



Computer science in four eras

Jean-Jacques Lévy
Inria Paris & Irif

Huashang College - 2

COMPUTER SCIENCE VS REAL WORLD



Science

nature

life sciences



machines





1970



Inria

rs du mo



PRIMARY
THE LOGICIAN

(1910 - 1950)

From paradoxes in logic

“the set of all sets”

to

Computability

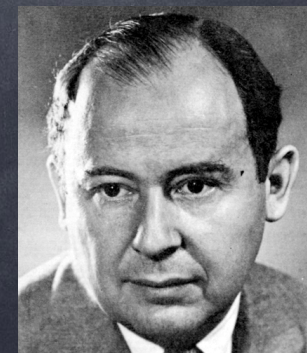
The logicians

Hilbert → Gödel → Church → Turing

→ Kleene

Post

von Neumann



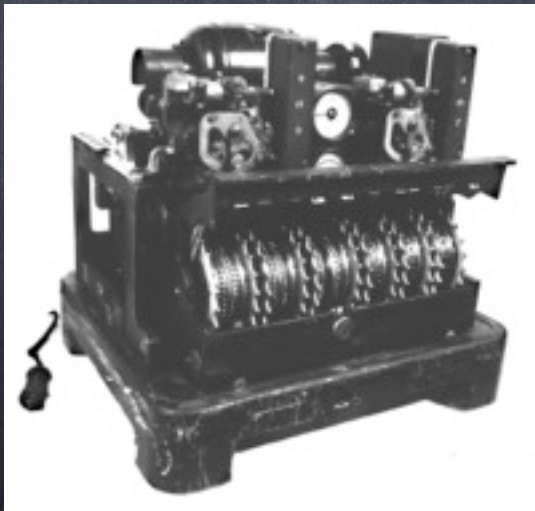
The logicians

- Turing : finite control, infinite memory
(decoding Enigma machine)
- von Neumann : data AND programs in
memory
(Manhattan project)
- machines at UPenn, Cambridge, Mark I

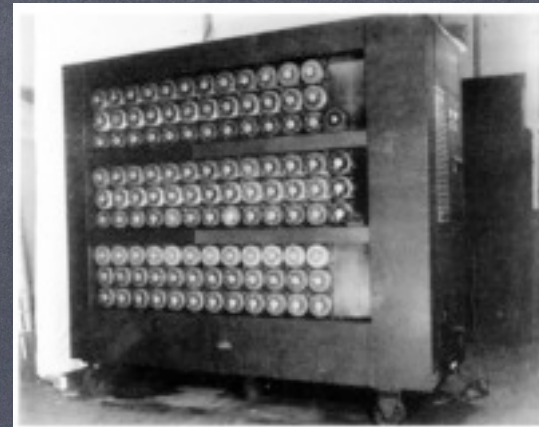
G
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y



Enigma



Lorenz



The Bombe



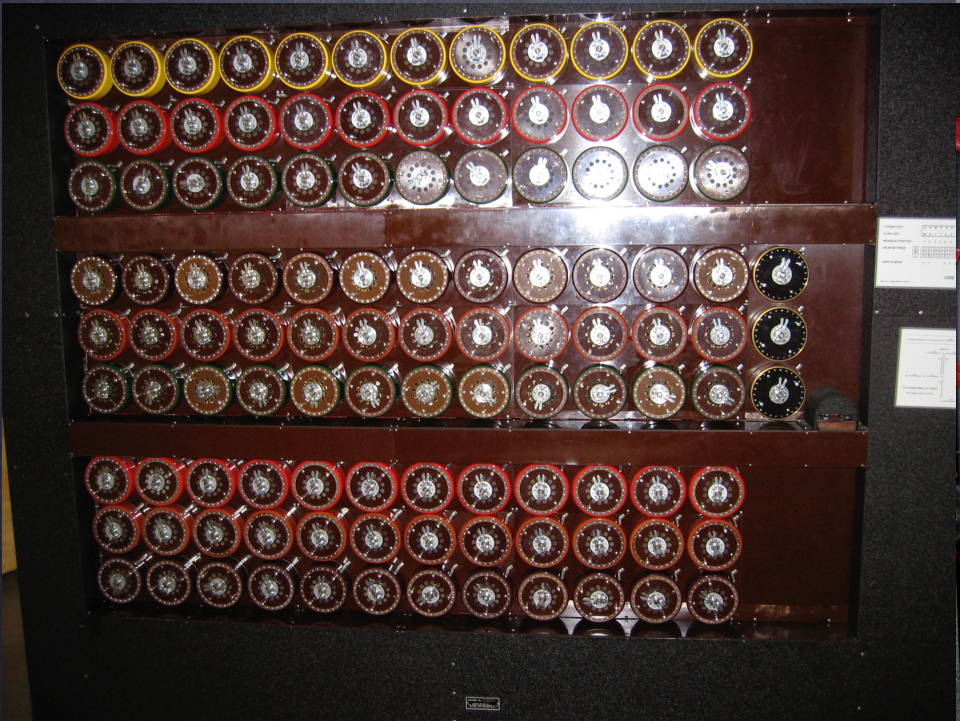
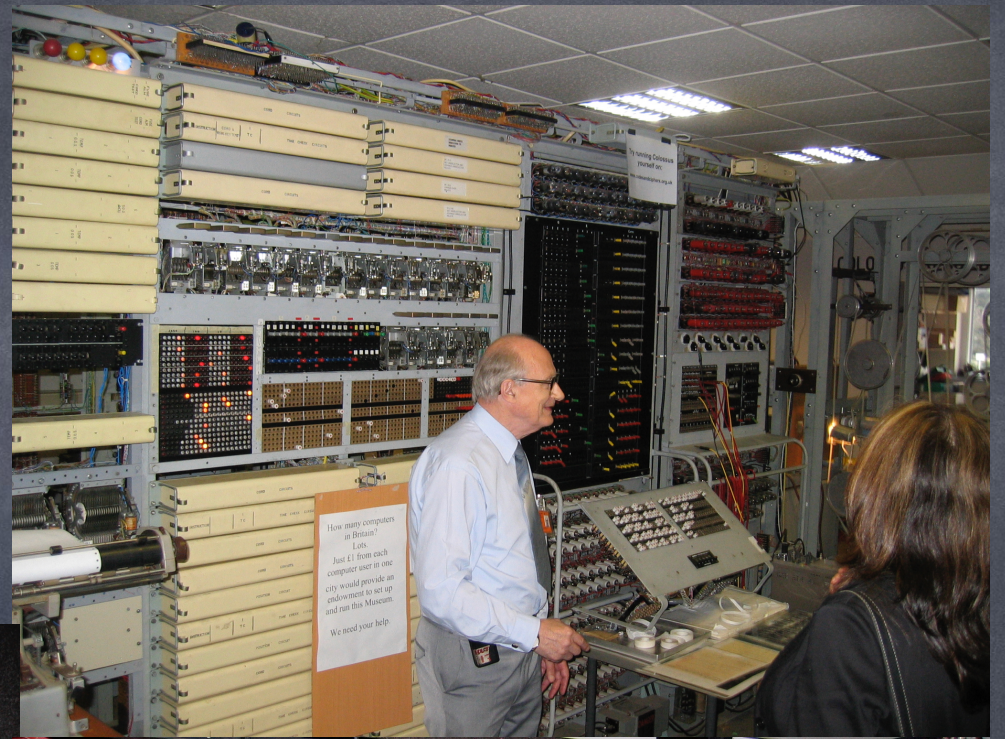
Colossus

