

UNIVERSITY OF  
Southampton

# Trailblazers: History of Hypertext Part 2

COMP3220 Web Infrastructure

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Interlude, 1939-1945

# Vannevar Bush

Engineer, inventor and  
science administrator

- Co-founder of Raytheon (1922)
- First vice-president of MIT (1932)
- Chair of the National Advisory  
Committee for Aeronautics (1940-41)
- Director of the US Office of Scientific  
Research and Development during WWII  
(1941-47)
- De facto director of the Manhattan  
Project until 1943





Bush, V. (1931) *The differential analyzer. A new machine for solving differential equations.* Journal of the Franklin Institute. 212(4), 447-488.

"All the News That's Fit to Print"

# The New York Times

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## TESTS BY VIKING STRENGTHEN HINT OF LIFE ON MARS

But Scientists Warn Signs of Biological Activity Will Need Confirming Study

TO VIKING ENTERS ORBIT

Orbit Path into Lopping Path to Enable It to Sample Wide Areas of Planet



## HOSPITAL STRIKE ENDS AS WORKERS SURRENDER RAISES

Union Consents to Give Up Cost-of-Living Increases to Restore 802 Jobs

MEMBERS APPROVE PACT

New York City Agrees to Set Further Limits This Year and Prohibit More Funds

## Iranians Planning to Spend \$10 Billion on U.S. Arms

ACCORD WITH AMIN

By HERBERT GOLDHAMER  
The Iranian government has agreed to purchase \$10 billion worth of American-made arms and military equipment, according to a report by a senior Iranian official. The deal, which is being negotiated by the Iranian Revolutionary Guard Corps, would include a wide range of weapons, including tanks, aircraft, and missiles. The agreement is seen as a major step towards normalizing relations between Iran and the United States.

## TESTS FAIL TO FIND Cause of Deaths

Beame, Goldin Reported To Ask S.E.C. Assurances

By HERBERT GOLDHAMER  
The Securities and Exchange Commission (S.E.C.) is reviewing the deaths of two prominent figures, Beame and Goldin, following reports that they had asked for assurances from the commission. The deaths occurred in the context of a major financial scandal involving the collapse of a large investment firm. The S.E.C. is currently conducting an investigation into the circumstances surrounding the deaths and the financial activities of the firm.

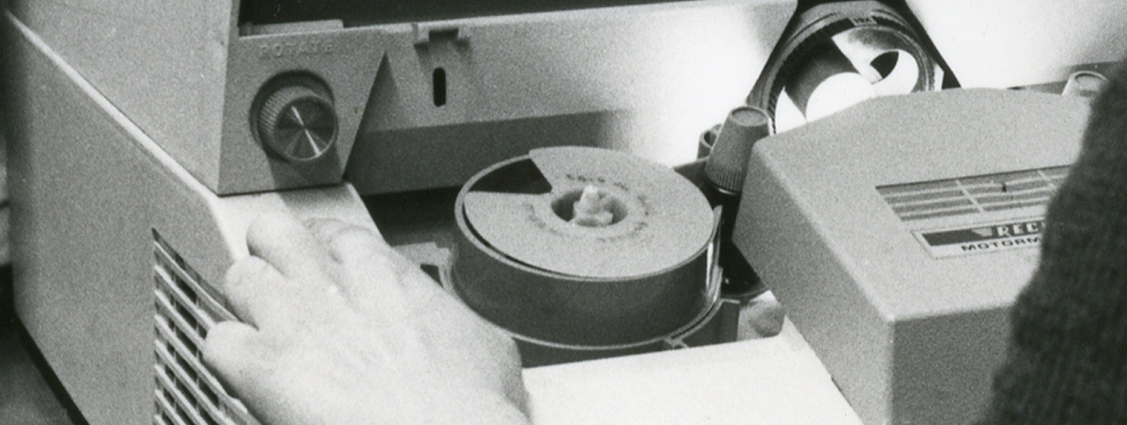
## Kenya Signs Accord with Amin

President of Uganda Signs

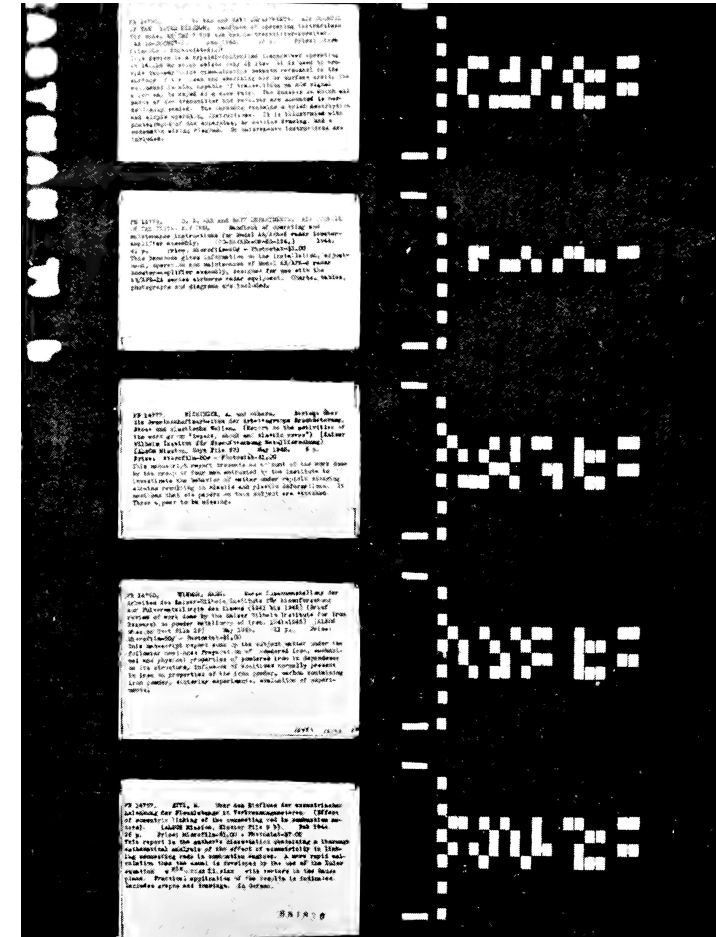
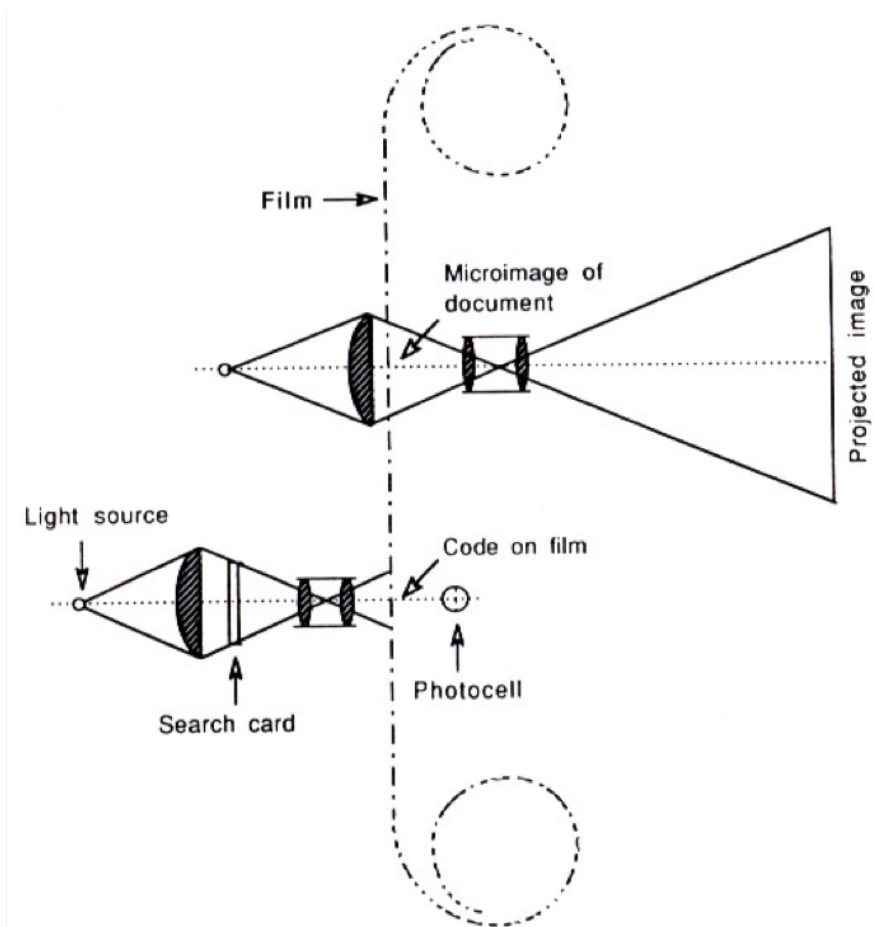
By HERBERT GOLDHAMER  
The President of Uganda, Idi Amin, has signed an agreement with Kenya, ending a period of tension between the two countries. The agreement, which was signed in Nairobi, Kenya, covers a wide range of issues, including border security, trade, and diplomatic relations. It is seen as a significant step towards stabilizing the region and improving relations between the two nations.

