



Mark Bernstein

Early Tools For Thought

# EARLY TOOLS FOR THOUGHT

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Mark Bernstein  
Eastgate Systems, Inc.



# TINDERBOX

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Desktop tool for organizing and visualizing notes  
Debuted in 2001 (!)

<https://www.eastgate.com/Tinderbox/>



# Visualization and Structural Intuition in Early Hypertext

Mark Bernstein, Eastgate Systems Inc.



Senate House, University of London  
December 15-16, 2022

Early visions of hypertext emphasize the necessarily-arbitrary arrangement of information stored on shelves or in files cabinets, and promise fast and facile retrieval, but hypertext originated as a reaction against the disasters of the 20th Century. This reaction inspired a great wave of inquiry into the abstract, structural foundations of history, language, machinery, and mathematics itself. Growing disciplinary incomprehension obscured this common origin and caused much tension, while the consequences of the systems in use, foreseen and otherwise, now seem to portend disaster.

Beyond Bush, Nelson, Engelbart and Berners-Lee

## The Origins of Digital Humanities In The Origins Of Hypertext

Cotton: Vitellius A.xv

"If you wanted to find Beowulf in Sir Robert Bruce Cotton's library, you would look for Vitellius A xv — the 15th book on the top shelf of the bookcase surmounted by the a bust of Vitellius (Beard, 2021)."

Beowulf



Not Cotton's Vitellius. Also not Vitellius

Mary Beard, Twelve Caesars

Edward Wilson-Lee, The Catalog of Shipwrecked Books

What would an INTRODUCTION TO COMPUTING look like, if "mainstream computing" was humanistic computing?



# DL.ACM.ORG

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Proceedings of The ACM Hypertext Conference  
1987-present



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Early Tools For Thought

5

TOOLS FOR THOUGHT

# LINKS

# INTELLECTUAL ROOTS OF HYPERTEXT

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Bernstein, Mark (2022), 'On The Origins Of Hypertext In The Disasters Of The Short 20th Century', The ACM Web Conference.

Bernstein, Mark (2023), 'Knowledge Machines: a Complex Web of History and Technology', in Wiebke Keim, Leandro Rodriguez Medina, Rigas Arvanitis (ed.), *Handbook of Academic Knowledge Circulation* (Routledge),

