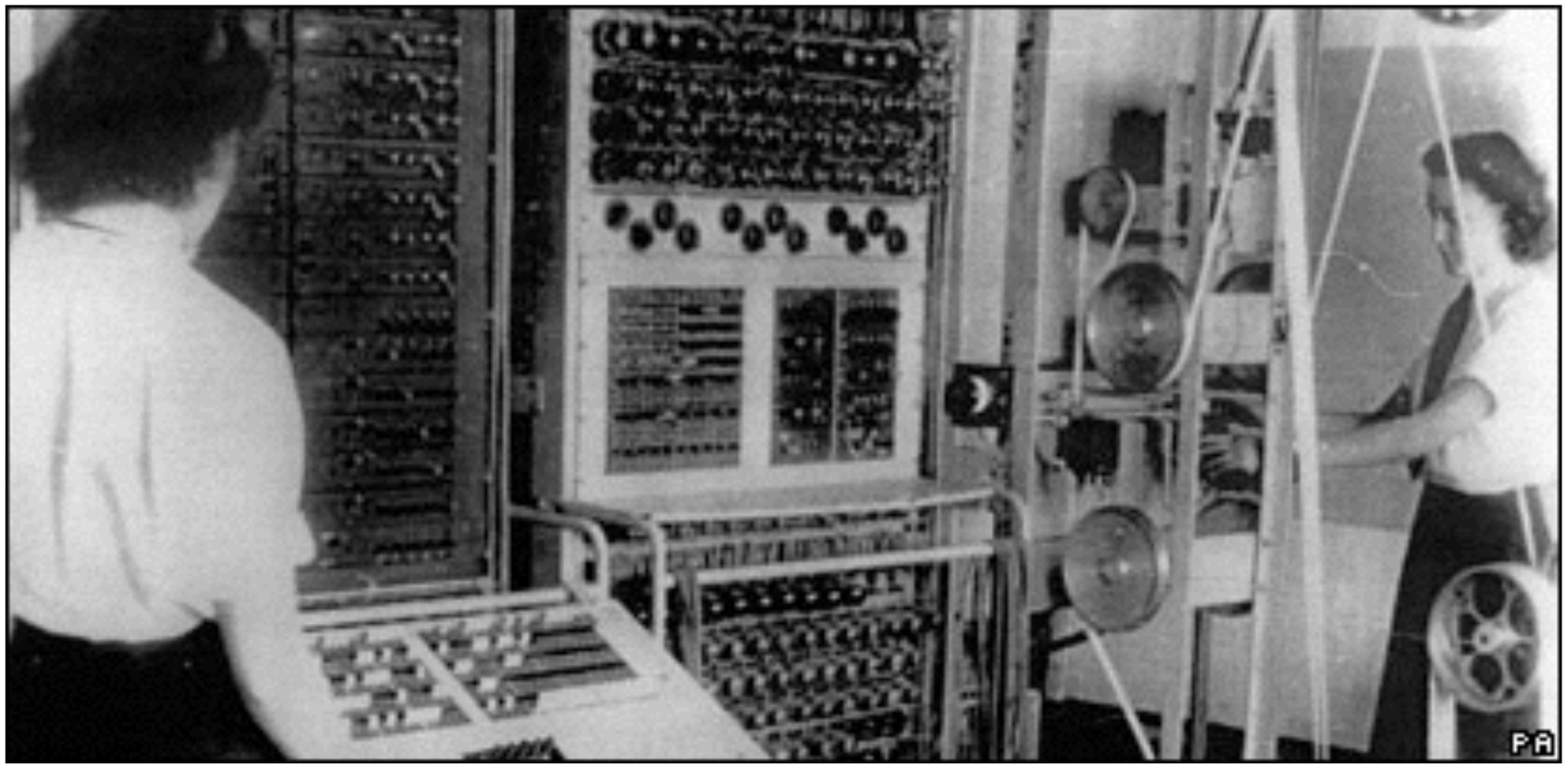
stored-program
(Electronic Numerical
Integrator Computer)
18,00 vacuum tubes, 70, 000 resistors,
10,000 capacitors, 6,000 switches, 1,500 relays