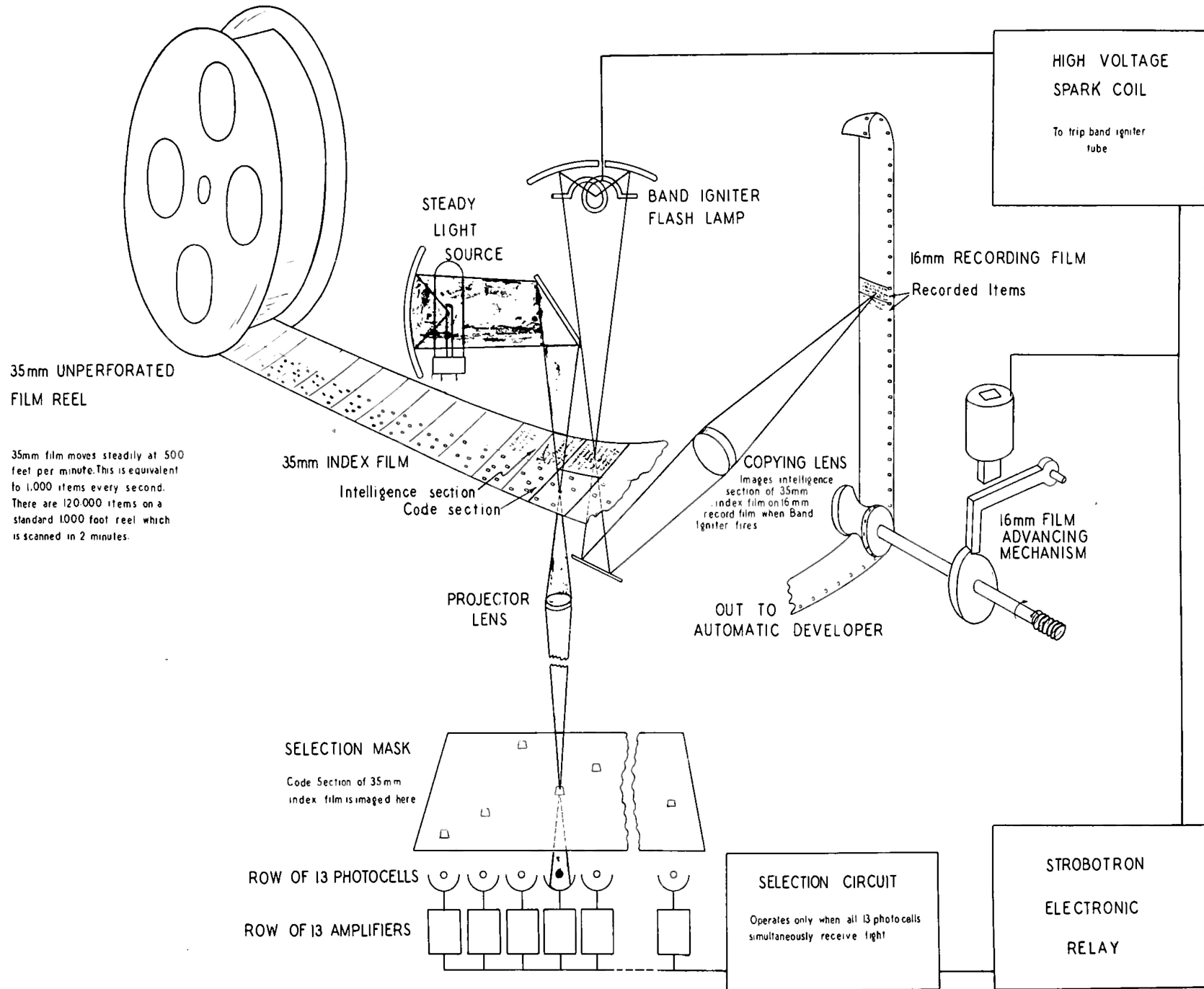
AUG 8 11

Catholics Hail Spirit of Parley

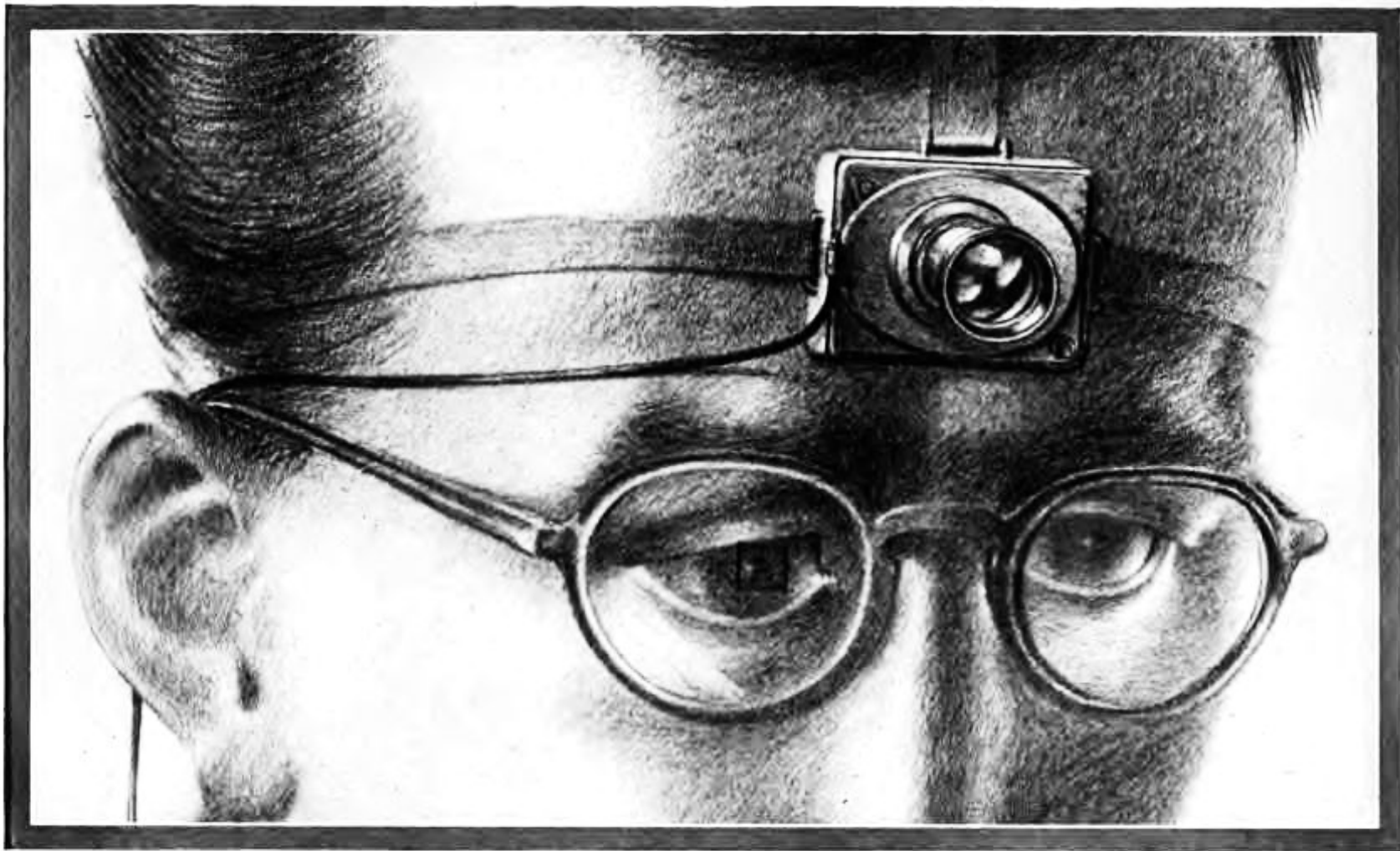


# The Rapid Selector









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

# As We May Think

*The difficulty seems to be, not so much that we publish unduly in view of the extent and variety of present-day interests, but rather that publication has been extended far beyond our present ability to make real use of the record.*



