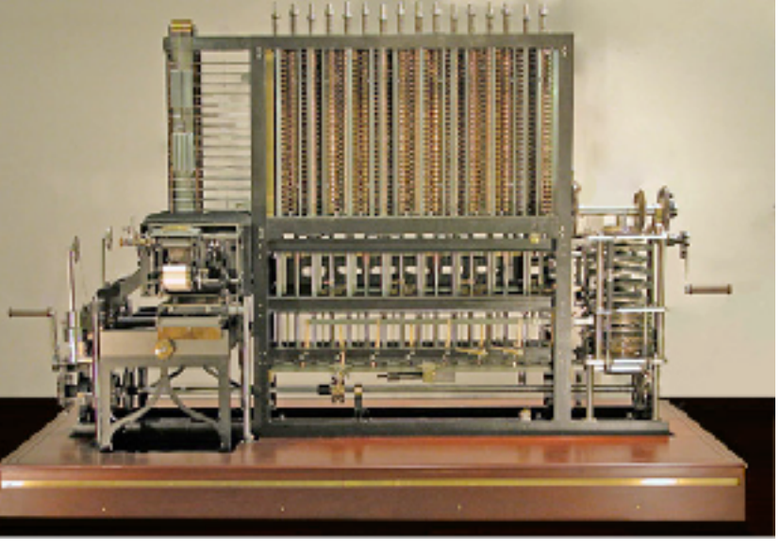


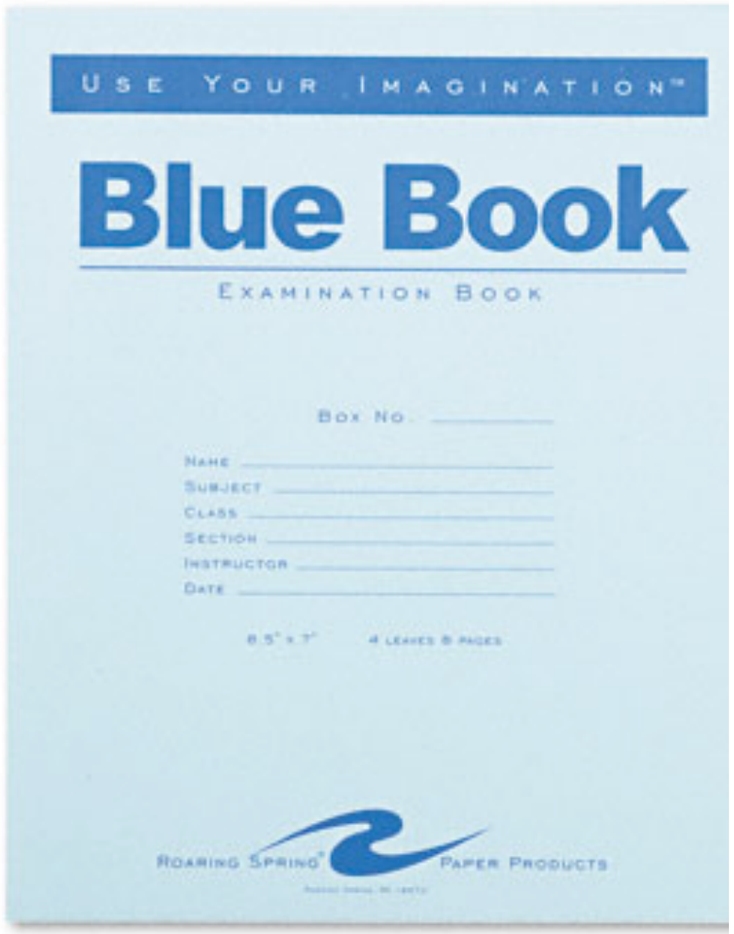
computer "revolution"

History of Information

March 31, 2017

Exam: Thursday
9:30 - 11:00

don't forget



Computer "Revolution"

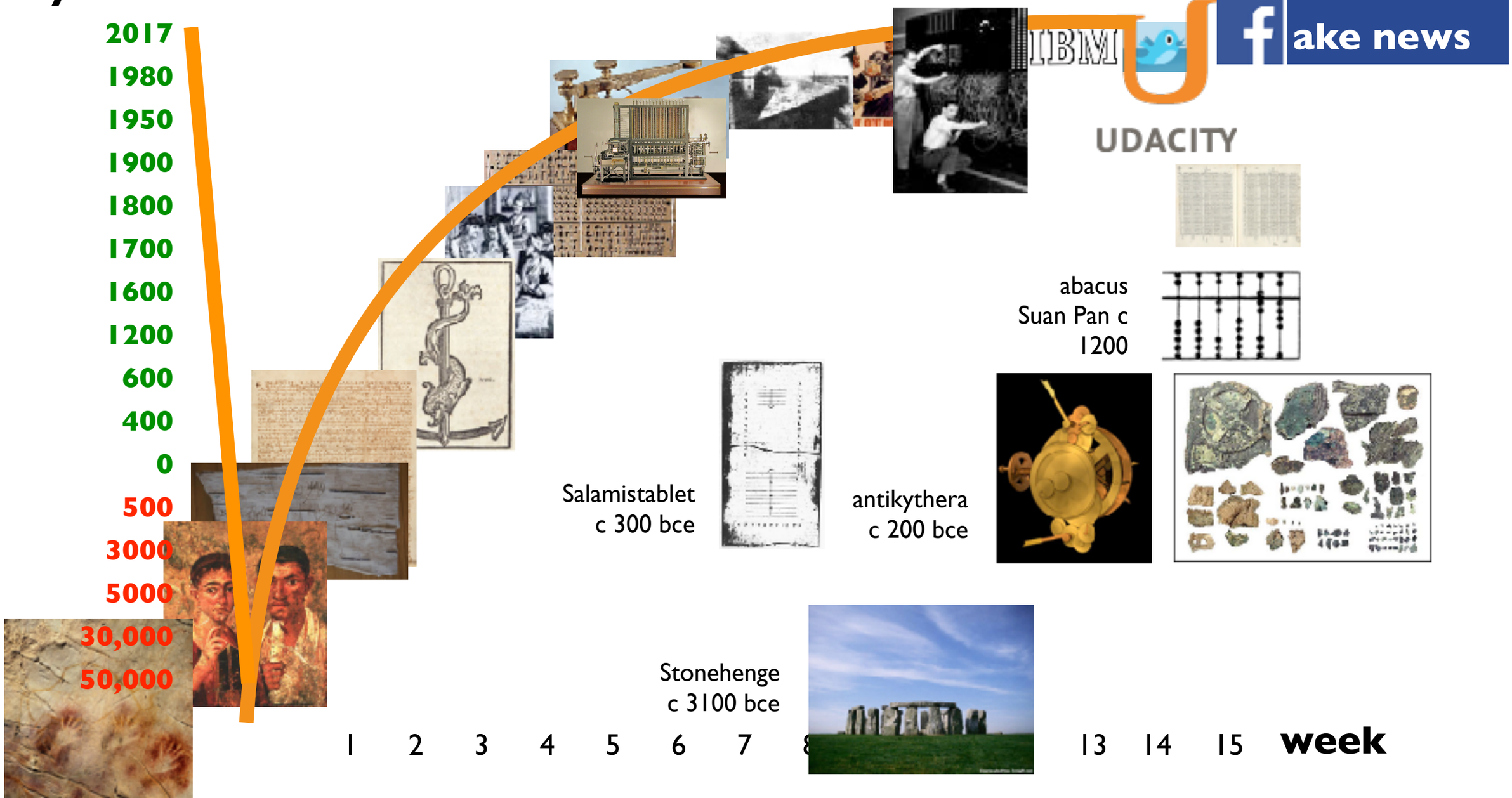
where are we?

Computer "Revolution"

not so fast

year

2017
1980
1950
1900
1800
1700
1600
1200
600
400
0
500
3000
5000
30,000
50,000



IBM

fake news

UDACITY

abacus
Suan Pan c
1200

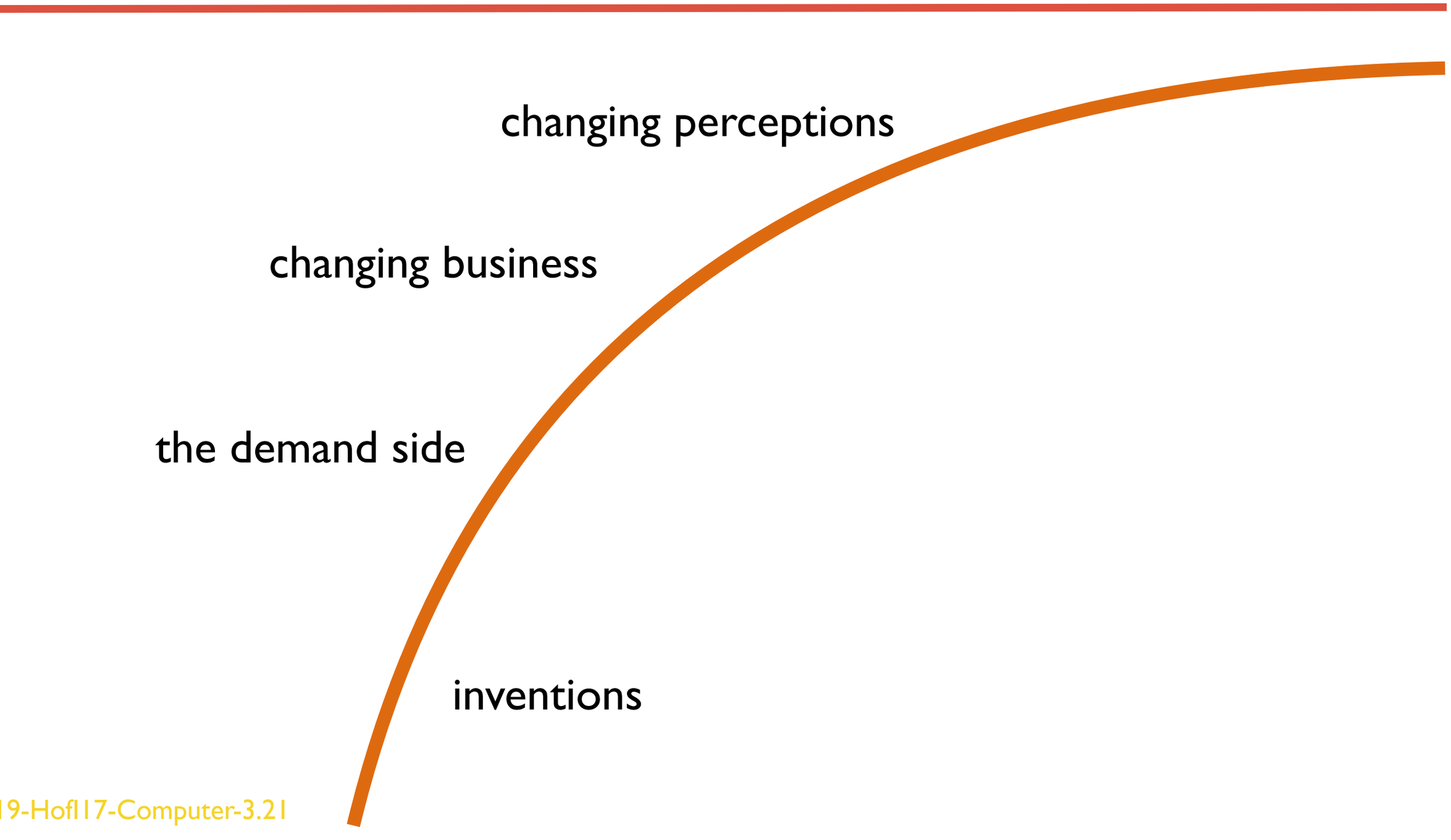
Salamistablet
c 300 bce

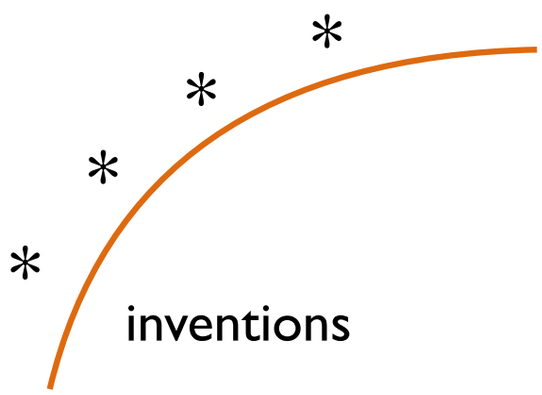
antikythera
c 200 bce

Stonehenge
c 3100 bce

1 2 3 4 5 6 7 8 13 14 15 **week**

Computer "Revolution"





Inventions … are almost always born out of a process that is more like farming than magic. From a complex ecology…that includes the condition of the intellectual soil, the political climate, the state of technical competence …

—Szarkowski, *Photography Until Now.*

invention to innovation

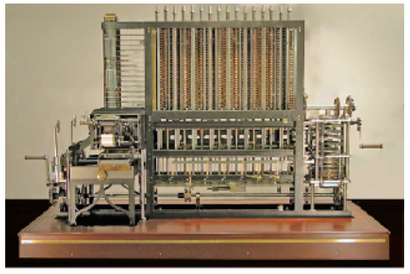
"The invention [of television] was no single event. ... a very complex interaction between new needs and new inventions ... **military ... government ... corporate** interests ... ."

-- 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



when was *the* computer?

Inventions	Technology	Applications	Media	Genres
cog	“computer” or “engine”	calculating	engines	tables
clock		registering	mainframe	ballistics
logarithm		sorting	desktop	accounting
loom		controlling …	cars …	registration
governors …			laptop	logistics …
vacuum tube			the net	bbs
transistor			the web	email
chip …			phones	social networks
genes			tablets	
			the cloud	

"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.

when was *the* computer?

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

Napier 1617

Schickard 1623

Pascal 1642

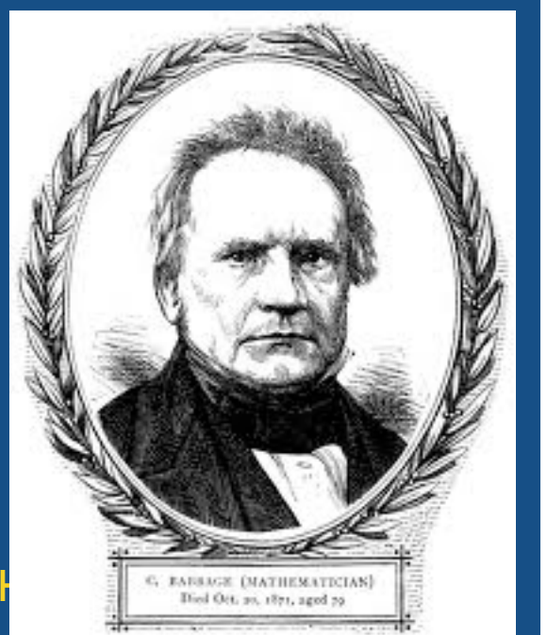
who invented *the* computer?