- Structuralism
- Existentialism
- Anti-Communitarianism



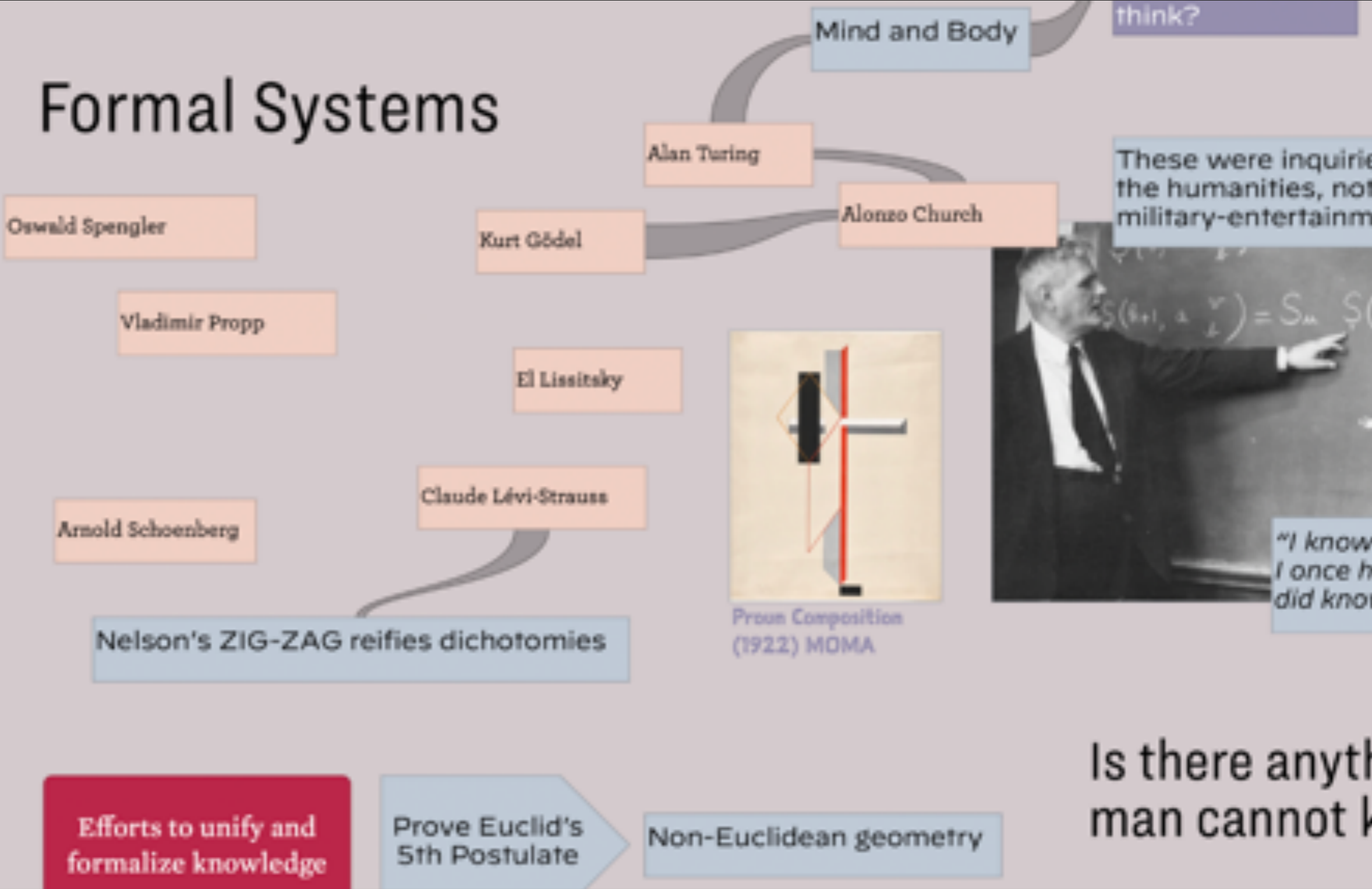
# STRUCTURALISM

Early Tools For Thought

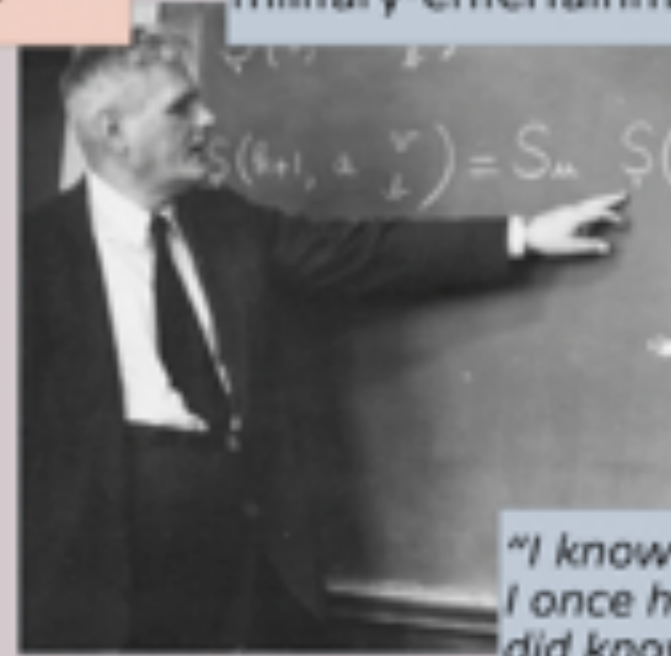
Mark Bernstein



## Formal Systems



Proun Composition (1922) MOMA



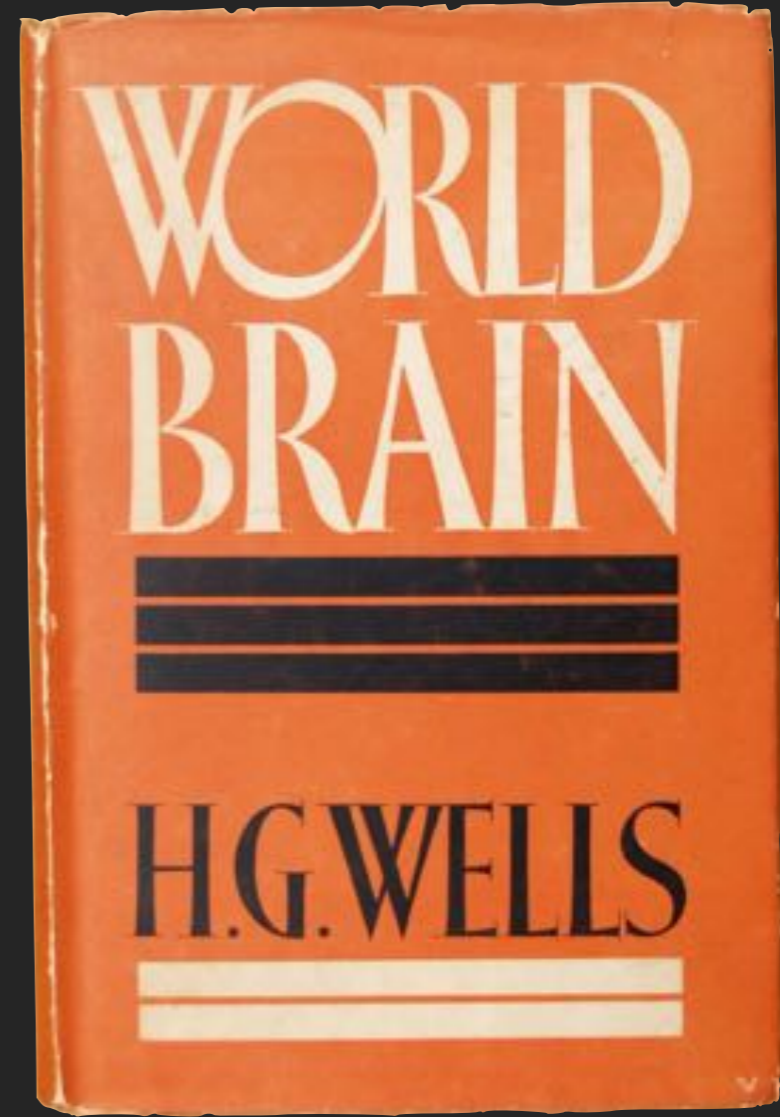
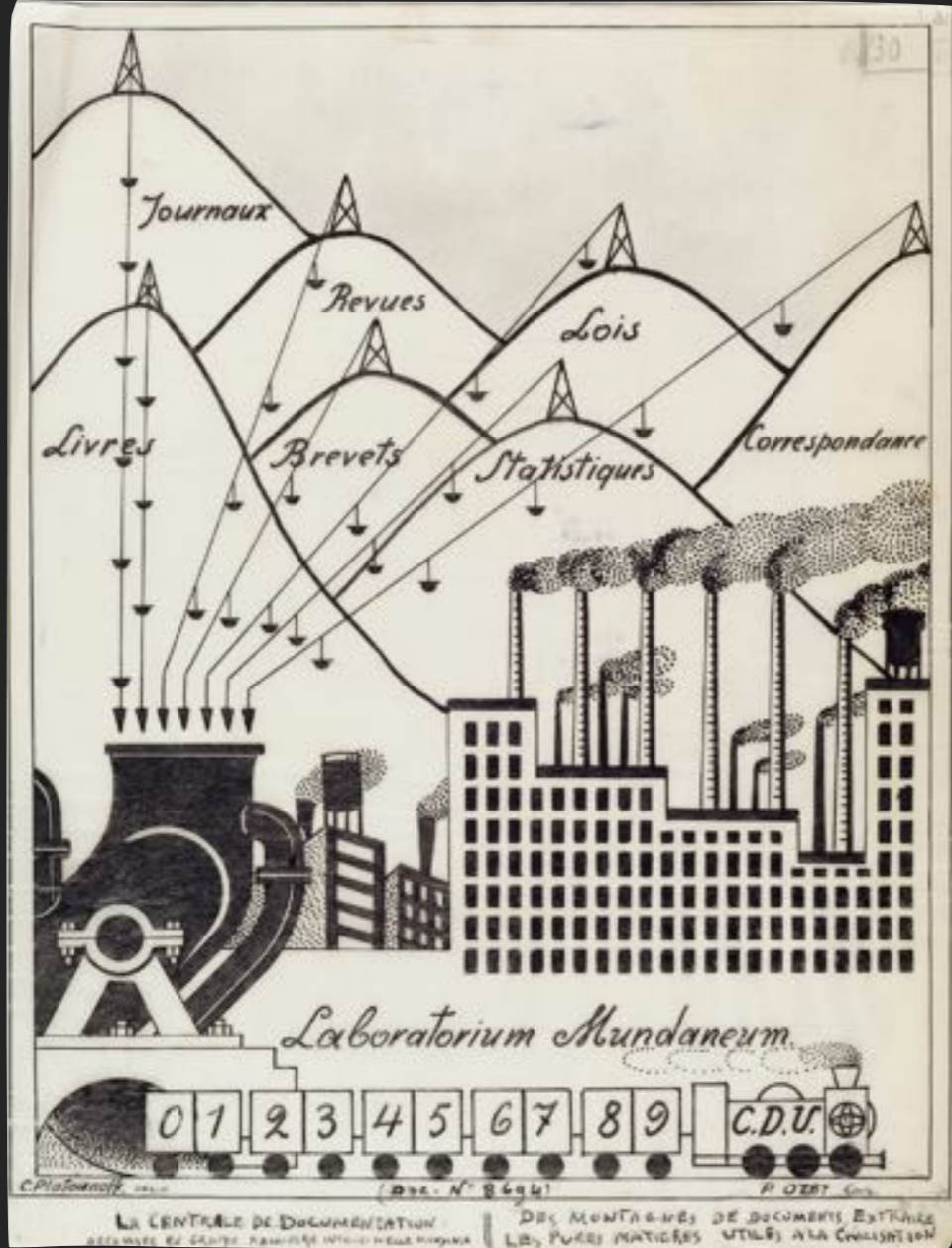
"I know I once had did know"



# PAUL OTLET H. G. WELLS

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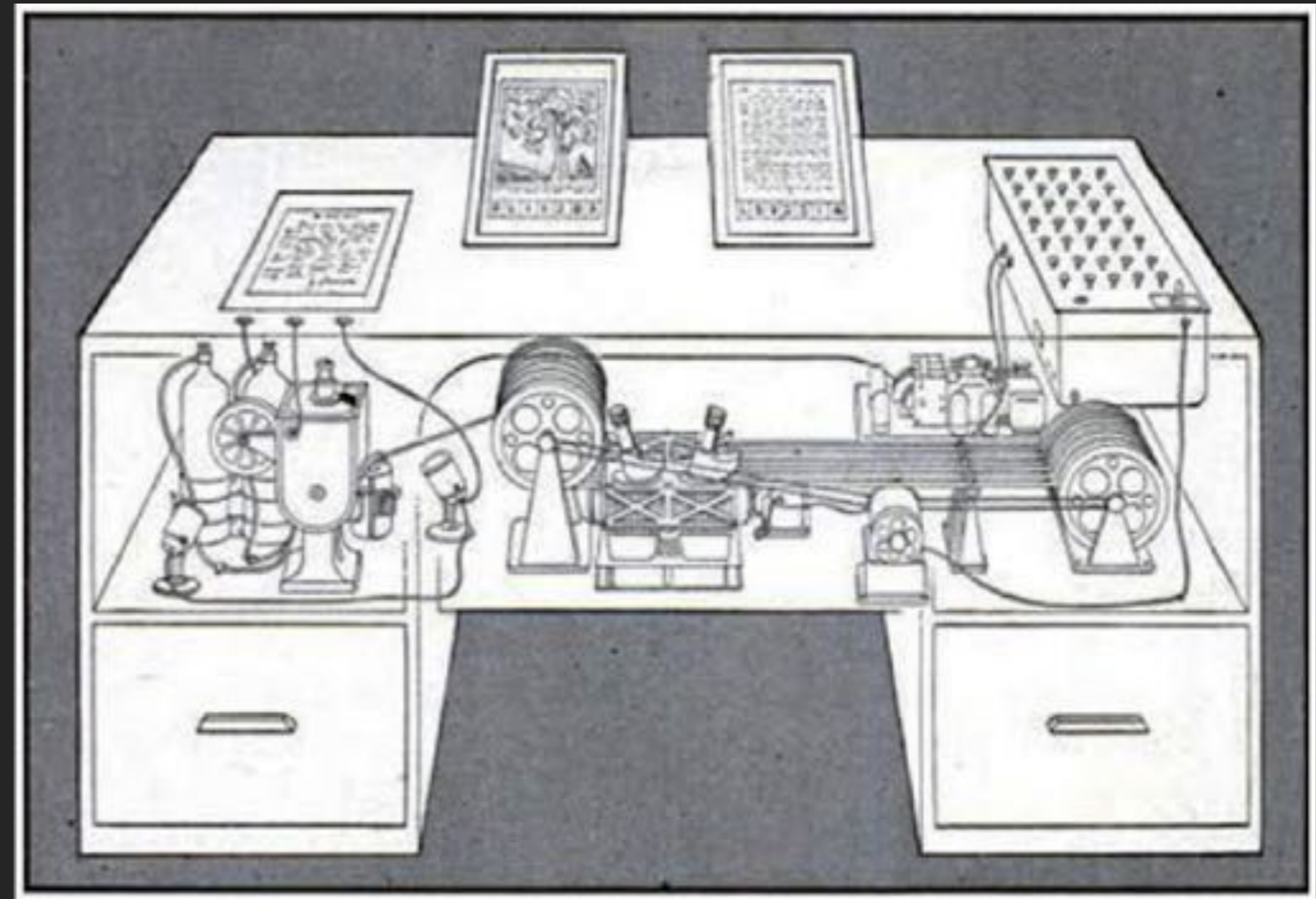
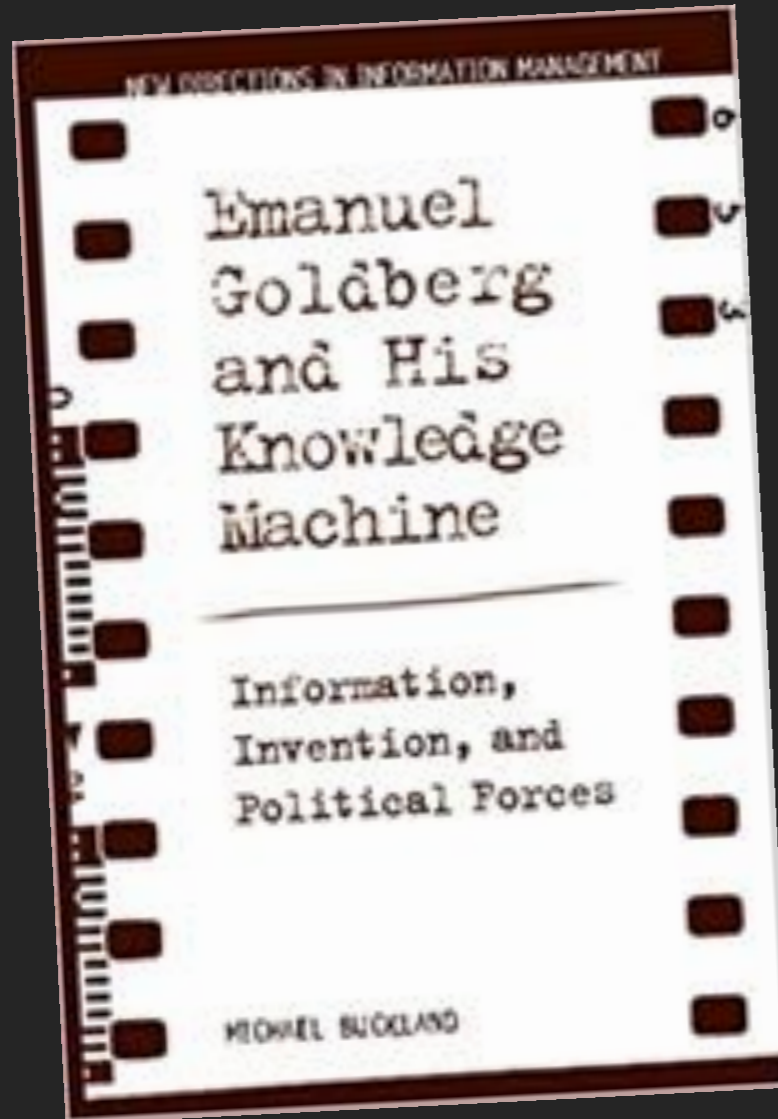
Mark Bernstein