# As We May Think

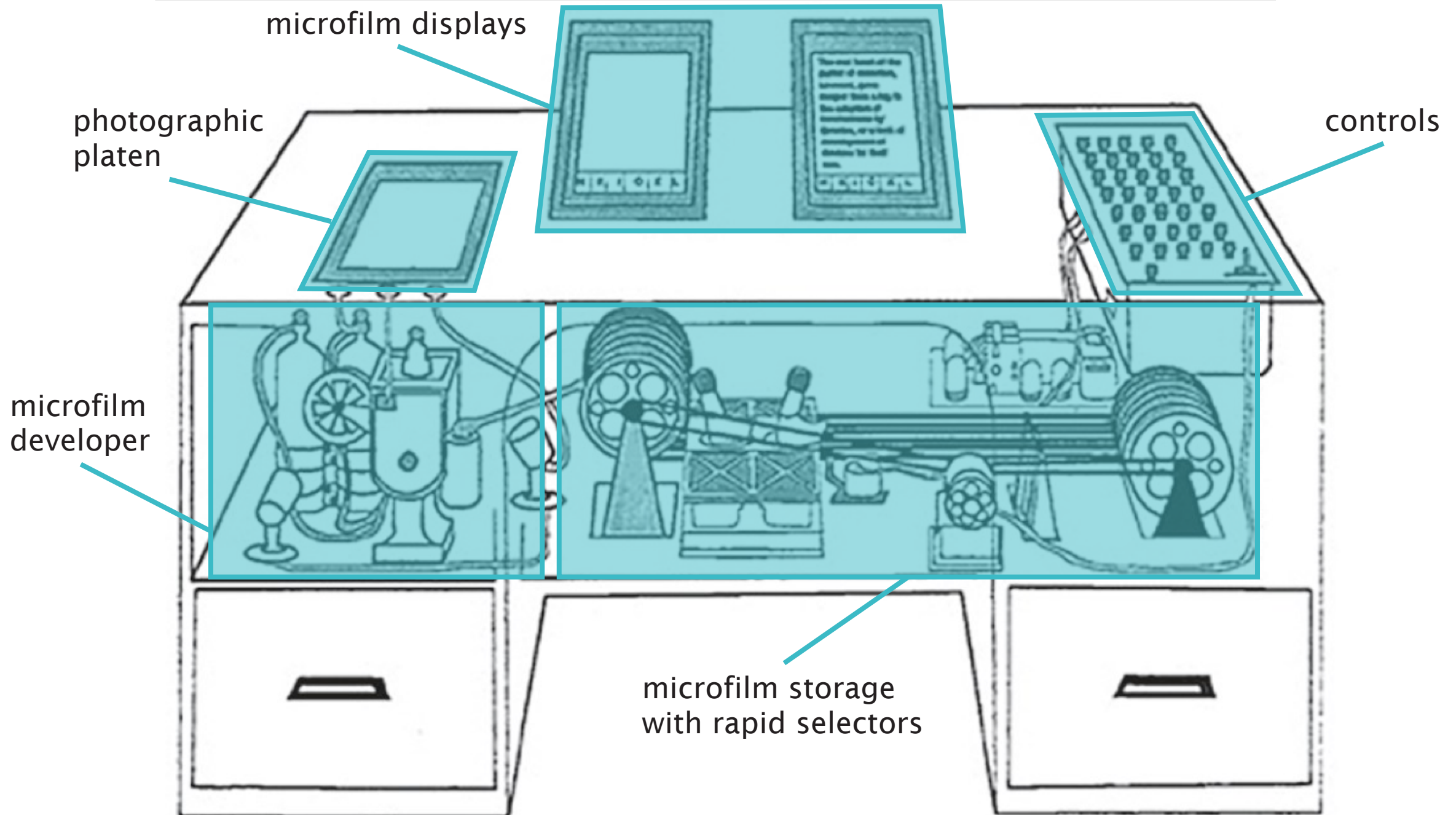
*Our ineptitude in getting at the record is largely caused by the artificiality of systems of indexing. When data of any sort are placed in storage, they are filed alphabetically or numerically, and information is found (when it is) by tracing it down from subclass to subclass. [...] Having found one item, moreover, one has to emerge from the system and re-enter on a new path.*



# As We May Think

*The human mind does not work that way. It operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain.*





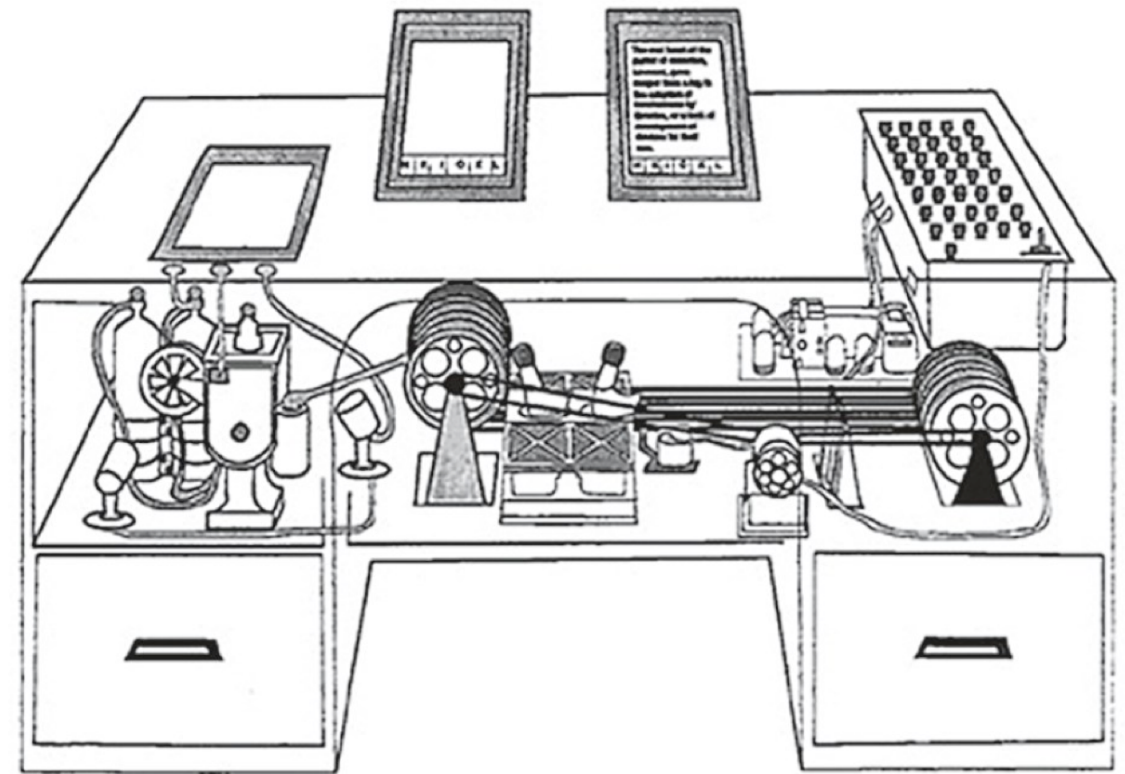
# The Memex

*“The process of tying two things together is the important thing”*

Key notion is of a *trail*:

- Link between pages
- Stored (branching) sequence of pages

*“a new profession of trail blazers, those who find delight in the task of establishing useful trails through the enormous mass of the common record”*



# As We May Think

*Wholly new forms of encyclopedias will appear, ready made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified.*