Leibniz 1671

cybersaints

"If I were to choose a patron saint for cybernetics … Leibniz… like his predecessor Pascal"

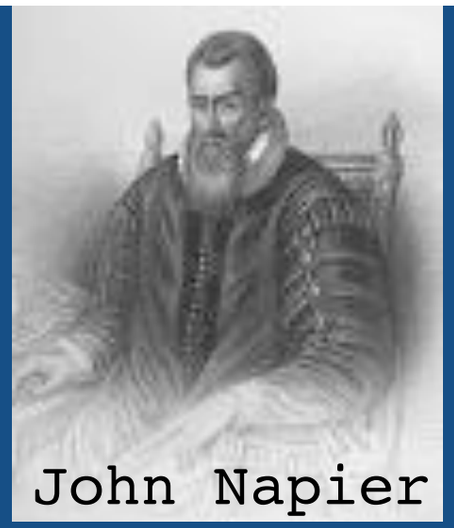
—Norbert Wiener, *Cybernetics* 1948



inventions

"I wish to God these calculations had been executed by steam" —Babbage, 1821

computing

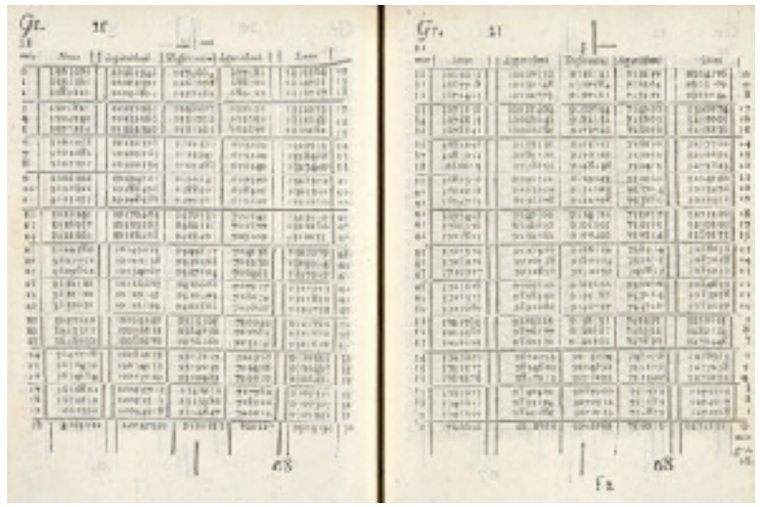


John Napier
1550–1617

Charles Babbage
RS, 1791–1871

John Napier
(a 'computer')

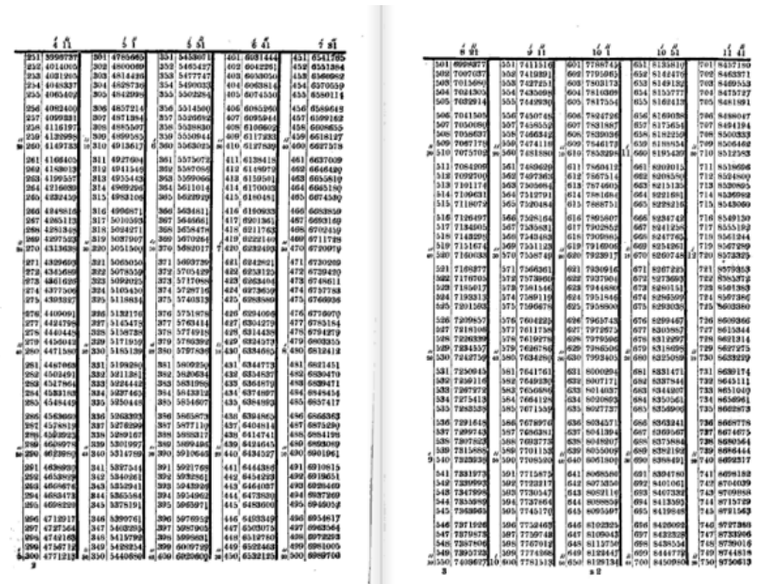
Mirifici Logarithmorum Canonis Descriptio, 1614

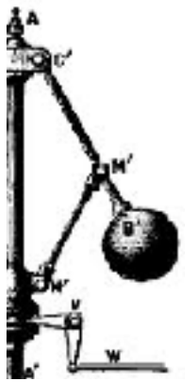


$x^a \cdot x^b = x^{(a+b)}$

Charles Babbage

Table of Logarithms from 1 to 108000
1827





on the economy of machinery and manufactures

an international perspective

1: Sources of the Advantages Arising from Machinery	7: Exerting Forces too great for human power; and executing operations too delicate for human touch
2: Accumulating Power	**8: Registering Operations**
3: Regulating Power "that beautiful contrivance, the steam governor…"	9: Economy of the materials employed
4: Increase and diminution of velocity	10: Of the identity of the work when it is of the same kind, and its accuracy when of different kinds
5: Extending the time of action of forces "watches & clocks … automatons"	11: Of copying
6: Saving time in natural operations	12: On the method of observing manufacturies
	…
	19: On the division of labor
	20 On the mental division of labour

o
machinery c

an international perspective

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: Exe
and e
touch
8: R
9: Ecc
10: C
same
kinds
11: C
12: C
...
19: C
20 C

J. C. ["Maestro"] Maxwell, "On Governors," RS, 1868

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

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

and that of M

$$\frac{d}{dt}\left(M\frac{dx}{dt}\right)=P-R-F\left(\frac{dx}{dt}-V\right)+Gy, \quad . \quad . \quad . \quad . \quad . \quad (4)$$

where G is the resistance applied by B when B moves through one unit of space.

[*] "On Uniform Rotation," Phil. Trans. 1866, p. 657.

what to register

pedometer

turns by the wheel of a carriage

number of strokes of a steam engine

coins struck by a press

watchman … tell-tale

gauging of casks

gas meters

water meters

barometer

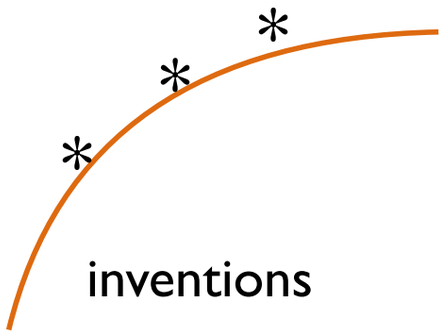
quantity of rain

traction of horses

number of vibrations

alarms

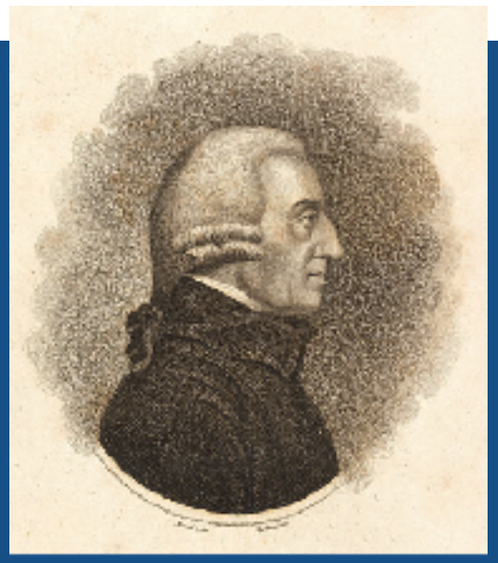
glass vase …



19: On the division of labor

20: On the mental division of labour

divisions and combinations



Adam Ferguson
1723-1816

automata, computer, copying, registering

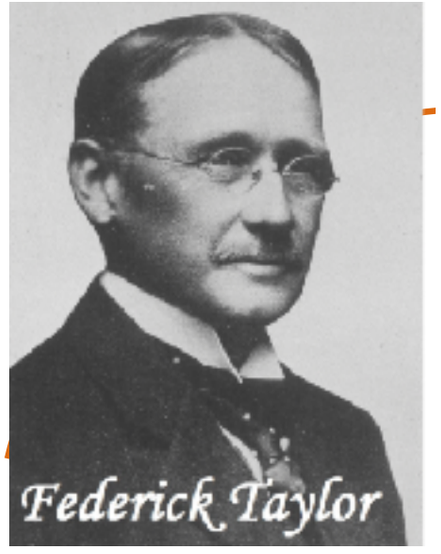
the "hands" --manual division of labor, pin-making

—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



"labour indeed worthy of Hercules .. to give back to the world something so heavenly … to dig up what is buried, to call back the dead, to repair what is mutilated, **to correct what is corrupted … especially by the fault of those common printers who reckon … profit worth more than the whole realm of letters**"

between Erasmus & Taylor

"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."

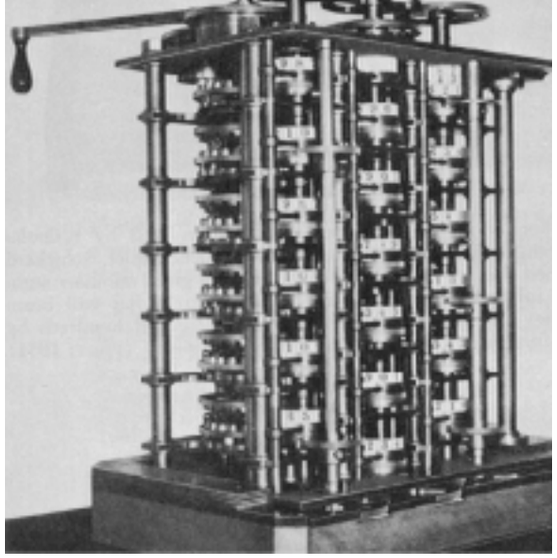
—Adam Ferguson, *Essay on the History of Civil Society*, 1767

"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

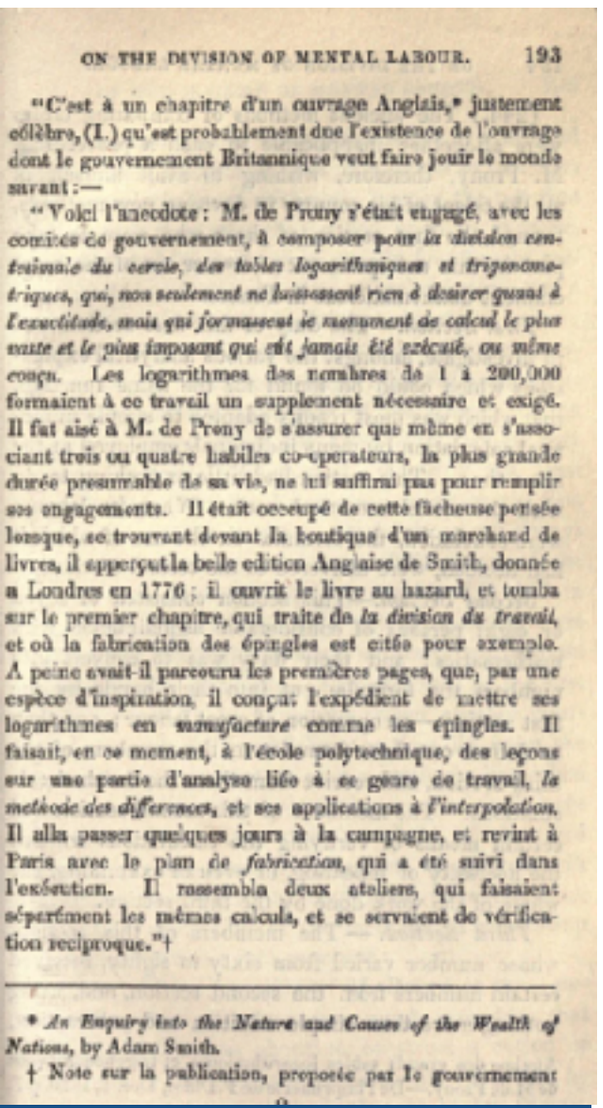
"a substitute for the compositor and the computer."

— Charles Babbage, "Letter to Humphrey Davy" 1822



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

differences



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 centésimale du cercle, des tables logarithmiques et trigonométriques, qui, non seulement ne laissassent rien à désirer 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 supplément nécessaire et exigé. Il fut aisé à M. de Prony de s'assurer que même en s'associant trois ou quatre habiles co-opérateurs, la plus grande durée présumable de sa vie, ne lui suffirait pas pour remplir ses engagements. Il était occupé de cette fâcheuse pensée lorsque, se trouvant devant la boutique d'un marchand de livres, il aperçut la belle édition Anglaise de Smith, donnée à 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 méthode des différences*, 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 réciproque."†

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

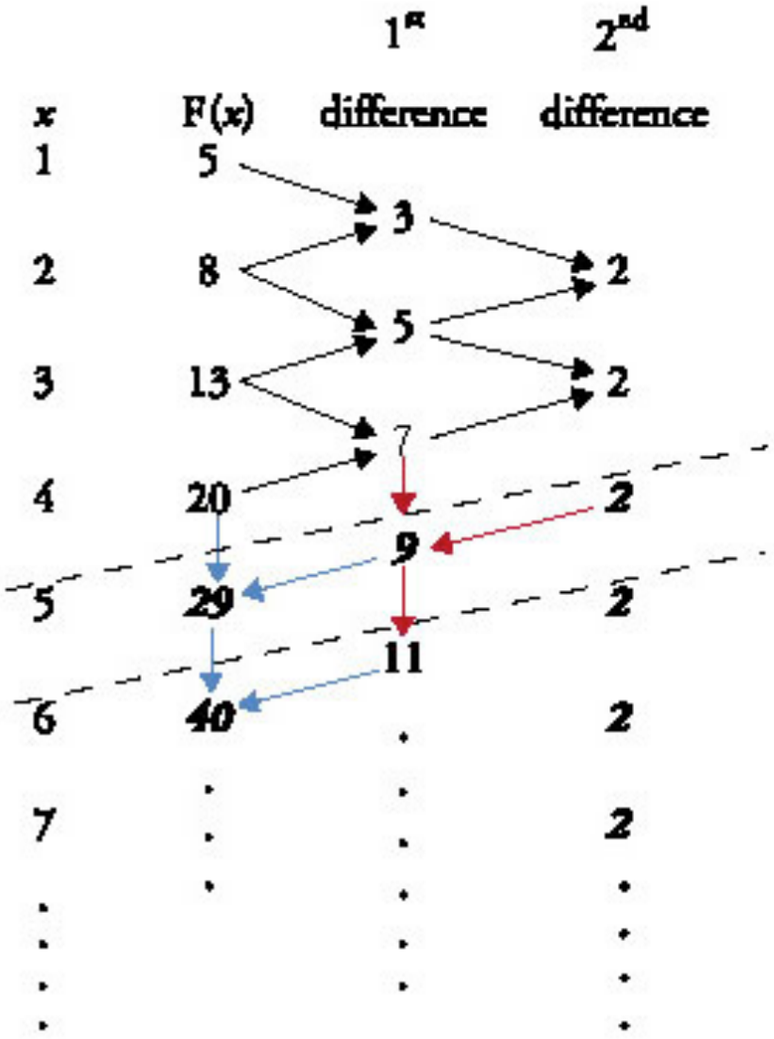
† Note sur la publication, proposée par le gouvernement

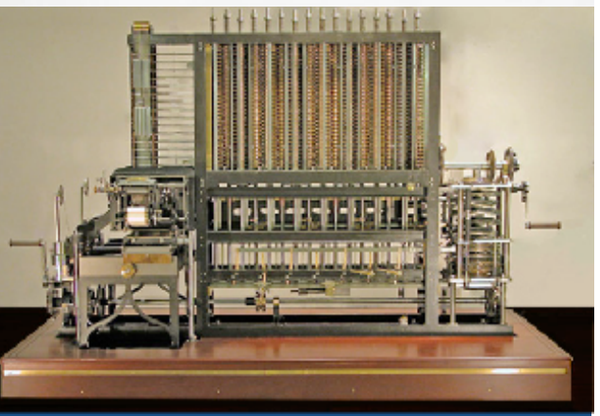
200 ON THE DIVISION OF MENTAL LABOUR.

