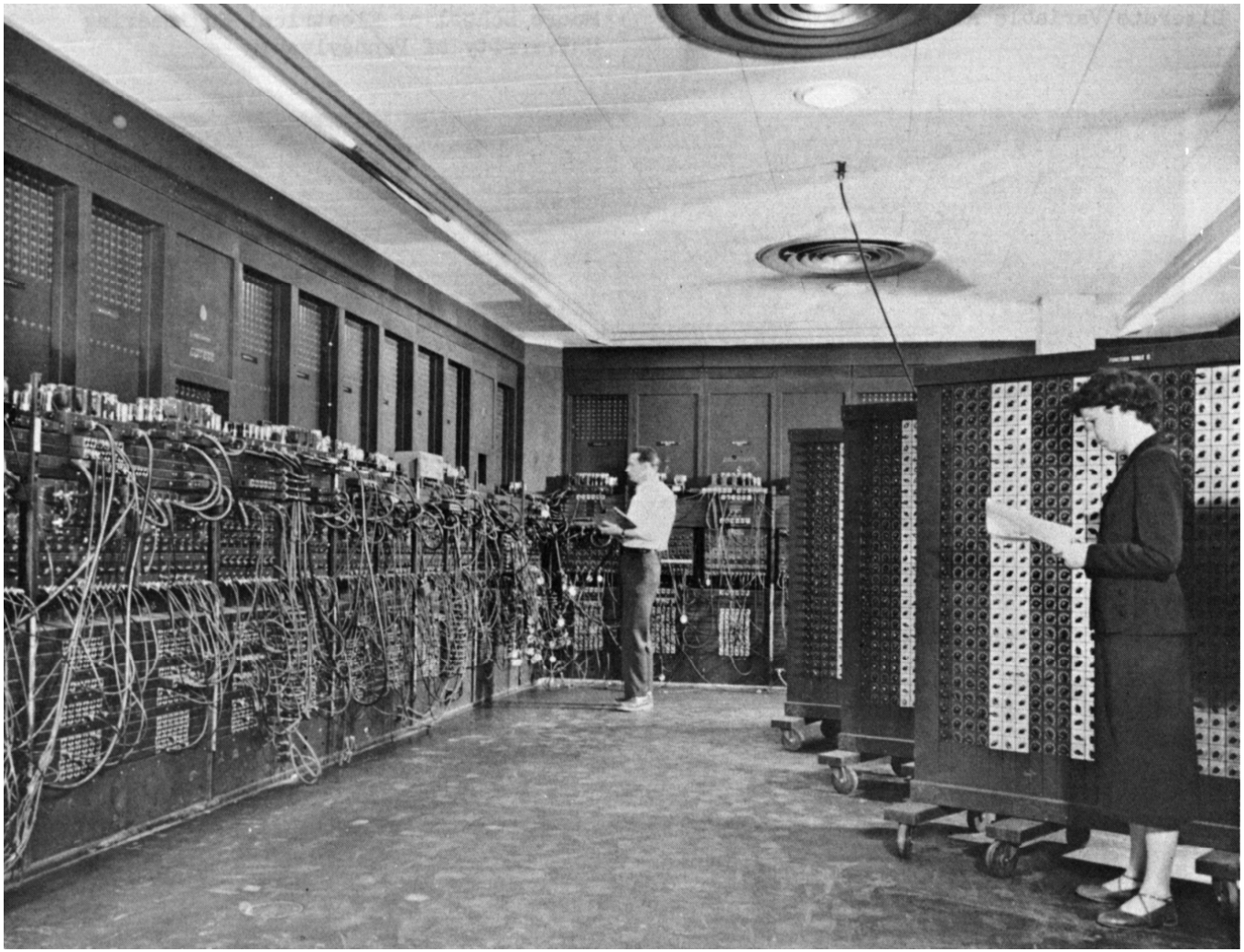
“As We May Think”

Vannevar Bush, 1945

- 1945
  - May: Allies victorious in Europe – beginning of the end of WW2
  - **July: Vannevar Bush publishes "As We May Think"**
  - July 16: Trinity nuclear test
  - August: First atomic bombs dropped on Japan – end of WW2
- 1946
  - February: ENIAC, first Turing-complete machine, unveiled
- 1947
  - December: Invention of the semiconducting transistor at Bell Labs
- 1952
  - November: First hydrogen bomb test detonation. ENIAC was used for calculations by scientists designing the H-bomb.