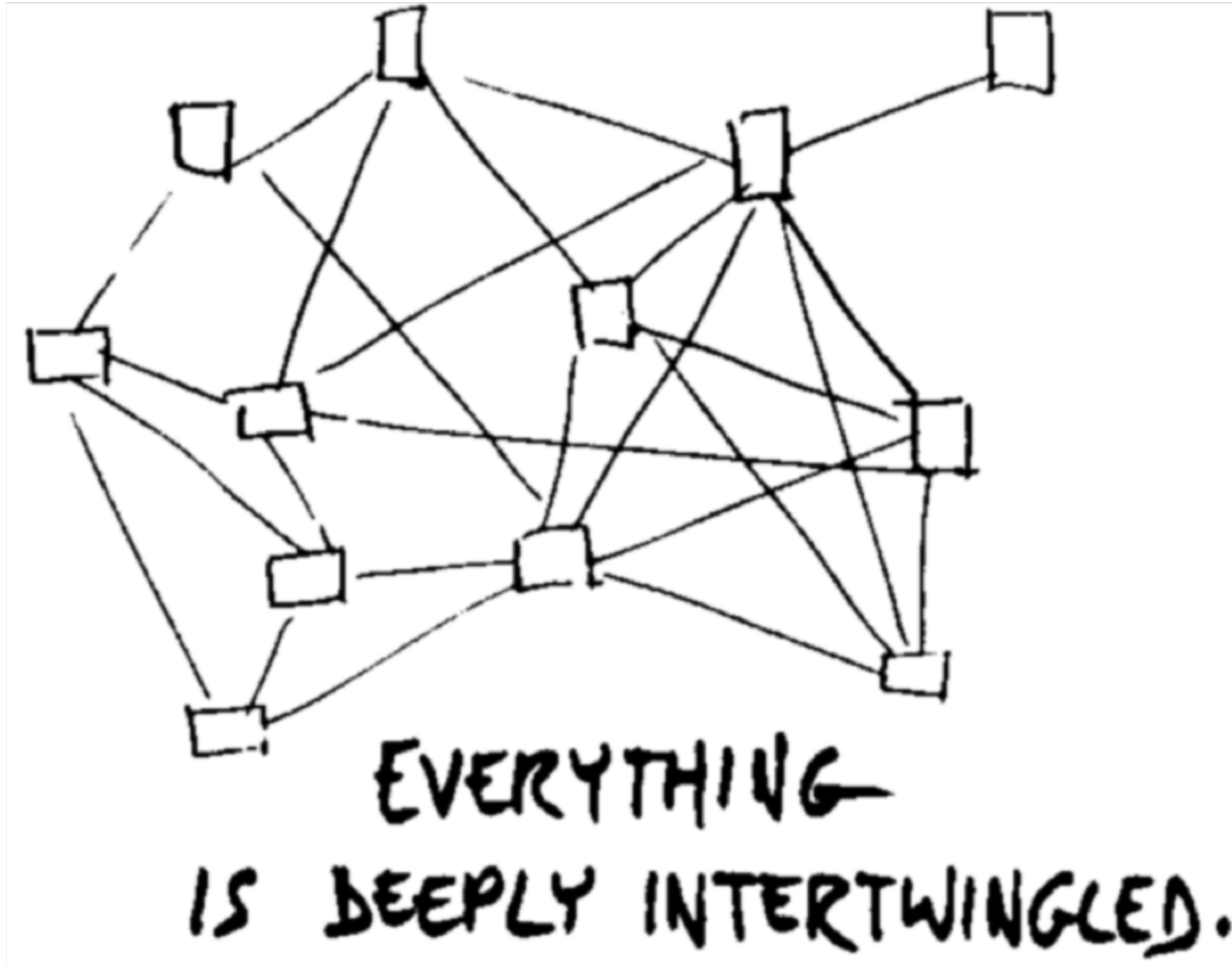




# The Information Age

Computer History Museum

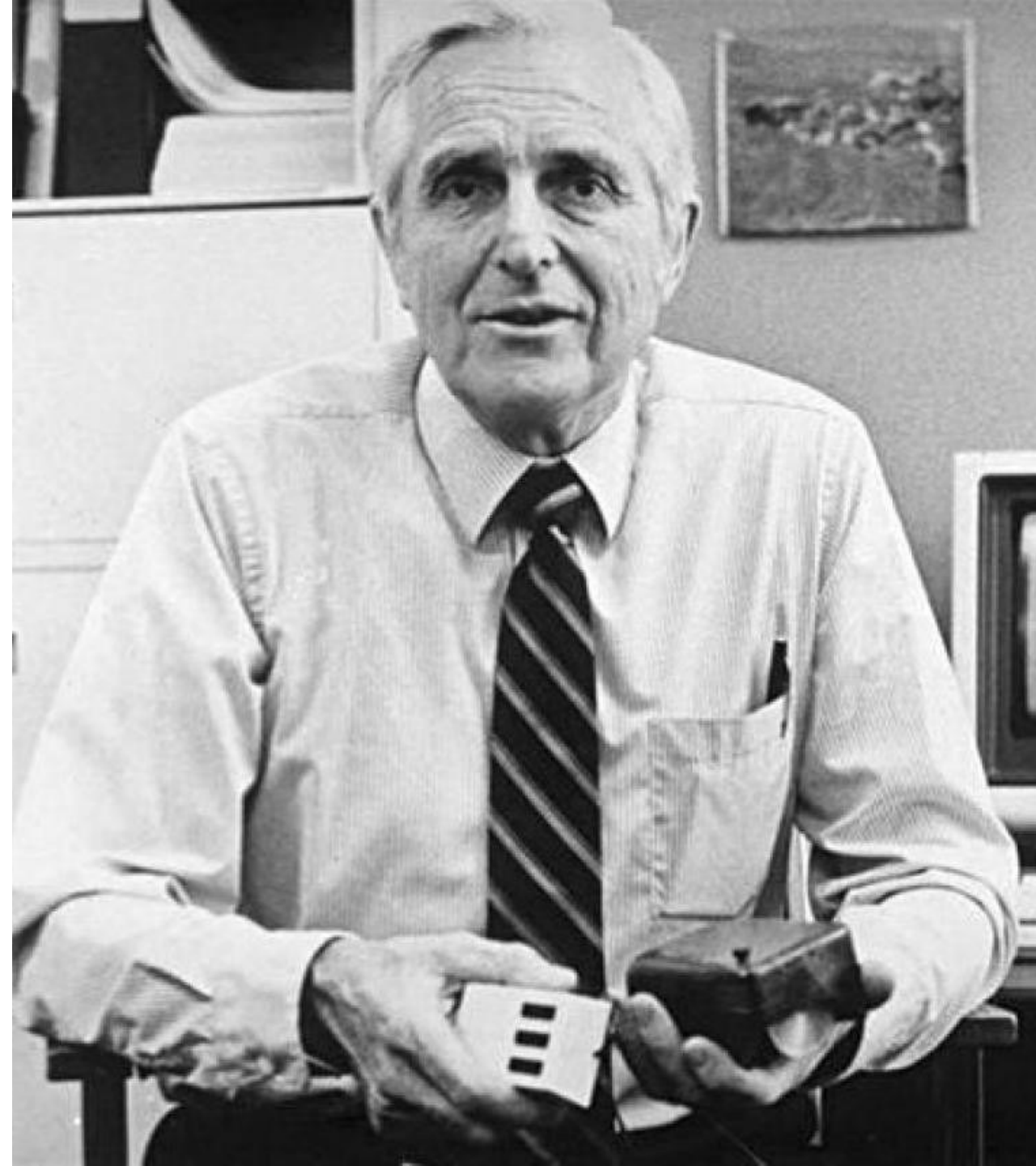




# Doug Engelbart

Member of the Stanford Research Institute

While at SRI, founded the  
Augmentation Research Center



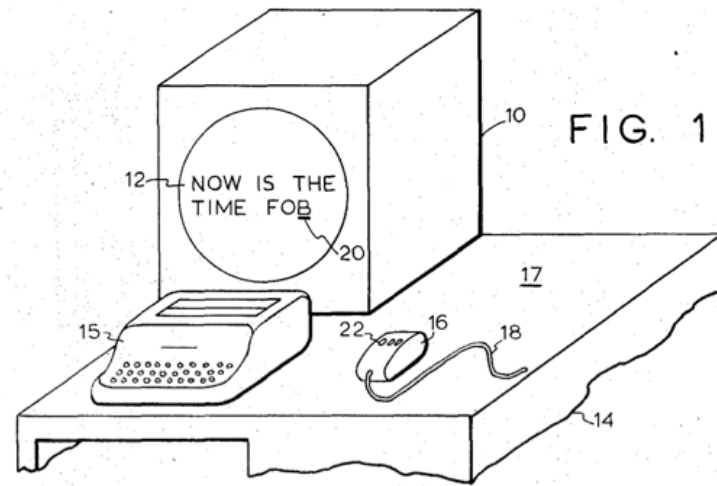


FIG. 1

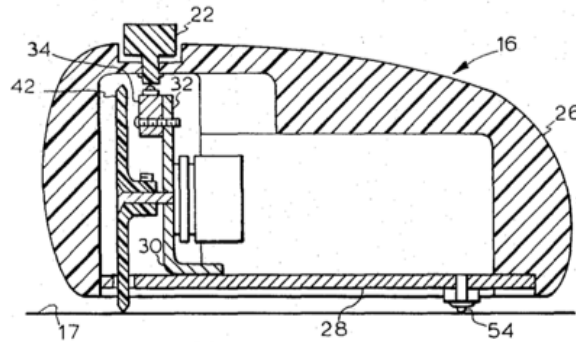


FIG. 2

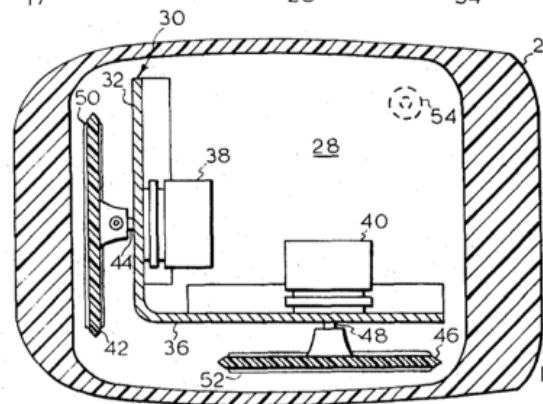


FIG. 3

INVENTOR.  
DOUGLAS C. ENGELBART

# Augmented external symbol manipulation

*In this stage [of the evolution of individual human intellectual capability], symbols with which the human represents the concepts he is manipulating can be arranged before his eyes, moved, stored, recalled, operated upon according to extremely complex rules—all in very rapid response to a minimum amount of information supplied by the human, by means of special cooperative technological devices.*

# NLS: the oN-Line System

Timesharing computer with multiple consoles


UI features:

- Windowed display
- Mouse
- Chorded keyboard
- Videoconferencing
- Links in content!



