

CSCI 1377

Tools for Thought

Introduction

“There are many man-machine systems. At present, however, there are no man-computer symbioses.”

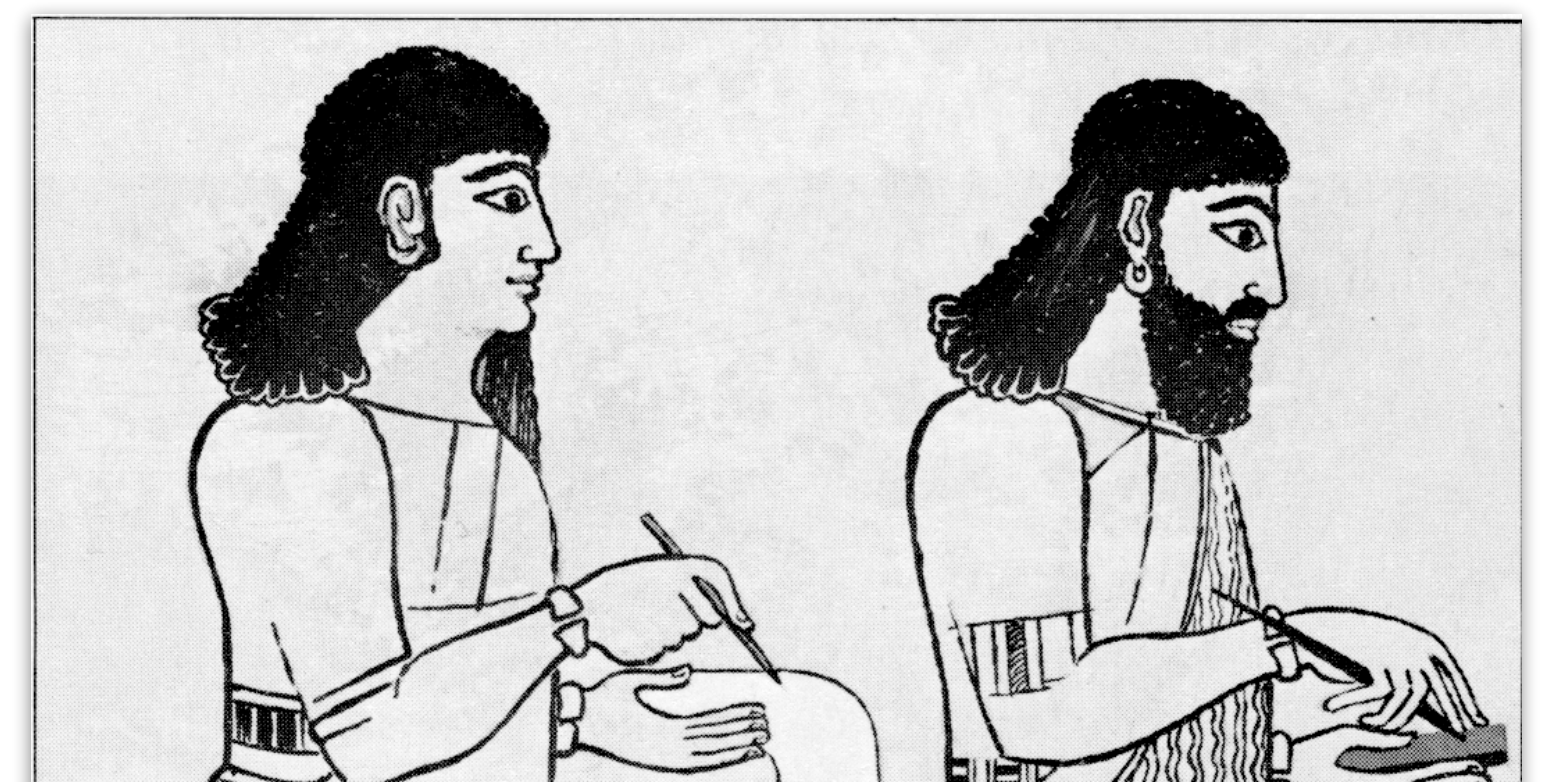
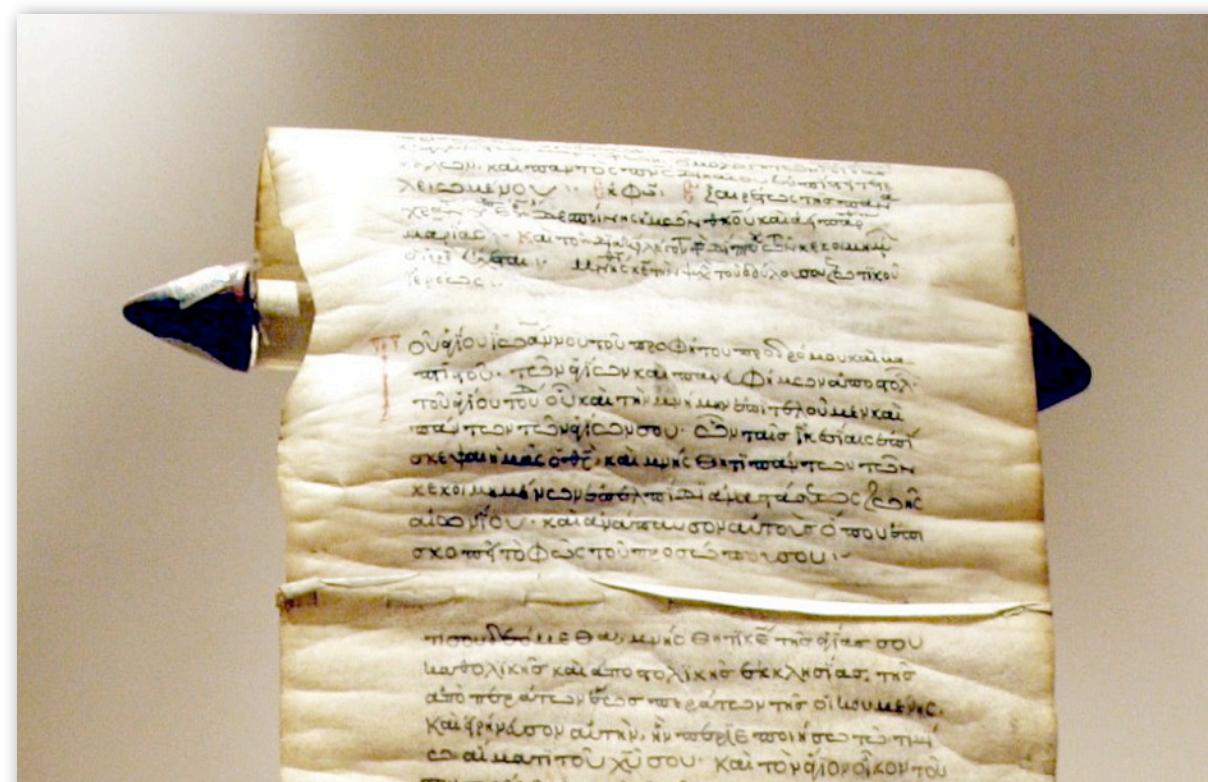
— J.C.R. Licklider, “Man-Machine Symbiosis” (1960)



Books used to be scrolls

Letters used to be tokens

Printers used to be people



of roots, 3. There remains 3. This is the root you wanted, whose square is 9. Alternatively, you may add the square root to half the number of roots and the sum is 7. This is then the root you wanted and the square is 49.”