# EMANUEL GOLDBERG VANNEVAR BUSH

Bush, V. (1945), 'As we may think',  
Atlantic Monthly, July 1945 101-8.



# EXISTENTIALISM

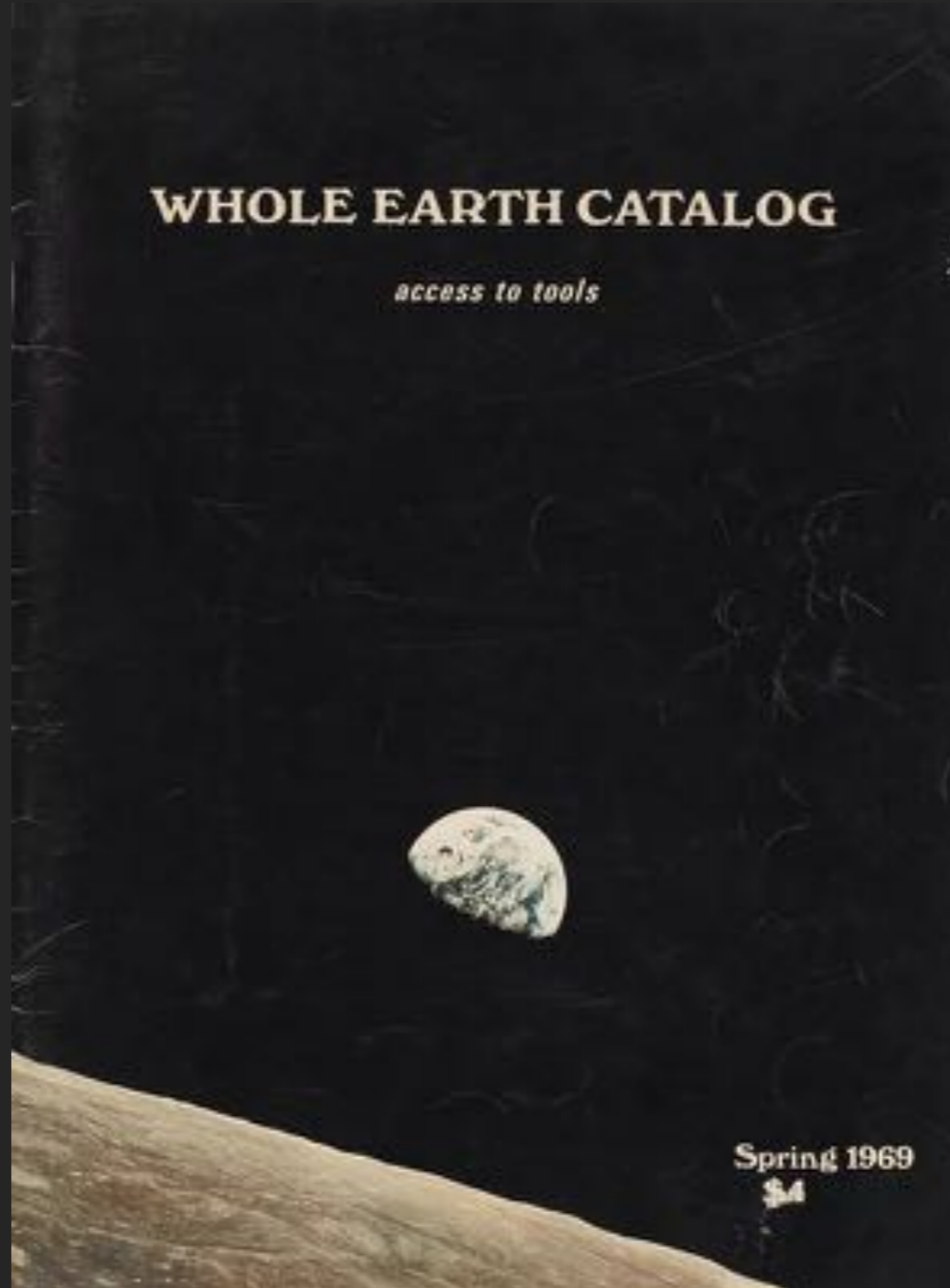
Robert Doisneau  
Simone Beauvoir and Jean-Paul Sartre, circa 1945



# ANTI-COMMUNITARIANISM

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# COMPUTER LIB / DREAM MACHINES

Nelson, Theodor Holm (1974),  
***Computer Lib/Dream Machines***,  
(Swarthmore, PA: Ted Nelson).

Nelson, T. (1982), ***Literary Machines***,  
(1987: Mindscape Press).

Barnet, Belinda. (2013), ***Memory machines*** : the evolution of hypertext,  
(London: Anthem Press) xxvi, 166  
pages.





# COMPUTER LIB

That reminds me. Nowhere in the book have I defined the phrase "computer lib." By Computer Lib I mean simply: making people freer through computers. That's all.

Fantically-- or fanatically--  
Yours for a better world,  
Before we have to settle for Any--

Ted Nelson



# TED NELSON



Mark Bernstein



Early Tools For Thought



# SKETCHPAD

Ivan E. Sutherland. 1963. **Sketchpad: a man-machine graphical communication system.**

In Proceedings of the May 21-23, 1963, spring joint computer conference (AFIPS '63 (Spring)). 329-346.

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# OBJECT-ORIENTED PROGRAMMING IN 1963