B
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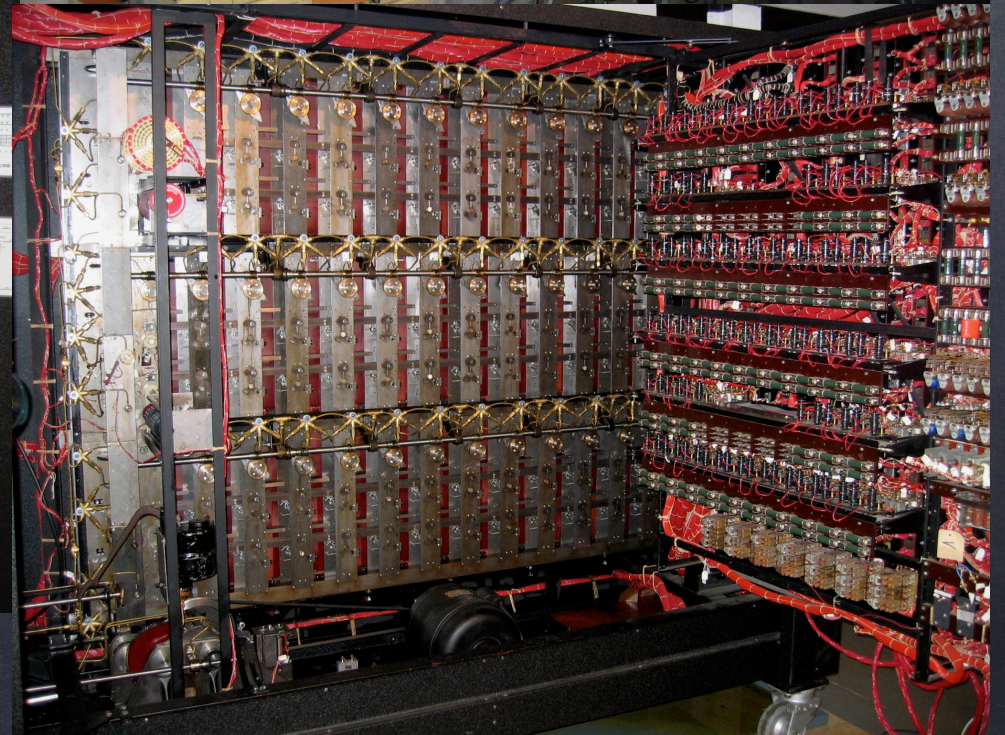
the Colossus