Math used to be prose

$$f(x) = ax^2 + bx + c$$

Numerals used to be many things

70			o	LXX
80			π	LXXX
90			9	LXXXX
100			0	C

Variables used to be boxes

$\frac{1}{4}$		di		$\tilde{m}$	$\frac{1}{4}$	di		$—$	1	
$\frac{1}{4}$		di		$—$	$1\frac{1}{4}$	di				
$\frac{1}{4}$		$—$	$—$	$—$	$—$	$1\frac{1}{4}$	$\tilde{n}$			
1				1				1		

**We are the inheritors of millenia
of progress in tools for thought!**

Design is about creativity,
novelty, and intuition

Engineering is about theories,
constraints, and problem-solving

**cognitive
design**

**cognitive
engineering**



Math UI

Software UI

Car UI

Road UI

English language

Ad jingles

Blue's Clues

Phonetic alphabet



Legend Color	• Light letters on a dark background are superior to dark letters on a light background (2). • Black-on-orange and white-on-green signs are detected at greater distances than black-on-white signs (3).
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4 units	<u>Road Construction Ahead</u> at <u>Jaspertown</u>
8 units	<u>Road Construction on Interstate 5</u> for next <u>10 miles</u> Take <u>Highway 99</u>
11 units	<u>Interstate 80 closed for construction</u> between <u>Iowa City</u> and <u>Cedar Rapids</u> <u>Exit at West Liberty</u> and drive <u>north</u> on <u>Highway 16</u>

h legibility index of 40 ft/in. of letter height should be

indicates that legibility distance increases as letter height
though the benefits are not proportional above letter
bout 8 in. (3).



A schema for tools for thought

Person

Task: what is a person trying to do?

Inference: how does a person use their brain to do a task?

Tool

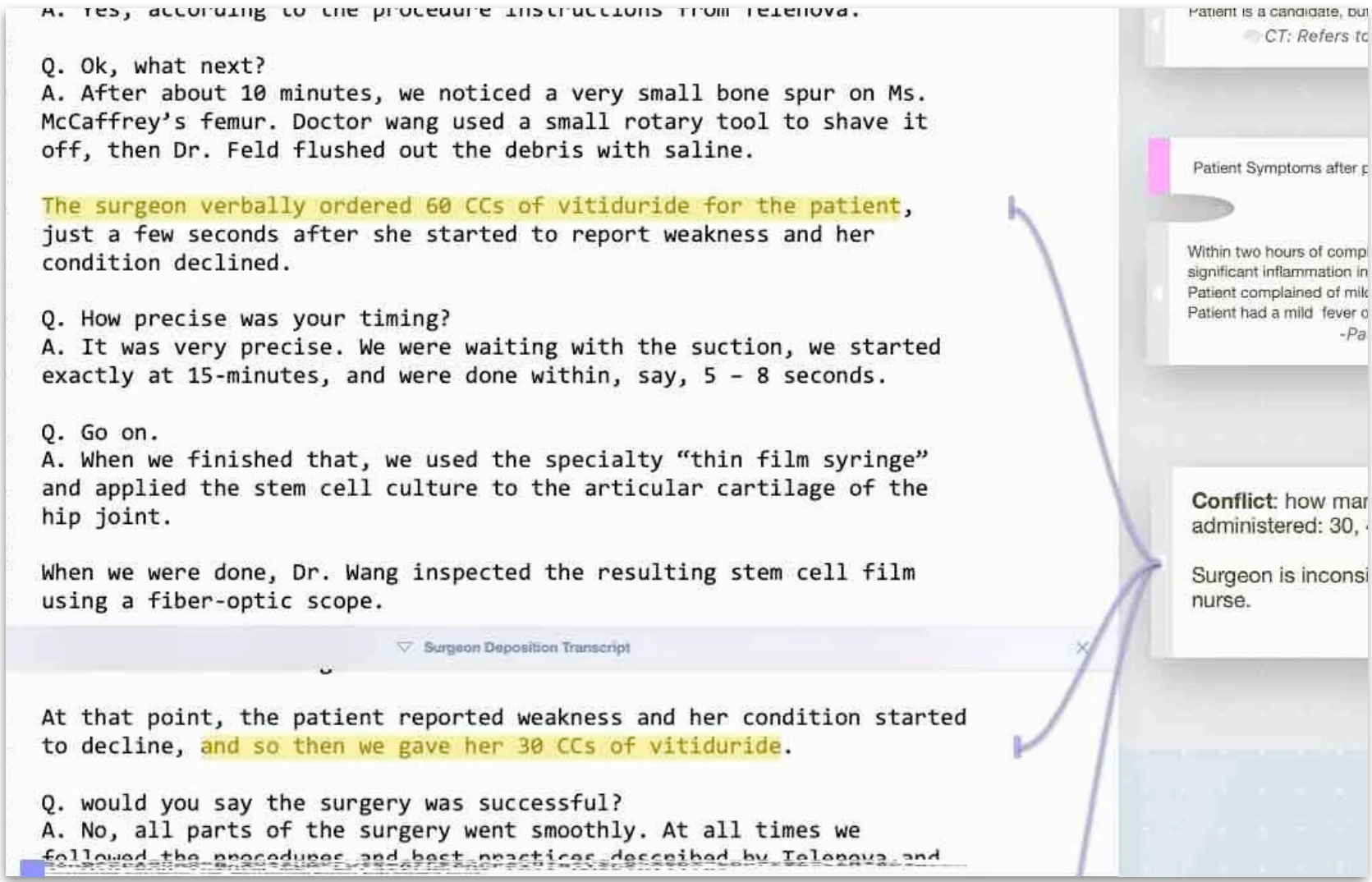
Representation: how is info given to a person?

[Automation]: how does a tool use its “brain” to do a task?