TABLE.

Repetitions of Process.	Movements.	Clock A. Hand set to I.	Clock B. Hand set to III.	Clock C. Hand set to II.
			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

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





difference to analytical engine

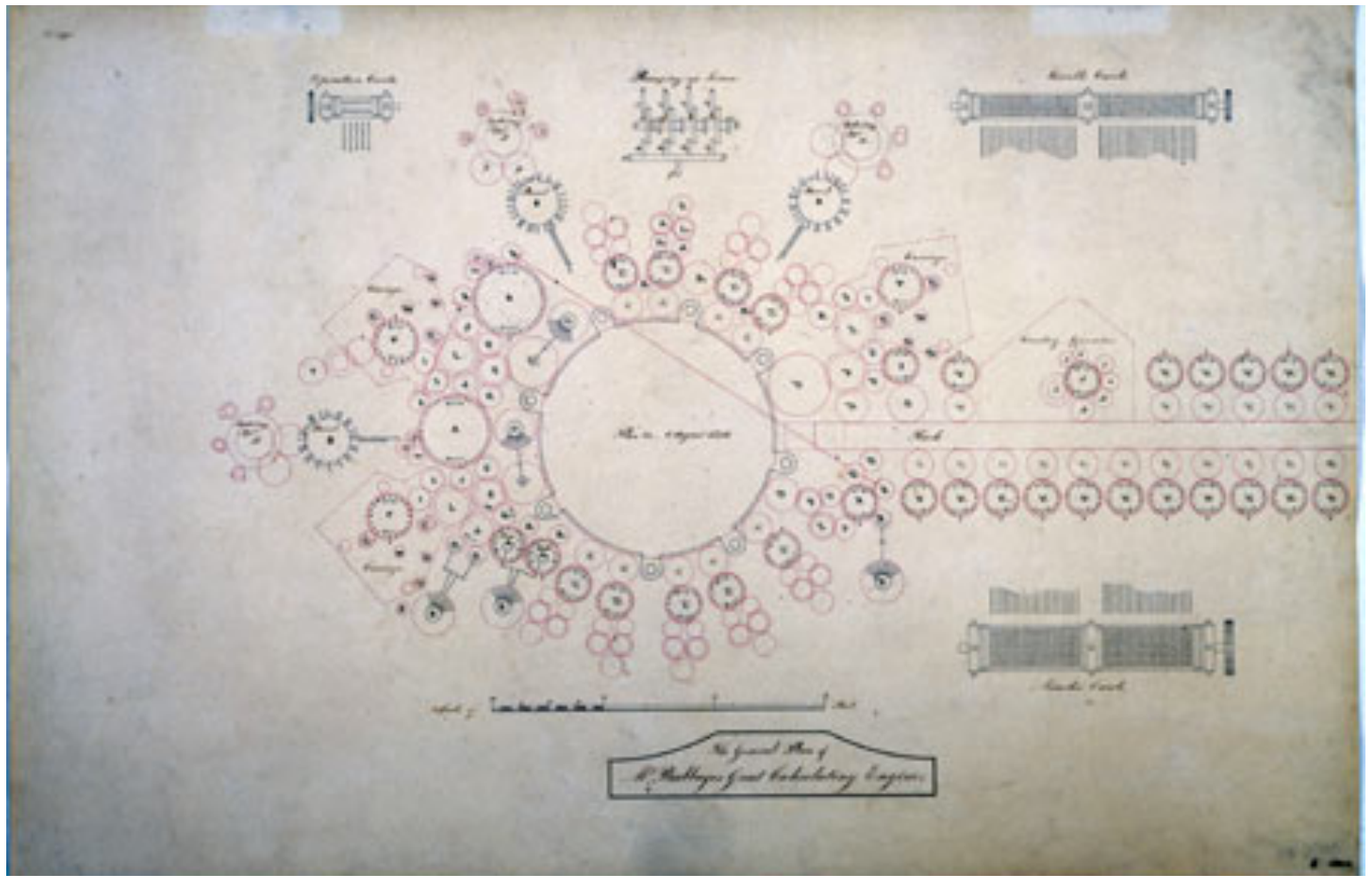
general purpose machine

programmable

storing

looping

branching



on the cards


FILETS
Nivet
de Montage
4e chaine
Fils impairs
Fils pairs
2e chaine
Fils impairs
Fils Pairs
3e chaine
Fils impairs
Fils pairs
4e chaine

on the cards

foresight

Ada Lovelace
1815-1852

"although it is not itself the being that reflects, it may yet be considered as the being which executes the conceptions of intelligence"

—Menabrea

"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

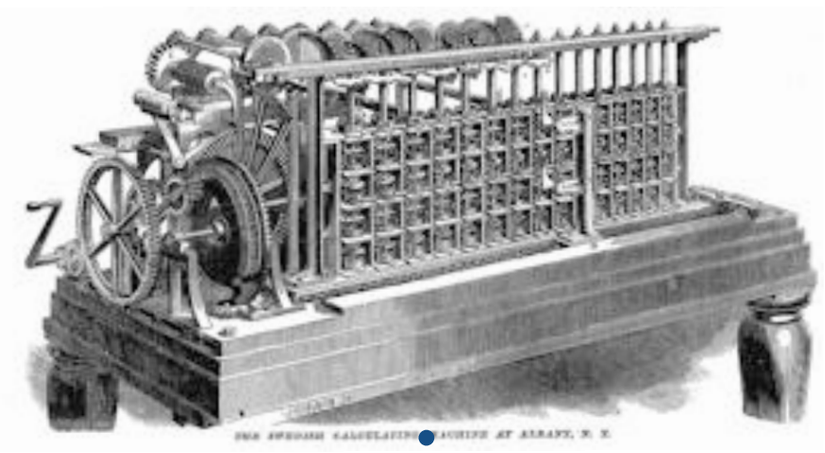
Thamus reborn?

[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



difference engines

Georg Scheutz
1785–1873

Edvard Scheutz
1822–1881

spreading the word

Scheutz Difference Engine, with printer c 1843

stepping westward

Dudley Observatory, Schenectady, 1857

lifelong calculations

"English Life Table" 1864

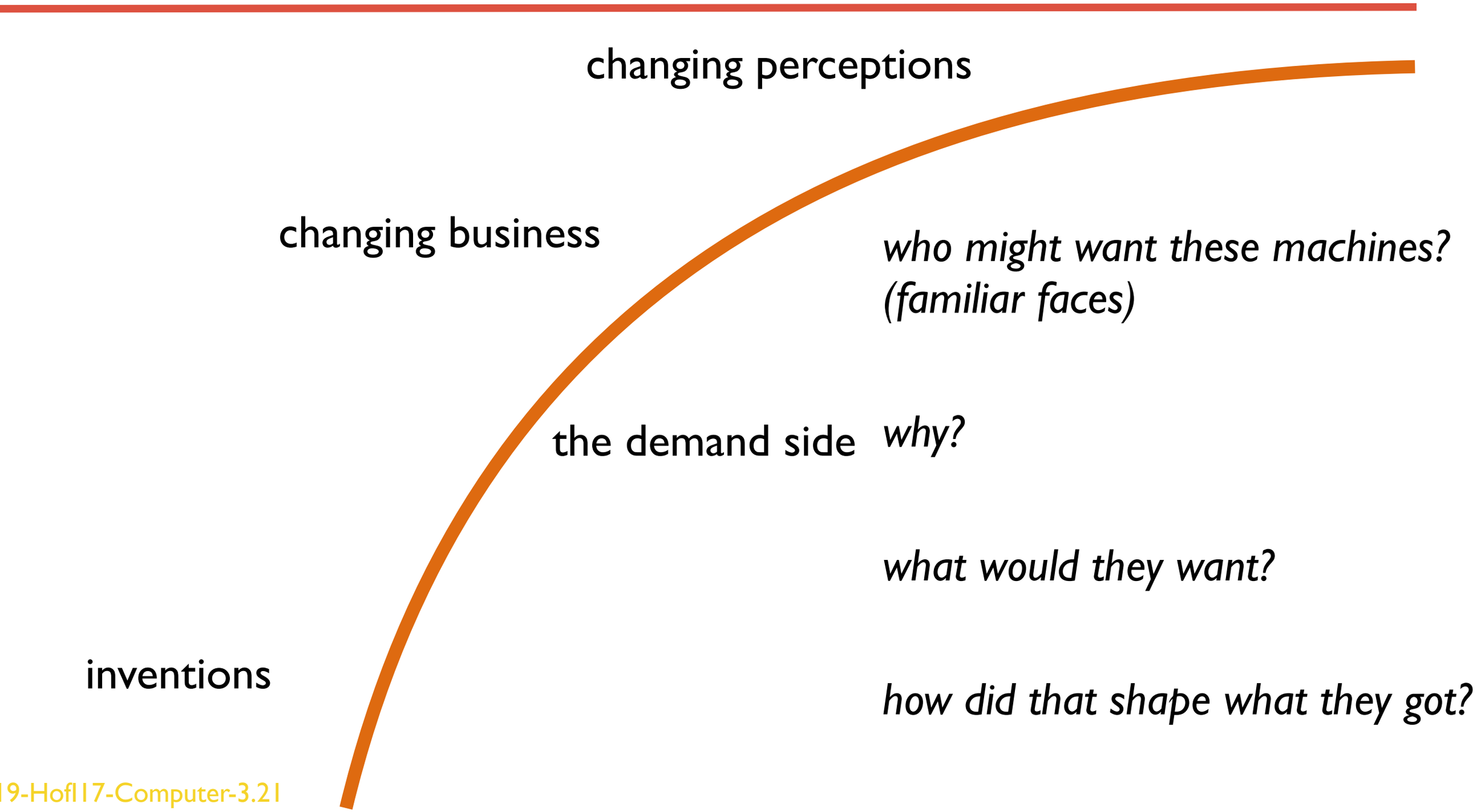
tide predictor, 1872

William Thomson, Lord Kelvin (1824-1907)

weather predictions,1922 [1916]
Lewis Fry Richardson (1881-1953)

Computer "Revolution"

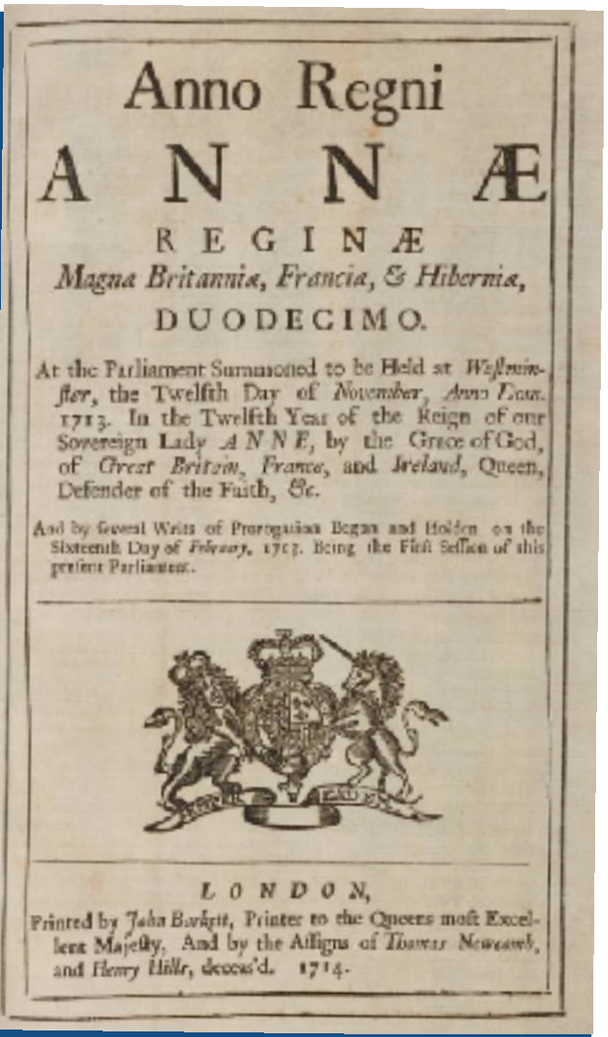
"… the surveyor, the architect, the builder, the carpenter, the miner, the gauger, the naval architect, the engineer, civil and military … interest, discount, and exchange ” —Lardner



"The tables of powers and products published at the expense of the Board of Longitude" — Babbage

"Astronomy … navigation … a country … inseparably connected to navigation " — Lardner

scientific calculation



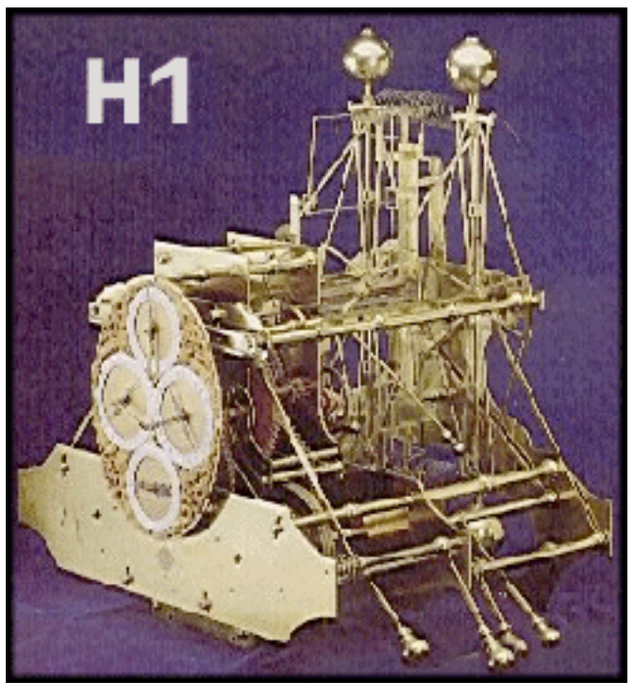
Anno Regni
ANNÆ
REGINÆ
Magna Britanniæ, Franciæ, & Hiberniæ,
DUODECIMO.

At the Parliament Summoned to be Held at *Westminster*, the Twelfth Day of *November*, *Anno Dom.* 1713. In the Twelfth Year of the Reign of our Sovereign Lady *ANNE*, by the Grace of God, of *Great Britain*, *France*, and *Ireland*, Queen, Defender of the Faith, &c.

And by Several Writs of Prorogation Began and Holden on the Sixteenth Day of *February*, 1713. Being the First Session of this present Parliament.