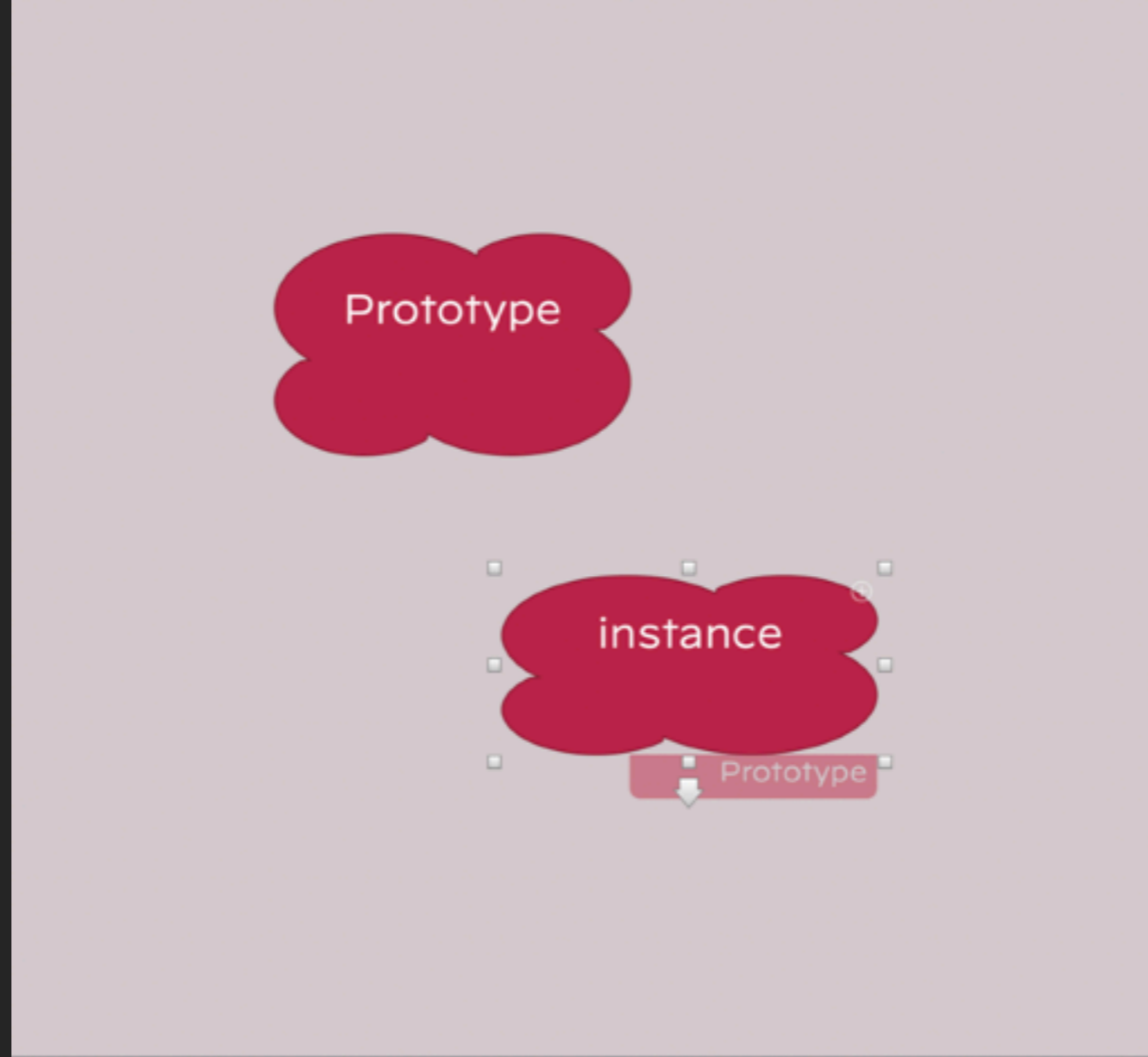
## EXPANDING SKETCHPAD

Addition of new types of things to the Sketchpad system's vocabulary of picture parts requires only the construction of a new generic block (about 20 registers) and the writing of appropriate subroutines for the new type. The subroutines might be easy to write, as they usually are for new constraints, or difficult to write, as for adding ellipse capability, but at least a finite, well-defined task faces one to add a new ability to the system. Without a generic structure it would be almost impossible to add the instructions required to handle a new type of element.





# TINDERBOX: INHERITANCE





TOOLS FOR THOUGHT

# NLS/AUGMENT

Engelbart, Douglas C. (1963), 'A Conceptual Framework for the Augmentation of Man's Intellect', in Howerton, P. (Ed.), *Vistas in Information Handling* (1; Washington DC: Spartan Books), 1-29.

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The first:

- \* outliner
- \* URI
- \* personal workstation
- \* mouse
- \* viewspec
- \* synchronous collaboration system





# DOUG ENGELBART

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# IMMORTAL SYSTEMS



# EMACS

Richard M. Stallman. 1981. **EMACS the extensible, customizable self-documenting display editor.** In *Proceedings of the ACM SIGPLAN SIGOA symposium on Text manipulation.* Association for Computing Machinery, New York, NY, USA, 147–156.



## EMACS The Extensible, Customizable Self-Documenting Display Editor

Richard M. Stallman  
Artificial Intelligence Lab  
Massachusetts Institute of Technology  
Cambridge, MA 02139

### Abstract

EMACS is a display editor which is implemented in an interpreted high level language. This allows users to extend the editor by replacing parts of it, to experiment with alternative command languages, and to share extensions which are generally useful. The ease of extension has contributed to the growth of a large set of useful features. This paper describes the organization of the EMACS system, emphasizing the way in which extensibility is achieved and used.

This report describes work done at the Artificial Intelligence Laboratory of the Massachusetts Institute of Technology. Support for the laboratory's research is provided in part by the Advanced Research Projects Agency of the Department of Defense under Office of Naval Research contract N00014-80-C-0505.

### 1. Introduction

EMACS<sup>1</sup> is a real-time display editor which can be extended by the user while it is running.

Extensibility means that the user can add new editing commands or change old ones to fit his editing needs, while he is editing. EMACS is written in a modular fashion, composed of many separate and independent functions. The user extends EMACS by adding or replacing functions, writing their definitions in the same language that was used to write the original EMACS system. We will explain below why this is the only method of extension which is practical to use: others are theoretically equally good but discourage use, or discourage nontrivial use.

Extensibility makes EMACS more flexible than any other editor. Users are not limited by the decisions made by the

add, the user can provide for himself. He can just as easily provide his own alternative to a feature if he does not like the way it works in the standard system.

A coherent set of new and redefined functions can be bound into a library so that the user can load them together conveniently. Libraries enable users to publish and share their extensions, which then become effectively part of the basic system. By this route, many people can contribute to the development of the system, for the most part without interfering with each other. This has led the EMACS system to become more powerful than any previous editor.

User customization helps in another, subtler way, by making the whole user community into a breeding and testing ground for new ideas. Users think of small changes, try them, and give them to other users. If an idea becomes popular, it can be incorporated into the core system. When we poll users on suggested changes, they can respond on the basis of actual experience rather than thought experiments.

To help the user make effective use of the copious supply of features, EMACS provides powerful and complete interactive self-documentation facilities with which the user can find out what is available.

A sign of the success of the EMACS design is that EMACS has been requested by over a hundred sites and imitated at least ten times.

#### 1.1. Background: Real-Time Display Editors

By a *display editor*, we mean an editor in which the text being edited is normally visible on the screen and is updated automatically as the user types his commands. No explicit commands to "print" text are needed.

# RICHARD STALLMAN

Photo: Sam Williams. CC by SA 3

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# STORYSPACE

Bolter, Jay David and Michael Joyce (1987), '**Hypertext and Creative Writing**', *Hypertext '87*, 41-50.

Joyce, Michael (1991), '**Storyspace as a hypertext system for writers and readers of varying ability**', *Hypertext'91*, 381- 387.

Bernstein, Mark (2016), '**Storyspace 3**', *Proceedings of the 27th ACM Conference on Hypertext and Social Media*, *HT '16*, 201-6.



Figure 5: Martha Joyce's students' Whitman Storyspace document

# ARCHITECTONIC WRITING

Bernstein, Mark (2016), **Those Trojan Girls: a hypertext**, (Watertown, MA: Eastgate Systems, Inc.).



The screenshot displays the 'Those Trojan Girls' hypertext editor interface. The top navigation bar includes tabs for 'Dash', 'Map', 'Prototypes', 'Map', 'Outline', 'Map', 'Treemap', and 'Hyperbolic'. The main workspace shows a hierarchical map of the document structure. The 'Preface' node is at the top, leading to 'Going Down'. Below 'Going Down' are three parallel nodes: 'Winter's End', 'Coming And Going', and 'Setting An Example'. 'Setting An Example' leads to 'The Fires Of Reconciliation'. A 'Reset Visits' node is also visible. The right-hand pane shows a preview of the 'Winter's End' section, including a title, a quote from Sofia Tcheka, and two paragraphs of text.

**Winter's End**

from Sofia Tcheka, *What Happened at Hill*, Postcolonial Press, London, 20...

In the years before the Occupation, Hill Academy was an old and decaying institution. Our young country came out of the First War with its independence, and had emerged from the Second War with a measure of credit, having assisted its former masters when assistance was indispensable. Still, that very success – and the circumstances that rendered our meager aid so vital to the freedom and survival of those who once had exercised cruel and unchallenged power over our lands – made ancient colonial institutions like Hill seem like relics of a power whose time had passed.

Hill and its peers – Maelton, St. Pantalaimon's, the Latin School and the rest – were still wealthy in those years, and held a certain place in the popular imagination. Tuition was costly, but there were plenty of children of the nobility and of prosperous merchants and industrialists who could afford the fees. Graduates were still admitted to the best universities abroad, and the schools all made a great show of announcing which future peer had been admitted to Stanford or Bryn Mawr, which heir to a mining or mercantile fortune would be studying in Oxford or Berlin. In truth, these press releases received greater attention from newspaper editors and broadcast producers each year



# INTERTWINGLED

Arnold, Mary-Kim (1993), 'Lust', *Eastgate Quarterly Review of Hypertext*, 1 (2)

Ensslin, Astrid (2022), *Pre-Web Digital Publishing and the Lore of Electronic Literature*, (Cambridge: Cambridge University Press).