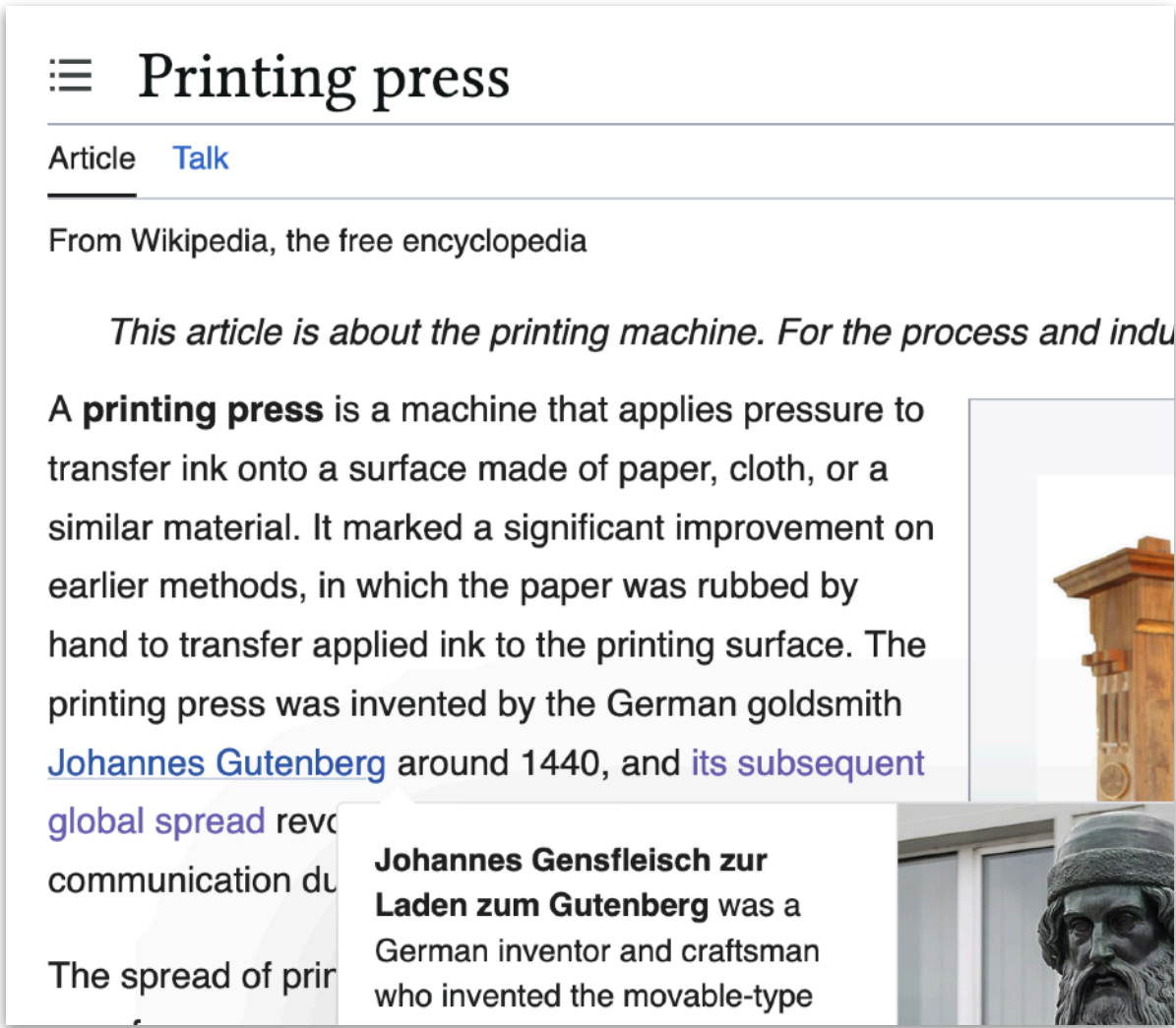
Spaced repetition



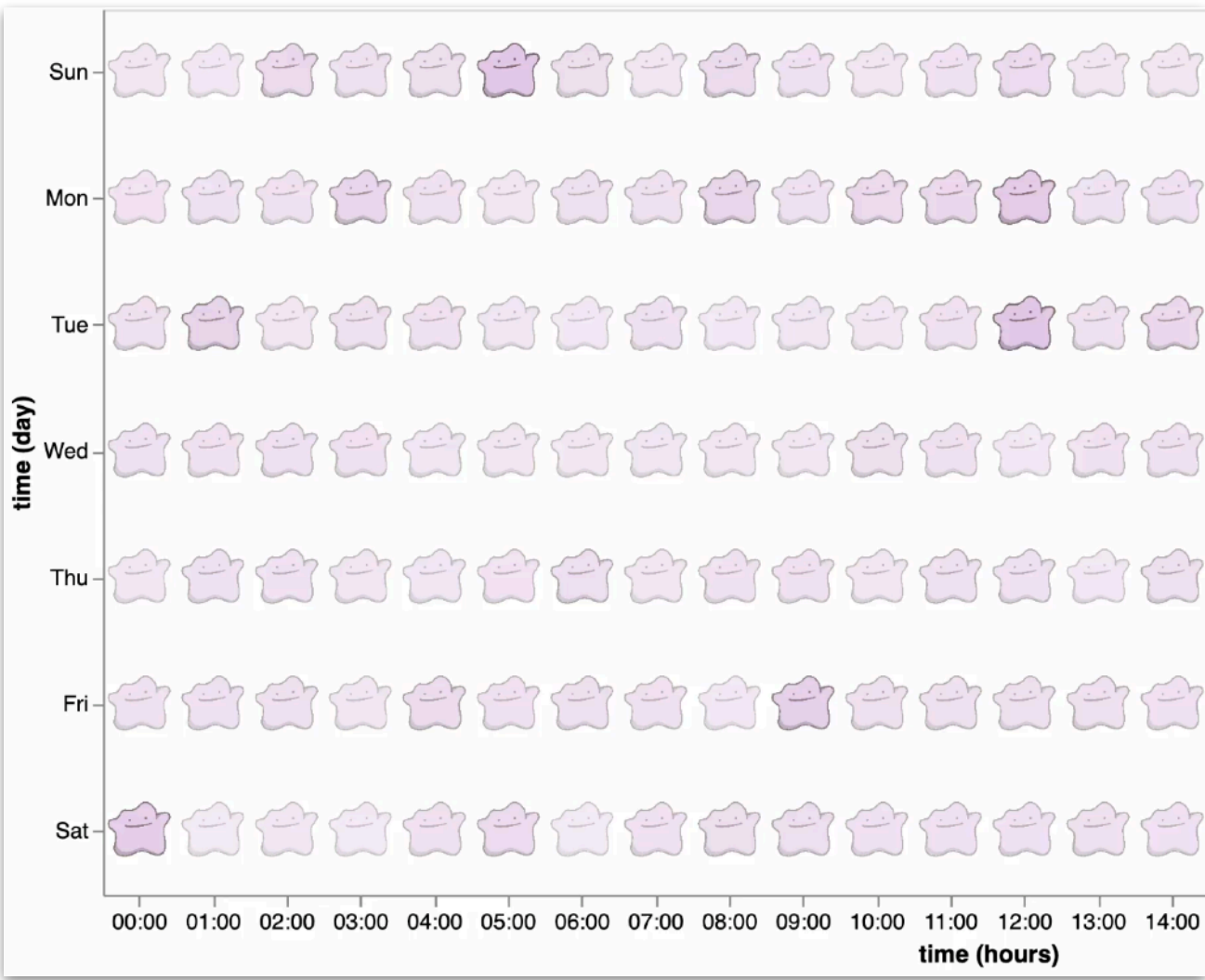
Reading & note-taking



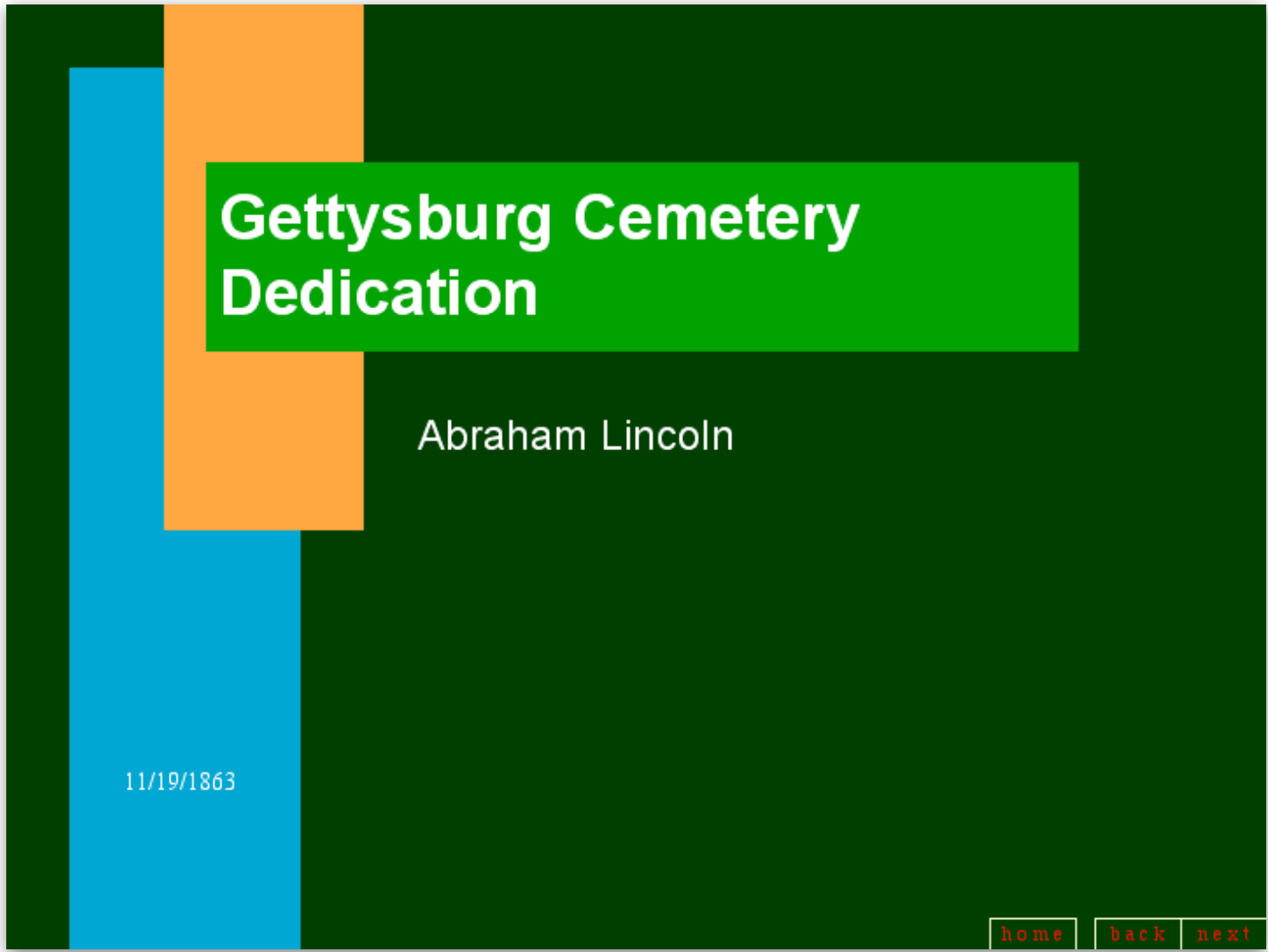
Hypertext



Data visualization



Slideshows



Spreadsheets

APLSheet							
fx =+ / A9 : A13							
	A	B	C	D	E	F	G
1	Item	Unit price	Quantity	Item total			Name
2	Bananas	11	2				Will
3	Eggs	2	10				Eleanor
4	Milk	25	1				Jinho
5							Charlene
6		Sales tax		Subtotal			Ditto
7		0.08					
8							Grade weights