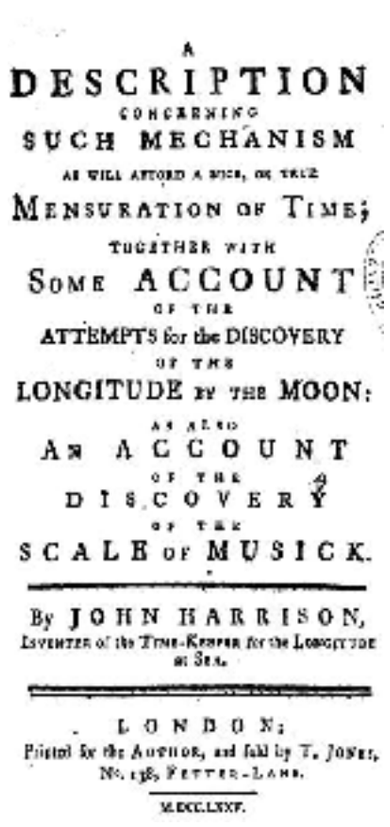
LONDON,
Printed by *John Barkett*, Printer to the Queens most Excellent Majesty. And by the Assigns of *Thomas Newcomb*, and *Henry Hills*, deceas'd. 1714.

John Harrison
1693-1776



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

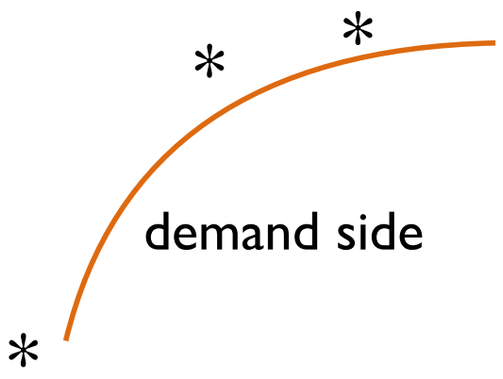
LONDON:
Printed by T. and J. W. PATTEN, in Black-Friars, and Sold by the BOOKSELLERS, in London and Westminster. MDCCXLIII.
[Price One Shilling.]



A
DESCRIPTION
CONCERNING
SUCH MECHANISM
AS WILL AFFORD A NICE, OR TRUE
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. 138, FETTER-LANE.
M.DCC.LXXX.



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

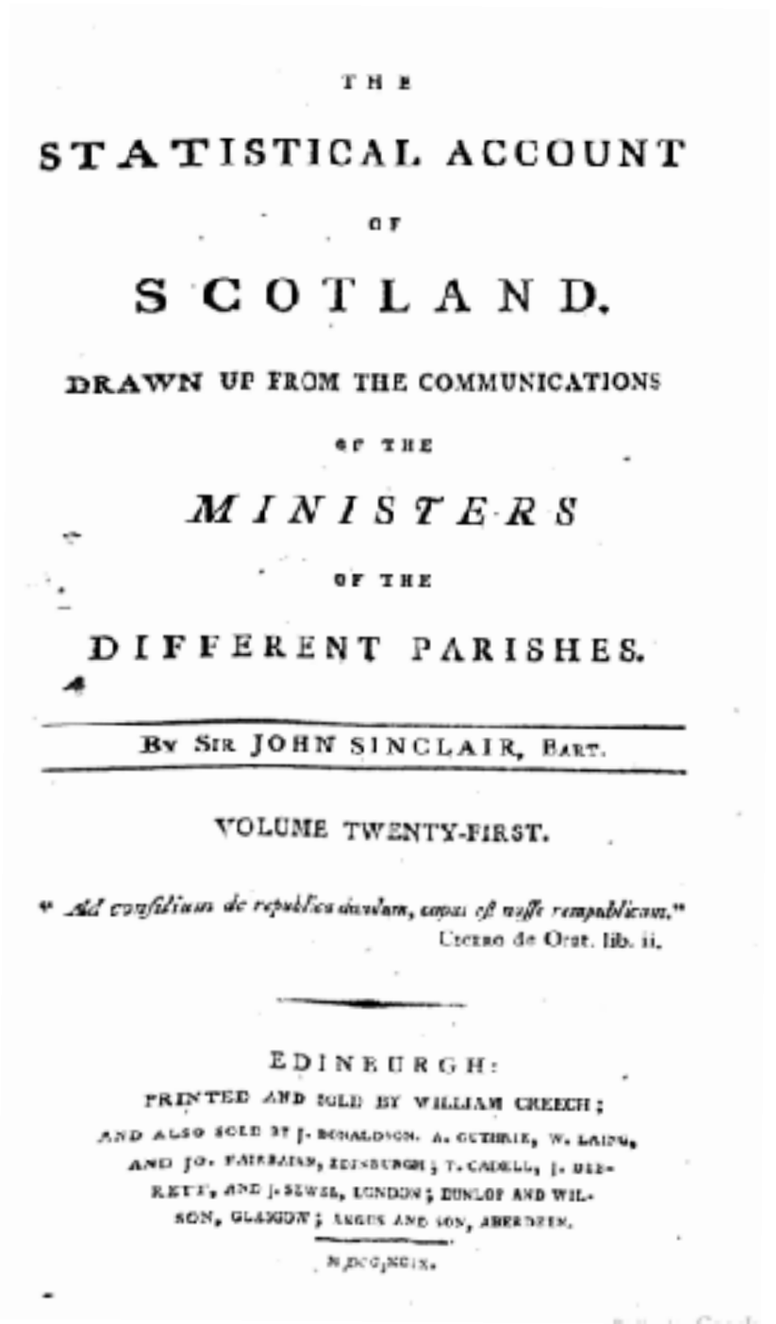
—John Sinclair

statistical accounts

"*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.

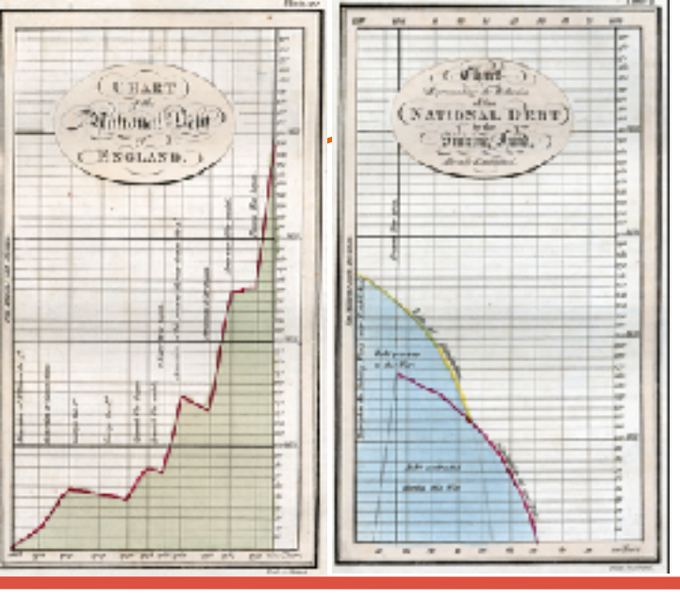
VOLUME TWENTY-FIRST.

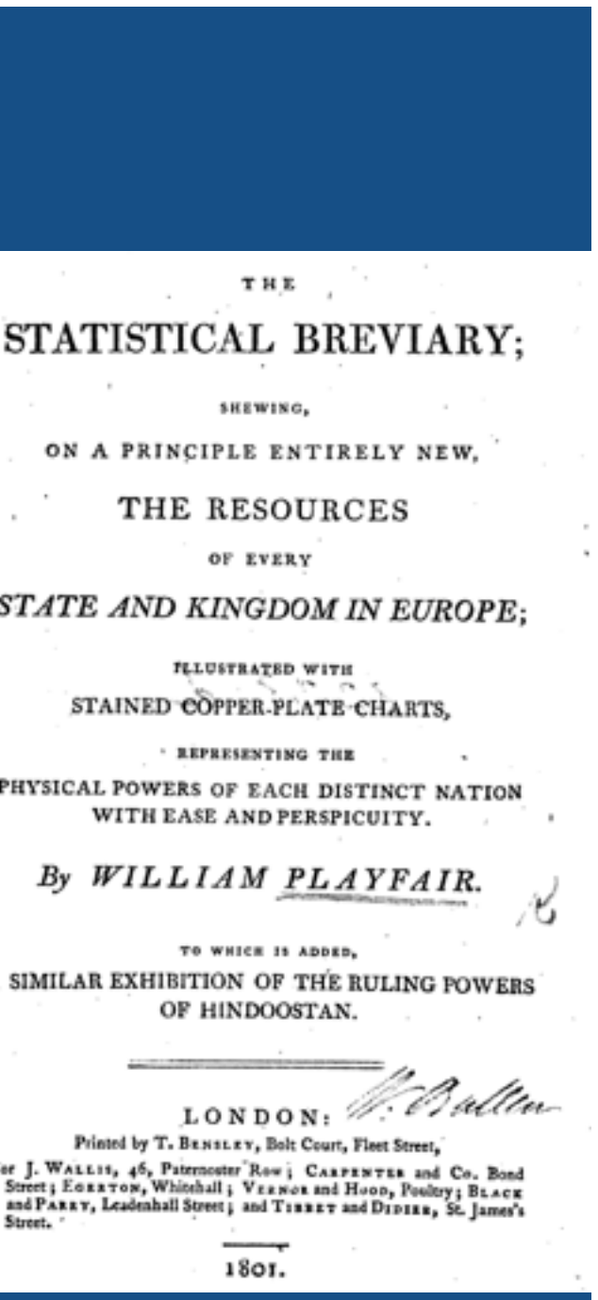
"*Ad consilium de republica dandum, capax est nisi reipublicæ.*"
Cicero de Orat. lib. ii.

EDINBURGH:
PRINTED AND SOLD BY WILLIAM CREECH;
AND ALSO SOLD BY J. BONALDSON, 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.

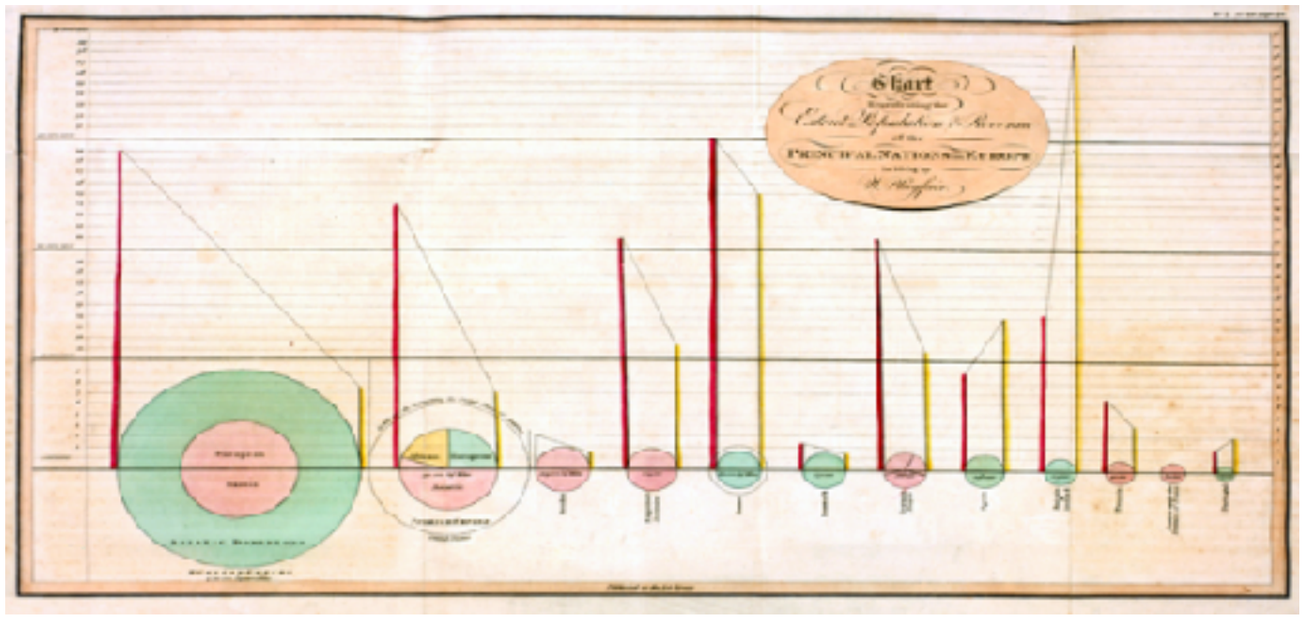
TO WHICH IS ADDED,

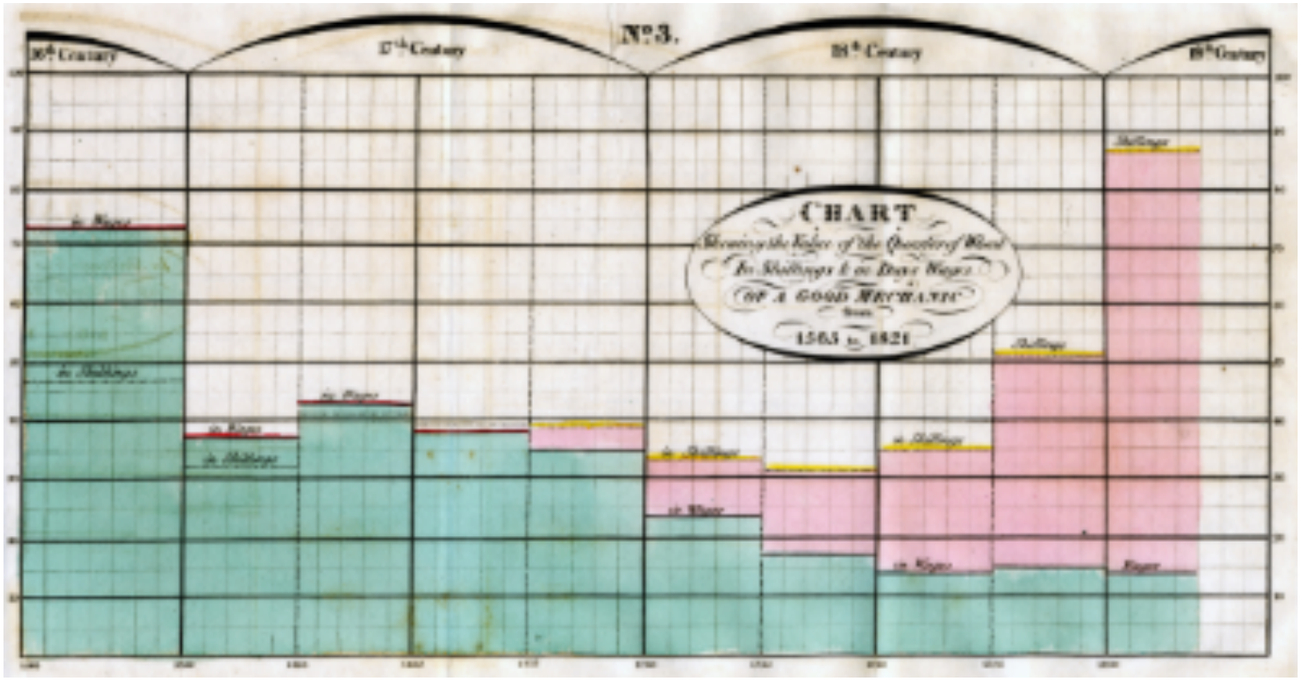
SIMILAR EXHIBITION OF THE RULING POWERS
OF HINDOOSTAN.