Alan Turing
1912-1954

decoding

1943, Colossus

Bletchley Park

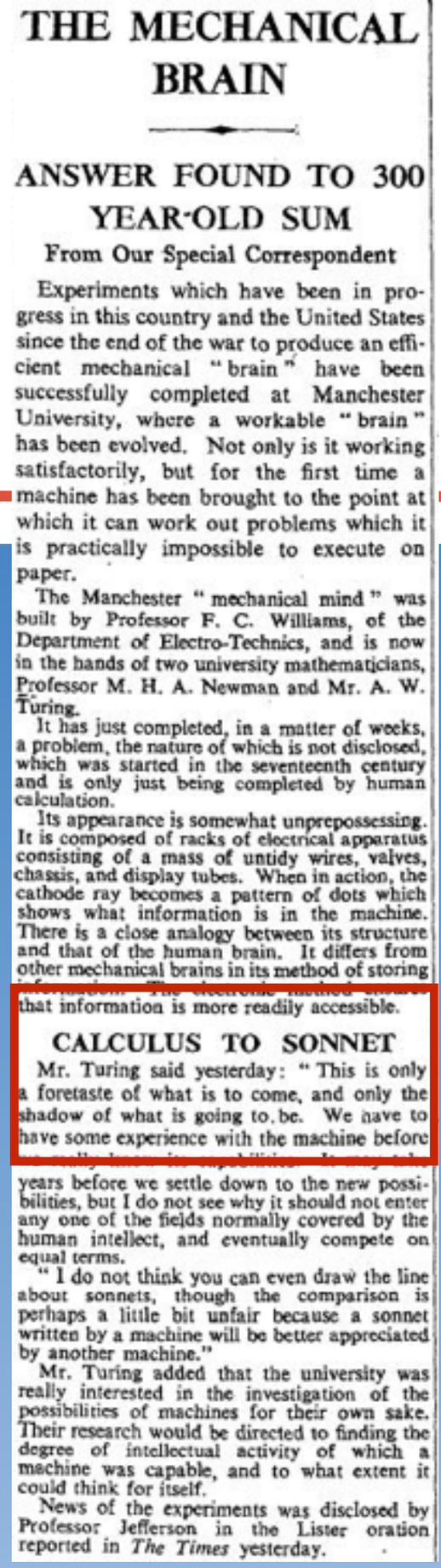


[just one] "would suffice the needs of the whole world" - Georg Scheutz

back to Thamus

"I went to see Professor Douglas Hartree, who had built the first differential analyzers in England and had more experience in using these very specialized computers than anyone else. **He told me that, in his opinion, all the calculations that would ever be needed in this country could be done on the three digital computers which were then being built**—one in Cambridge, one in Teddington, and one in Manchester. No one else, he said, would ever need machines of their own, or would be able to afford to buy them."

--Lord Bowden, *American Scientist* 58 (1970) pp. 43–53



THE MECHANICAL BRAIN

ANSWER FOUND TO 300 YEAR-OLD SUM

From Our Special Correspondent

Experiments which have been in progress in this country and the United States since the end of the war to produce an efficient mechanical "brain" have been successfully completed at Manchester University, where a workable "brain" has been evolved. Not only is it working satisfactorily, but for the first time a machine has been brought to the point at which it can work out problems which it is practically impossible to execute on paper.

The Manchester "mechanical mind" was built by Professor F. C. Williams, of the Department of Electro-Technics, and is now in the hands of two university mathematicians, Professor M. H. A. Newman and Mr. A. W. Turing.

It has just completed, in a matter of weeks, a problem, the nature of which is not disclosed, which was started in the seventeenth century and is only just being completed by human calculation.

Its appearance is somewhat unprepossessing. It is composed of racks of electrical apparatus consisting of a mass of untidy wires, valves, chassis, and display tubes. When in action, the cathode ray becomes a pattern of dots which shows what information is in the machine. There is a close analogy between its structure and that of the human brain. It differs from other mechanical brains in its method of storing that information is more readily accessible.

CALCULUS TO SONNET

Mr. Turing said yesterday: "This is only a foretaste of what is to come, and only the shadow of what is going to be. We have to have some experience with the machine before years before we settle down to the new possibilities, but I do not see why it should not enter any one of the fields normally covered by the human intellect, and eventually compete on equal terms.

"I do not think you can even draw the line about sonnets, though the comparison is perhaps a little bit unfair because a sonnet written by a machine will be better appreciated by another machine."

Mr. Turing added that the university was really interested in the investigation of the possibilities of machines for their own sake. Their research would be directed to finding the degree of intellectual activity of which a machine was capable, and to what extent it could think for itself.

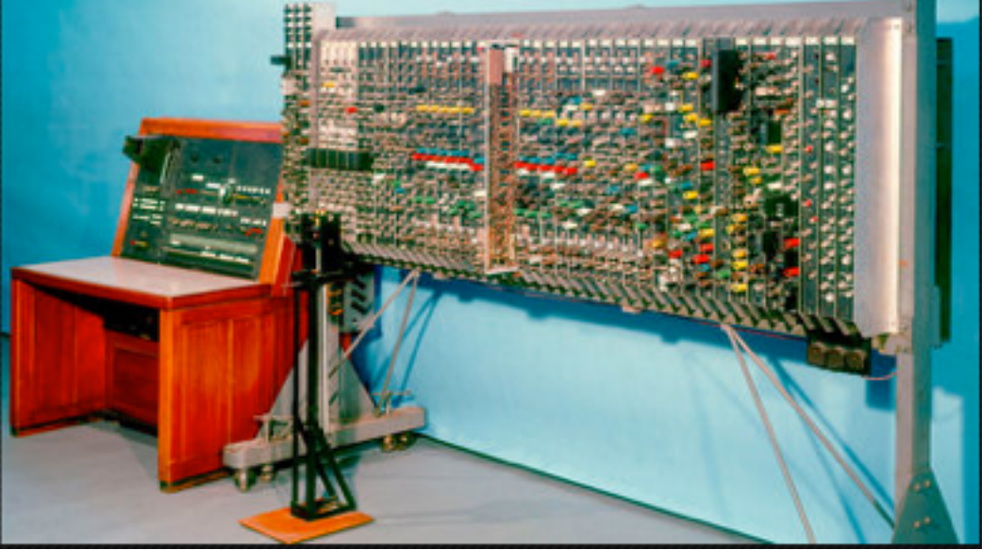
News of the experiments was disclosed by Professor Jefferson in the Lister oration reported in *The Times* yesterday.

Times, June 11, 1949

"at most" or "only a foretaste"?

"In reports to the US government, and in funding requests to the military (to calculate the effects of thermonuclear explosions), von Neumann and his colleagues expressed the view that '**at most six or so machines should suffice for the whole country.**' Turing, in an interview with the *Times* in 1949, declared: 'This is only a foretaste of what is to come, and only the shadow of what is going to be … I do not see why it should not enter any one of the fields normally covered by the human intellect and eventually compete on equal terms.'"