Bletchley Park



the Bombe

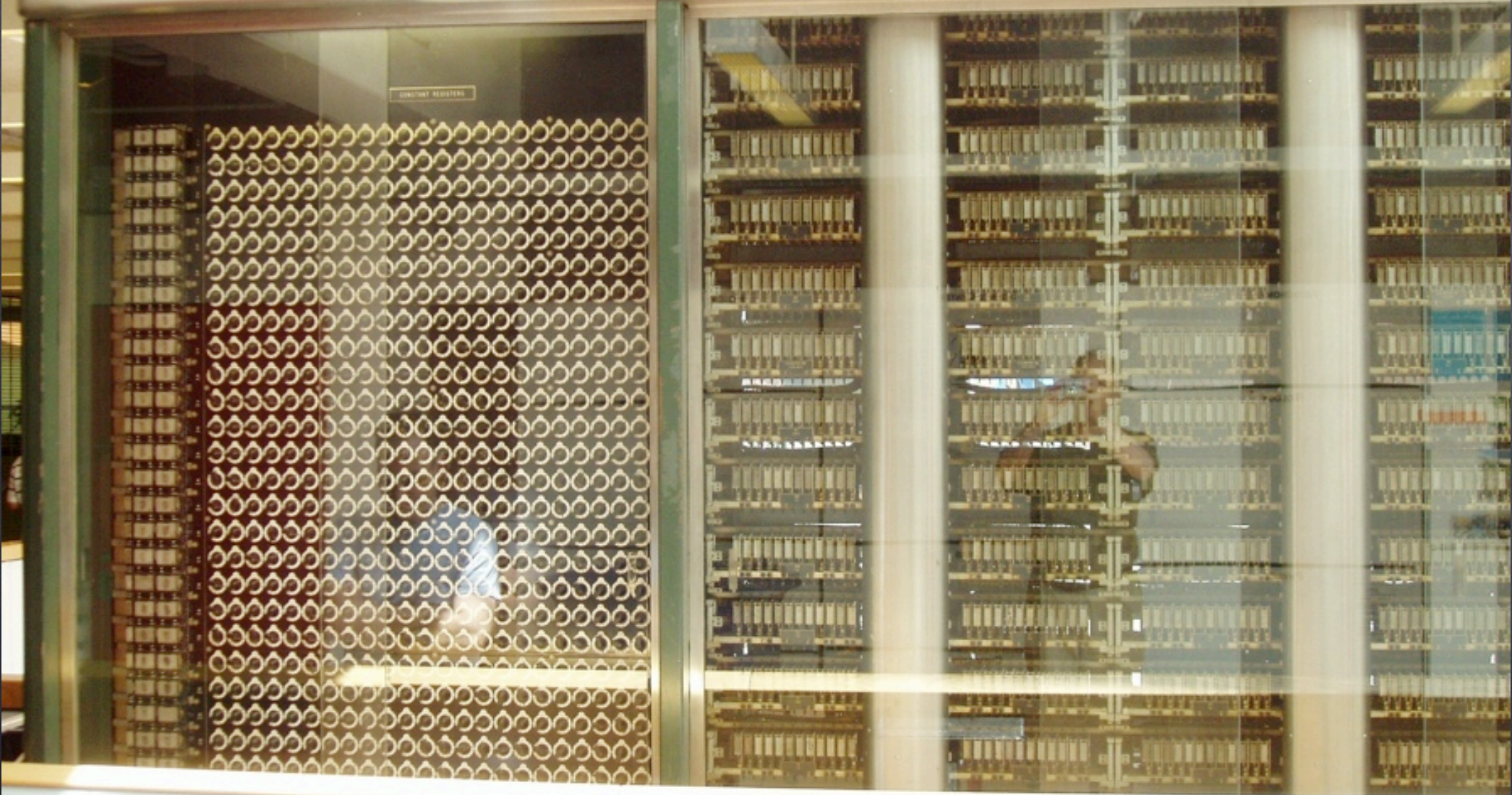




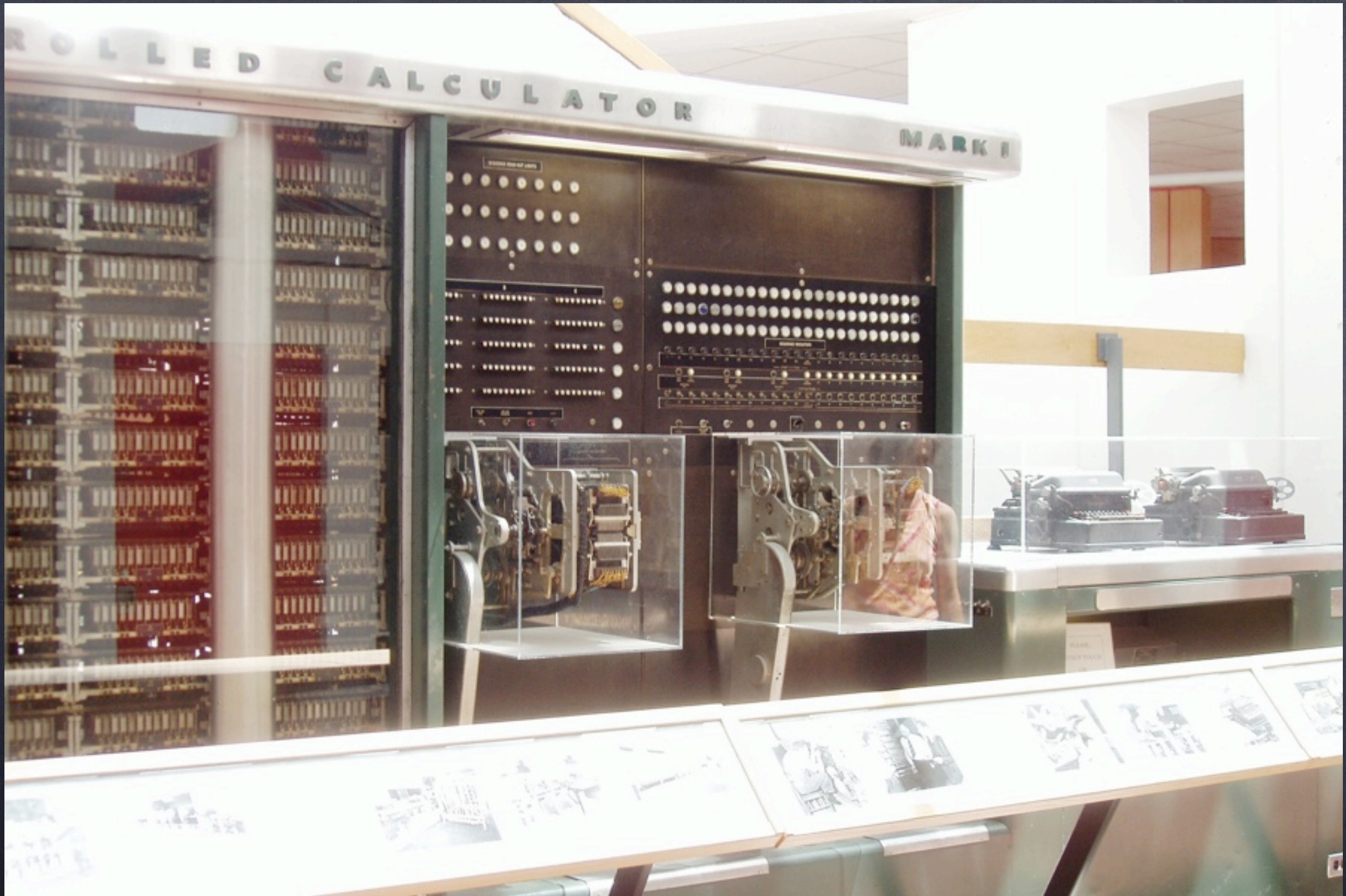
Bletchley Park

Tony Sale
and the Colossus rebuild team
Cliff Horrocks, team manager
Bob Alexander Don Grieg John Pether
Frank Carter Phil Hayes Don Skeggs
Charles Coultas Gil Hayward David Stanley