## Augmenting human intellect

*[...] we are concentrating fully upon reaching the point where we can do all of our work on line — placing in computer store all of our specifications, plans, designs, programs, documentation, reports, memos, bibliography and reference notes, etc., and doing all of our scratch work, planning, designing, debugging, etc., and a good deal of our intercommunication, via the consoles.*



**monday afternoon**  
**december 9**  
**3:45 p.m. / arena**

*Chairman:*  
**DR. D. C. ENGELBART**  
*Stanford Research Institute  
Menlo Park, California*

**a research center  
for augmenting human  
intellect**

This session is entirely devoted to a presentation by Dr. Engelbart on a computer-based, interactive, multiconsole display system which is being developed at Stanford Research Institute under the sponsorship of ARPA, NASA and RADC. The system is being used as an experimental laboratory for investigating principles by which interactive computer aids can augment intellectual capability. The techniques which are being described will, themselves, be used to augment the presentation.

The session will use an on-line, closed circuit television hook-up to the SRI computing system in Menlo Park. Following the presentation remote terminals to the system, in operation, may be viewed during the remainder of the conference in a special room set aside for that purpose.

1  
/ENOPSTNGLT: 32285788

1 BOVTE GEEALPHA)

2 MARKET - SEE 1

3 SHOE STORE -

4 HARDWARE:

5 ART SUPPLY

6 SHUG STORE

7 LIBRARY

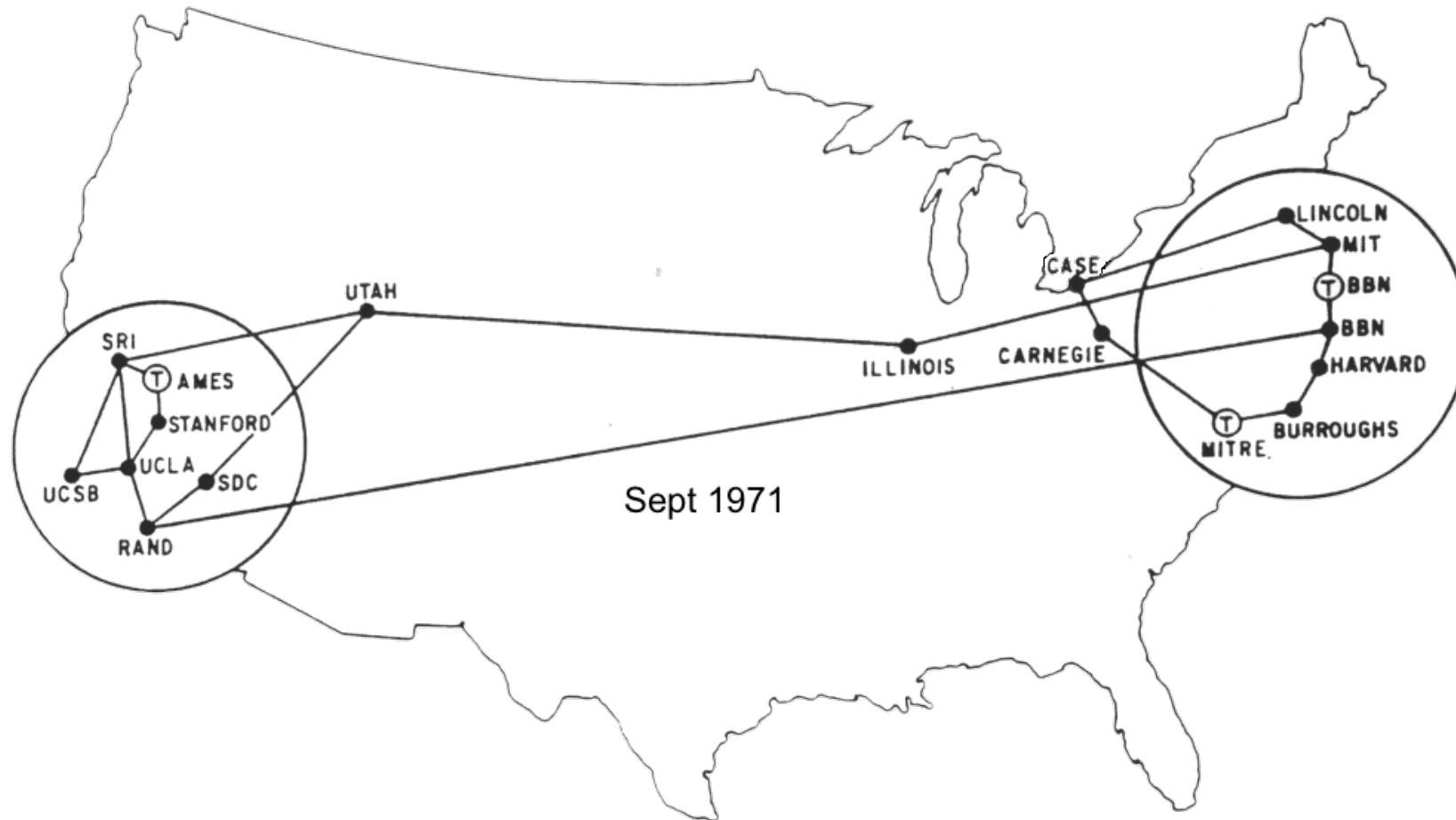




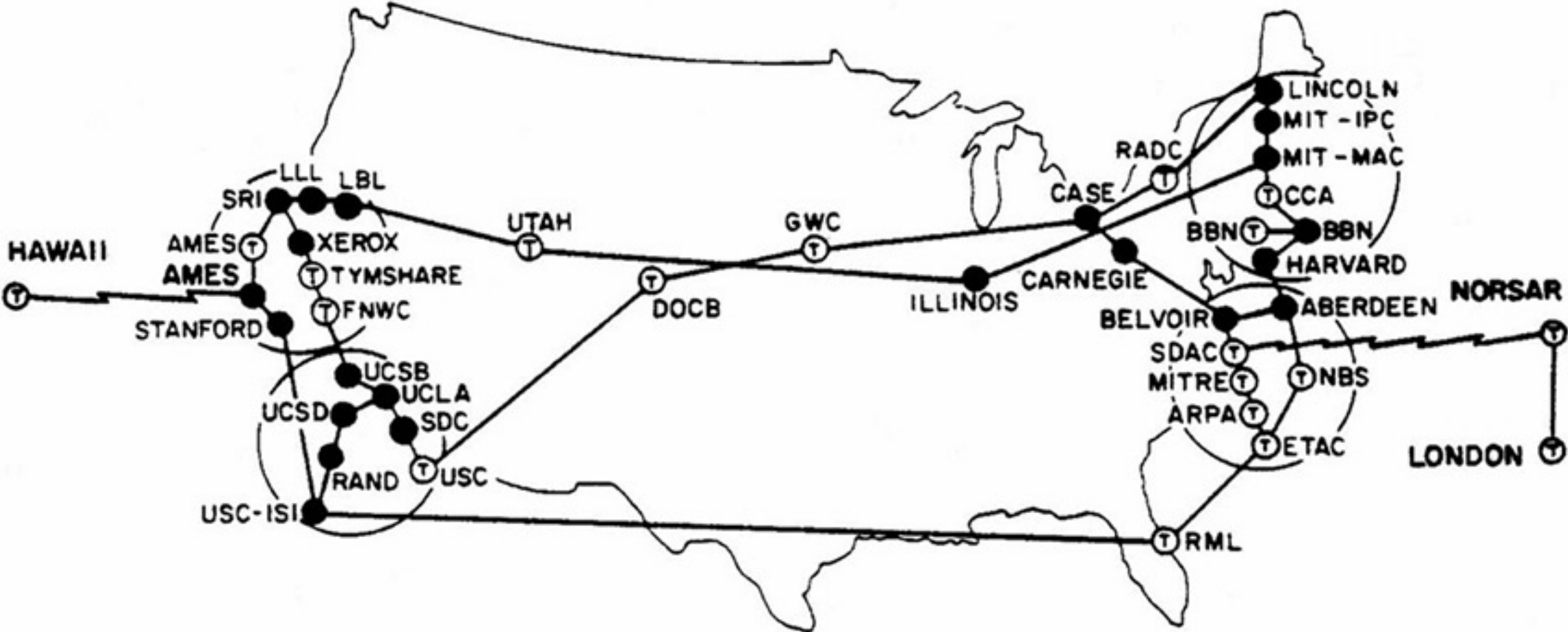
CONTROL TECHNIQUES  
CONTROL DEVICES  
CONTROL DIALOGUE  
CONTROL METALANGUAGE

29 OCT 69	2100	LOADED OP. PROGRAM EDIC BEN BARKER BBV	CSK
	22:30	Talked to SRS Host to Host	CSL
		Left op. program running after sending a host dead message to imp.	CSL