—Philip Welch, *London Review of Books*, 2012



Manchester's mechanical brain

1948

first stored-program computer

THE MECHANICAL BRAIN.—The apparatus which has been evolved in the electrical engineering laboratories of Manchester University to work out problems which are almost impossible to execute on paper. The section on the left contains the control circuit, in the middle rack of which is a cathode ray tube screen with (below) the control desk. The racks on the right-centre of the picture with the box-like containers provid the memory section of the machine. Nearer the camera are racks containing the calcu lating circuits. The machine is "fed" at the control desk and the answer is read on th cathode ray tube, which is the only visible means of showing that the brain is at work

overview

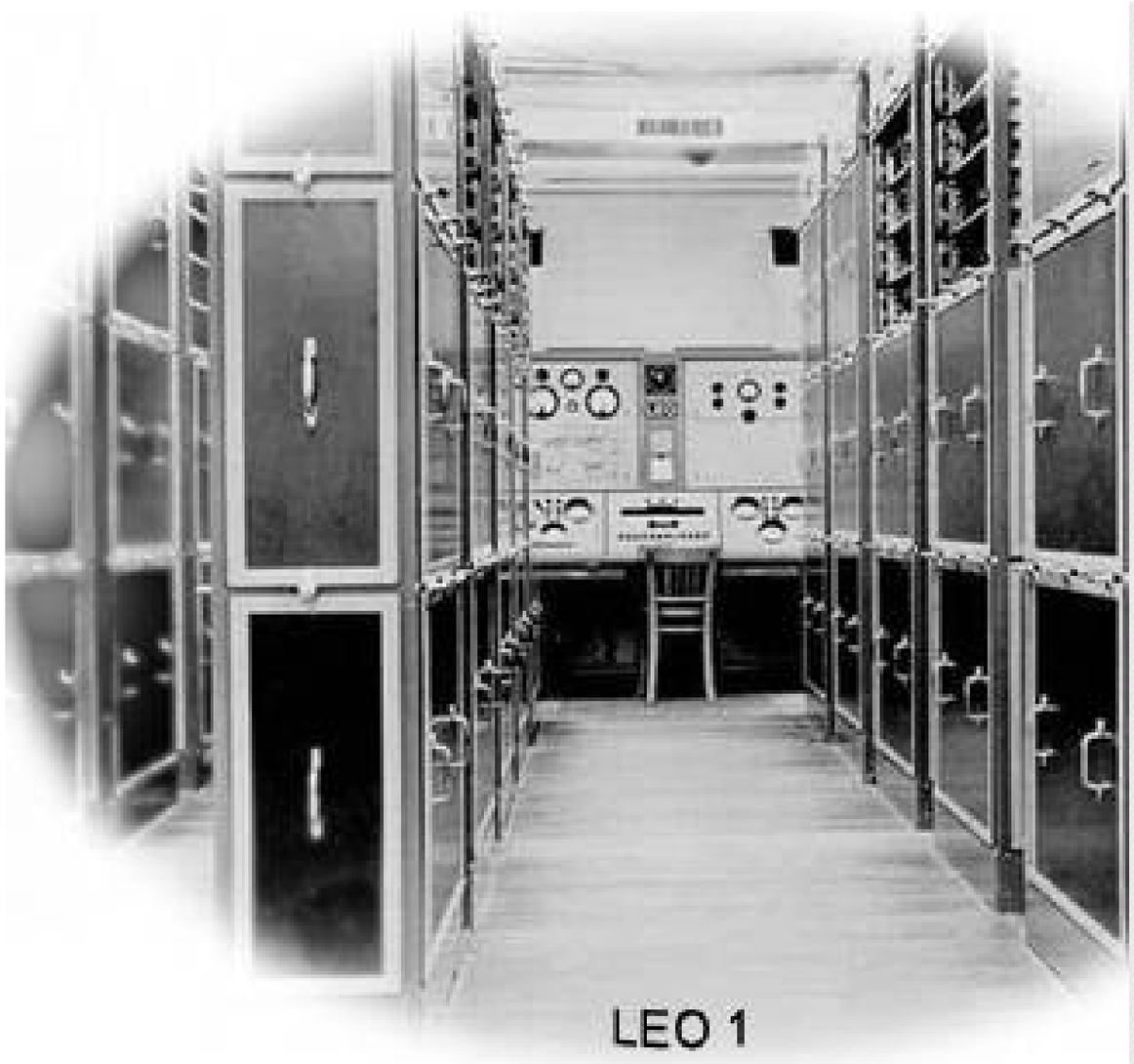
changing perceptions

changing business

the demand side

inventions

back in business
vertical integration



LEO 1

How a chain of tea shops kickstarted the computer age

In November 1951 a British company switched on the world's first business computer