Ron Clayton Mark Hyman Derek Turton
Adrian Cole John Lloyd Richard Watson
Rob Dickson Peter Merriman John Wheller

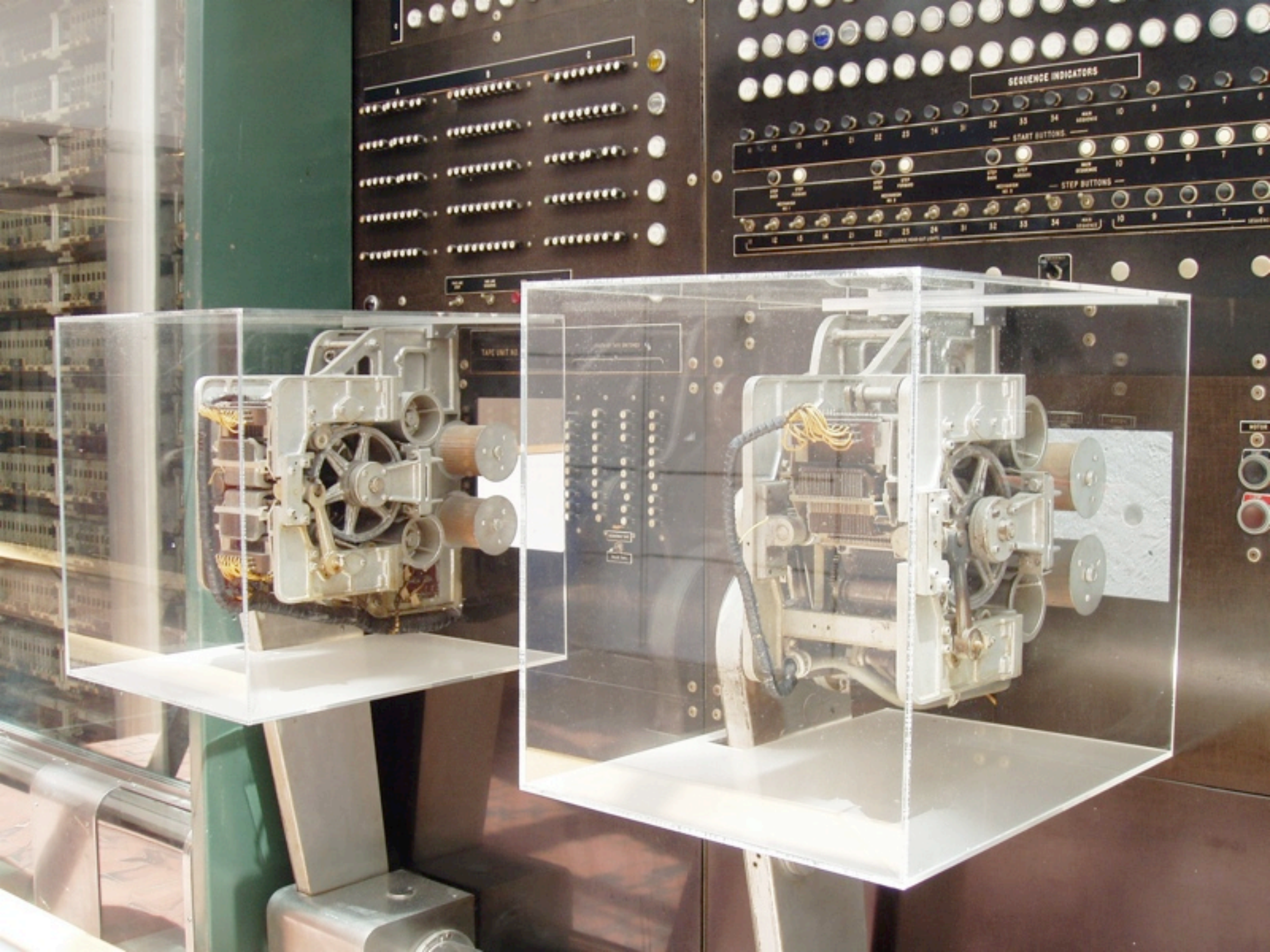
AIKEN - IBM AUTOMATIC SEQUENC



Mark I, Harvard



Mark I, Harvard



SEQUENCE INDICATORS

START BUTTONS

STEP BUTTONS

TAPE UNIT NO.