9	1	1	=+ / A9 : A13				A1
10	2	2					A2
11	3	3					A3

A brief history of computers as a tool for thought



By Harris & Ewing - MIT Museum, GCP-00003581,
Public Domain, via Wikimedia Commons

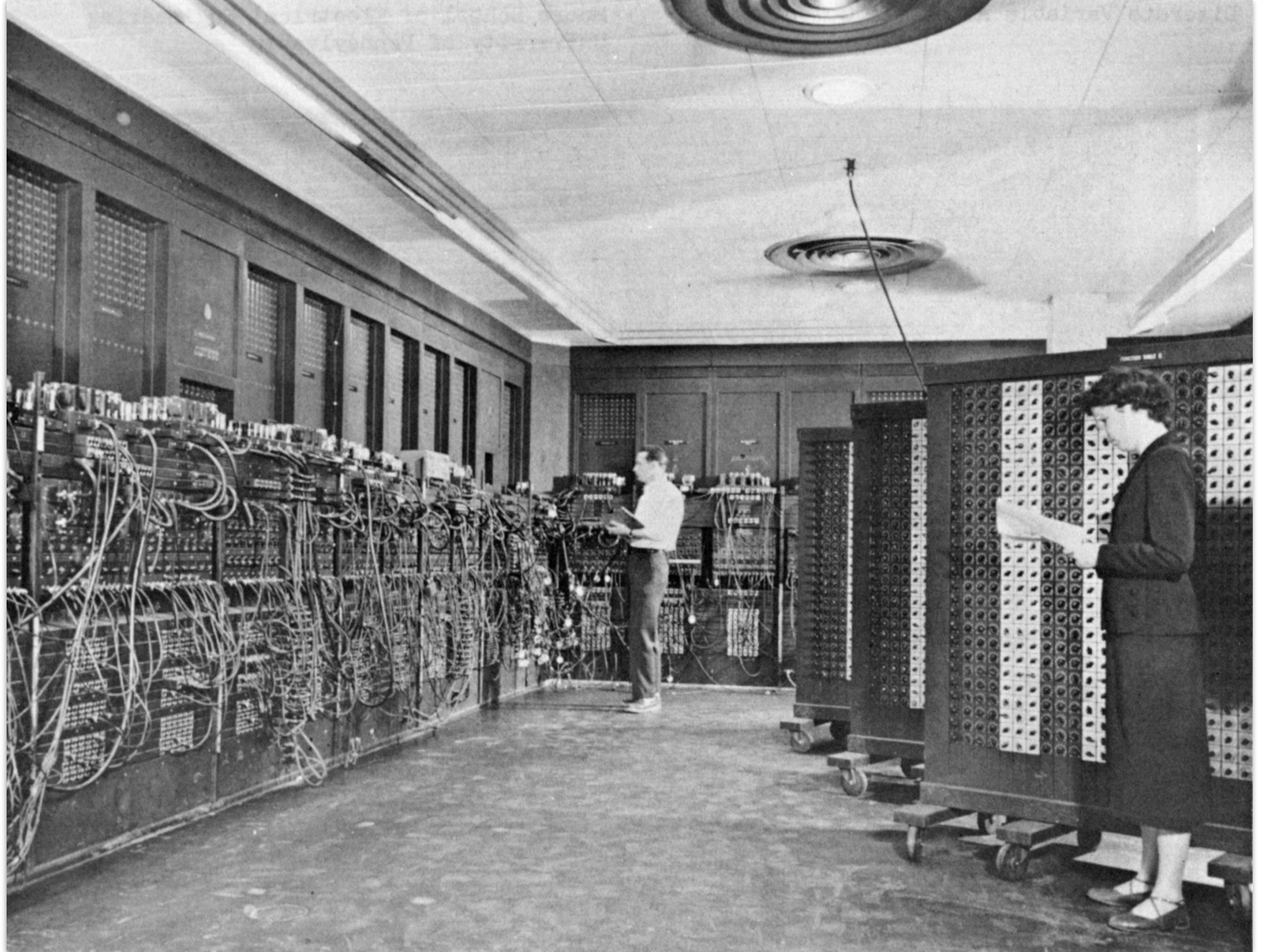
Vannevar Bush

Head of US Office of
Scientific Research and
Development during WWII

Early administrator of the
Manhattan Project

Key proponent of the
National Science
Foundation

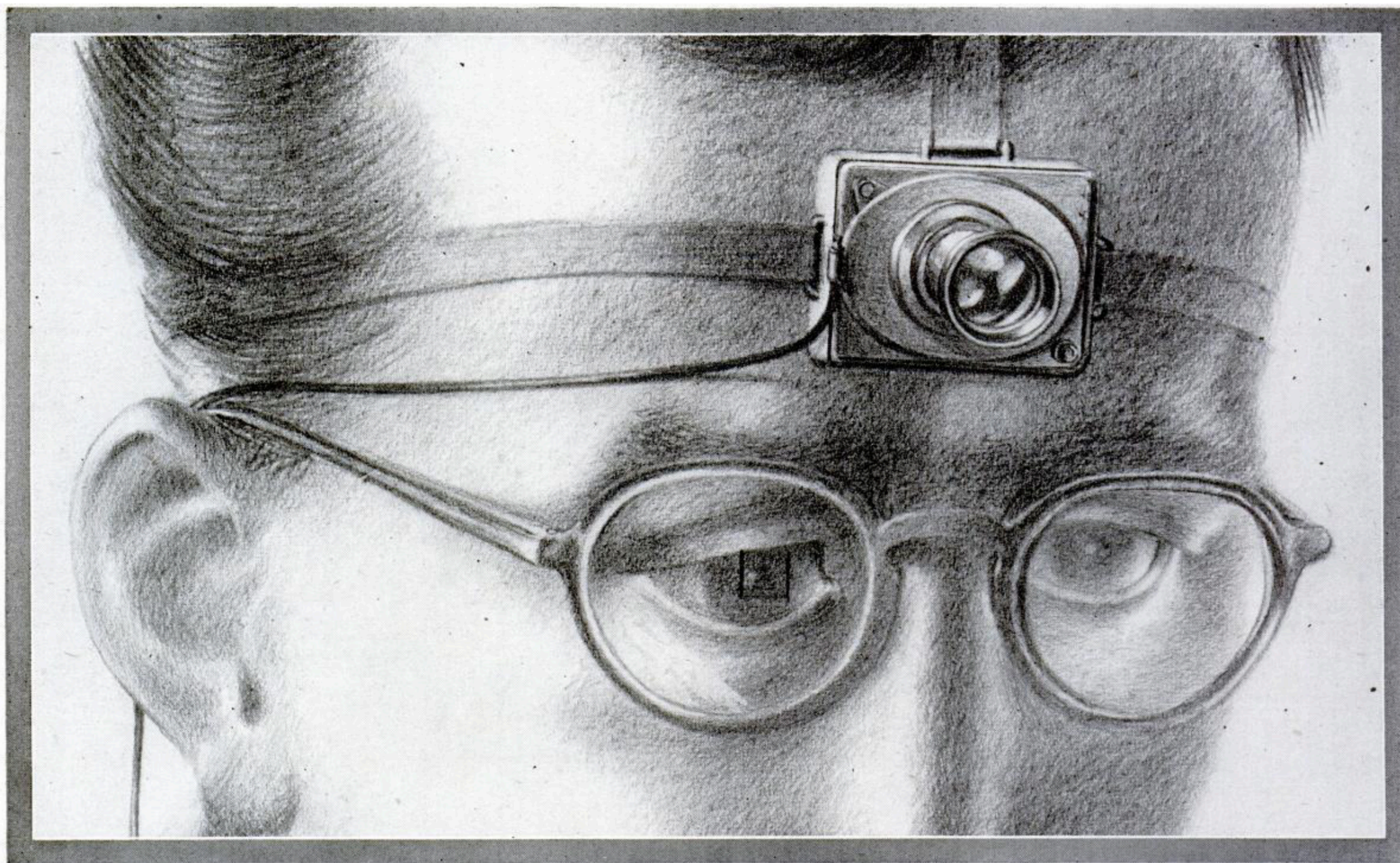
ENIAC (1945)