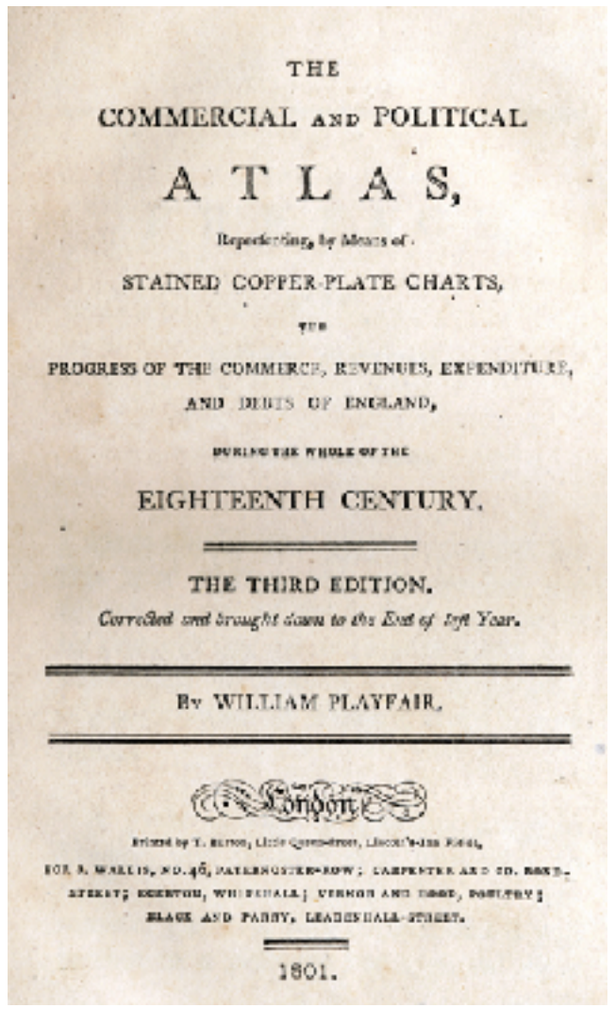
LONDON:

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 Tibbet 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 1st 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.

"tables of interest, discount, and exchange, tables of annuities, and other tables necessary in life insurances; tables of rates of various kinds necessary in general commerce" —Lardner

"time is money" —Franklin

business interests

sorting operation: the cogs in the clearing house wheel

"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

business IT

carbon paper
Wedgewood, 1806

typewriter
Remington, 1874

calculator
Burroughs,1892

cash *register*
mechanical register, 1884

"against the inattention, the idleness, or the dishonesty of human agents." —Babbage

demand side

"Situation wanted—by lady, rapid stenographer and typewriter."

— *New York Herald* 1884

information processors

clerks (UK)

1871: 262,100

1891: 534,622

1911: 918,186

female clerks

1891: 17,859

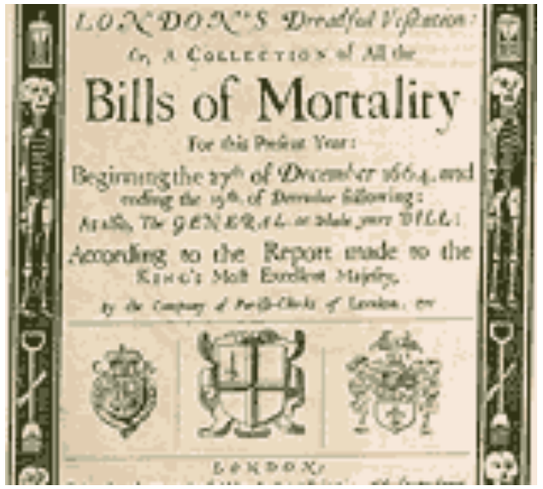
1911: 117,057

1921, women 46% of all clerks

typewriter girls

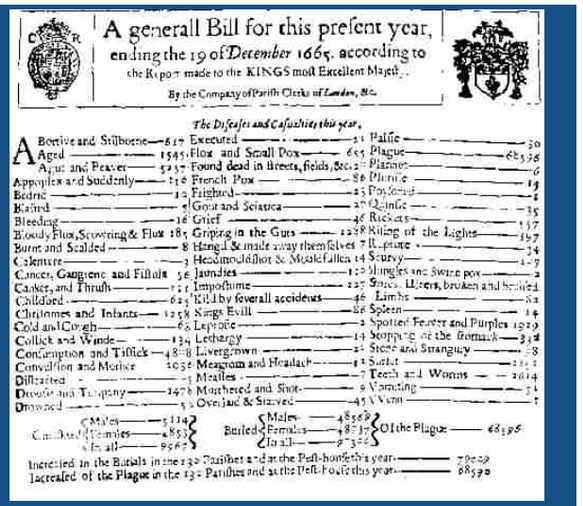
1931, 212,296 female typists

5,155 male typists


LONDON'S Dreadful Visitation:
Or, A COLLECTION of All the
Bills of Mortality
For this Present Year:
Beginning the 27th of December 1664, and ending the 19th of December following:
Wherein, The GENERAL or whole year's BILL:
According to the Report made to the KING's Most Excellent Majesty,
by the Company of Parish-Clerks of London, &c

"The Mortality Bill is come to 267" —Pepys

government registration

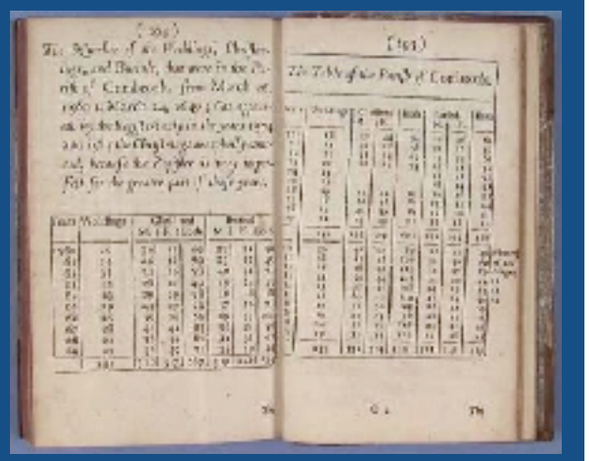

A generall Bill for this present year, ending the 19 of December 1665. according to the Report made to the KINGS most Excellent Majest..
By the Company of Parish Clerks of London, &c.

The Diseases and Casualties this year,

Abortive and Stillborne	617	Executed	21	Palsie	50
Aged	1545	Flox and Small Pox	655	Plague	68596
Ague and Feaver	5257	Found dead in Streets, fields, &c.	18	Planet	6
Appoplex and Suddenly	116	French Pox	86	Plurisie	19
Bedrid	12	Frighted	23	Poysoned	4
Blasted	5	Gout and Sciatica	27	Quinsie	35
Bleeding	36	Grief	46	Rickets	557
Bloody Flux, Scowring & Flux	185	Griping in the Guts	1288	Riling of the Lights	1917
Burnt and Scalded	8	Hang'd & made away themselves	7	Rupture	34
Calenture	2	Headmould-shot & Mould-fallen	14	Scurvy	17
Cancer, Gangrene and Fistula	56	Jaundice	110	Shingles and Swine pox	2
Canker, and Thrush	111	Impostume	227	Sores, Ulcers, broken and Scabbed	
Childbed	625	Kill'd by severall accidents	46	Limbs	82
Chrisomes and Infants	1258	Kings Evill	86	Spleen	14
Cold and Cough	65	Leprosie	2	Spotted Feaver and Purples	1929
Collick and Winde	134	Lethargy	14	Stopping of the Stomach	331
Consumption and Tissick	4808	Livergrown	21	Stone and Strangury	98
Convulsion and Mother	1036	Meagrom and Headach	8	Suddat	11
Distracted	5	Measles	7	Teeth and Worms	2614
Dropsie and Tympany	1478	Murthered and Shot	9	Vomiting	14
Drowned	50	Overlaid & Starved	45	Worm	7

Christened: Males 5114, Females 4853, In all 9967
Buried: Males 48568, Females 43717, In all 92285
Of the Plague 68596

Increased in the Burials in the 130 Parishes and at the Pest-house this year 70630
Increased of the Plague in the 130 Parishes and at the Pest-house this year 68590



bills of mortality

births & marriages

parish members

population

"[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.

taxpayers

military eligible

aliens

racial groups

the poor

professions

midwives

prostitutes

cars

'National Insurance'

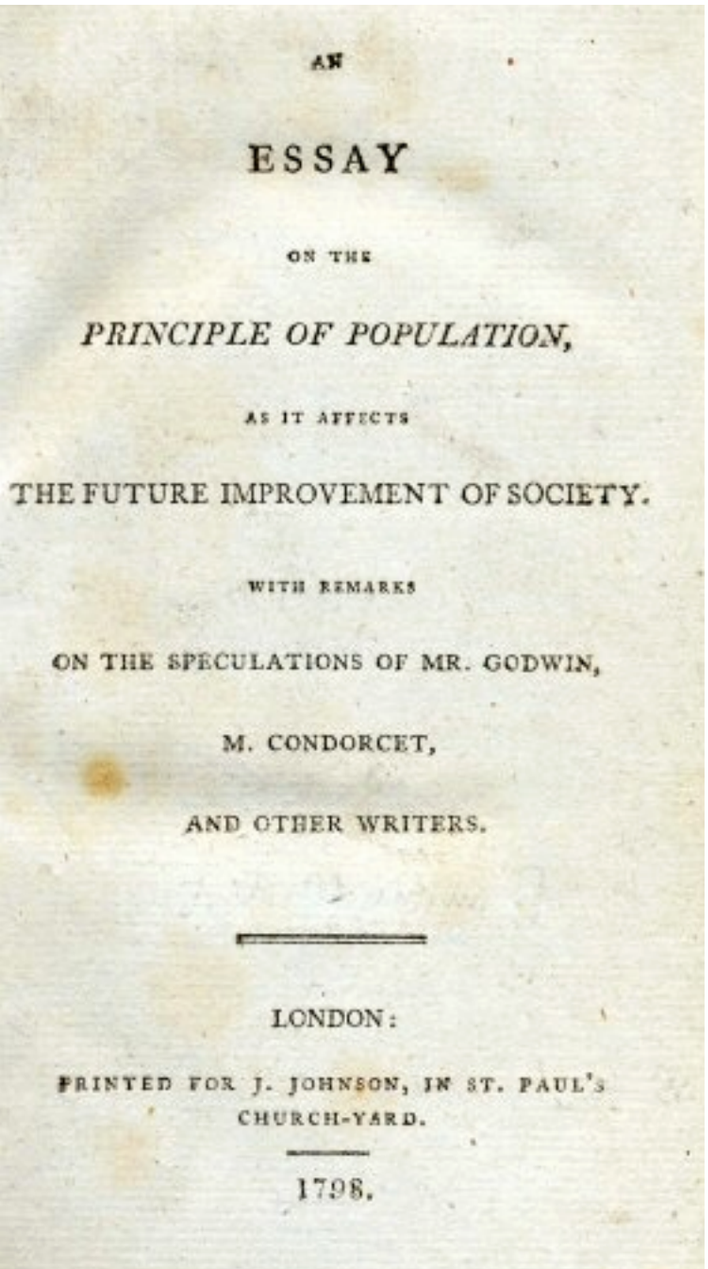
social security

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."

big data

s



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.

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	-	-	

demand side

tabulating tools

Herman Hollerith
1860–1929

Hollerith

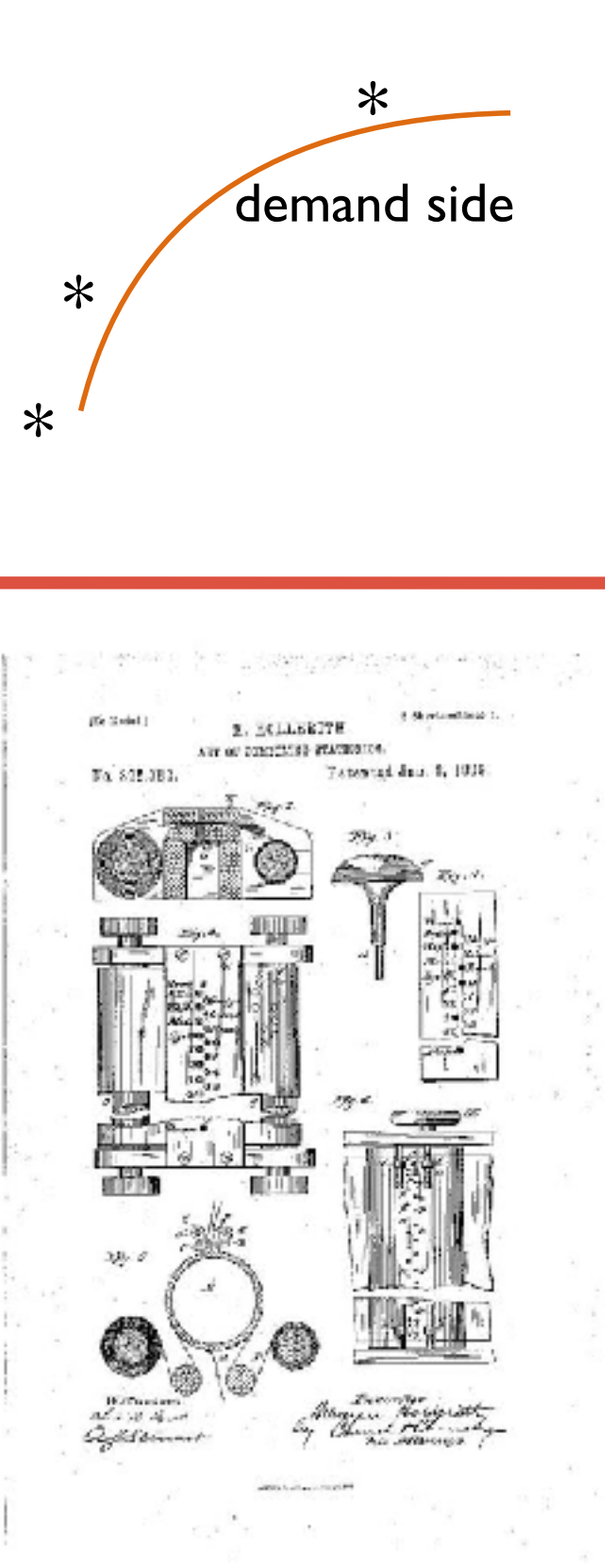
Electronic Tabulating Machine

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 … managed to maintain a near monopoly by periodically filing for new key patents or by acquiring those of unsuccessful rivals." -- Mounier-Kuhn,2012

supply & demand: business & government

Hollerith

Tabulating Machine Company

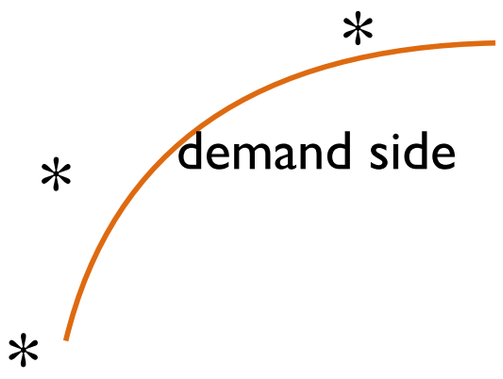
CTR:
Computing-Tabulating-Recording Company

Thomas Watson
NCR to CTR to ...