POWER ON SWITCH

STOP

STOP

STOP

STOP

The logicians



Mark II,
Harvard

92

9/9

0800 Antan started
 1000 " stopped - antan ✓

			{ 1.2700	9.037 847 025
				9.037 846 995 correct
	13" MC (032)	MP - MC	1.982647000	
			2.130476415	4.615925059(-2)
	(033)	PRO 2	2.130476415	
		correct	2.130676415	

Relays 6-2 in 033 failed special speed test
 in relay "11.000 test"

Relay
 3145
 Relay 3370

1100 Started Cosine Tape (Sine check)
 1525 Started Mult + Adder Test.

1545



Relay #70 Panel F
 (moth) in relay.

First actual case of bug being found.

~~1630~~ 1630 antan started.
 1700 closed down.

SECONDARY

THE IBMZOIC

(1950-1980)

Multics

- IBM 704, 7040, 360/370
- SDS 940 (Lampson)
- GE 645, Multics; MIT, Bull



- batch processing, time sharing
- 10 to 100 users / computer
- electronic mail

Unix, the nirvanha of programmers

- simplification of Multics
- modular “small is beautiful”



Ritchie



Thompson

- AT&T Bell laboratories
- theoreticians AND practitioners
- system of hackers for hackers
- pdp 11; Vax 780/750

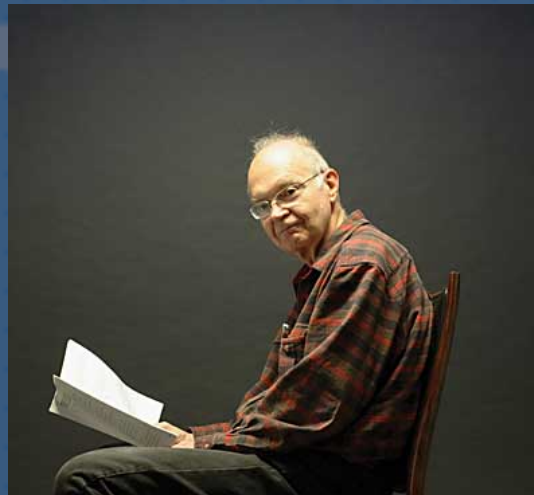
Run programs

- programming languages
- write correct programs

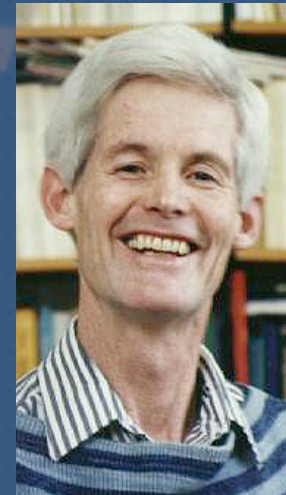


Jean Ichbiah

- find simple algorithms
- moreover efficient



Don Knuth

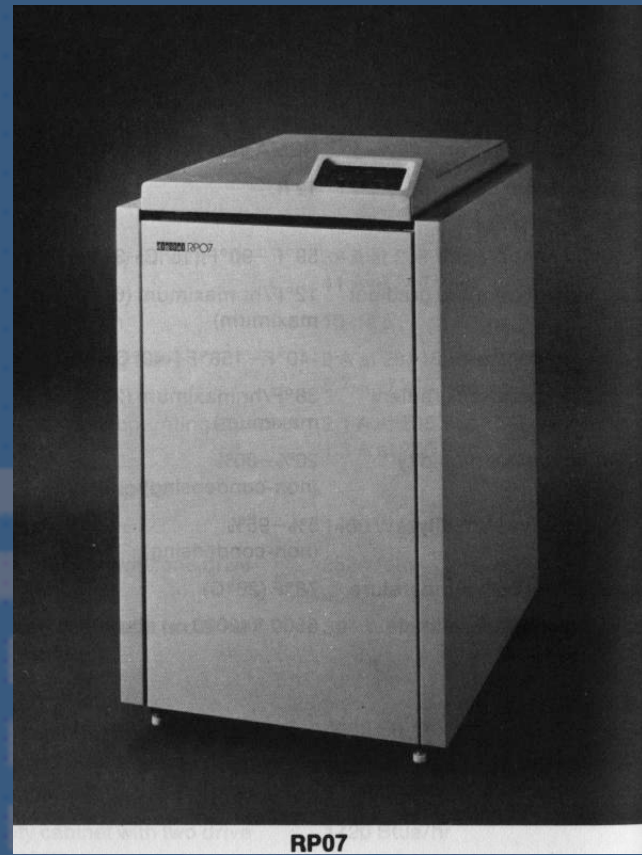


Steve Cook

$P=NP$?