Wartime Computers

ENIAC



The Military-Industrial Complex

•1940: Vannevar Bush convinces FDR to support and provide funding for the "program" that would later be called the Military-Industrial Complex (or the Iron Triangle in NMR, p. 35)

•Collaborative relationship between military, industry and academic research

•No congressional oversight on funding

Some developments that came out of the MIC:

•Manhattan Project / Nukes

•ENIAC

•Space program/NASA

•(D)ARPA (and Licklider)

- •Aspen Movie Map
- •ARPANET (the Internet)

Eisenhower_farewell_address.mp3

The gist

- *Atlantic Monthly* magazine aimed at nation's lead thinkers
- Much scientific progress made during the war due to "demand of a common cause" (NMR 37).
- Bush wants to redirect these efforts to peacetime goals (he became disturbed by military's destructiveness)
- Turn mountain of information into mountain of knowledge
  - Have at our disposal, for our consultation, the record of the race.

The problem(s)

- "... publication has extended far beyond our present ability to make real use of the record" (NMR 38).
- "...the means we use for threading through the **consequent maze** to the momentarily important item is the same as it was used in the days of square-rigged ships" (NMR 38).

- "About 85 per cent of my 'thinking' time was spent getting into position to think... . Much more time went into finding or obtaining information than into digesting it. [...] Throughout the period I examined, in short, my 'thinking' time was devoted mainly to activities that were essentially clerical or mechanical... ."
  - Licklider, "Man-Computer Symbiosis" (NMR 76).

To this end...

Some new technologies:

- Mini camera
- Dry photography
- Hi-res microfilm
- The Memex
- Hypertext

Vannevar's 7-step Program

STEP 0: Make information easier to capture and collect.

- E.g. Minicam, dry photography

Vannevar's 7-step Program

- **STEP 1: Reduce physical space needed to store information.**
- Information storage on tiny microfilm with linear reduction factor of 100 – fine-grained film, quality optics and lighting.
- Magnetic tape was still some years away, hence the use of microfilm.
- Microfilm of human-readable text is not very machine-readable.
  - Bush proposes a system that amounts to OCR...
  - ... but ultimately decides that machine-readable media like punch-cards are best, and if only humans could read them....

Vannevar's 7-step Program

- **STEP 2: Allow information to be recorded to file more efficiently.**
- Voder/Vocoder for voice-activated typing
- Wasn't Licklider hung up on this too?

Vannevar's 7-step Program

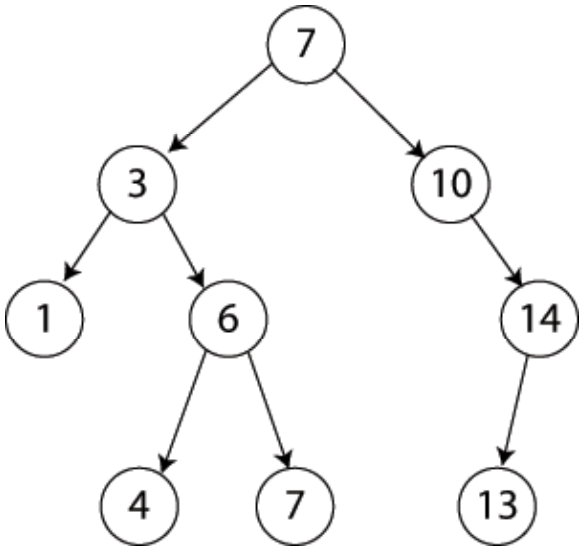
- **STEP 3: Farm out calculation and other repetitive grunt-work to machines.**
- Machines for the minutia of store inventory tracking.
- Logic machines: plug in some premises in propositional logic, and it will crank out conclusions all day.