IBM to pay more than $30m in compensation for census fail, Prime Minister Malcolm Turnbull suggests

By political reporter Henry Belot

Updated 24 Nov 2016, 9:24pm



a 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

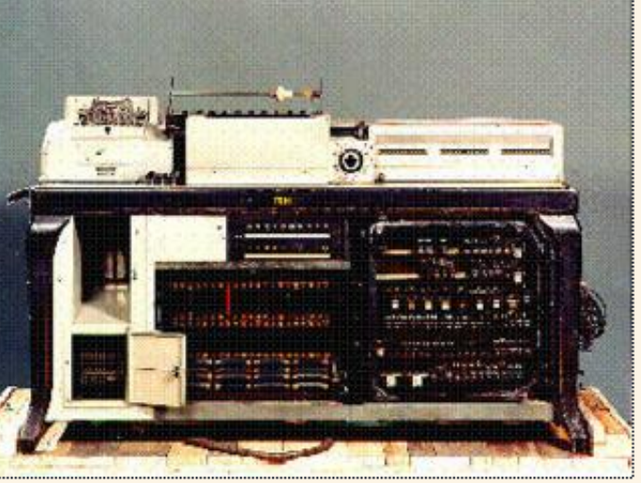
To provide for the general welfare by establishing a system of Federal old-age benefits, and by enabling the several States to make more adequate provision for aged persons, blind persons, dependent and crippled children, maternal and child welfare, public health, and the administration of their unemployment 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

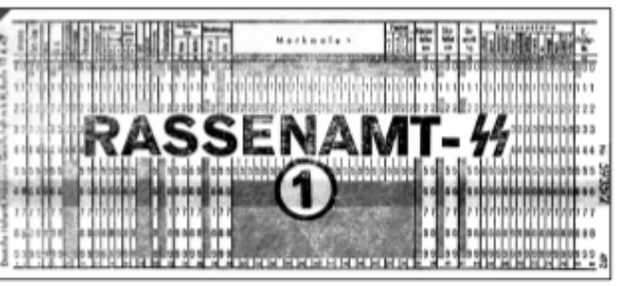
APPROPRIATION

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

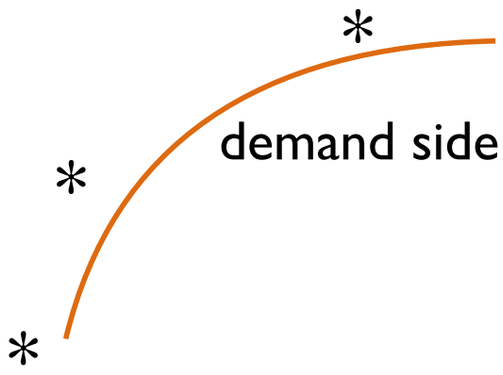
Labor Book, 1935

Health Pedigree book, 1936

Registry of the Populace, 1939

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

Personal Identification Number, 1944

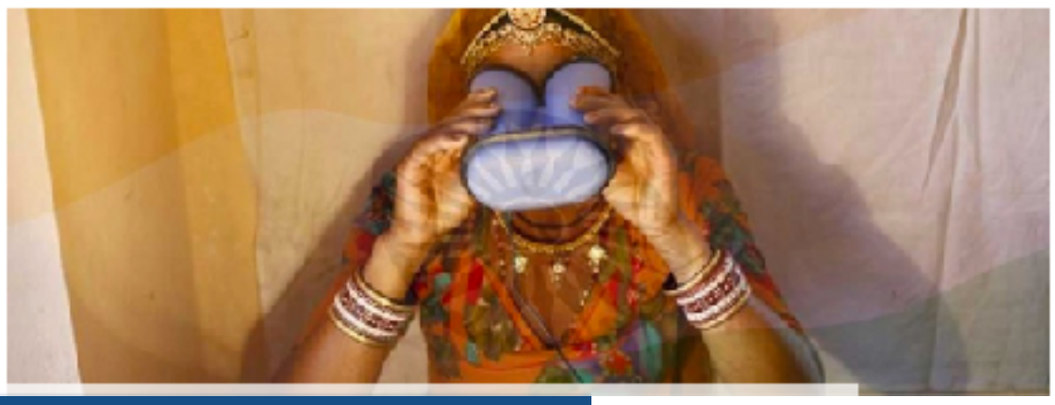


still registering

WORLD

India scans a billion irises in interest of national security

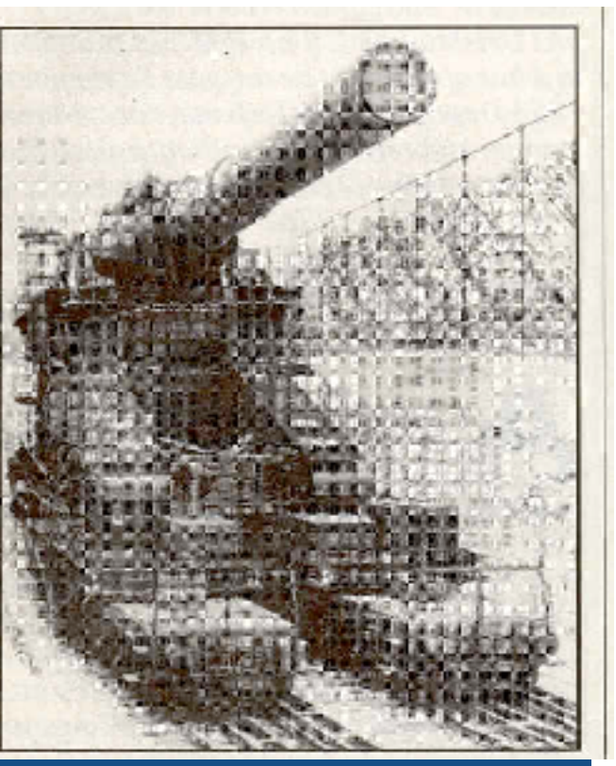
Alice MacGregor Wed 16 Mar 2016 12.33pm



"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]

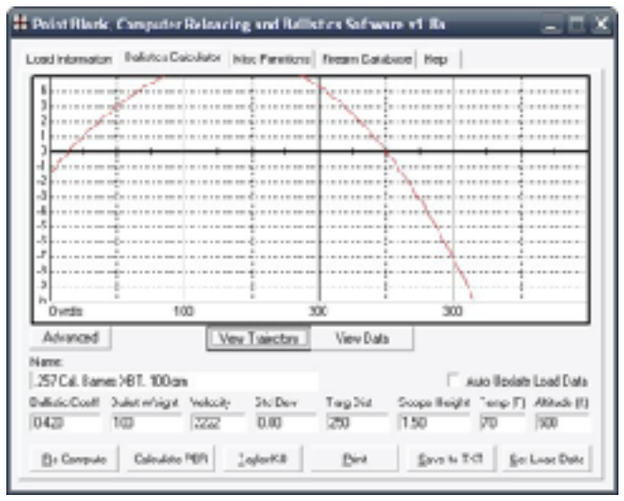
military takeover



ballistics "firing tables"

Vannevar Bush, 1935,

Differential Analyzer

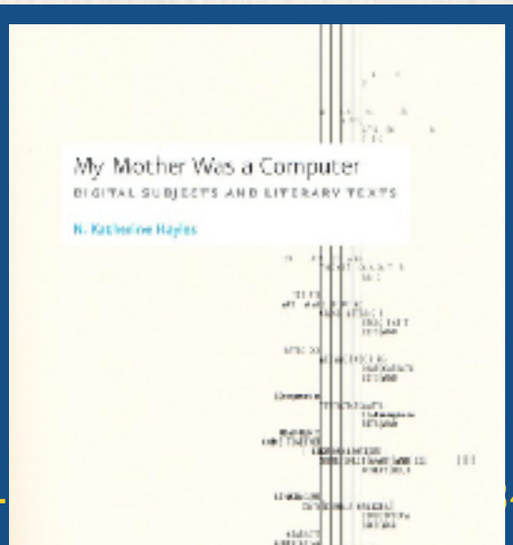


analytical work

(Babbage)

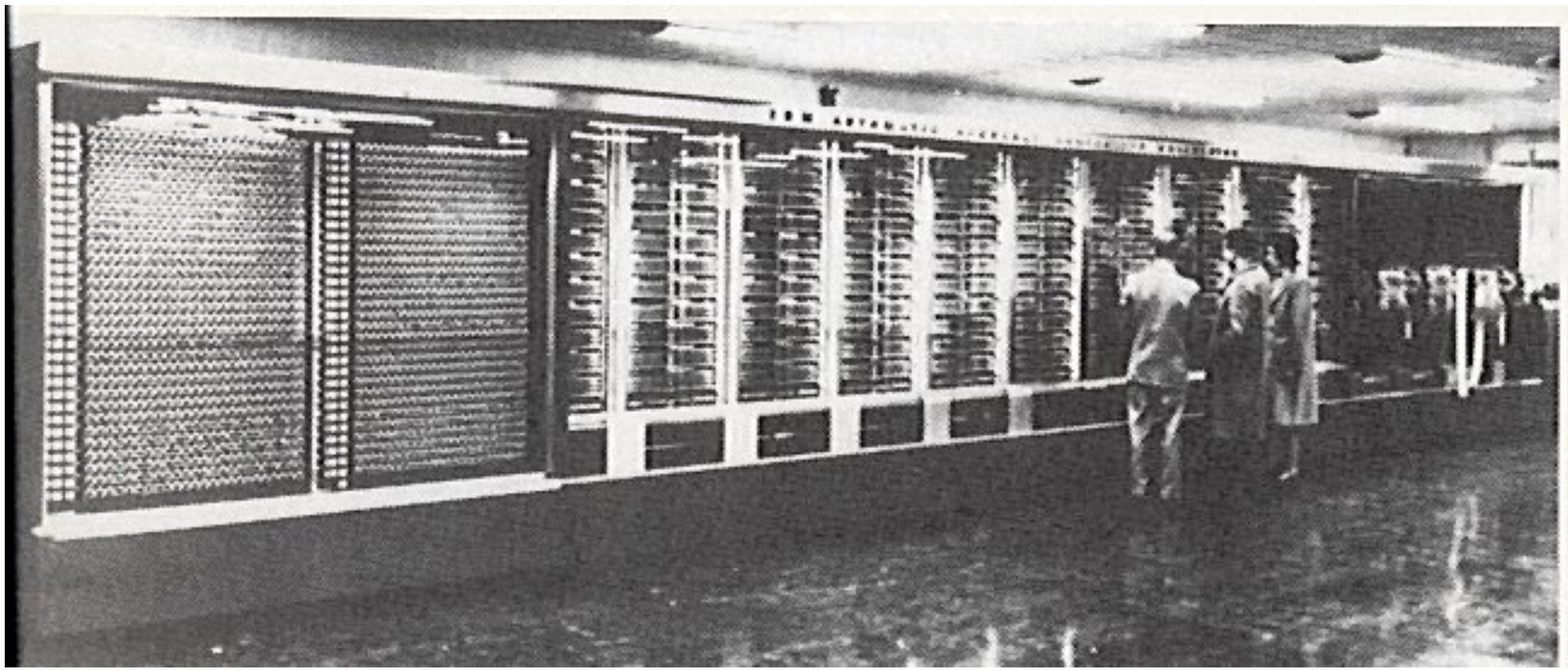
Bush

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



Harvard mark I

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

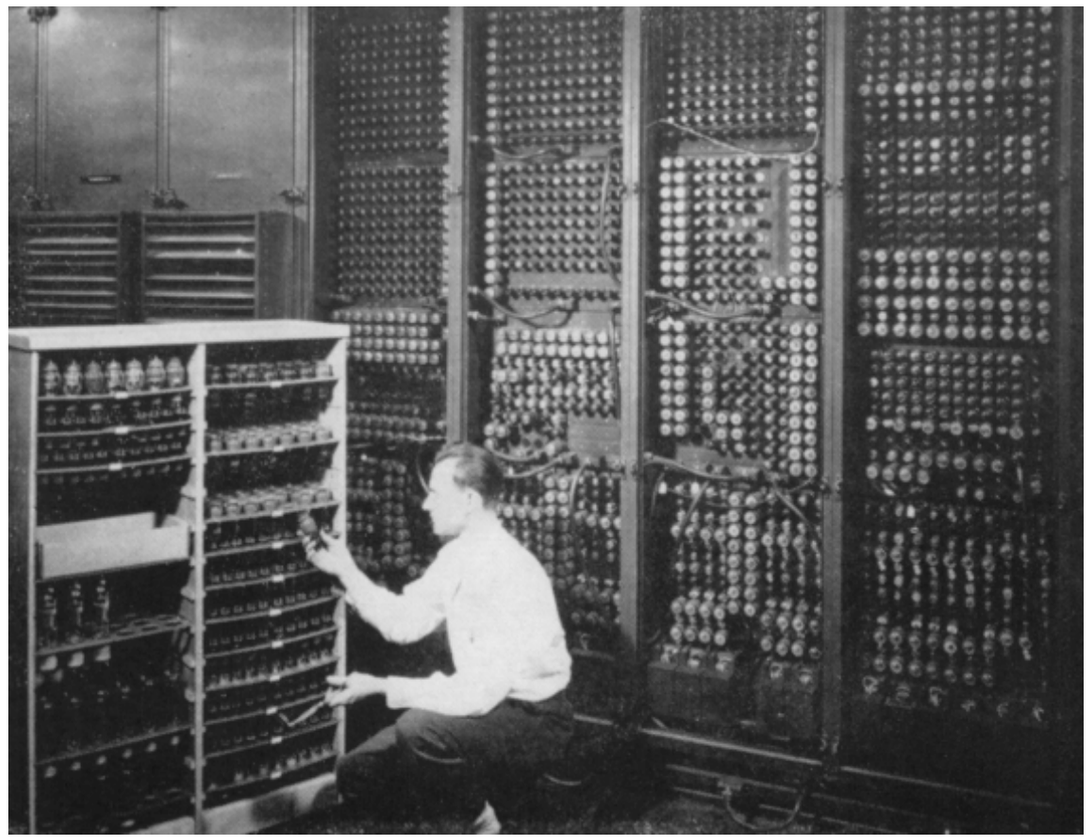


John von Neumann 1903-1957

military processing

Moore School

Aberdeen Proving Ground



Eckert & Mauchly

1945, ENIAC

stored-program

(Electronic Numerical Integrator Computer)