U.S. Army Photo, Public Domain,
via Wikimedia Commons

“There is a growing mountain of research. But there is increased evidence that we are being bogged down today as specialization extends. The investigator is staggered by the findings and conclusions of thousands of other workers — conclusions which he cannot find time to grasp, much less to remember, as they appear. Yet specialization becomes increasingly necessary for progress, and the effort to bridge between disciplines is correspondingly superficial.”

Vannevar Bush, “As We May Think” (1945)



A SCIENTIST OF THE FUTURE RECORDS EXPERIMENTS WITH A TINY CAMERA FITTED WITH UNIVERSAL-FOCUS LENS. THE SMALL SQUARE IN THE EYEGLASS AT THE LEFT SIGHTS THE OBJECT

AS WE MAY THINK

A TOP U. S. SCIENTIST FORESEES A POSSIBLE FUTURE WORLD
IN WHICH MAN-MADE MACHINES WILL START TO THINK

Cyclops Camera

Worn on forehead, it would photograph anything you see and want to record. Film would be developed at once by dry photography.

Microfilm

It could reduce *Encyclopaedia Britannica* to volume of a match-box. Material cost: 5¢. Thus a whole library could be kept in a desk.

Vocoder

A machine which could type when talked to. But you might have to talk a special phonetic language to this mechanical supersecretary.

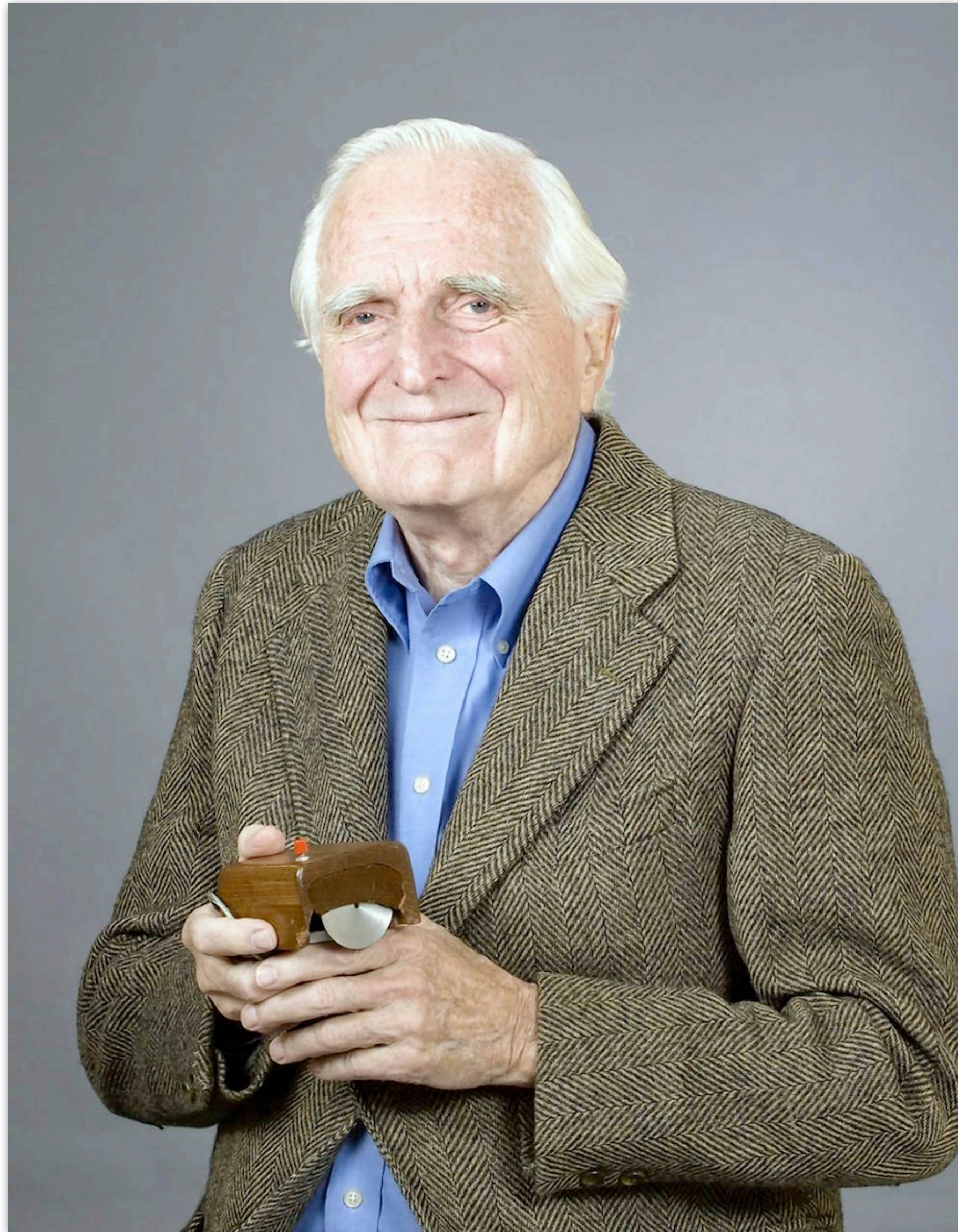
Thinking machine

A development of the mathematical calculator. Give it premises and it would pass out conclusions, all in accordance with logic.

Memex

An aid to memory. Like the brain, Memex would file material by association. Press a key and it would run through a "trail" of facts.

<https://youtu.be/c539cK58ees?t=4>



Turing Award portrait via ACM

Doug Engelbart

Director of Augmentation
Research Center at SRI

Contributed to the
invention of the **personal
computer**: mouse, GUIs,
word processing, and
hypertext

Cray CDC 6600 (1964)

Twin CDC 6600 consoles

Stills via Computer History Archive Project

By Jitze Couperus, CC BY 2.0,
via Wikimedia Commons

Engelbart read "As We May Think" in 1945...

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THE ATLANTIC MONTHLY

At a recent World Fair a machine called a Voder was shown. A girl stroked its keys and it emitted recognizable speech. No human vocal chords entered into the procedure at any point; the keys simply combined some electrically produced vibrations and passed these on to a loud-speaker. In the Bell Laboratories there is the converse of this machine, called a Vocoder. The loud-speaker is replaced by a microphone, which picks up sound. Speak to it, and the corresponding keys move. This may be one element of the postulated system.