The image shows a screenshot of a hypertext editor interface. On the left, a 'Map: Prologue' window displays a dense network of interconnected nodes representing text segments. Nodes include 'Agency', 'He Washing', 'He Expects', 'He Listens', 'Soft Flesh', 'This Night', 'Innocence', 'Remembering', 'The Child Speaks', 'Innocent', 'John', 'Jeffrey', 'Michael', 'He and the Child', 'Summer', 'Coming', 'The Child', 'Aching', 'Nearly Naked', 'Counting', 'Try', 'She and the Child', 'Fibers', 'She', 'She Washing', 'Crying', 'Knife', 'Touching', 'Things', 'Paris Things', 'Morning', 'She Expects', 'She Aches', and 'Washing'. On the right, an 'Outline: Lust copy' window shows a preview of the text 'Summer' with four paragraphs:

Summer

She is aching. She wants to sit down. She sits on the carpet, touches her toes.

He speaks to her, asks her to follow him, to stay with him. Here he is like a child, slowly, deliberately.

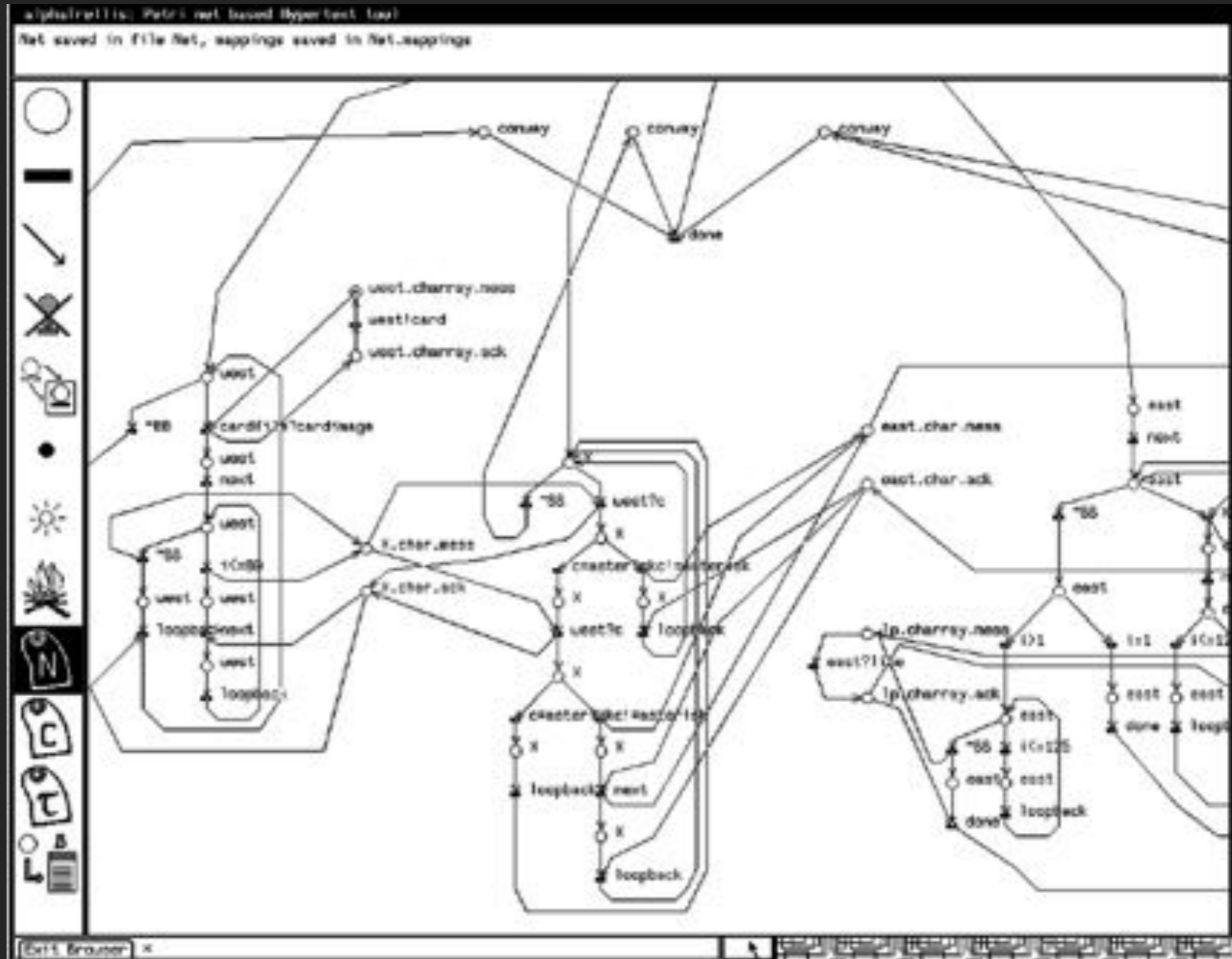
There is no mourning. They do not speak. There are no screams. There is no blood. That night, there are no tears. There are blankets of words, the fibers fraying.

The summer sun is sweet and heavy.



# TRELLIS

Stotts, P. David and Richard Furuta (1989), 'Petri-net based hypertext: Document structure with browsing semantics', *ACM Transactions on Office Information Systems*, 7 (1), 3-29.







# STANDARDS & MODELS

# HYPERSET

H. Van dyk Parunak, “**Don't link me in: set based hypermedia for taxonomic reasoning**”,  
HYPERTEXT '91: Proceedings of the  
third ACM conference on Hypertext,  
233-42

**“Users move from one node to another in the same set, and from one set to another by way of nodes in the intersection of those sets.**

They do not think of nodes as linked directly to one another, but in terms of the sets to which they belong. Implementation of such a model in a conventional graph-based hypermedia shell is at best difficult, since the corresponding graph needs nondirectional links of arity greater than two.”



# SETS IN TINDERBOX



The screenshot displays the Tinderbox application interface. The main window is titled "Untitled - Edited" and contains a map titled "Map: untitled". The map shows a container labeled "Artifacts" containing three objects: a light gray rectangle labeled "A", a red rectangle labeled "B", and another red rectangle labeled "C". Below the "Artifacts" container is a larger container labeled "agent" which contains the two red rectangles "B" and "C".

On the right side, the "Outline: untitled" panel is visible, showing the "Action Inspector: untitled" window. The "Action Inspector" has a toolbar with icons for search, undo, redo, text, and other actions. Below the toolbar, the "agent" is selected, and the "Query" tab is active. The query text is:

```
inside(/Artifacts) & $Color=="red"
```

Below the query, there are "Examples:" and "Items Found" columns. The examples listed are:

- `$Text.contains("Lincoln")` with 2 items found.
- `$Prototype=="Person"` with 2 items found.

At the bottom of the "Action Inspector", there are settings for "Priority" (set to "Normal") and "Cleanup" (set to "grid").



# A CAMBRIAN EXPLOSION

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Lots of wonderful ideas

Stone knives and bearskins

# KMS

Akscyn, Robert, Donald McCracken,  
and Elise Yoder (1987), '**KMS: A  
Distributed Hypermedia Systems for  
Managing Knowledge in  
Organizations**', Hypertext 87



Halasz, Frank. (1987), **"Seven Issues": Revisited**, Hypertext 91, <https://www.eastgate.com/hypertext/Halasz/Halasz7Rev.pdf>