Image 1 of 3

LEO at Lyons HQ in Hammersmith

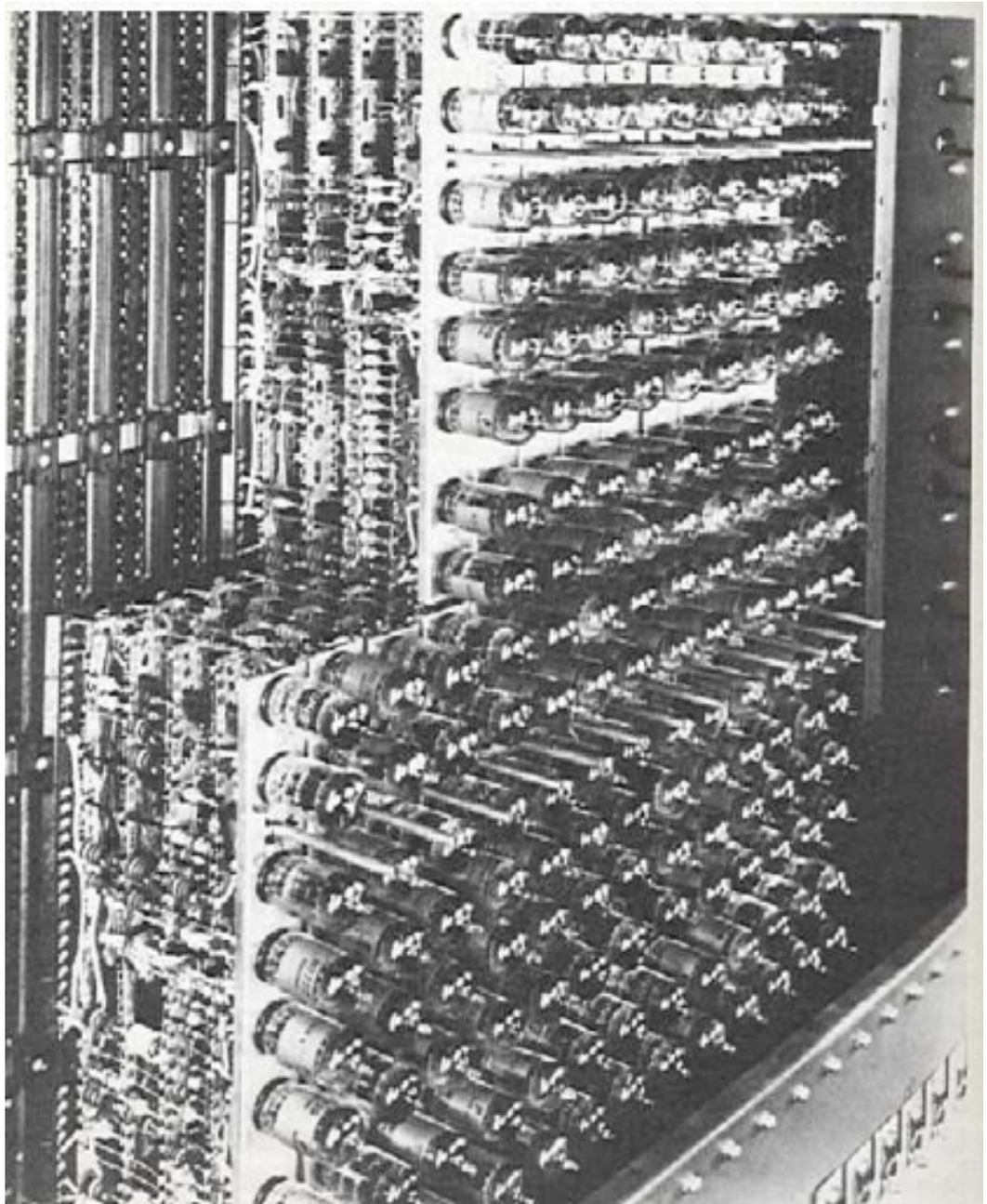
By Christopher Williams, Technology Correspondent

7:00AM GMT 10 Nov 2011

changing business

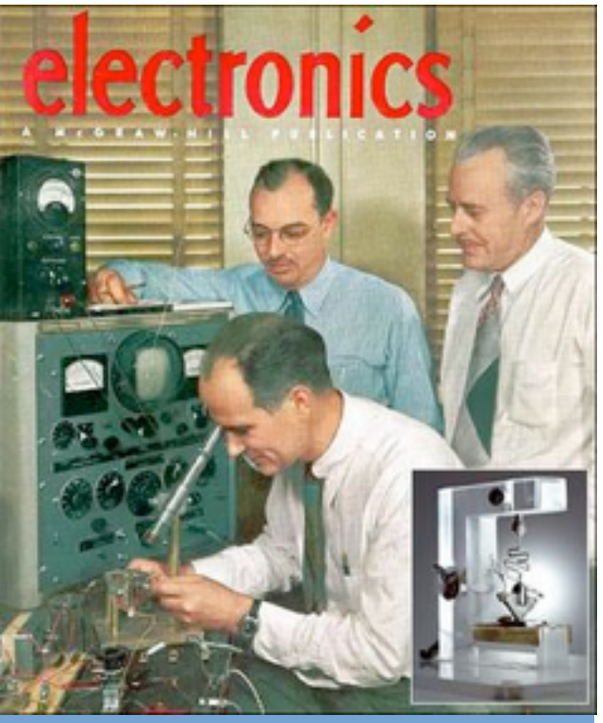
breaking down

Cathode-ray tube memory, from the IBM 701 Defense Calculator, 1952



changing business

breaking things down



1947 transistor

Bell Labs

John Bardeen, William Brattain, William Shockley

1958 integrated circuit

Texas Instruments

Jack Kilby

Shockley
Fairchild
Intel

corporate computing

100. Console – IBM System/360 Model 30

1960 DEC PDP-1

"programmable data processor"

1964 IBM 360

1969 Xerox PARC

"the architecture of information"

(**1946** SRI)

changing business

more breaking down

vertical disintegration 1970-1990

Software	IBM
OS	IBM
CPU	IBM
Hardware	IBM

not dead yet

The Mainframe Is Dead! Long Live the Mainframe!

Posted by **samzenpus** on Thursday January 15, 2015 @04:06AM
from the brand-new-stuff dept.