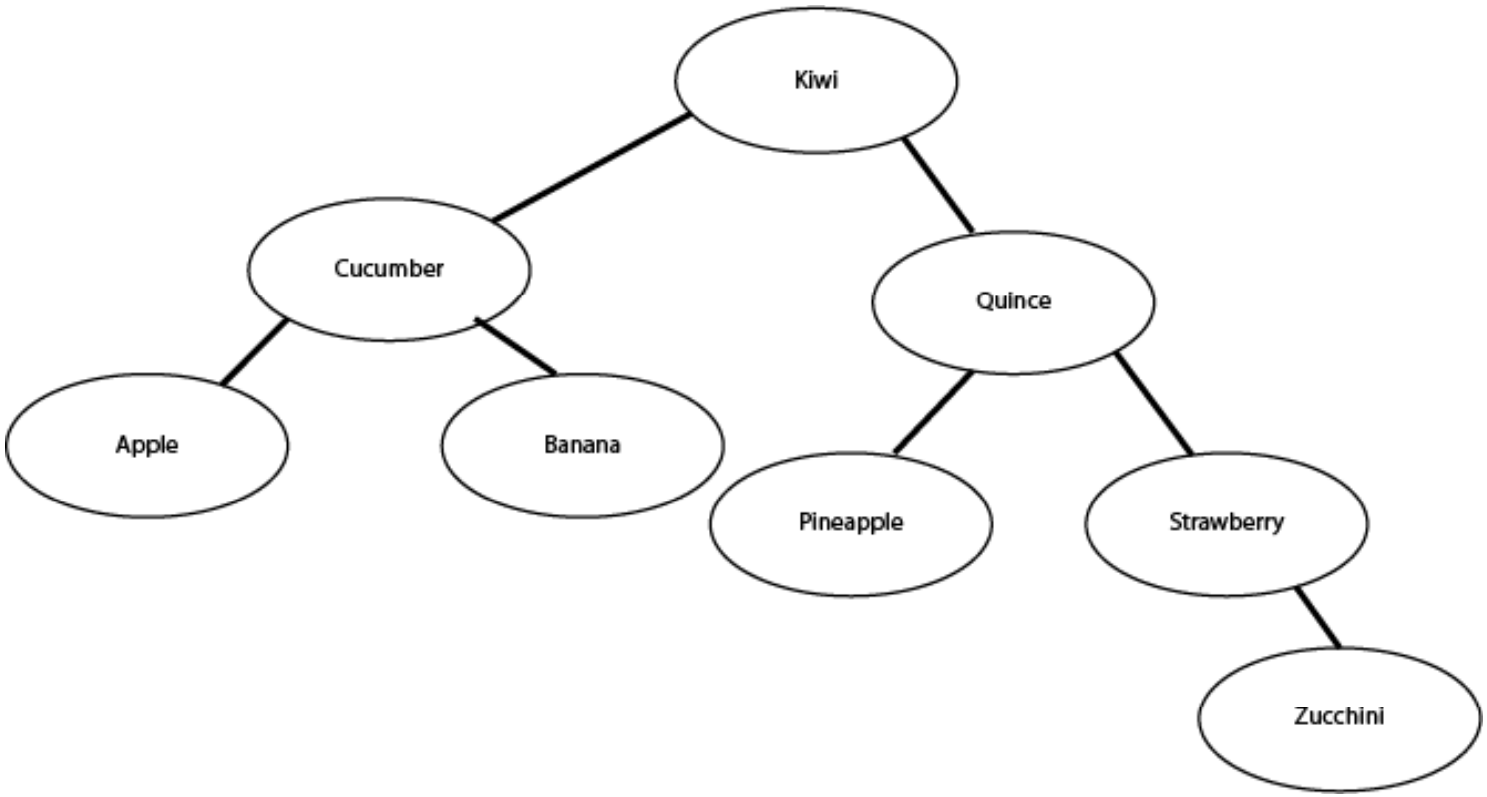
Vannevar's 7-step Program

- **STEP 4: Streamline the selection process.**
- Again, if only we all just used punch cards instead of letters, our representational system would be immediately machine-readable.