# CARD SHARKS AND HOLY SCROLLERS

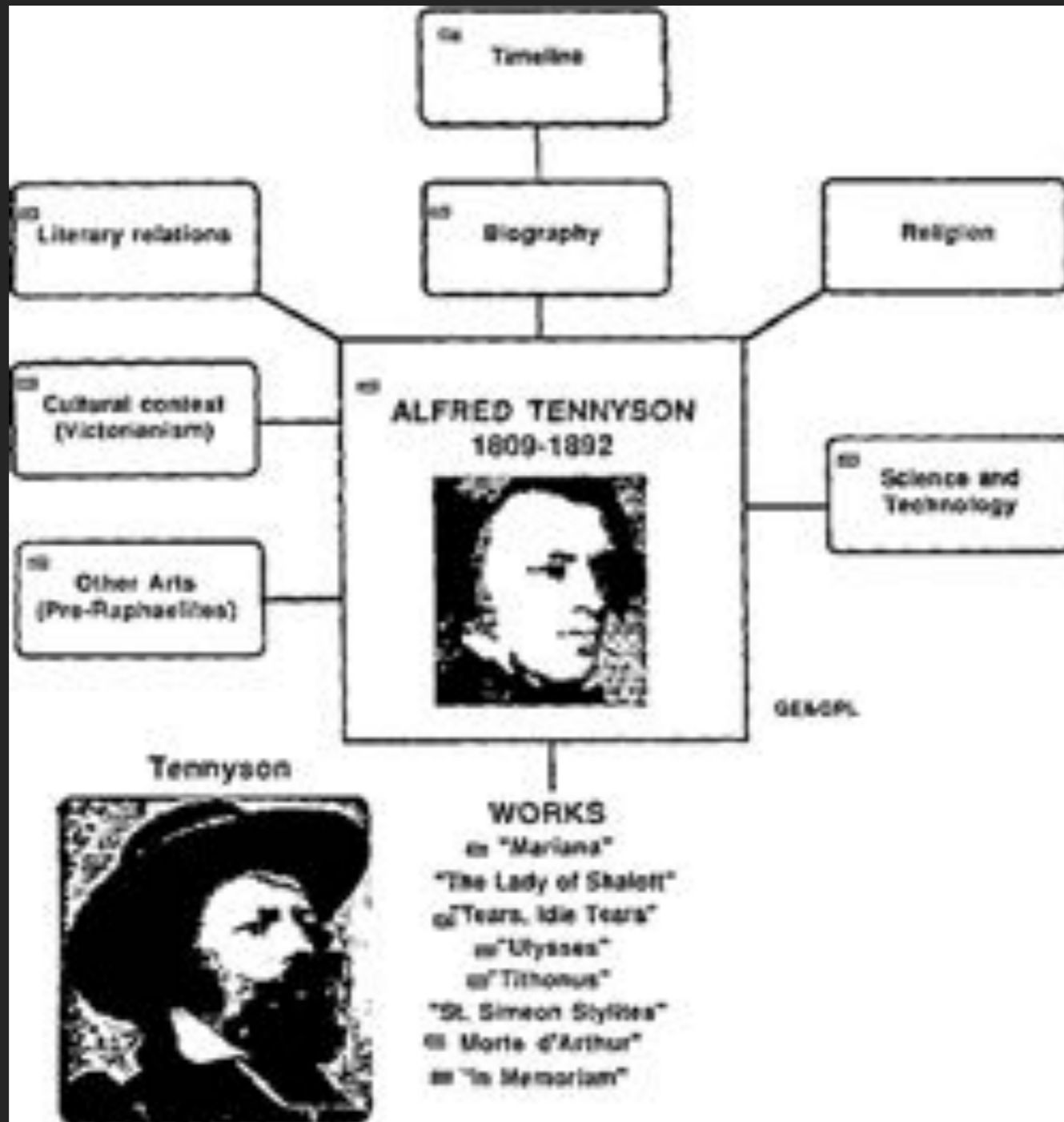




# INTERMEDIA

Yankelovich, N., N. Meyrowitz, and A. van Dam (1985), 'Reading and Writing the electronic book', IEEE Computer, Oct. 1985

Yankelovich, N., et al. (1988), 'Intermedia: The Concept and the Construction of a Seamless Information Environment', IEEE Computer, 21 (1), 81-96.



# VICTORIANWEB.ORG



What is the Victorian Web?

What countries does the Victorian Web discuss?

Can I use materials from The Victorian Web?

Which browsers work best with this site?

Are the articles on this site refereed?

French version

Spanish version

How do I cite The Victorian Web?

Directions for contributors

Contact

Web Awards

Credits

Conferences and calls for papers of interest to Victorianists



# RHETORIC

“The link is the  
most significant  
new punctuation  
since the medieval  
invention of the  
comma.”

— me

Landow, George P. (1987),  
**‘Relationally Encoded Links and  
the Rhetoric of Hypertext’**,  
Hypertext 87, 331-44.

Bernstein, Mark, Michael Joyce, and  
David B. Levine (1992), **‘Contours  
of Constructive Hypertext’**,  
European Conference on  
Hypermedia Technology, 161.

Lanham, Richard A. (1993), **The  
Electronic Word: Democracy,  
Technology, and the Arts**, (Chicago:  
University of Chicago Press).

Bernstein, Mark and Stacey Mason  
(2020), **‘Links: Exercises In Style’**,  
Proceedings of the 30th ACM  
Conference on Hypertext And Social  
Media,



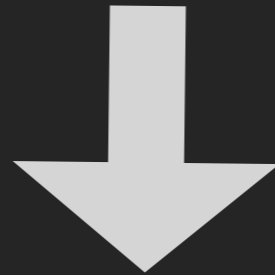
# GUIDE

Brown, Peter J. (1987), '**Turning Ideas Into Products: The Guide System**', Proceedings of the ACM Conference on Hypertext, 33-40

Brown, Peter J. (1989), '**Do we need maps to navigate round hypertext documents?**', Electronic Publishing — Organization, Dissemination and Design, 2 (2), 91-100.

P. J. Brown. 1993. **UNIX guide: lessons from ten years' development.** In Proceedings of the ACM conference on Hypertext (ECHT '92). Association for Computing Machinery, New York, NY, USA, 63–70.

Stretchtext **replaces** links



Stretchtext **extends and changes** links





Bernstein, Mark (2009),  
**'On Hypertext Narrative'**,  
20<sup>th</sup> ACM Conference on  
Hypertext and Social  
Media. 5-14



# HYPERTIES

Early Tools For Thought

Mark Bernstein



Alphabetical List [main] - Main View Page 1 of 1

Space Shuttle Telescope - Main View

Left Margin 1  
Top Margin 1

- Space Shuttle Telescope - Main View
- target (Main view - shape F00) (Faint Object Spectrograph - Exploded view)
- target (Main view - shape F01) (Faint Object Camera - Exploded view)
- target (Main view - shape H01) (High Resolution Spectrograph - Exploded view)
- target (Main view - word Support System Module) (Support System Module)
- target (Main view - word Faint Object Spectrograph) (Faint Object Spectrograph)
- target (Main view - word High Resolution Spectrograph) (High Resolution Spectrograph)

The Support System Module (Fig. 1) will enclose the telescope. To locate flexibility and mechanical instrumentation and will provide all interfaces with the Shuttle orbiter.

The module has four main sections: the light shield, the forward shell, the equipment section, and the aft shield. These four pieces fit together like joined containers to enclose the telescope assembly and scientific instruments.

The aperture door, which also serves as a light shield, is located at the front of the Support System Module. The telescope will be located behind the primary mirror, at the focal plane, where they can pick up light reflected from the telescope. They are the wide field-of-view camera, the faint object spectrograph, the high resolution spectrograph, the high speed photometer, and the faint object camera, the latter provided by the European Space Agency.

In addition, the fine guidance sensor, part of the support system module, because of their ability to accurately locate stars, could be considered a sixth scientific instrument.

Each instrument is housed in a separate module and will draw 100 to 150 watts of power. All are exchangeable during maintenance visits by the Space Shuttle.

Articulate  
Laser  
Defocus  
Target  
Picture

Optical Telescope Assembly - diagram  
A diagram of the Optical Telescope Assembly

High Resolution Spectrograph - exploded view  
High Speed Photometer - exploded view  
Faint Object Camera - exploded view  
Wide Field-of-View Camera - Exploded view  
Frame 8: from image and  
Frame 9: from telescope and

Wide-Field and Faint-Object Camera  
Support System Module  
High-Resolution Spectrograph  
Faint-Object Camera  
High-Speed Photometer  
Faint-Object Spectrograph

RETURN TOPICS INDEX HOME SHOW SEARCH QUIT

# RANDY TRIGG TYPED LINKS

Trigg, Randall (1983), 'A Network-Based Approach to Text Handling for the Online Scientific Community', (University of Maryland Technical Report, TR-1346).