The other element is found in the stenotype, that somewhat disconcerting device encountered usually at public meetings. A girl strokes its keys languidly and looks about the room and sometimes at the speaker with a disquieting gaze. From it emerges a typed strip which records in a phonetically simplified language a record of what the speaker is supposed to have said. Later this strip is retyped into ordinary language, for in its nascent form it is intelligible only to the initiated. Combine these two elements, let the Vocoder run the stenotype, and the result is a machine which

way in which we have learned to write figures. If we recorded them positionally, simply by the configuration of a set of dots on a card, the automatic reading mechanism would become comparatively simple. In fact, if the dots are holes, we have the punched-card machine long ago produced by Hollorith for the purposes of the census, and now used throughout business. Some types of complex businesses could hardly operate without these machines.

Adding is only one operation. To perform arithmetical computation involves also subtraction, multiplication, and division, and in addition some method for temporary storage of results, removal from storage for further manipulation, and recording of final results by printing. Machines for these purposes are now of two types: keyboard machines for accounting and the like, manually controlled for the insertion of data, and usually automatically controlled as far as the sequence of operations is concerned; and punched-card machines in which separate operations are usually de-

character-
recog.
allocated
if
brake
acting
used
(binary)

arith
machines

hand spec

at

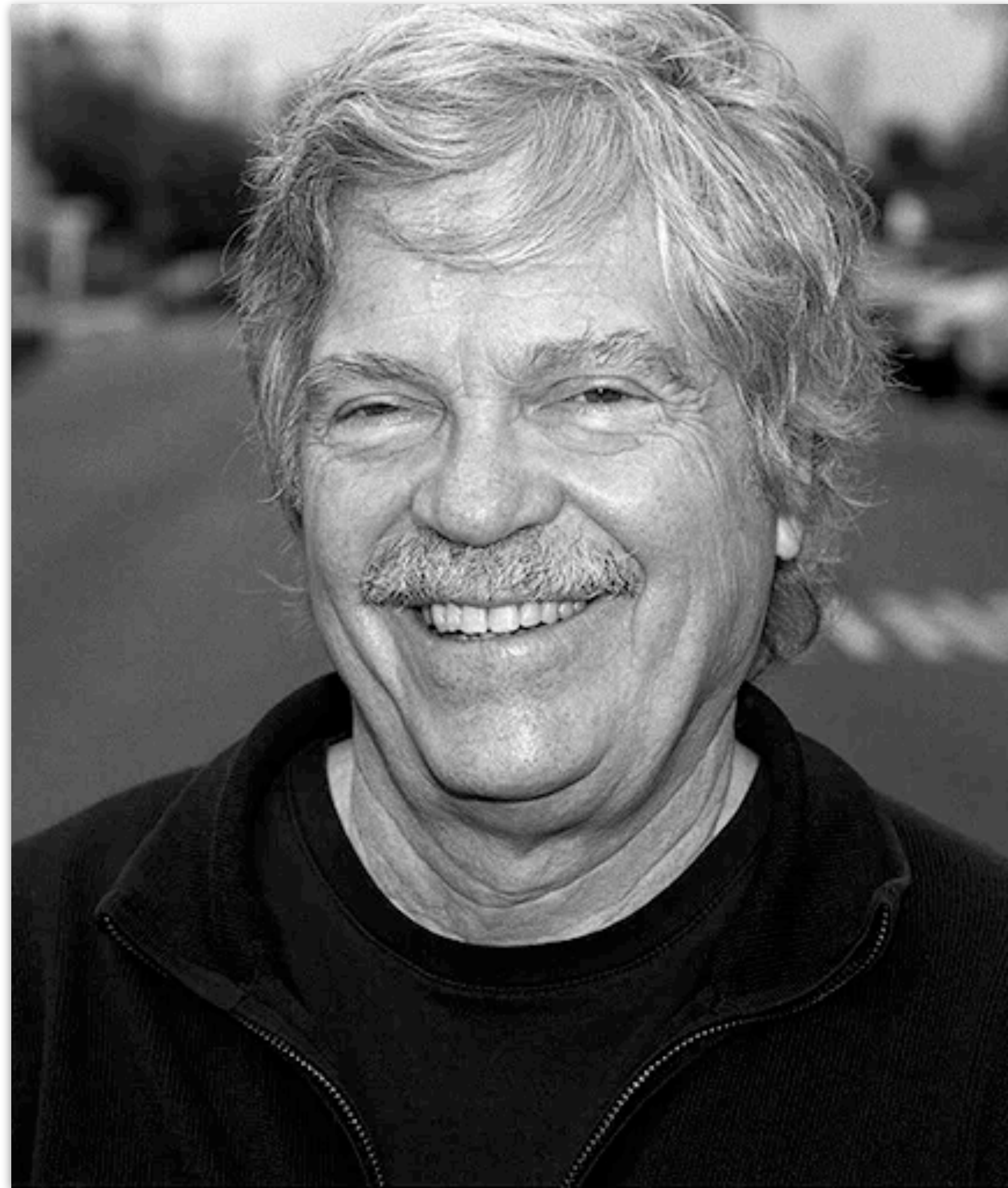
card spec

...20 years later... <https://youtu.be/B6rKUf9DWRI>

“The objective of this study is [...]:

- (1) to find the factors that limit the effectiveness of the individual's basic information-handling capabilities in meeting the various needs of society for problem solving in its most general sense; and
- (2) to develop new techniques, procedures, and systems that will better match these basic capabilities to the needs' problems, and progress of society.”

Doug Engelbart, “Augmenting Human Intellect: A Conceptual Framework” (1962)



via Heidelberg Laureate Forum

Alan Kay

While researcher at Xerox PARC, key contributor to:

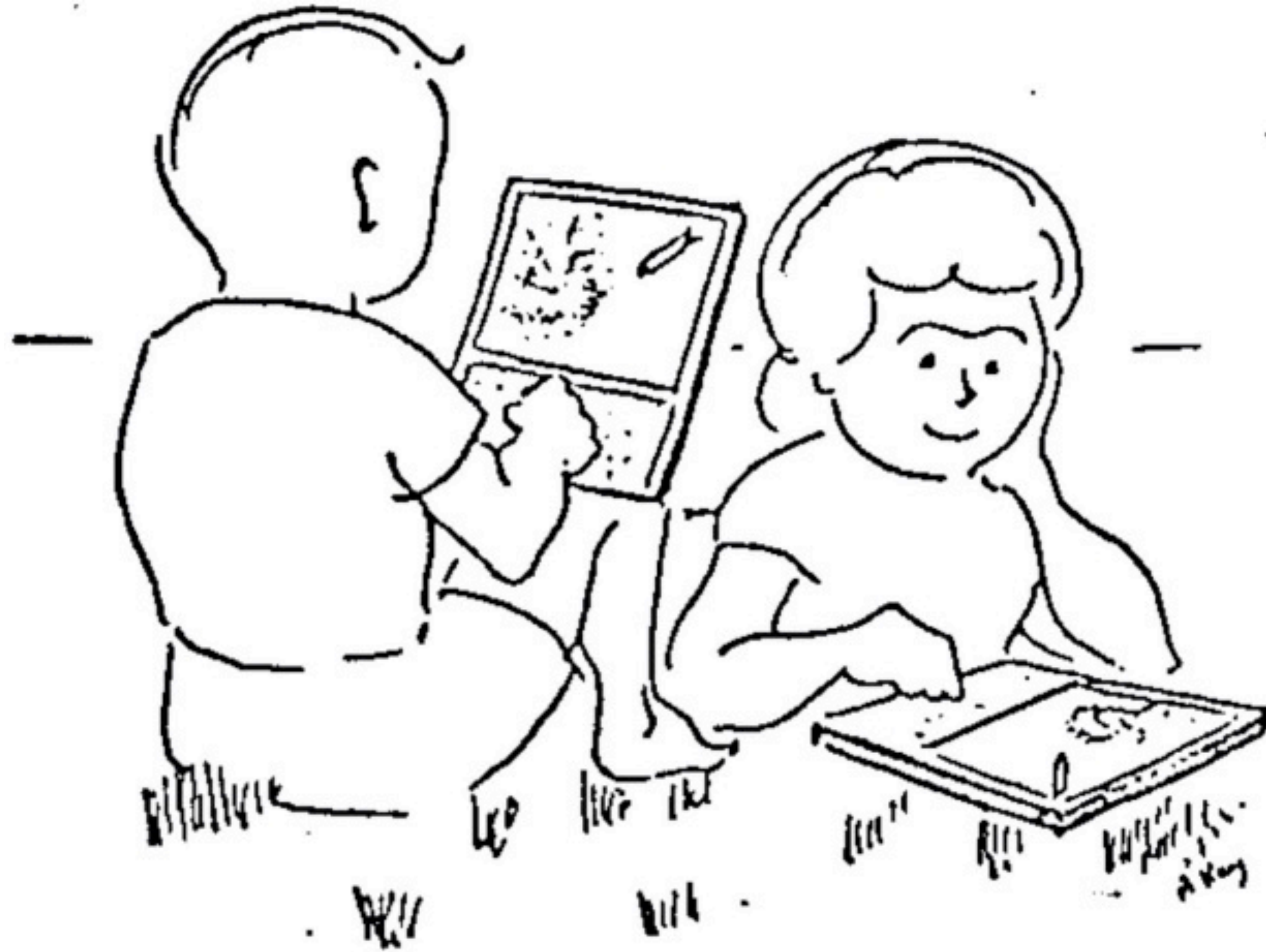
- SmallTalk, and object-oriented programming
- Windowed GUIs
- Tablet computers