HughPickens.com writes

> The death of the mainframe has been predicted many times over the years but it has prevailed because it has been overhauled time and again. Now Steve Lohr reports that IBM has just released the z13, a new mainframe engineered to cope with the huge volume of data and transactions generated by people using smartphones and tablets. "This is a mainframe for the mobile digital economy," says Tom Rosamilia. "It's a computer for the bow wave of mobile transactions coming our way." IBM claims the z13 mainframe is the first system able to process 2.5 billion transactions a day and has a host of technical improvements over its predecessor, including three times the memory, faster processing and greater data-handling capability. IBM spent $1 billion to develop the z13, and that research generated 500 new patents, including some for encryption intended to improve the security of mobile computing. Much of the new technology is designed for real-time analysis in business. For example, the mainframe system can allow automated fraud prevention while a purchase is being made on a smartphone. Another example would be providing shoppers with personalized offers while they are in a store, by tracking their locations and tapping data on their preferences, mainly from their previous buying patterns at that retailer.
>
> IBM brings out a new mainframe about every three years, and the success of this one is critical to the company's business. Mainframes alone account for only about 3 percent of IBM's sales. But when mainframe-related software, services and storage are included, the business as a whole contributes 25 percent of IBM's revenue and 35 percent of its operating profit. Ronald J. Peri, chief executive of Radixx International was an early advocate in the 1980s of moving off mainframes and onto networks of personal computers. Today Peri is shifting the back-end computing engine in the Radixx data center from a cluster of industry-standard servers to a new IBM mainframe and estimates the total cost of ownership including hardware, software and labor will be 50 percent less with a mainframe. "We kind of rediscovered the mainframe," says Peri.

Bits

ENTERPRISE COMPUTING

IBM Introduces z13, a Mainframe for the Smartphone Economy

By STEVE LOHR JANUARY 13, 2015 4:30 PM 16 Comments

IBM's new z13 mainframe includes more than 500 new patents. Augusto Menezes/Feature Photo Service for IBM

They seem a computing odd couple: the mainframe, the old workhorse, and the smartphone, the cool-kid computer of today.

overview

changing perceptions

changing business

the demand side

inventions

social networks?

THE

BEGGAR'S COMPLAINT,

AGAINST

RACK-RENT LANDLORDS, CORN FACTORS, GREAT FARMERS, MONOPOLIZERS, PAPER MONEY MAKERS, AND WAR,

and many other

Oppressors and Oppressions.

ALSO,

SOME OBSERVATIONS

ON THE

CONDUCT OF THE LUDDITES,

In Reference to the

Destruction of Machinery,

&c. &c.

BY ONE WHO PITIES THE OPPRESSED.

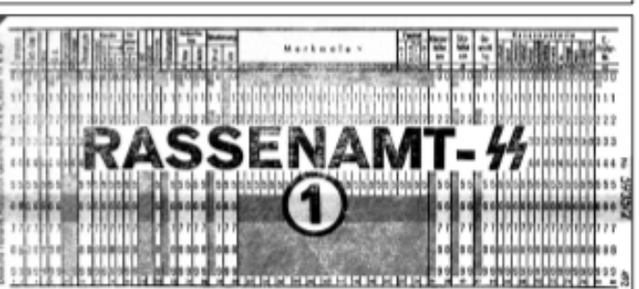
" Nature and time destroy the vain opinions of the day,
But sooner or later confirm the dictates of wisdom. " CICERO.

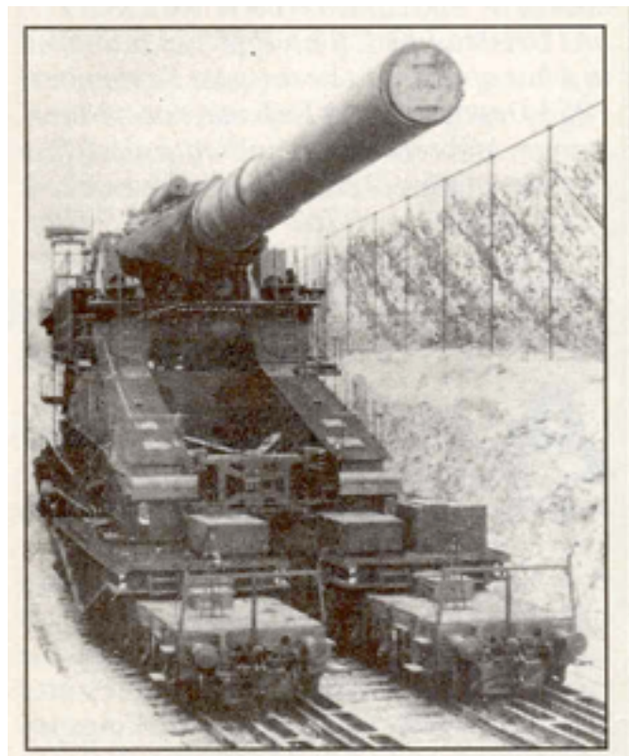
THE SECOND EDITION GREATLY ENLARGED.

SHEFFIELD:

Printed for the Author by J. Crome,

1812





PUTNAM'S MONTHLY.

A Magazine of Literature, Science, and Art.

VOL. II.—NOVEMBER 1853.—NO. XI.

BARTLEBY, THE SCRIVENER.

A STORY OF WALL-STREET.

I AM a rather elderly man. The nature of my avocations for the last thirty years has brought me into more than ordinary contact with what would seem an interesting and somewhat singular set of men, of whom as yet nothing that I know of has ever been written:—I mean the law-copyists or scriveners. I have known very many of them, professionally and privately, and if I pleased, could relate divers histories, at which good-natured gentlemen might smile, and sentimental souls might weep. But I waive the biographies of all other scriveners for a few passages in the life of Bartleby, who was a scrivener the strangest I ever saw or heard of. While of other law-copyists I might write the complete life, of Bartleby nothing of that sort can be done. I believe that no materials exist for a full and satisfactory biography of this man. It is an irreparable loss to literature. Bartleby was one of those beings of whom nothing is ascertainable, except from the original sources, and in his case those are very small. What my own astonished eyes saw of Bartleby, *that* is all I know of him, except, indeed, one vague report which will appear in the sequel.

Ere introducing the scrivener, as he first appeared to me, it is fit I make some mention of myself, my *employées*, my business, my chambers, and general surroundings; because some such description is indispensable to an adequate understanding of the chief character about to be presented.