Vannevar's 7-step Program

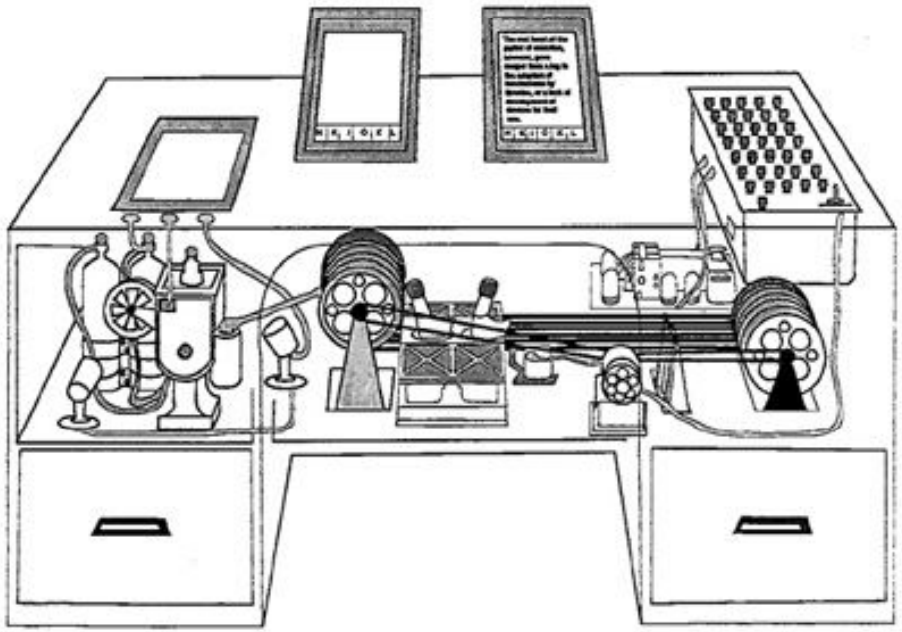
- **STEP 5: Streamline selection process.**
- "The prime action of use is selection" (NMR 42).
- Scrap linear-search in favour of a switching paradigm
  - What computer scientists Dictionary search, using search trees




Kiwi
Cucumber
Quince
Apple
Banana
Pineapple
Strawberry
Zucchini

Vannevar's 7-step Program

- **STEP 6: Make a device that eases associative selection and consultation.**



Vannevar's 7-step Program

- **STEP 7: Become a friggin' cyborg.**
- "All our steps in creating or absorbing material of the record proceed through one of the senses – the tactile when we touch keys, the oral when we speak or listen, the visual when we read. Is it not possible that some day the path may be established more directly?" (NMR 47).

HYPERTEXT: A Brief History

- 1945: The Memex (Vannevar Bush)

- 1960: Project Xanadu (Ted Nelson)
- 1960: *Man-Computer Symbiosis* (Licklider)

- 1965: Ted Nelson coins terms “Hypertext” and “Hypermedia”

- 1977: Aspen Movie Map, first Hypermedia app, at MIT (funded by ARPA)

- 1980: ENQUIRE, by Tim Berners-Lee
  - Bi-directional hyperlinking
  - Wiki-style editing of database

  - 1991: World Wide Web made publicly accessible (again Berners-Lee)
  - 1995: WikiWikiWeb
  - 2000: Nupedia/Wikipedia