# The birth of the Internet



# The birth of the Internet



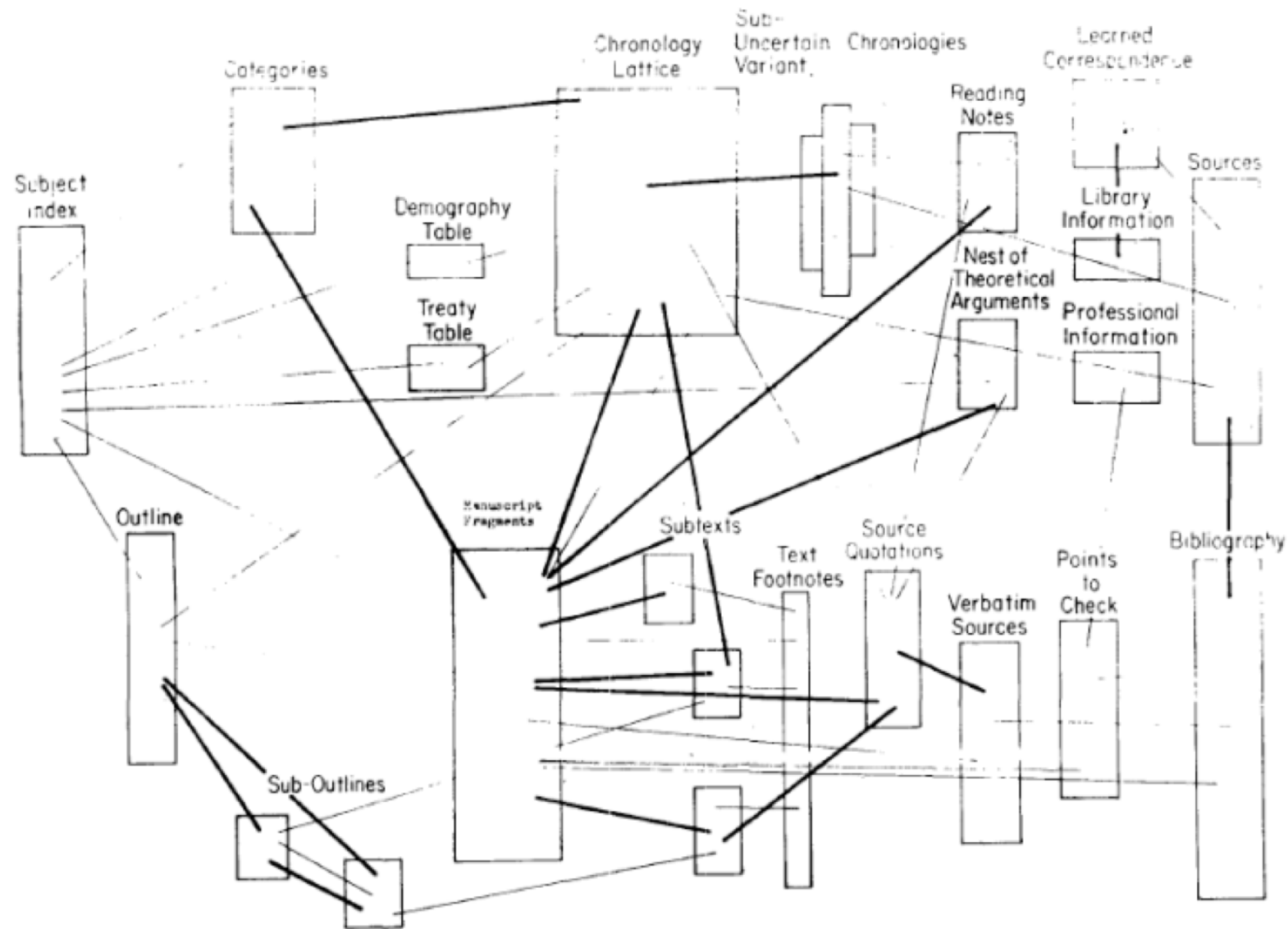
# Ted Nelson

Sociologist, philosopher and film maker

Coined the term “hypertext” in 1965

*A user interface should be so simple that a beginner in an emergency can understand it within ten seconds.”*

*Most people are fools, most authority is malignant, God does not exist, and everything is wrong.*





Hyperland (1990) Produced by Max Whitby [Television Programme]. London: British Broadcasting Corporation.

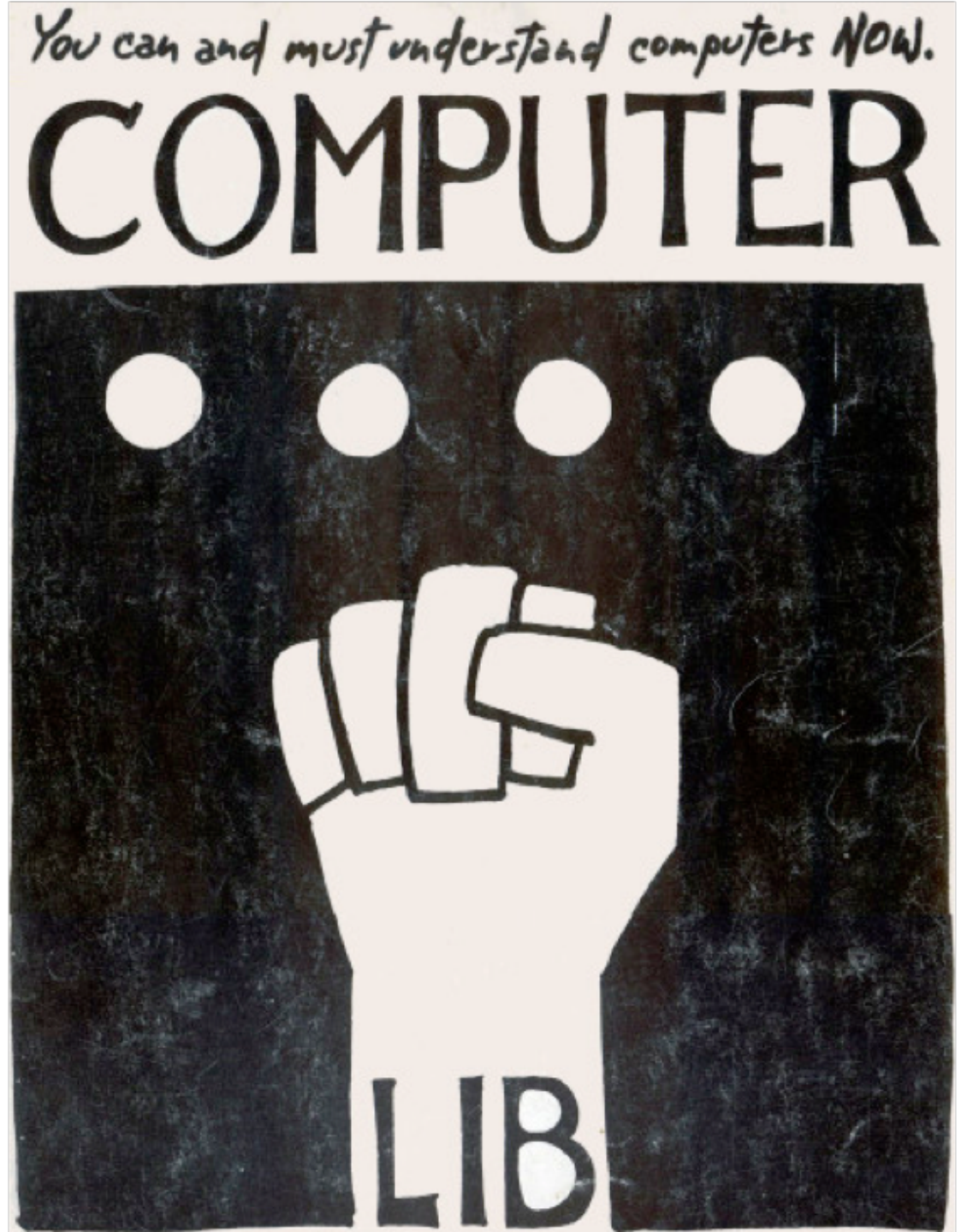
# Computer Lib / Dream Machines

*"No one's life has yet been simplified by a computer."*

Two books in a dos-a-dos binding:

- Computer Lib is a clarion call for people to understand computers deeply
- Dream Machines is a sketch of the flexible media potential of computers

Nelson, T.H. (1974) *Computer Lib/Dream Machines*. Chicago, IL: Nelson, T.H.





# A Vision in a Dream

In 1797, Samuel Taylor Coleridge (supposedly) wrote the poem Kubla Khan after awaking from an opium dream:

*In Xanadu did Kubla Khan  
A stately pleasure-dome decree:  
Where Alph, the sacred river, ran  
Through caverns measureless to man  
Down to a sunless sea.*

He was interrupted by a visitor from Porlock, and never completed the poem...