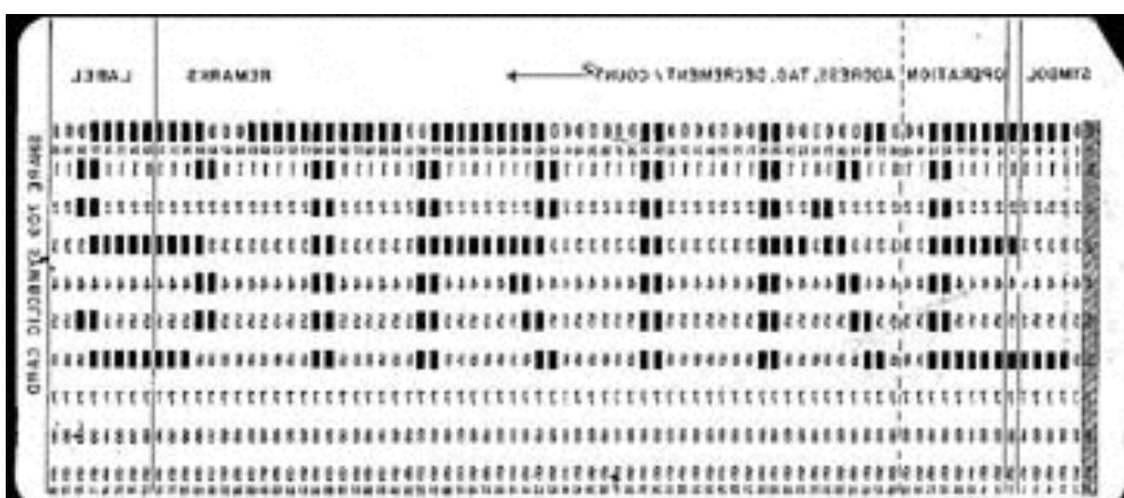
Imprimis: I am a man who, from his youth upwards, has been filled with a profound conviction that the easiest way of life is the best. Hence, though I belong to a profession proverbially energetic and nervous, even to turbulence, at times, yet nothing of that sort have I ever suffered to invade my peace. I am one of those unambitious lawyers who never addresses a jury, or in any way draws down public applause; but in the cool tranquillity of a snug retreat, do a snug business among

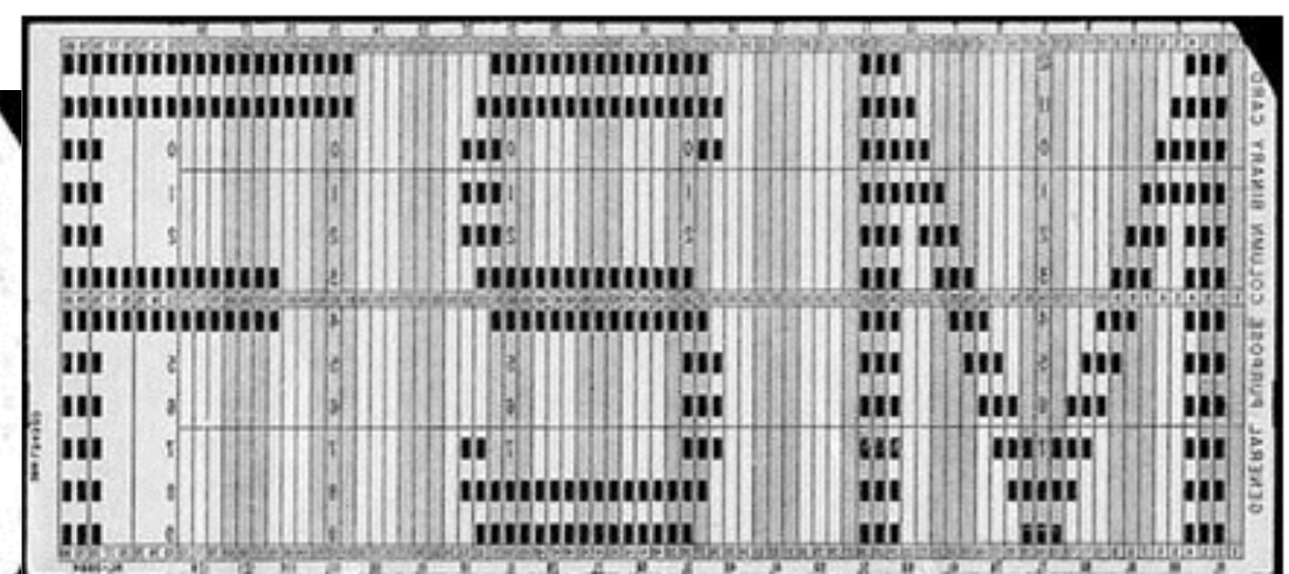
rage against the machine

FSM

"And you've got to put your bodies upon the gears and upon the wheels, upon the levers, upon all the apparatus -- and you've got to make it stop! And you've got to indicate to the people who run it, to the people who own it -- that unless you're free the machine will be prevented from working at all!!" —Mario Savio, December 2, 1964

"I am a student at the University of California. Please do not fold, spindle or mutilate me."