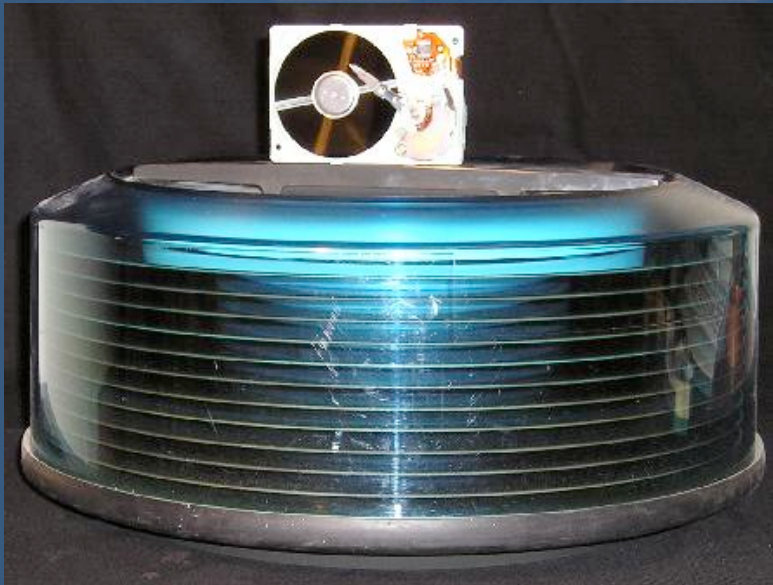


vax 11/750

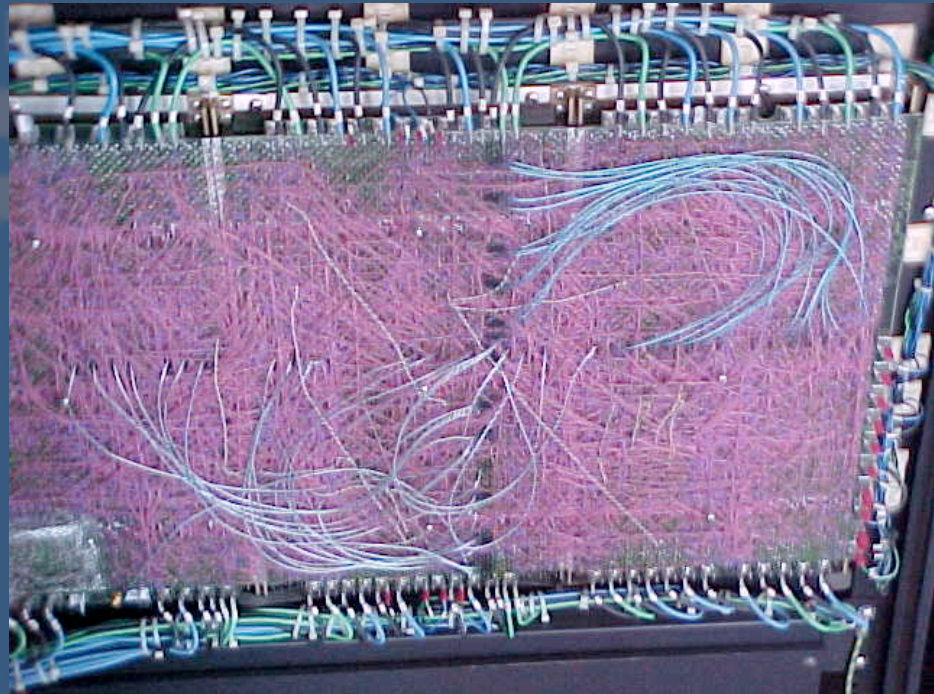


RP07

RP07
(700MO)



RM05 (256 MO)



back
of a
dec 10



vax 11/780



TERNARY

THE WINDOZOÏC

(1980-2000)

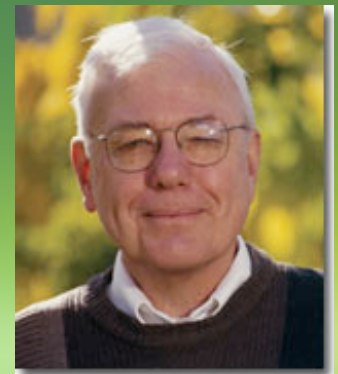
The garage

- intel 4004
- Xerox PARC (alto, dorado)
- the Apple garage (apple II, lisa, macintosh)
- IBM PC (ms-dos)



Alto

- selfish vision
- everyone has his own computer
- all is in user interface



Chuck Thacker



Apple II



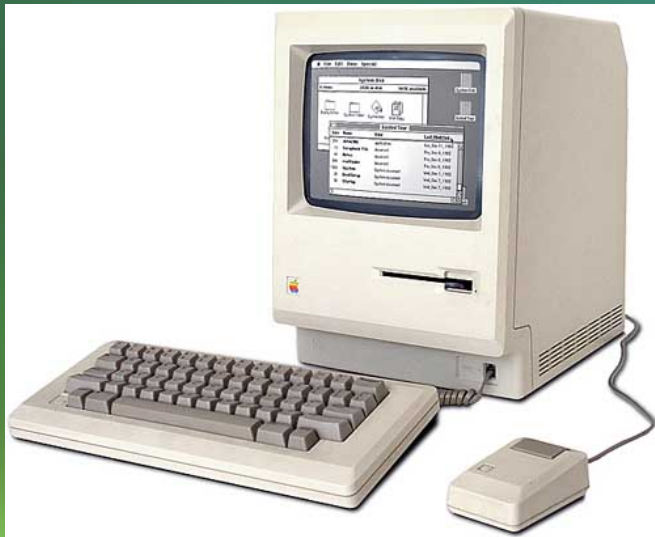
Lisa



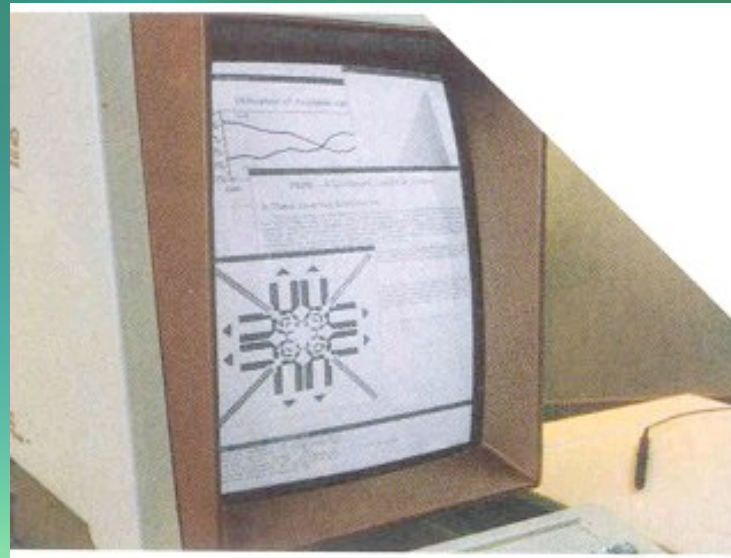
Apollo



Sun 1



Macintosh



PerQ



Blit 5620

Microsoft

- computer in each home
- bureautics (Word, Excel, Powerpoint)
- editor of software, no hardware
- improvements in systems (NT, 95, XP, Vista, ...)
- Dave Cutler (DEC-VMS, NT)