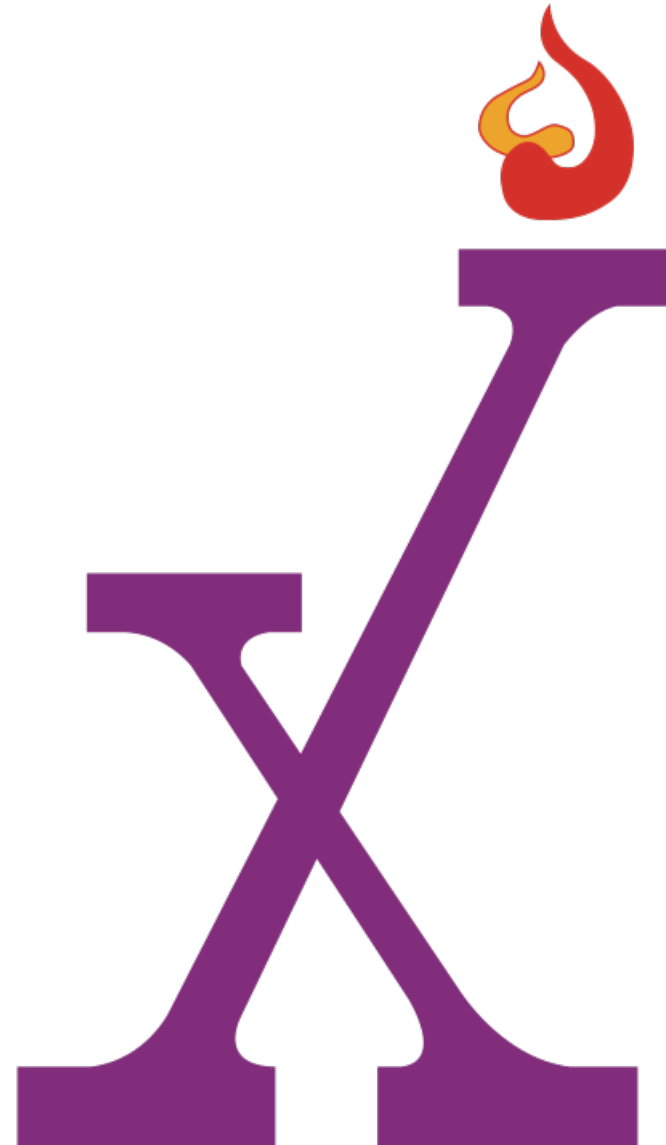


# Project Xanadu (1960-)

Founded in 1960, still ongoing  
(also famously never completed...)

Hugely influential, nonetheless

Described in *Dream Machines*, and  
Nelson's subsequent book *Literary  
Machines*





Hyperland (1990) Produced by Max Whitby [Television Programme]. London: British Broadcasting Corporation.

# Project Xanadu

- Intercomparison of parallel documents
- World-wide publishing without barriers
- Transclusion
- Transcopyright
- Versioning
- Links that don't break

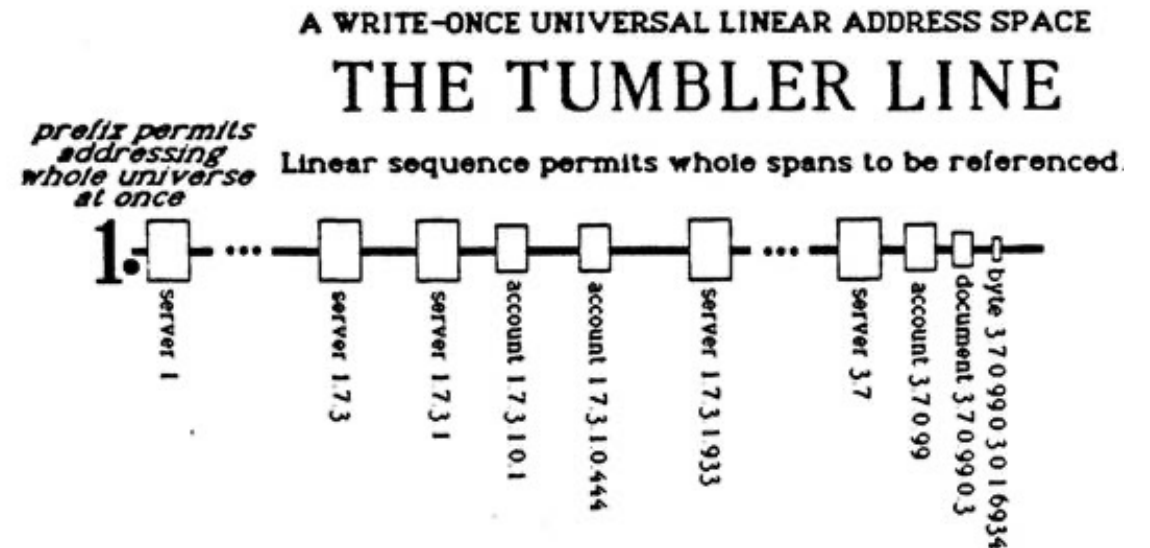
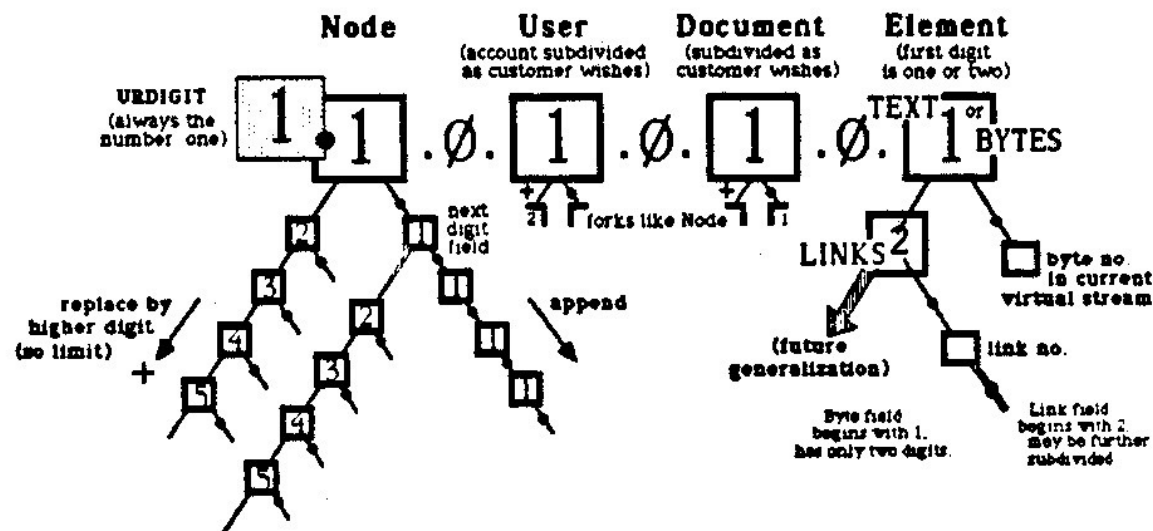


# Addressing

Document addressing in Xanadu uses numeric identifiers known as *tumblers*

Expandable, write-once address space that allows referencing of document fragments

## TUMBLER ADDRESS MASTER DIAGRAM



# Links

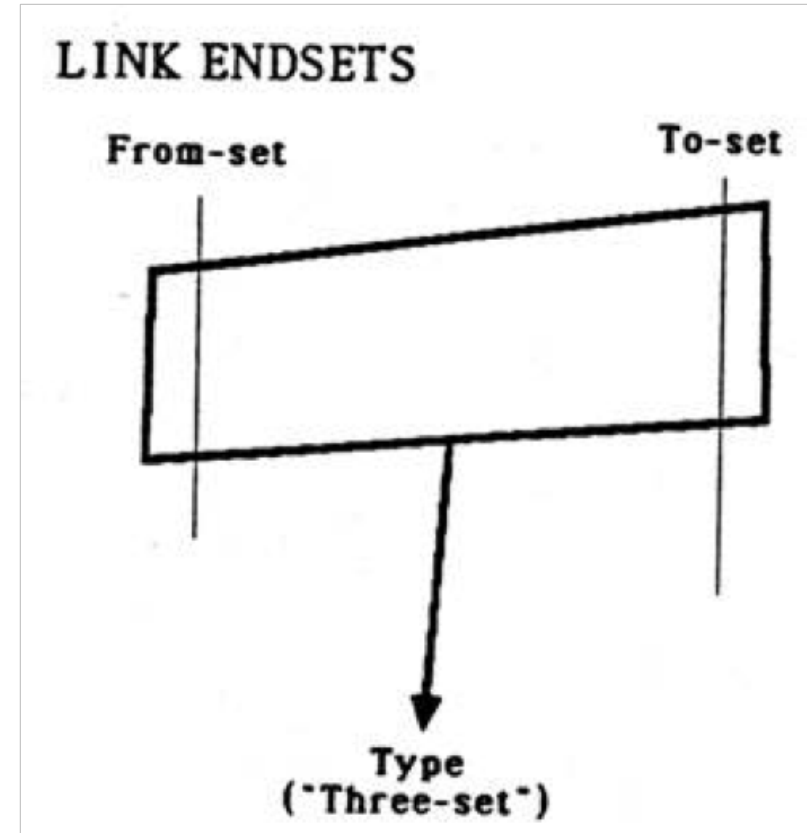
Can be stored separately from documents  
(i.e. first-class)

Can be stored within a document  
(in its *link-train*)

N-ary – multiple addresses in the from-set  
and to-set

Multiple types associated with the link (via  
the three-set – more addresses)

- Markup considered as link type!