culture clash

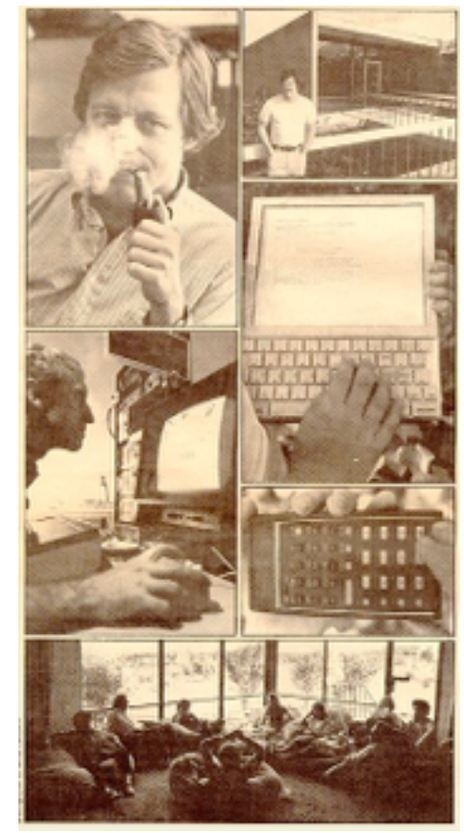
home brew, fone freaks

1975 Altair

1976 Apple 1

1983 Lisa

1984 Macintosh



Stewart Brand, "Fanatic Life and Symbolic Death Among the Computer Bums"
--*Rolling Stone*, 7 December, 1972

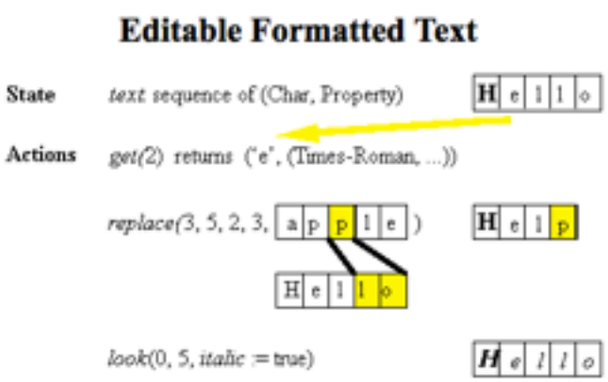
changing perceptions

killer apps

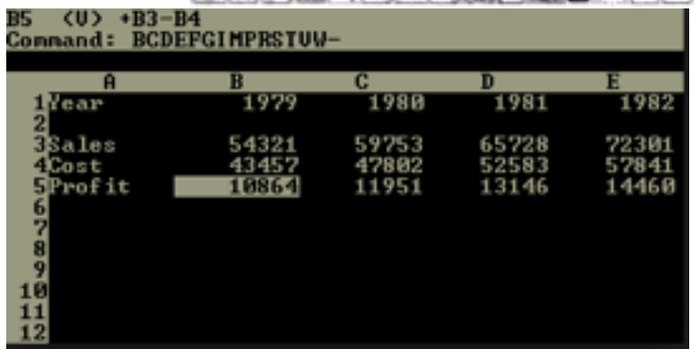
Charles Simonyi
Xerox PARC

Dan Briklin &
Bob Frankston
HBS

Bravo, 1974



Visicalc, 1978



Lotus 1-2-3, 1983

Excel (for Mac), 1984

Ken Thompson
Dennis Ritchie
Bell Labs

unix

Thompson, Ritchie, & AT&T

1965: AT&T, MIT& GE work on multics

1969: multics to unix

```
tty;
  FILENAME
  CHANGEDIRECTORY PATHNAME
```

"What we wanted to preserve was not just a good environment in which to do programming, but a system around which a fellowship could form. We knew from experience that the essence of communal computing, as supplied by remote-access, time-shared machines, is not just to type programs into a terminal instead of a keypunch, but to encourage close communication."

--Ritche, "Evolution of the Unix Time-Sharing System"

unix at ucb

Bill Joy
UCB

1973: Thompson at Berkeley

Bill Joy develops em editor

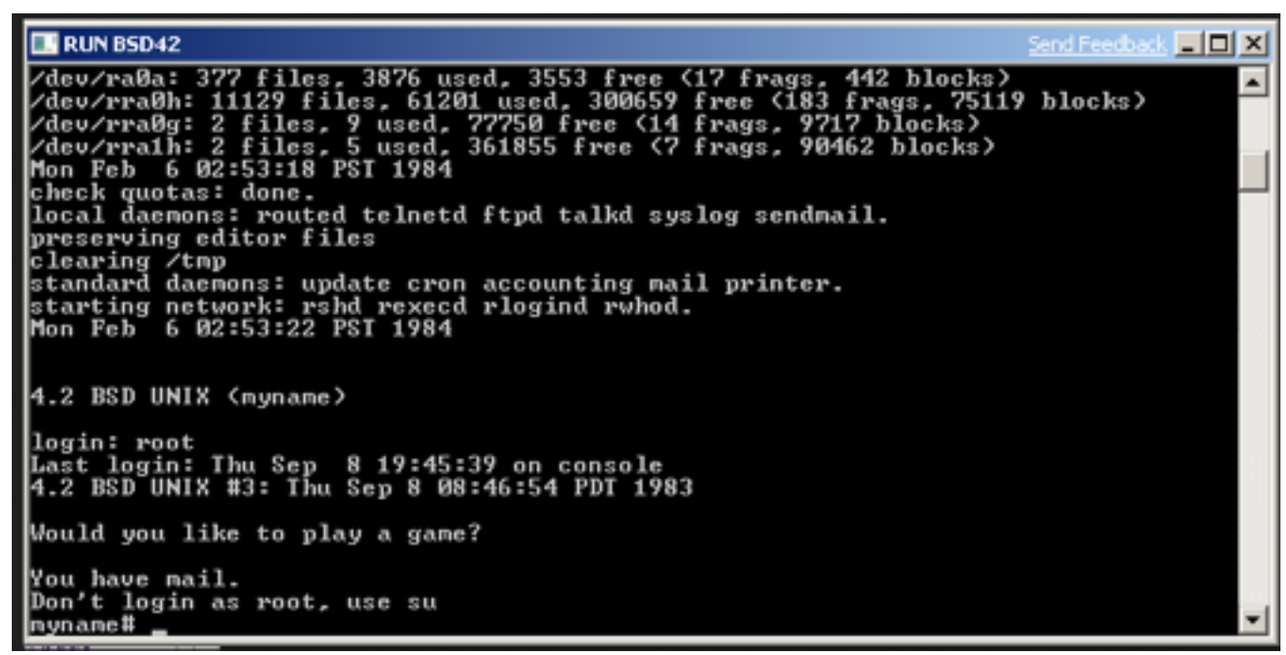
1977: 1BSD released

1979: 3BSD (for Vax)