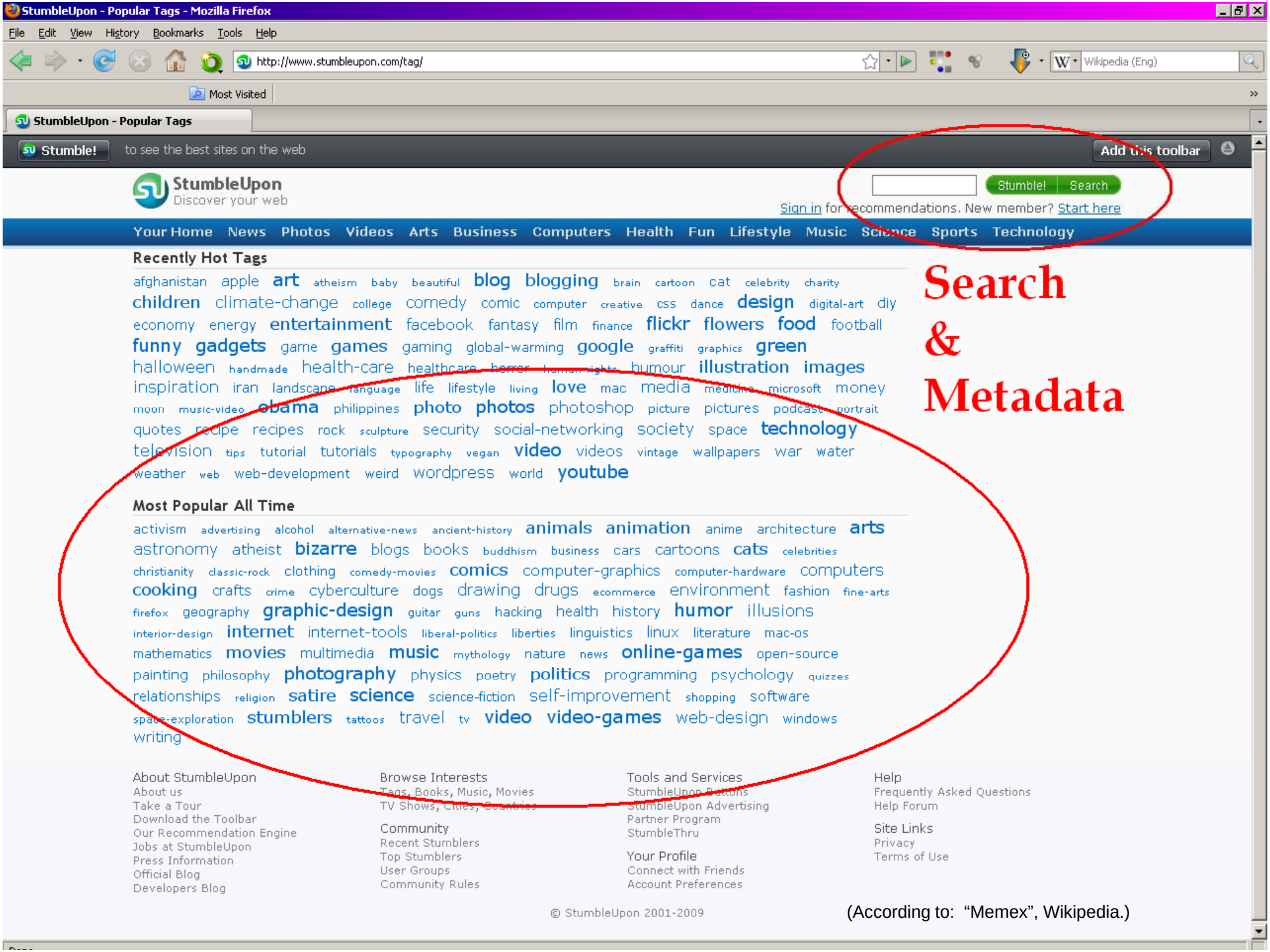
Characteristics of the Memex

- Associative paths, linkages, webs
- Ability to write-in
- Massive amount of data available
- Browsing, index-lookup
- Knowledge-sharing

- “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.”
- “There is 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.”