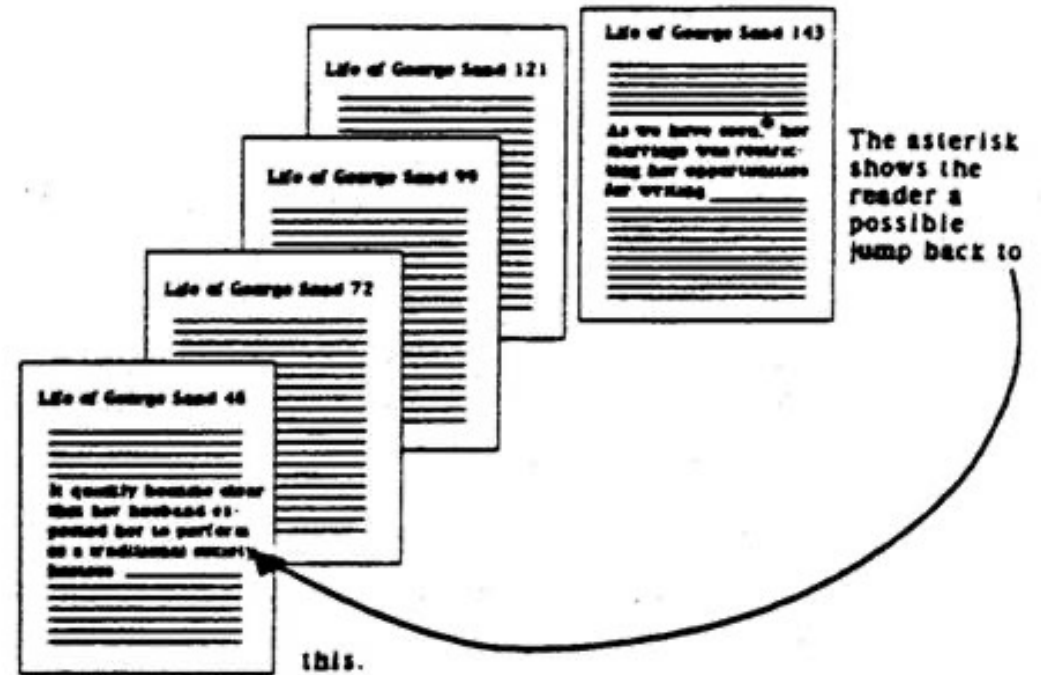


# Transclusion

Documents are composite objects that can contain parts of other documents, via special links: transclusions

Instead of copy and pasting, the address of a fragment of another document is inserted and the referenced content is retrieved and displayed at runtime

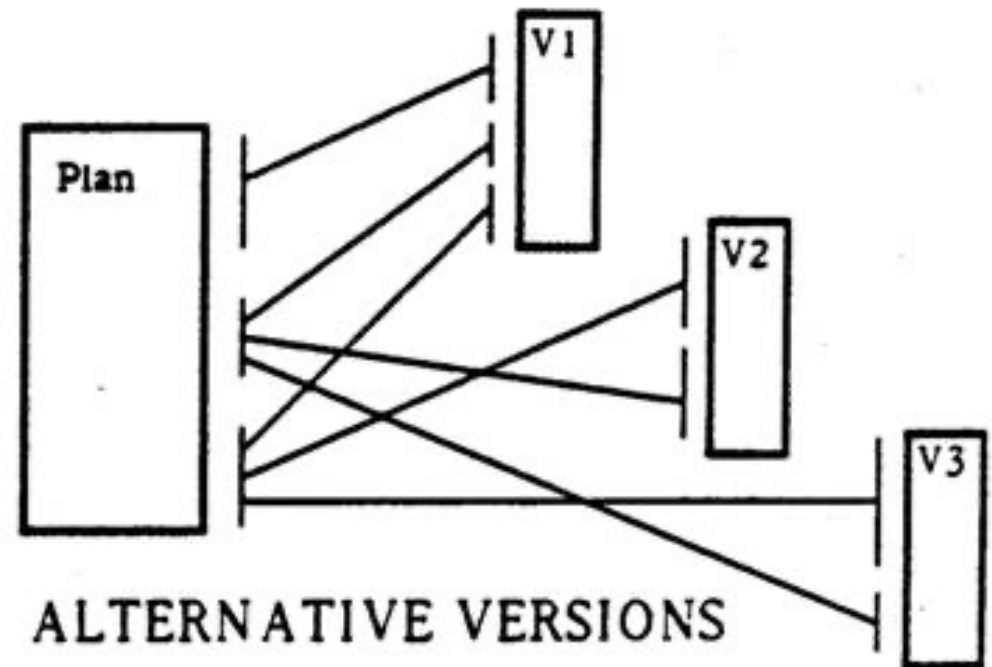
(also provides a mechanism for tracking fractional royalties for use of these fragments – transcopyright)



# Versioning

Transparent versioning of documents

- Editing a document creates a new *revision* (possibly with transclusion of material from previous version)
- Versioning also permits different *variants* (alternative versions) of a document





# Distribution

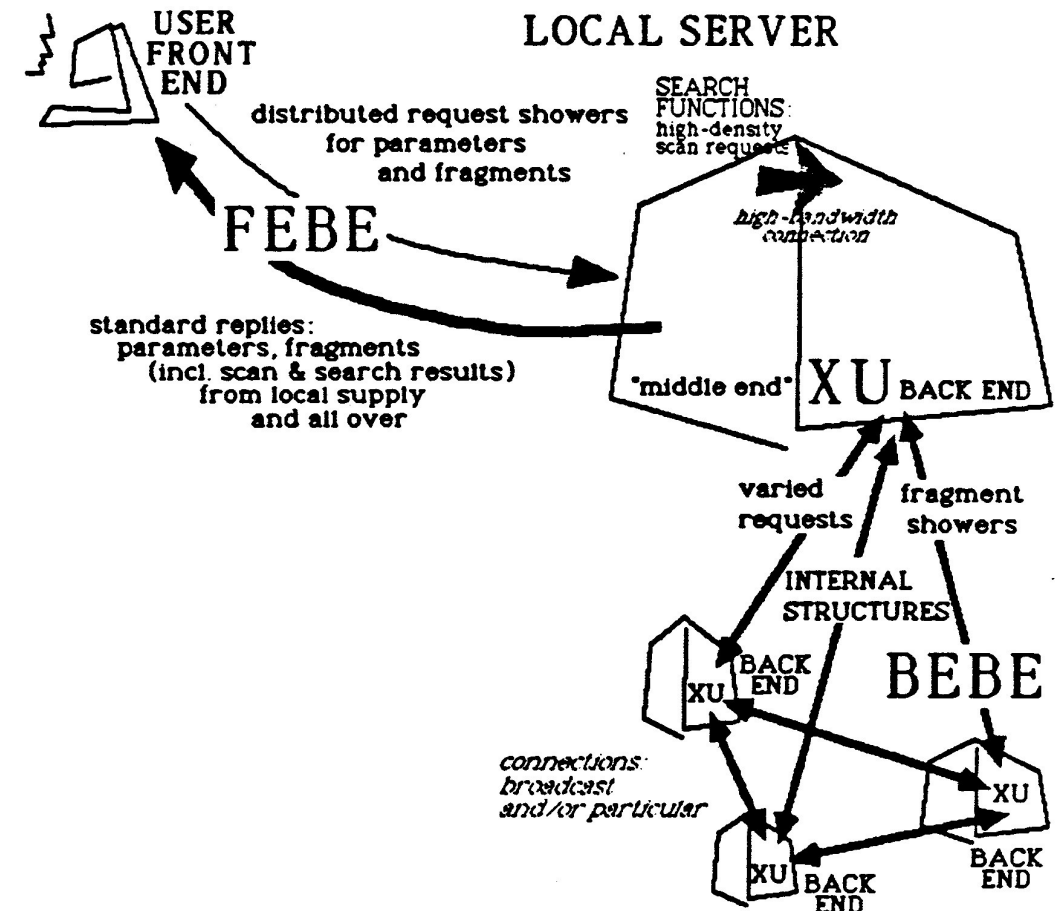
Xanadu separates the front end clients that display content to users from the back end servers that manage that content

## Front End to Back End (FEBE) Protocol

- Used for user interaction

## Back End to Back End (BEBE) Protocol

- Used to manage consistency between back end servers



## THE 2020 VISION

Forty years from now (if the human species survives), there will be hundreds of thousands of file servers--machines storing and dishing out materials. And there will be hundreds of millions of simultaneous users, able to read from billions of stored documents, with trillions of links among them.

All of this is manifest destiny. There is no point in arguing it; either you see it or you don't. Many readers will choke and fling down the book, only to have the thought gnaw gradually until they see its inevitability.

The system proposed in this book may or may not work technically on such a scale. But some system of this type will, and can bring a new Golden Age to the human mind.

## Nelson on the Web

*The Xanadu project did not 'fail to invent HTML'. HTML is precisely what we were trying to PREVENT – ever-breaking links, links going outward only, quotes you can't follow to their origins, no version management, no rights management.*

Next Lecture: Trailblazers, Part 3