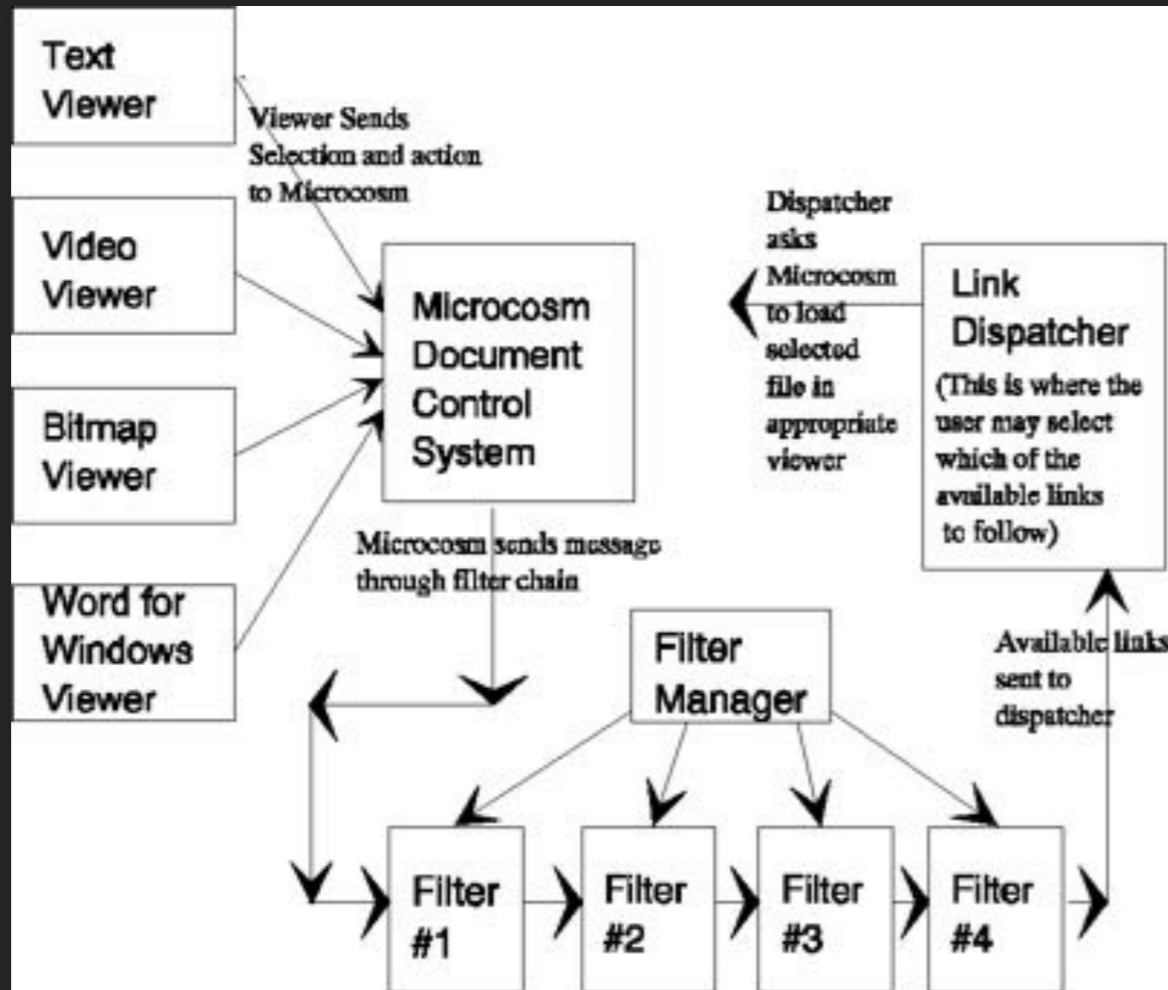


Normal link types		
Citation C-source C-pioneer C-credit C-leads C-epon	Generalization/Specification Abstraction/Example Formalization/Application	Summarization/Detail Alternate-view Rewrite
Background Future	Argument A-deduction A-induction A-analogy A-intuition	Simplification/Complication Explanation
Refutation Support	Solution	Correction Update
Methodology Data		Continuation
Commentary link types		
Comment Critics Supportive	Points Pt-comment Pt-trivial Pt-unimportant Pt-irrelevant Pt-redherring Pt-contradict Pt-dubious Pt-counter Pt-inclegant Pt-simplistic Pt-arbitrary Pt-unmotivated	Data D-comment D-inadequate D-dubious D-ignored D-irrelevant D-inapplicable D-misinterpreted
Environment E-comment E-misrepresent E-vacuum E-ignored E-supersede E-lrefute E-lsupport E-lrepeat	Arguments A-comment A-invalid A-insuff A-immaterial A-mislead A-alternate A-strawman	Style S-comment S-boeing S-unimaginative S-incoherent S-arrogant S-rambling S-awkward
Problem Posing P-comment P-trivial P-unimportant P-impossible P-ill-posed P-solved P-ambitious		

Table 4.1: Link types.



# MICROCOSM



Fountain, A. M., et al. (1990), '**MICROCOSM: An Open Model for Hypermedia With Dynamic Linking**', in A. Rizk, N. Streitz, and J. André (ed.), *Hypertext: Concepts, Systems and Applications (Proceedings of ECHT'90)* (Cambridge: Cambridge University Press), 298-311.

Davis, Hugh C. (1998), '**Referential Integrity of Links in Open Hypermedia Systems**', The Proceedings of the Ninth ACM Conference on Hypertext and Hypermedia, Hypertext 98, 207-16.

Michaelides, Danius T., et al. (2001), '**Auld Leaky: A Contextual Open Hypermedia Link Server**', Proceedings of the 7th Workshop on Open Hypermedia Systems,



# SCULPTURAL HYPERTEXT

Hargood, Charlie, Mark J. Weal, and David E. Millard (2018), '**The StoryPlaces Platform: Building a Web-Based Locative Hypertext System** Proceedings of the 29th on Hypertext and Social Media', HT '18, 128-35.

Bernstein, Mark and Diane Greco (2002), '**Card Shark and Thespis: exotic tools for hypertext narrative**', in Wardrip-Fruin, Noah and Pat Harrigan (eds.), *First Person* (Cambridge: MIT Press)

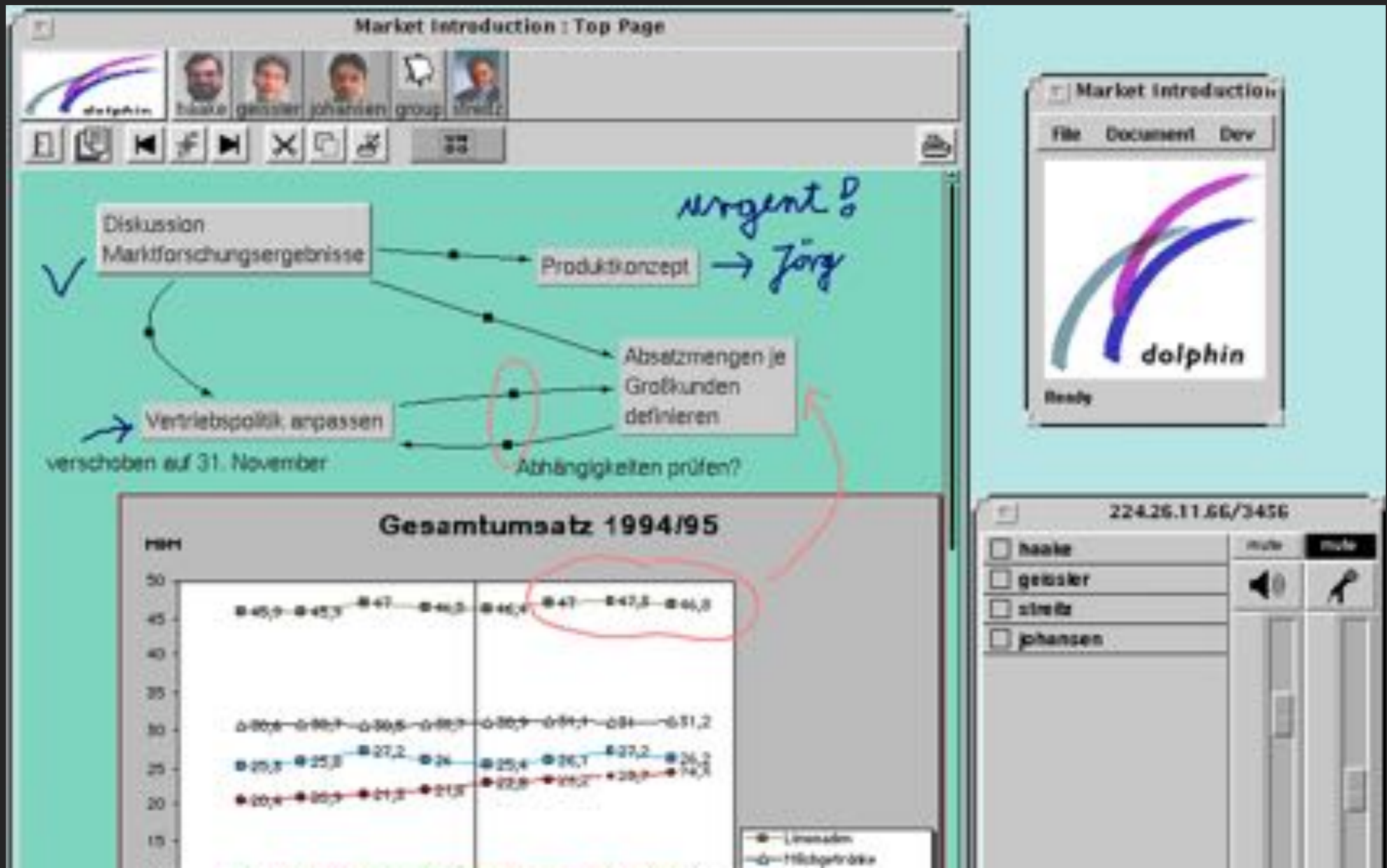
## SEE REMNOTE AND NOTION



# SEPIA/DOLPHIN

Streitz, Norbert, et al. (1994), 'DOLPHIN: Integrating meeting support across local and remote desktop environments and liveboards', CSCW 94, 345-59

Streitz, Norbert, et al. (1992), 'SEPIA: A cooperative Hypermedia Authoring Environment', ECHT 92, 11-22.