(NMR 46)

What’s missing?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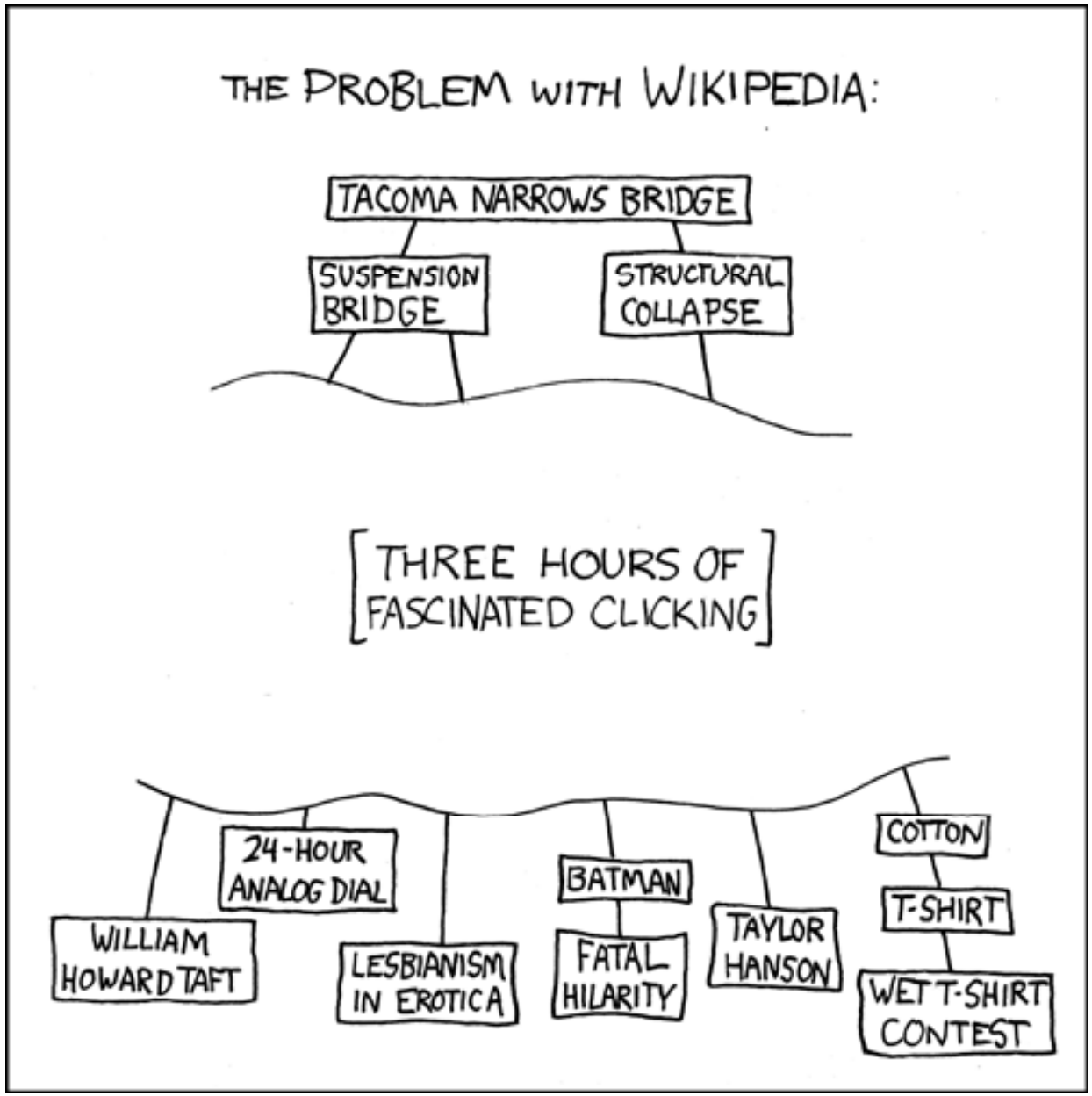
Search & Metadata
(According to: "Memex", Wikipedia.)



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