18,00 vacuum tubes, 70, 000 resistors,

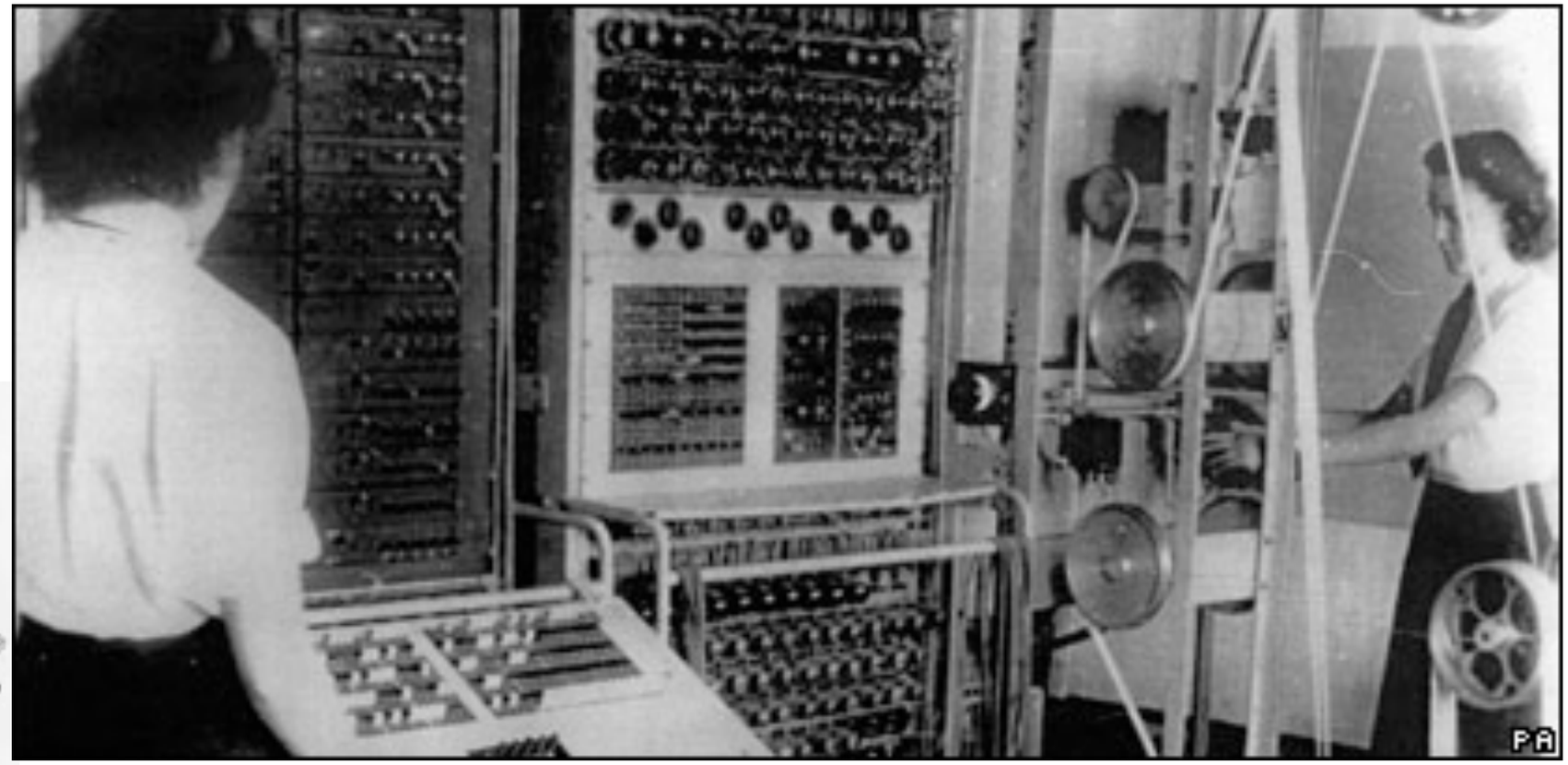
10,000 capacitors, 6,000 switches, 1,500 relays

Alan Turing
1912-1954

decoding Enigma

1943, Colossus

Bletchley Park



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 information. The electronic method ensures 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 we really know its capabilities. It may take 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

back to Thamus

"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

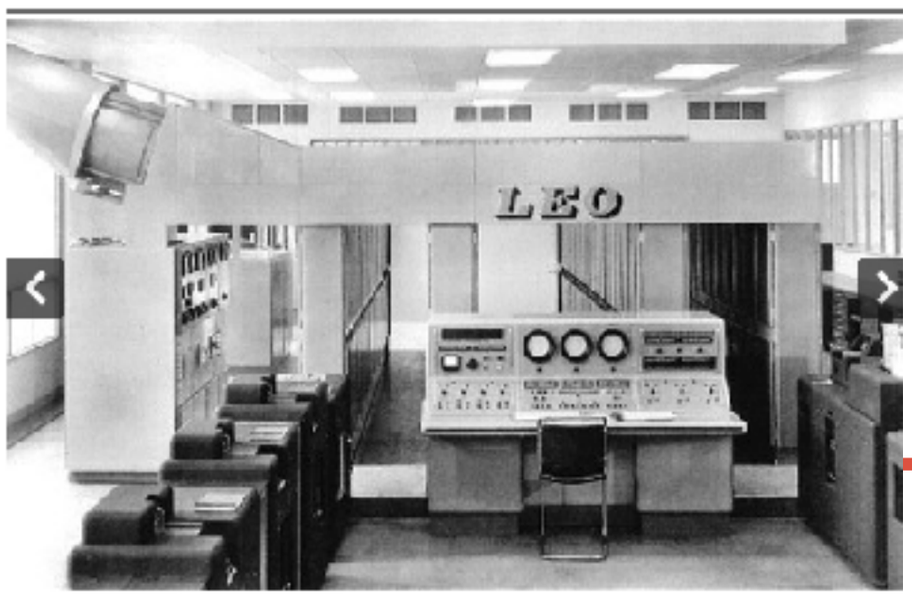
Computer "Revolution"

changing perceptions

changing business

the demand side

inventions



back in business: vertical integration

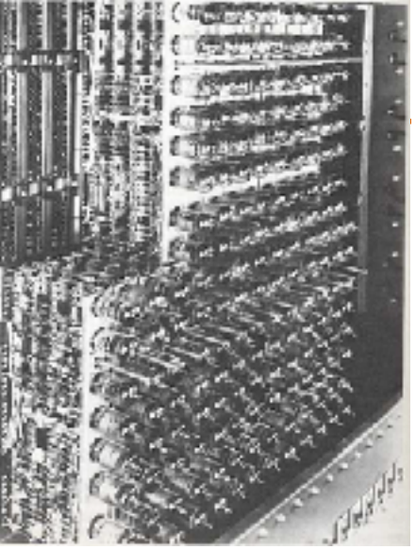
military - industrial complexities

from missiles *to* payroll to baking

U. Penn: ENIAC, EDVAC, UNIVAC,
Cambridge: EDSAC

to

LEO (Lyons electronic office)
CLEO (Clear language for expressing orders)



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

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

1960 DEC PDP-1

"programmable data processor"

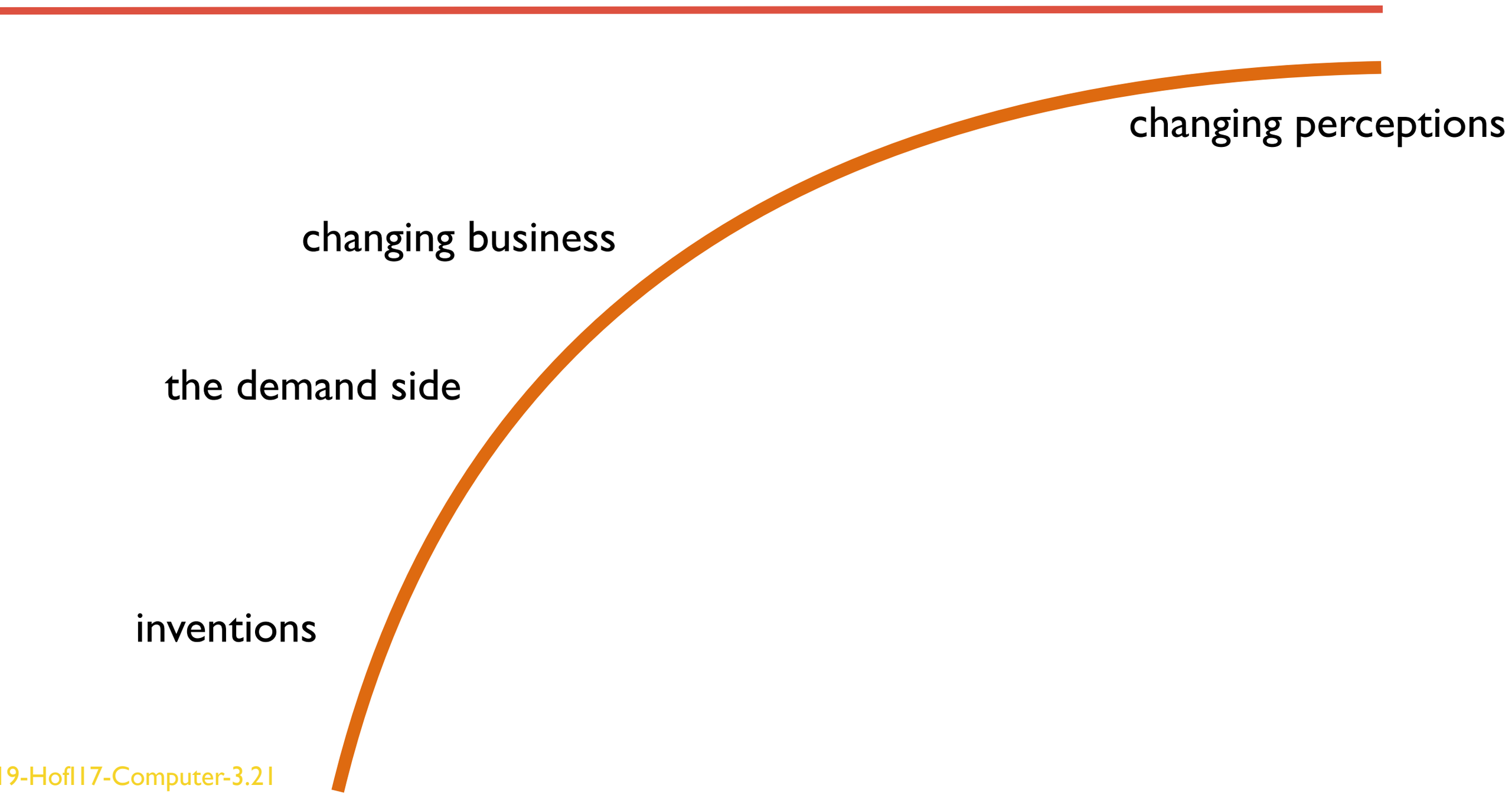
1964 IBM 360

1969 Xerox PARC

"the architecture of information"

(**1946** SRI
Doug Engelbart)

Computer "Revolution"



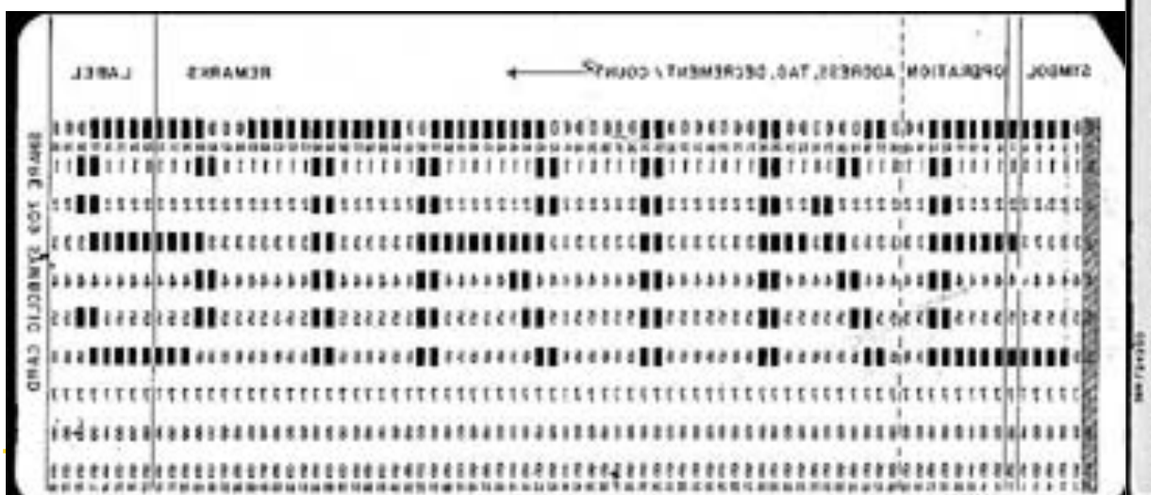
rage against the machine

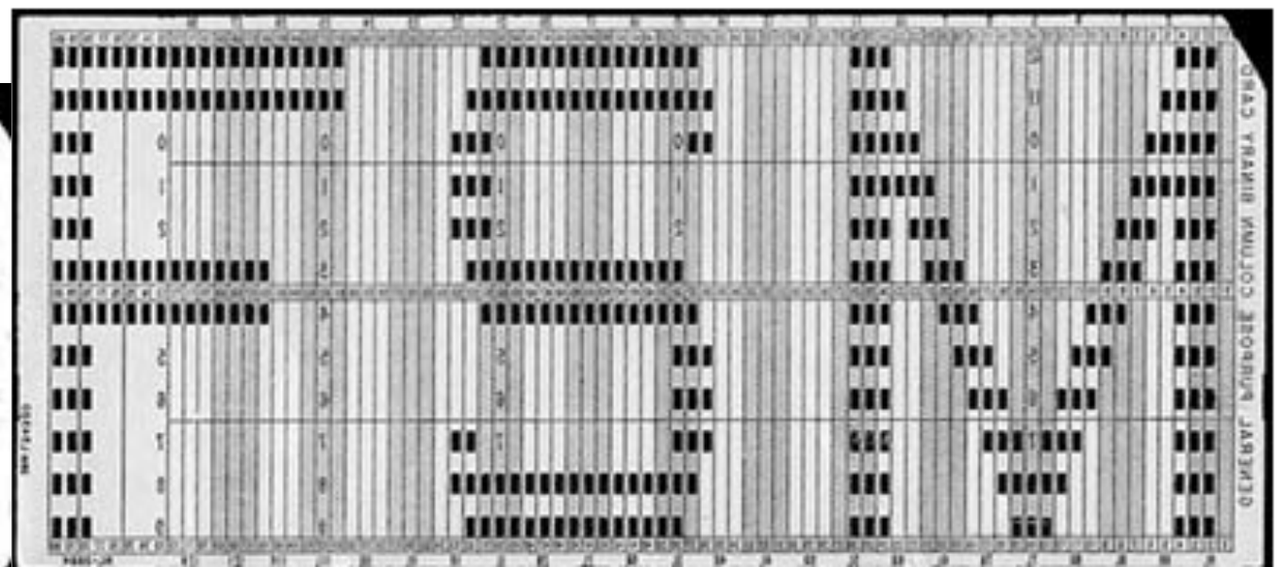
FSM

"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

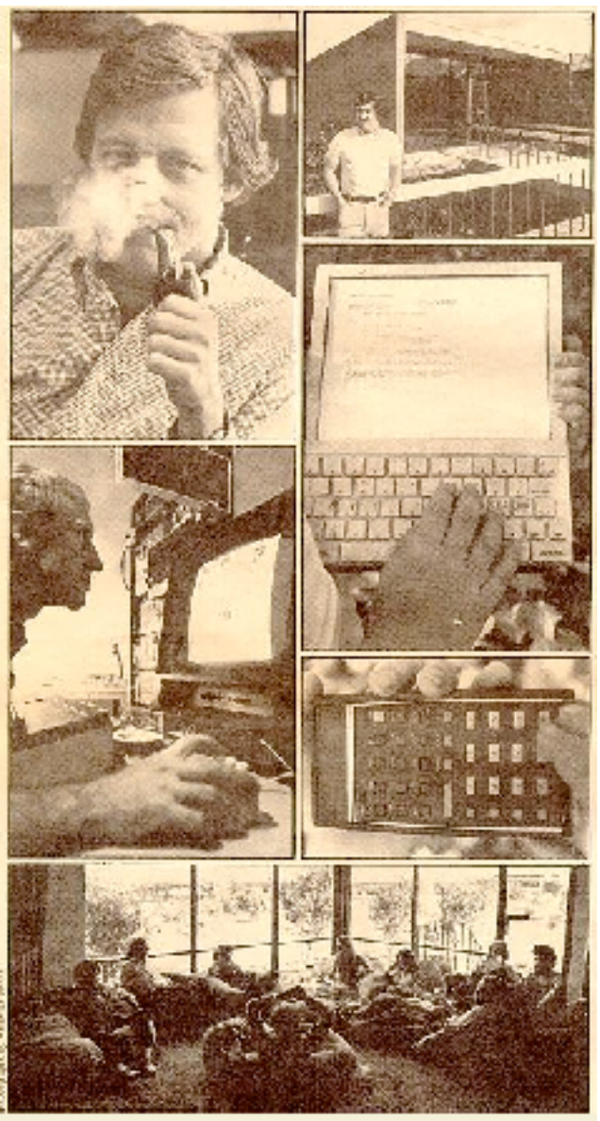
"I am a student at the University of California. Please do not fold, spindle or mutilate me."