1981: 4.1BSD

1983: 4.2 BSD
(with tcp/ip stack)

1-800-ITS-UNIX



IP(roblems)

1991: Networking release 2; 386 BSD

1992: AT&T sues UCB

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW JERSEY

UNIX SYSTEM LABORATORIES, INC. Plaintiff, vs. BERKELEY SOFTWARE DESIGN, INC., and certain named individuals in their collective capacity as The Regents of the University of California, Defendants.	Civ. No. 92-1667 O P I N I O N

1994 settlement: USL, UCB, Novell

SETTLEMENT AGREEMENT

This Settlement Agreement is entered into between UNIX System Laboratories, Inc. ("USL"), a Delaware corporation, and The Regents of the University of California (the "University"), a California corporation.

Recitals

1. USL contends it is the owner of the intellectual property rights in portions of certain computer operating system software (the "UNIX System").

2. USL and USL's predecessor in interest, the American Telephone and Telegraph Co. ("AT&T"), have licensed the University to use certain versions of UNIX® system software,

The GNU Manifesto
by
Richard Stallman

GNU, which stands for GNU's Not Unix, is the name for the complete Unix-compatible software system that I am writing so that I can give it away free to everyone who can use it. Many other programmers are helping me. Contributions of time, money, programs, and equipment are greatly needed.

So far we have a portable C and Pascal compiler which compiles for Vax and 68000, an Emacs-like text editor with Lisp for writing editor commands, a yacc-compatible parser generator, a linker, and around 35 utilities. A shell (command interpreter) is nearly completed. When the kernel and a debugger are written, by the end of 1985 I hope, it will be possible to distribute a GNU system suitable for program development. After this we will add a text formatter, an Empire game, a spreadsheet, and hundreds of other things, plus on-line documentation. We hope to supply, eventually, everything useful that normally comes with a Unix system, and more.

GNU will be able to run Unix programs, but will not be identical with Unix. We will make all improvements that are convenient, based on our experience with other operating systems. In particular, we plan to have longer filenames, file version numbers, a crashproof file system, filename completion, perhaps, and eventually, a Lisp-based window system through which several Lisp programs and ordinary Unix programs can share a screen.

GNU - March 30, 1985

Dr Dobbs Journal

elsewhere ...

```
From: torvalds@klaava.Helsinki.FI (Linus Benedict Torvalds)
Newsgroups: comp.os.minix
Subject: What would you like to see most in minix?
Summary: small poll for my new operating system
Message-ID:
Date: 25 Aug 91 20:57:08 GMT
Organization: University of Helsinki


Hello everybody out there using minix -

I'm doing a (free) operating system (just a hobby, won't be big and
professional like gnu) for 386(486) AT clones.  This has been brewing
since april, and is starting to get ready.  I'd like any feedback on
things people like/dislike in minix, as my OS resembles it somewhat
(same physical layout of the file-system (due to practical reasons)
among other things).

I've currently ported bash(1.08) and gcc(1.40), and things seem to work.
This implies that I'll get something practical within a few months, and
I'd like to know what features most people would want.  Any suggestions
are welcome, but I won't promise I'll implement them :-)

              Linus (torvalds@kruuna.helsinki.fi)

PS.  Yes - it's free of any minix code, and it has a multi-threaded fs.
It is NOT protable (uses 386 task switching etc), and it probably never
will support anything other than AT-harddisks, as that's all I have :-(.
```

natural monopoly?

Ma Bell
1876 Bell Telephone
1885 AT&T
1894 Bell Patents expire
1899 AT&T incorporates Bell
1910 AT&T buys Western Union
1913 Kingsbury (monopoly) Commitment
1915 AT&T San Francisco
1927 transatlantic telephone
1982 break up: the Baby Bells

going "open"?

WIRED

101 Ways to Save Apple

By James Daly

An assessment of what can be done to fix a once-great company.

Dear Apple,

In the movie *Independence Day*, a PowerBook saves the earth from destruction. Now it's t you look a little beleaguered these days: a confusing product line, little inspiration from the

But who wants to live in a world without you? Not us. So we surveyed a cross section of har salvation. We chose not to resort to time travel or regurgitate the same old shoulda/could your price/performance in 1993).

We don't believe Apple is rotten to the core. Chrysler nearly went under in the late 1970s a to fix your once-great company using the material at hand. Don't wait for a miracle. You ha

Edited by James Daly

1. Admit it. You're out of the hardware game. Outsource your hardware production, or se manufacturing boxes.

2. License the Apple name/technology to appliance manufacturers and build GUIs fo them all use the same communications protocol. Result: you monopolize the market for sma

ANDROID

up ahead

9 April: Advent of the Internet

Required Reading

Berners-Lee, Tim. 2000. "info.cern.ch." Chapters 1-3 in *Weaving the Web*. New York City: HarperCollins.
Read: pp. 266-279.
Source: Course reader.

Additional Materials

Leiner, Barry M., Vinton G. Cerf, David D. Clark, Robert E. Kahn, Leonard Kleinrock, Daniel C. Lynch, Jon Postel, Larry G. Roberts, Stephen Wolff, "A Brief History of the Internet," *The Internet Society.*
Source: The Internet Society [hyperlink].