On Engelbart's demo: "It was one of the greatest experiences in my life"

Wang 2200 desktop computer (1973)

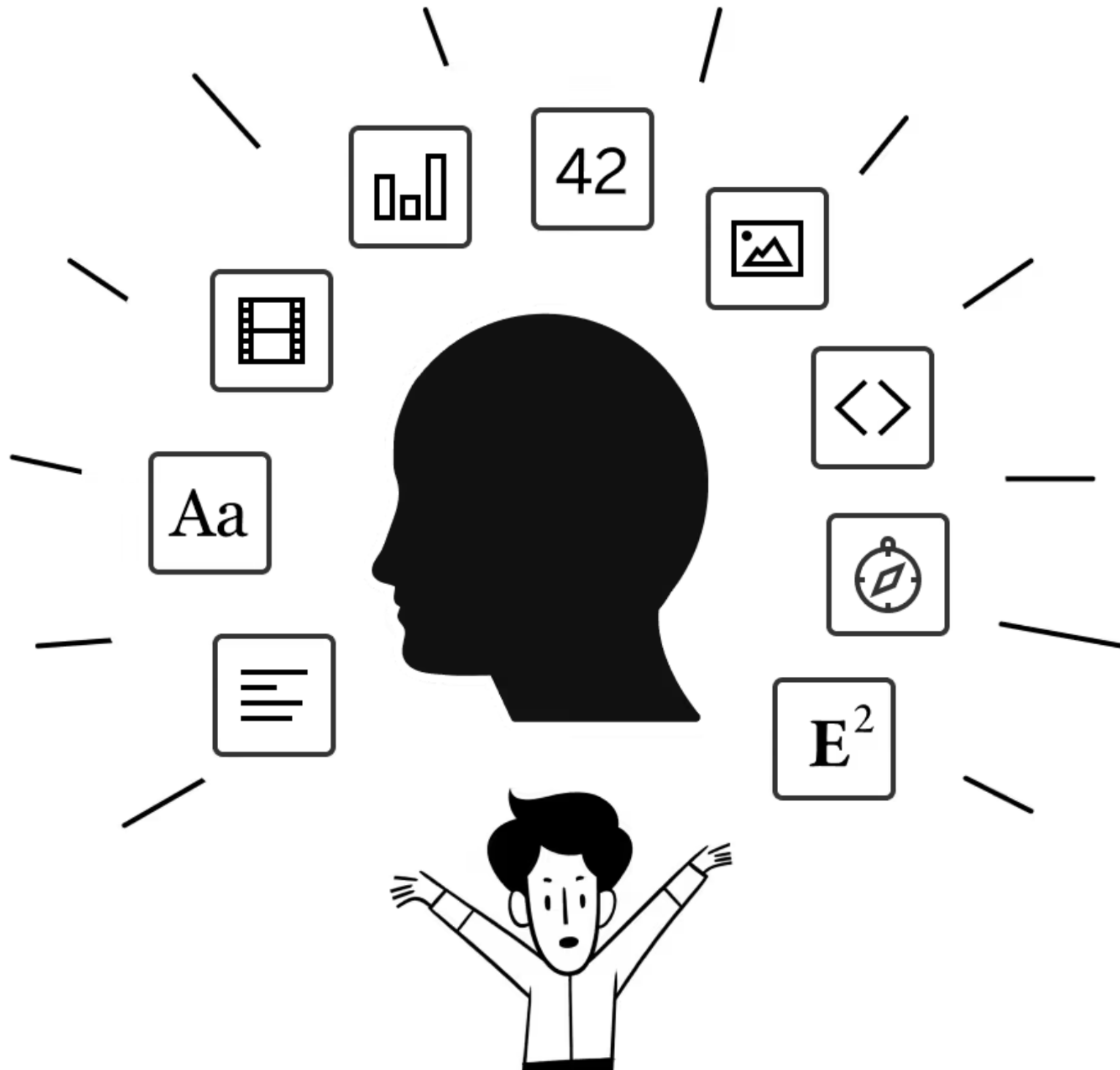


Dynabook (1972)



<https://youtu.be/lwL3yXdupv0?t=3042>

Notion, “A story of tools and the future of work”



Then something magical happened in the 1970s!

A generation of pioneers saw the computer as something far beyond a number-crunching machine. They dreamt a future where computers could amplify imagination (Alan Kay), augment intellect (Doug Engelbart), and expand our thoughts far beyond text on paper (Ted Nelson).

A tool unlike anything we have seen before.



Bilby, CC BY 3.0, via
Wikimedia Commons



<https://youtu.be/welKoeoK6zl>

C11 (L) TOTAL C1 25

	A	B	C	D
	ITEM	NO.	UNIT	COST
1	MUCK RAKE	43	12.95	556.85
4	BUZZ CUT	15	6.75	101.25
5	TOE TONER	250	49.95	12487.50
6	EYE SNUFF	2	4.95	9.90
SUBTOTAL				13155.50
9.75% TAX				1282.66
TOTAL				14438.16