Charles Simonyi

Linux and free software

- Emacs, extendible text editor
- gcc, C compiler of the Free Software Foundation
- Linux = Unix redone by Linus Torvalds
- everyone participates to Linux
- source is public but invasive
- high quality software



Richard Stallman

Xerox PARC

August 1972

AUG '72

2487

A Personal Computer for Children of All Ages

Alan C. Kay
Xerox Palo Alto Research Center

Abstract

This note speculates about the emergence of personal, portable information manipulators and their effects when used by both children and adults. Although it should be read as science fiction, current trends in miniaturization and price reduction almost guarantee that many of the notions discussed will actually happen in the near future.

teacher? Maybe. But first, it must decide that it is a necessary and desirable goal to do so.

What we would like to do in this brief note is to discuss some aspects of the learning process which we feel can be augmented through technological media. Most of the notions have at their root a number of theories about the child that lie much closer to Piaget than to Skinner. We feel that a child is a "verb" rather than a "noun" — an actor rather than an object; he is not

Distributed calculations

- $F_9 = 2^{512} + 1$

=

13407807929942597099574024998205846127479365820592393377723
56144372176403007354697680187429816690342769003185818648605
0853753882811946569946433649006084097

= 2424833

× 7455602825647884208337395736200454918783366342657

× 7416400626275308015247871419019374740599407810975190239058

213161444157 59504705008092818711693940737

- 100 machines during 1 month [Manasse, Lenstra, 1990].

QUATERNARY

THE GOOGLOÏC

(2000-2018)

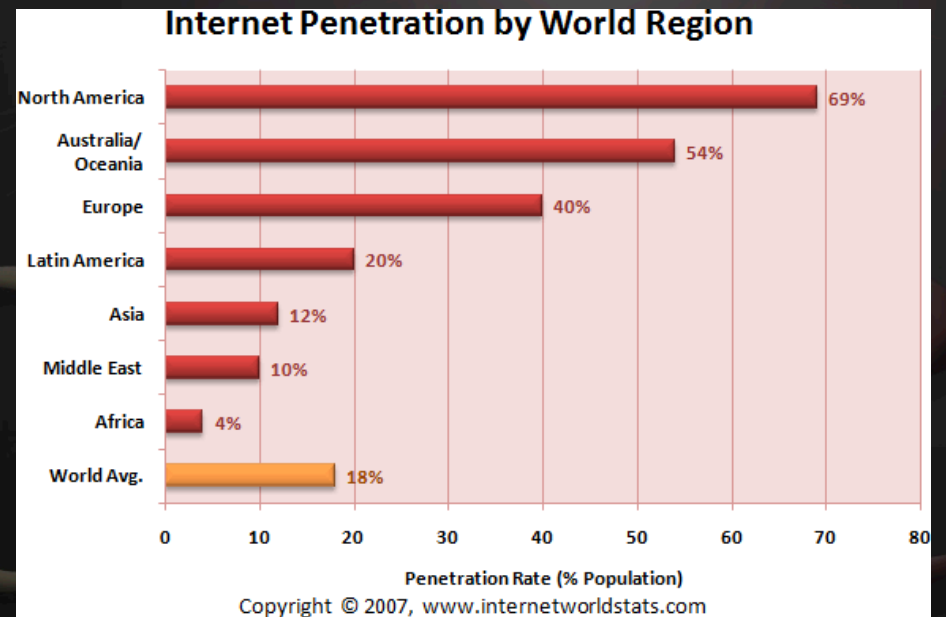
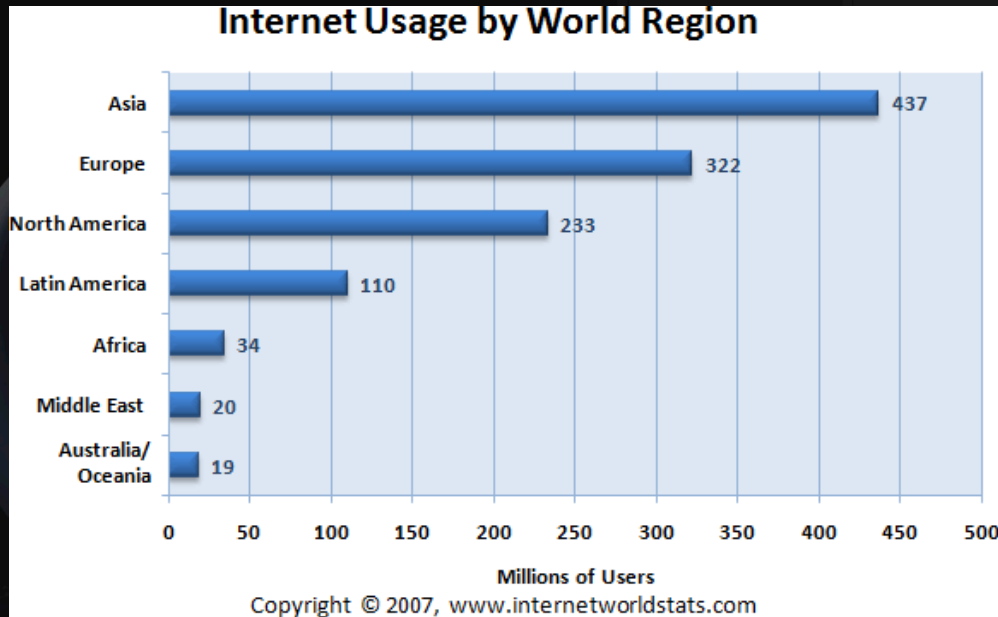
1 - Internet (1/3)