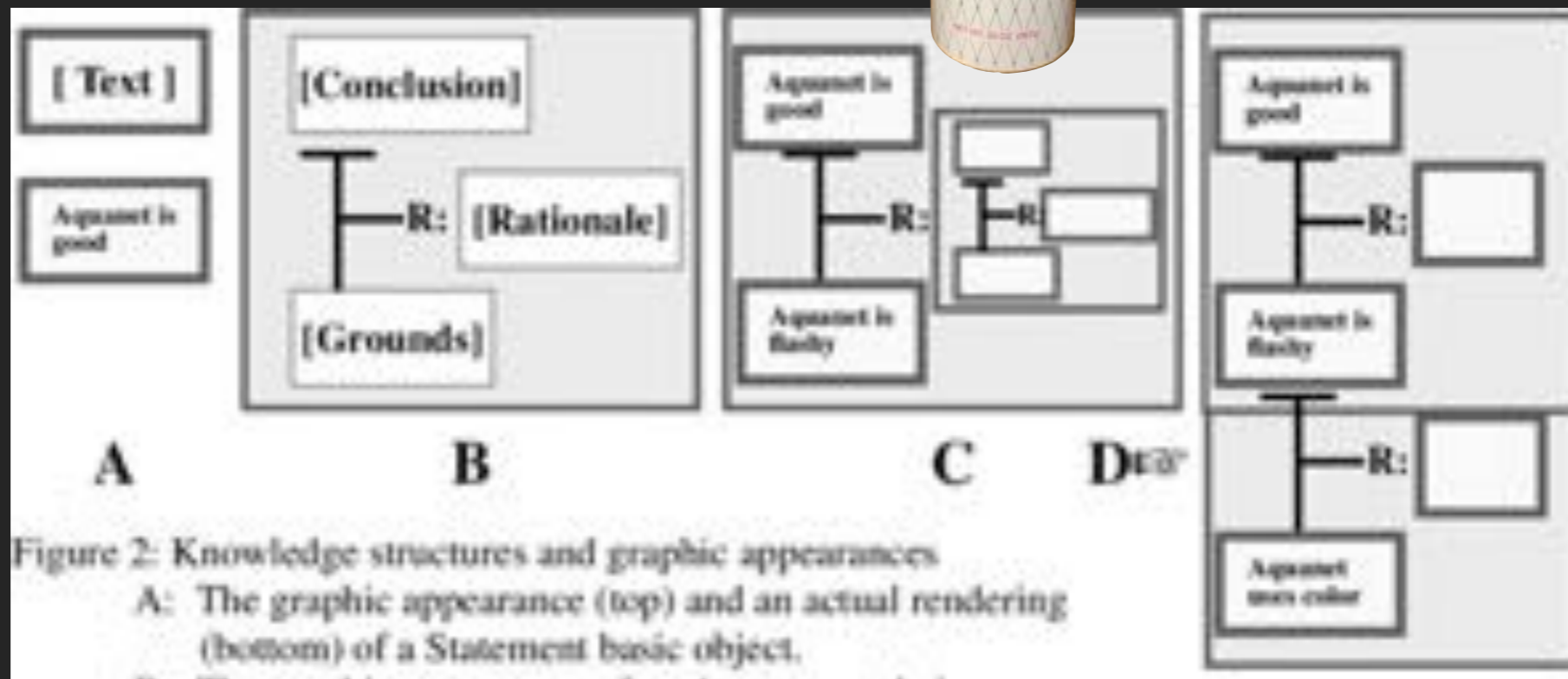
# AQUANET

“A system to hold your ideas in place”

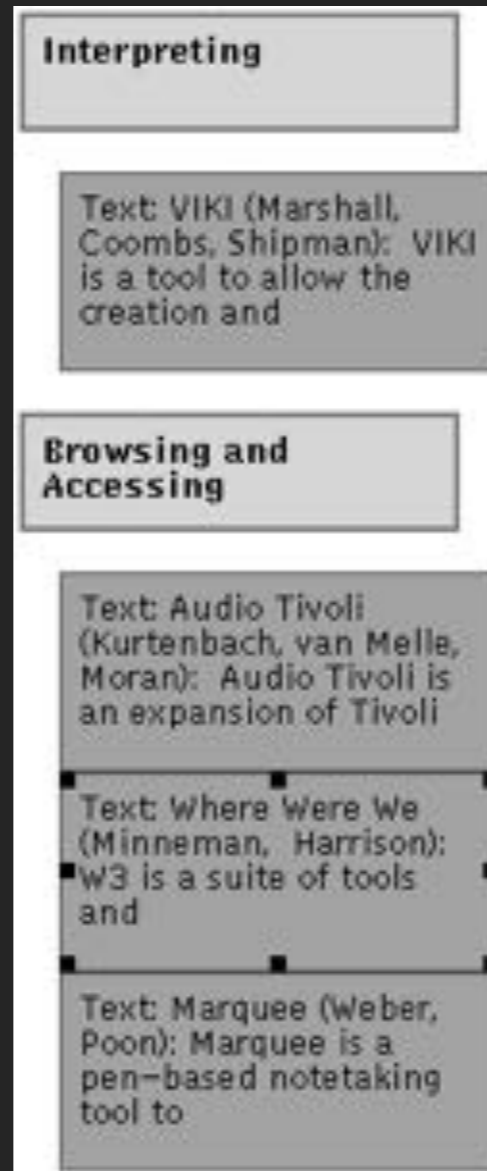


Marshall, C.C., et al. (1991), ‘**Aquanet: A Hypertext Tool to Hold Your Knowledge in Place**’, Hypertext’91, 261-75.

Marshall, C.C. and R.A. Rogers (1992), ‘**Two Years before the Mist: Experiences with Aquanet**’, ECHT’92, 53-62.



# VIKI



Shipman, Frank and Catherine C. Marshall (1999), '**Formality Considered Harmful: Experience, emerging themes, and directions on the use of formal representations in interactive systems**', CSCW, 333-52.

Marshall, Catherine C., Frank M. Shipman III, and James H. Coombs (1994), '**VIKI: Spatial Hypertext Supporting Emergent Structure**', ECHT'94, 13-23.

Marshall, Catherine C. and III Shipman, Frank M. (1997), '**Spatial hypertext and the practice of information triage**', Proceedings of the eighth ACM conference on Hypertext, 124-33.

**“Tinderbox was meant to be by Tiny VIKI.**

**It turned into Tiny Aquanet.”**

- Me



# SPATIAL HYPertext

Bernstein, Mark (2011), 'Can We Talk About Spatial Hypertext?', Proceedings of the 22nd ACM Conference on Hypertext and Hypermedia, 103-12.

## Sketches toward a map grammar

Mark Bernstein




# VKB AND VITE


Shipman, Frank, et al. (2001),  
**'The Visual Knowledge Builder:**  
 A Second Generation Spatial  
 Hypertext', Hypertext 2001:  
 Proceedings of the 12th ACM  
 Conference on Hypertext and  
 Hypermedia, 113-22.

**Applications**


**Information Triage**



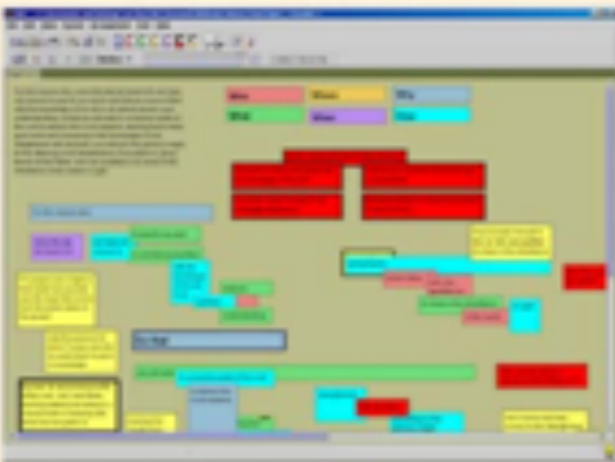
**Conference Planning**



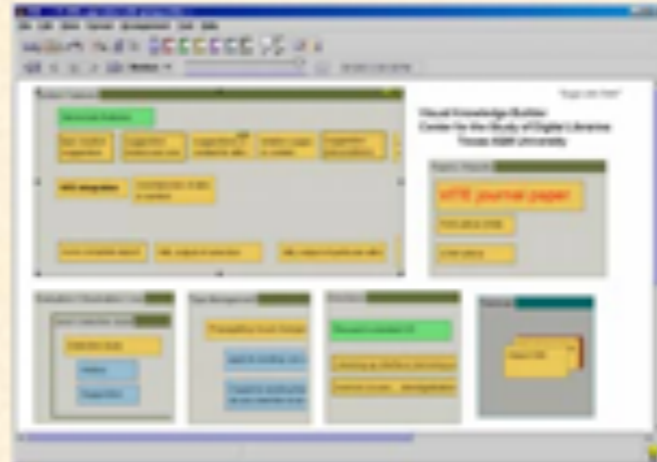
**Writing & Presentations**



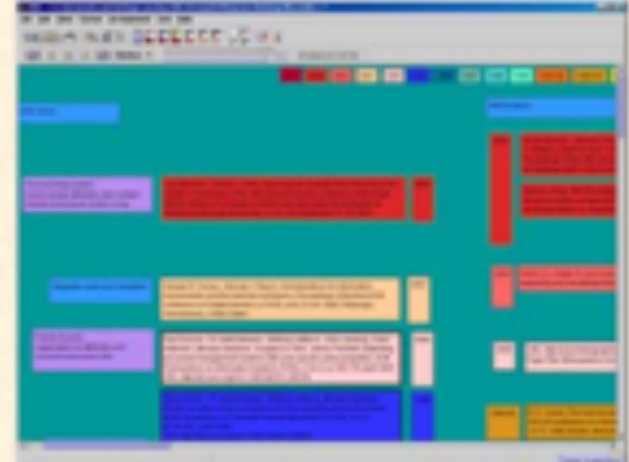
**Personal Interpretation**



**Project Management**



**References Organization**









# THERE'S LOTS MORE!

Agenda

Aha

Auld Leaky

Chandler

Cyc/Eurisko

Dexter Model

Fluid

FRESS

Frontier

Gateway

HES

HyperCard

Hypergate

iMapping

Information Cities

KEE

Literate Programming

MacWeb

Mother/Hell/Mitgard

NoteCards

Ntergaid

Pad++

Perseus

Structure Server

Sun Link Service

SuperBook

Symbolics Document Examiner

TINAC Manifesto

Twine

WikiWiki

Xanadu



# IT CONTINUES





# THOUGHTFUL TOOLS



**BERNSTEIN@EASTGATE.COM**