VisiCalc

AppleWorks



Oregon
Trail



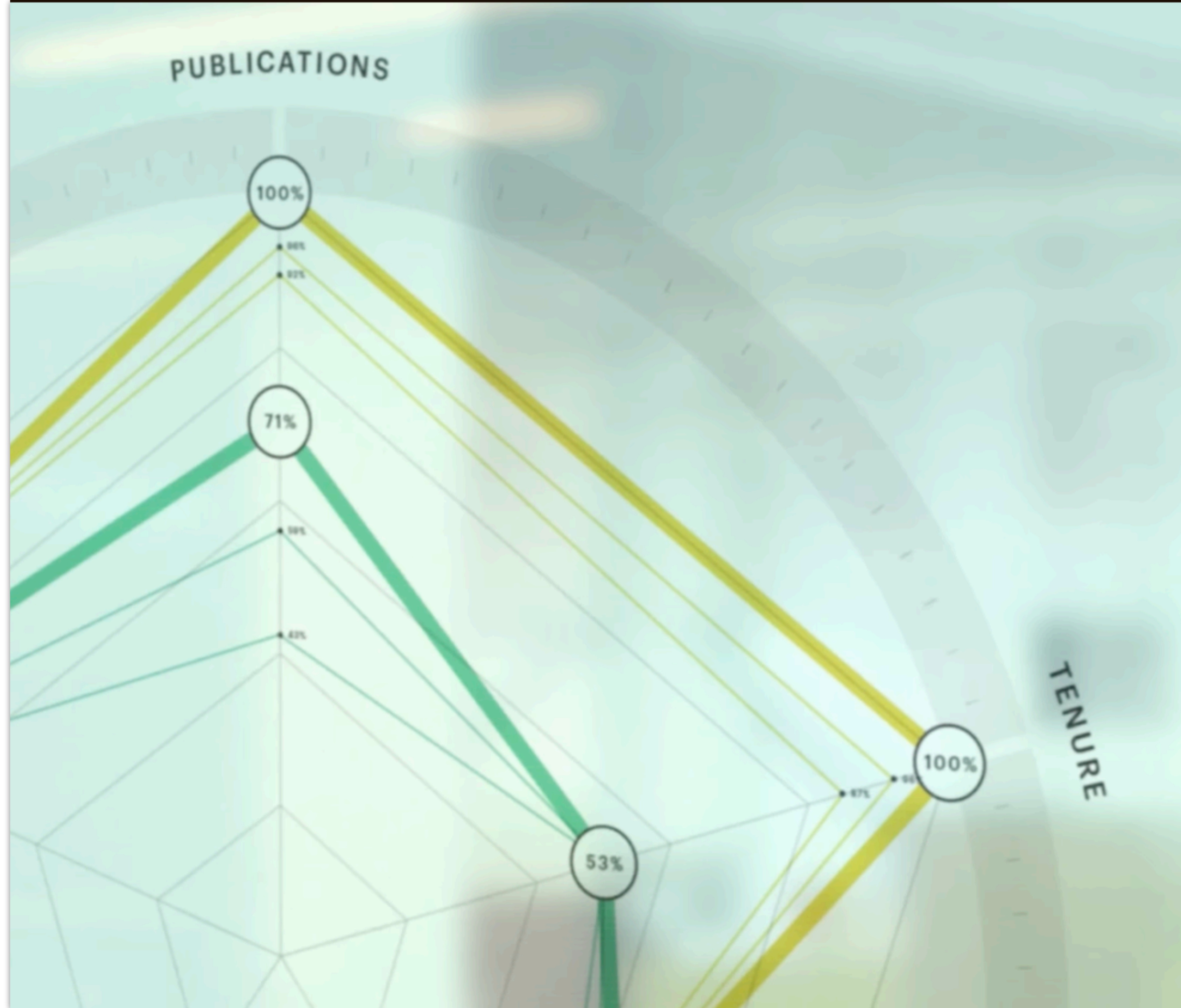
“A future-generation Macintosh, which we should have early in the twenty-first century, might well be a wonderful fantasy machine called the Knowledge Navigator, a discoverer of worlds, a tool as galvanizing as the printing press.”

Sculley and Byrne. *Odyssey: Pepsi to Apple*. 1987

“These pieces were marketing materials. They supported the sale of computers by suggesting that a company making them has a plan for the future. They were not inventing new interface ideas. (The production cycles didn’t allow for that.) Instead, they were about visualizing existing ideas—and pulling many of them together into a reasonably coherent environment and scenario of use.”

Hugh Dubberly, “The Making of Knowledge Navigator” in Bill Buxton, *Sketching User Experiences*. 2007

<https://youtu.be/w-tFdreZB94>



DYNAMICLAND

<https://youtu.be/PixPSNRDNMU?>

Course logistics

- **Assignments:** given weekly, with optional lab component (50%)
 - Lab times will be scheduled after admissions is complete
- **Midterm:** will have a midterm on conceptual content (25%)
 - We will distribute an Anki deck + last semester's midterm
- **Final project:** four weeks at the end of the semester (25%)
 - 1-4 people per project, collaboration encouraged
 - This semester: w/ support from the Wikimedia Foundation!
- **Attendance:** no textbook, so engaging with lecture is important
 - I will be working on lecture notes throughout the semester
 - All lectures will be recorded and posted online (but more fun in-person!)
 - My wife and I are having a baby due Nov 6!

My wonderful course staff

HTA



Alex Khosrowshahi

GTA



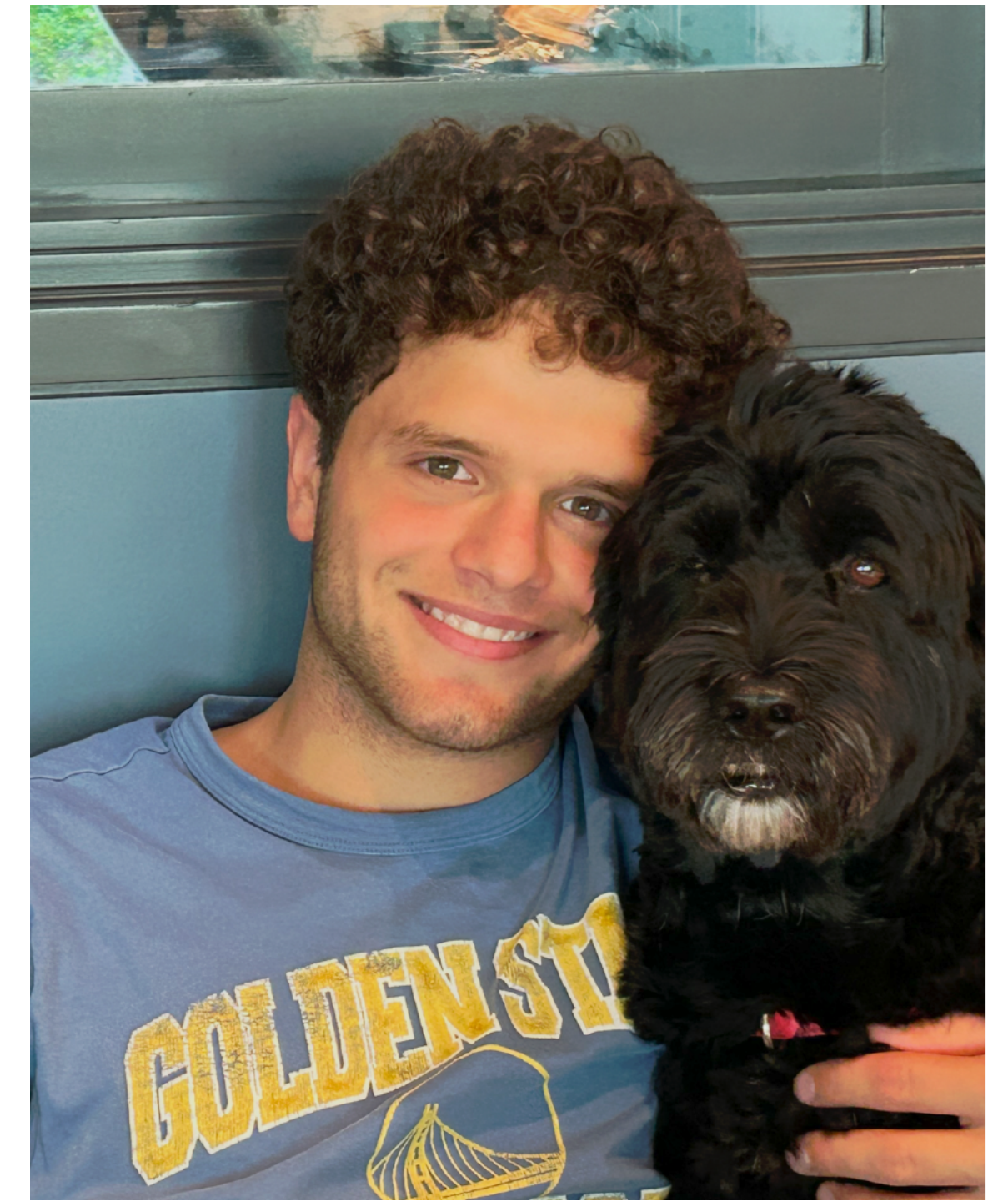
Zheyuan Wu

UTA



Sophie Martinez

UTA



Nico DiLullo

Submit your application by **tomorrow** (Friday)!



<https://forms.gle/FEMwSJyX4BV7oGya8>