changing perceptions

fast forward



Stewart Brand, "Fanatic Life and Symbolic Death Among the Computer Bums"

--*Rolling Stone*, 7 December, 1972

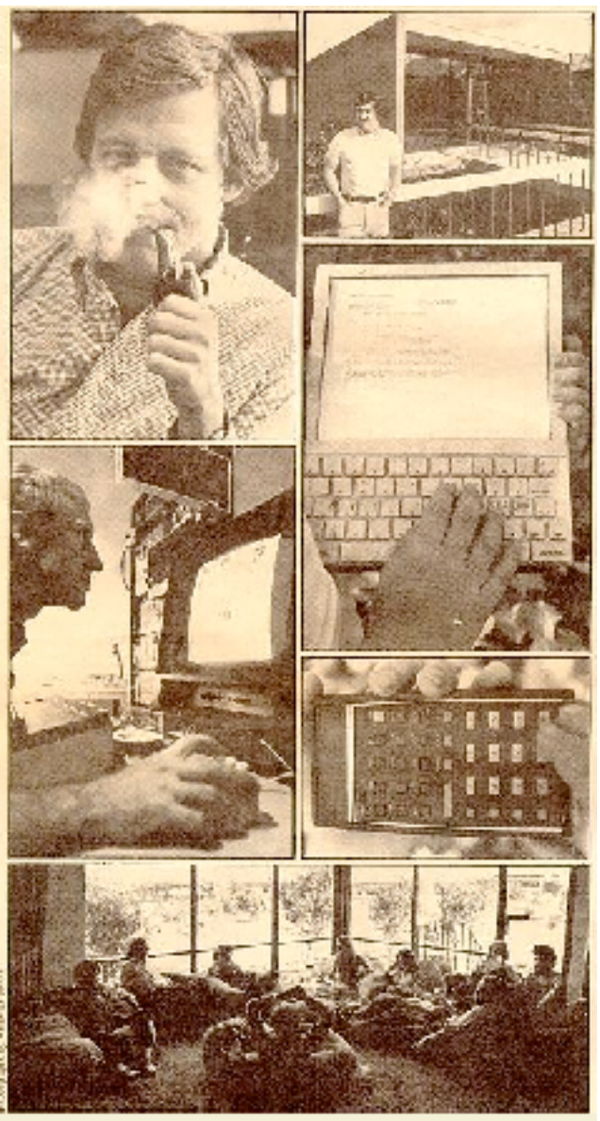
a libertarian vision

Brand, Barlow, Dyson, Gilder, Kelly, Rosetto,

"the internet ... an exciting kind of metaphor for spontaneous order" — Gilder

Fred Turner, *From Cyberculture to Counterculture*, 2006

changing perceptions



Stewart Brand, "Fanatic Life and Symbolic Death Among the Computer Bums"

--*Rolling Stone*, 7 December, 1972

a libertarian vision

Brand, Barlow, Dyson, Gilder, Kelly, Rosetto,

"the internet ... an exciting kind of metaphor for spontaneous order"
— Gilder

Fred Turner, *From Cyberculture to Counterculture*, 2006

culture clash

home brew, fone freaks

1975 Altair

1976 Apple 1

1983 Lisa

1982 GRID Compass

1984 Macintosh

TECHNOLOGY

John Ellenby, Visionary Who Helped Create Early Laptop, Dies at 75

By JOHN MARKOFF AUG. 26, 2016

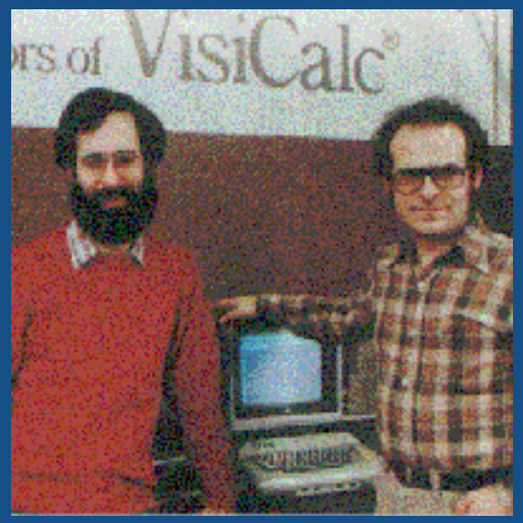
The Compass computer became an important tool for corporations, government spies, White House officials and astronauts. GRID Systems

John Ellenby, a British-born computer engineer who played a critical role in paving the way for the laptop computer, died on Aug. 17 in San Francisco. He was 75.

changing perceptions

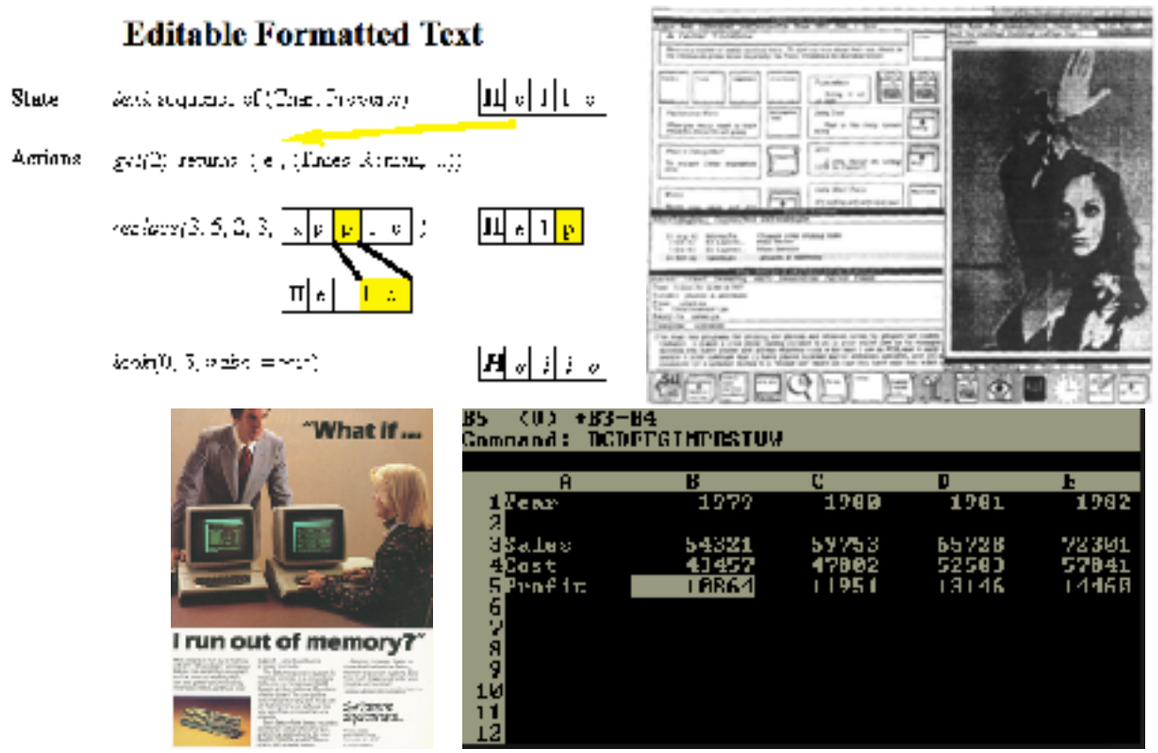
killer apps

Charles Simonyi
Xerox PARC



Dan Briklin &
Bob Frankston

Bravo, 1974
WYSIWYG



Visicalc, 1978

Lotus 1-2-3, 1983

Excel (for Mac), 1984

Ken Thompson
Dennis Ritchie
Bell Labs

tty;
FILENAME
CHANGEDIRECTORY PATHNAME

another social revolution

Thompson, Ritchie, & AT&T

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

1969: multics to unix

"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"

changing perceptions

unix at ucb

Bill Joy
UCB

1975: Thompson at Berkeley

Bill Joy develops em editor

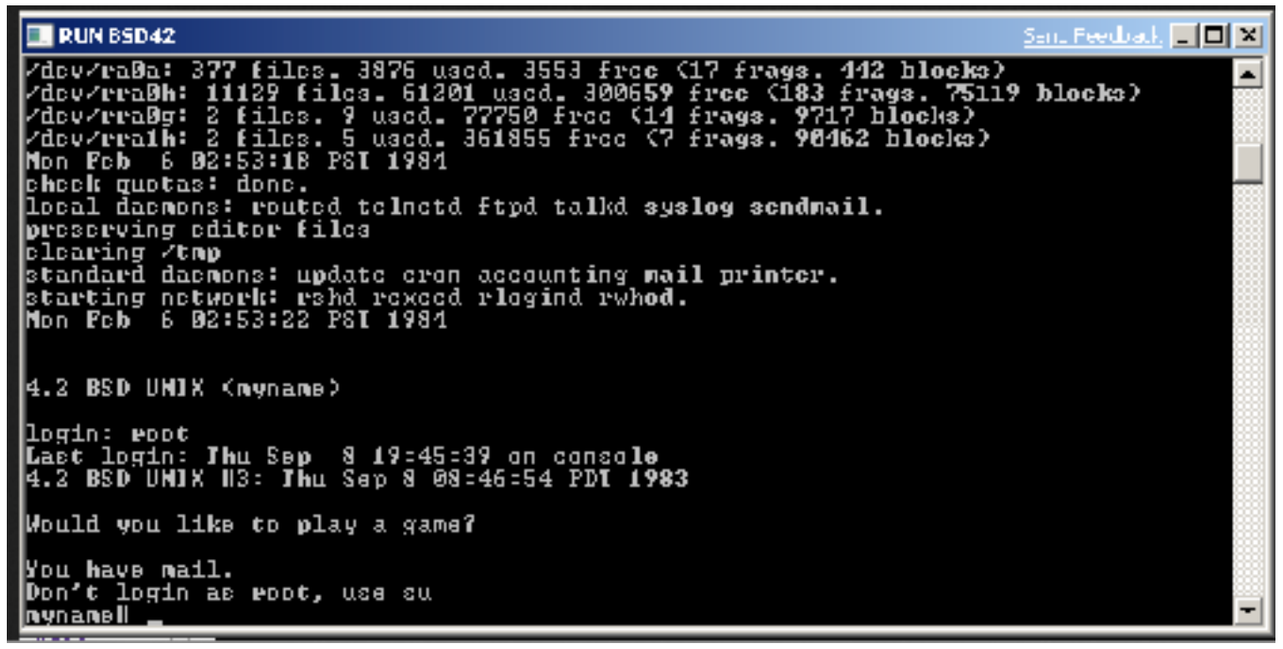
1977: 1BSD (released March 1978)

1979: 3BSD (for Vax)

1981: 4.1BSD

1983: 4.2 BSD
(with tcp/ip stack)

1-800-ITS-UNIX



changing perceptions

SO ...

1991: Networking release 2; 386 BSD

1992: AT&T sues UCB

1994 settlement: USL, UCB, Novell

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

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,

elsewhere ...

Richard Stallman
MIT

Linus Torvalds
Helsinki

```
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 :-(.
```

changing perceptions?

open & shut cases

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 ha
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 s
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

changing perceptions?

Grace Hopper
compiler

COBOL

Margaret Hamilton

NASA

Katherine Johnson

NASA

Adele Goldberg
Smalltalk — OOP

Xerox

Grace Hopper, Margaret Hamilton receive Presidential Medals of Freedom

in sum

keep an eye not only on production but on consumption

- who uses

- why?

- how does that influence what gets built?

more revolutions

- going open

- going closed

- hiding history

23 March: Midterm Exam

ahead

WEEK 11

27-31 March: Spring Break

WEEK 12

4 April: Broadcast

The shaping of radio and television in the twentieth century was a product of complex interactions between the developers of the technology, the military, the state, commercial interests, and public institutions, which led to broadcast media taking different forms in different nations. These issues are still with us as "broadcast" moves to a new technological base.

Required Reading

Czitrom, Daniel J. 1982. "The Ethereal Hearth: American Radio from Wireless through Broadcasting, 1892-1940," pp. 60-88. in *Media and the American Mind*. University of North Carolina Press.
Source: Course reader.

Bliven, Bruce. 1924. "Radio's Promise and Pitfalls." in David Welky, ed. America Between the Wars, 1919-1941: A Documentary Reader. Wiley. pp. 85-88. Source: Google Books [link]

assignment

Writing in 1924, Bruce Bliven makes a number of predictions about the future of radio, some negative and some positive, and adds some others from engineers who are enthusiastic about the possibilities for the medium. Some of these are similar to the predictions that people have made for the Internet. Pick one prediction that did not come true for radio (including broadcast television) but that in your opinion will be (or has been) realized for the Internet. Pick one prediction that was realized for radio but is unlikely to be realized for the Internet. How do you account for the differences? Finally, pick one prediction that is unlikely to be realized for either medium. Consult Czitrom for observations about the early history of radio.

(Note: a prediction that X will not happen should be considered realized if X does not happen, and as not realized if X does happen.)