- arpanet (1970), ethernet - cyclades (1975)
- uucp (1985), internet (1992), wifi (1999)
- 1 billion of internauts (2007)
- web 30%, p2p 30%, mail 2% of traffic (2007)
- 25% of phone is on IP



Louis Pouzin

1 - Internet (2/3)



- 33 M internauts in France (2007)
- 53 M internauts in France (2018)

1 - Internet (3/3)

JAN
2018

DIGITAL AROUND THE WORLD IN 2018

KEY STATISTICAL INDICATORS FOR THE WORLD'S INTERNET, MOBILE, AND SOCIAL MEDIA USERS

TOTAL
POPULATION



7.593
BILLION

URBANISATION:
55%

INTERNET
USERS



4.021
BILLION

PENETRATION:
53%

ACTIVE SOCIAL
MEDIA USERS



3.196
BILLION

PENETRATION:
42%

UNIQUE
MOBILE USERS



5.135
BILLION

PENETRATION:
68%

ACTIVE MOBILE
SOCIAL USERS



2.958
BILLION

PENETRATION:
39%

we
are
social



we
are
social



2 - Indexers (1/2)

- data is ubiquitous
- internet is the property of everybody
- data are no longer localized
- need for indexing (google, baidu, bing ...)

Louis Monier



Mike Burrows



altavista

2 - Google (2/2)

- global search
- hired most of Unix team from Bell labs
- 15 centers with global data
- ~1 million of servers
- net services (mail, calendar, maps)

3 - Smart phones

- Ericsson, Nokia, LG, Samsung, Blackberry
- iPhone (2007) with tactile interface
- integration of music, photo, and video
- net services
- appStore (iPhone), Googleplay

NeXT

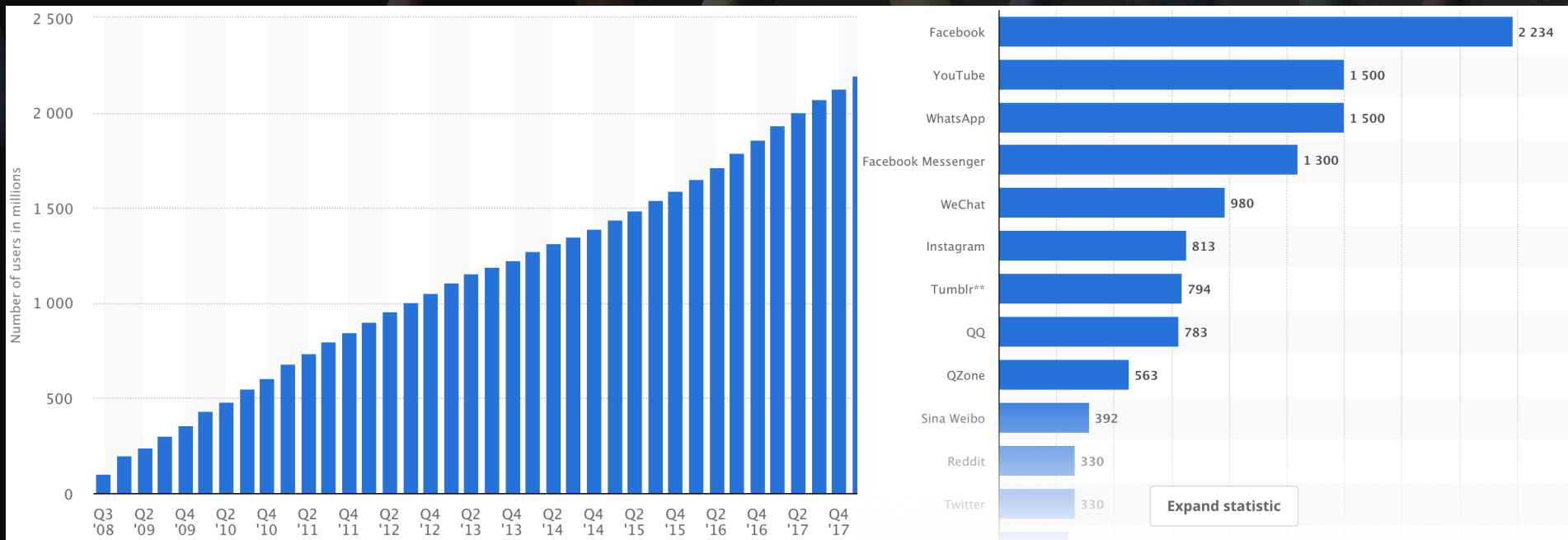


iPhone

Jean-Marie Hullot

4 - Social networks

- youtube (2004),facebook (2005), IG, twitter, ...
- whatsapp, viber, wechat, skype
- wikipedia



Impact on economy

- online shops (Amazon, eBay, Taobao, ..)
- Apple = Netherlands, Google = Belgium, ..
- management of companies
- engineering
- medical apps
- computational sciences
- banking (applepay, alipay, wechatpay, bitcoin)
- (distributed) games

Networks — Distribution

- security (secrecy, authentication, integrity)
- distribution of data (public Clouds)
- distribution of computing
- sensors
- energy

FUTURE

(2019- ??)

Future?

- computers may disappear
- software will be still present
- sensors everywhere
- medical apps
- programming bio cells
- computer science and environment
- working AI
- ???



Computer Science
is
THE invention
of
20th century