Hypermedia and Cognition

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Hypertext

- Information stored as a network of nodes connected by links
- Hypertext with multimedia is called *Hypermedia*
- Hypertext systems :
  - allow people to create, annotate, link together and share information from a variety of resources
  - incorporate the notions of navigation, annotation and tailored presentation

History of Hypertext

Ted Nelson coined the term "hypertext" in 1965, he defined it as:

"*a body of written or pictorial material interconnected in a complex way that it could not be conveniently represented on paper. It may contain summaries or maps of its contents and their interrelations; it may contain annotations, additions, and footnotes from scholars who have examined it.*"

But Vannevar Bush (in July 1945) had the original idea for hypertext in his memex system in which:

"*an individual stores his books, records and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.*"

History of Hypertext (2)

- Motivation for Memex: Bush was concerned about the explosion of scientific information
- Bush also proposed "*associative indexing*" – where any item can be caused at will to select immediately and automatically another
- Importance of tying these together is the essential nature of the Memex

History of Hypertext (3)

- Xanadu:
  - Nelson working on his vision of a “docuverse” – document universe
  - Everything should be available to everyone (at a price)
  - Users should be able to follow original links and find earlier versions
  - Unified environment for everyone to use
  - System has no concept of deletion (write-once system)
  - Current file systems don’t handle his vision

What is Hypertext?

- A database method for providing a novel way of directly accessing and managing data (but the user has complete freedom to show how to browse the data)
- It is also a representation scheme to mix informal textual material with more formal and mechanized processes
- It is a user interface modality that features special link markers that can be embedded in the content and then used for navigational purposes

Pad++ and Hypertext

- A Zooming Web Browser
- Motivation:
  - No graphical depiction of the relationships among windows (even when there is a strong semantic relationship)
  - Web browsers do provide some history mechanisms and bookmarks, but not enough…
- When a new page is loaded it is loaded to scale and then zoomed into view
- Pad++ could be used for browsing the web

Zoomable Web Browser

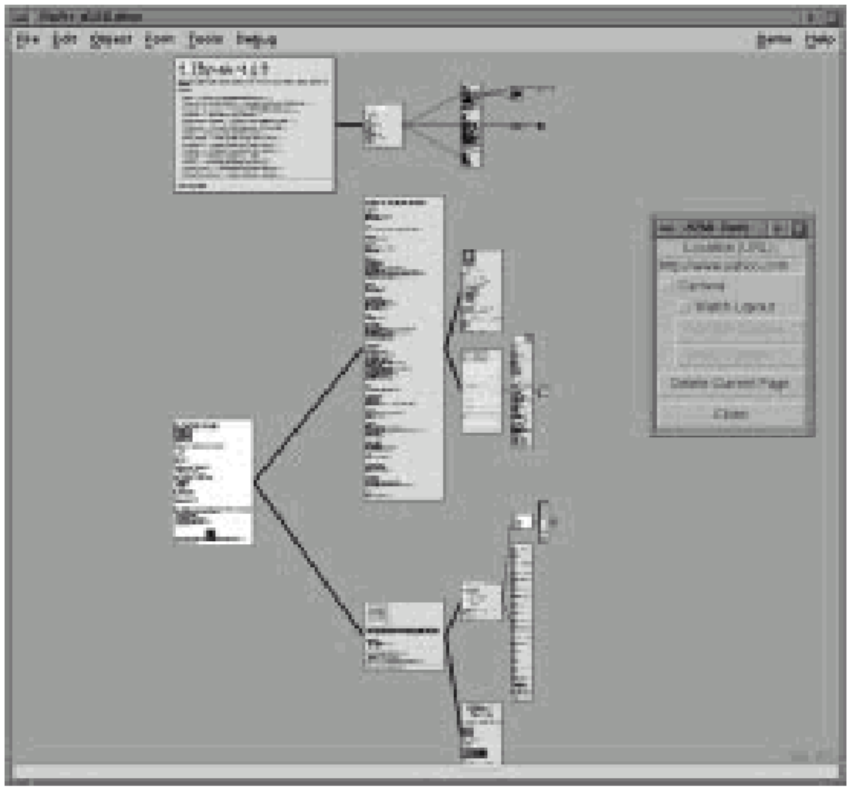


Figure 1: Snapshot of Pad++ Web Browser.

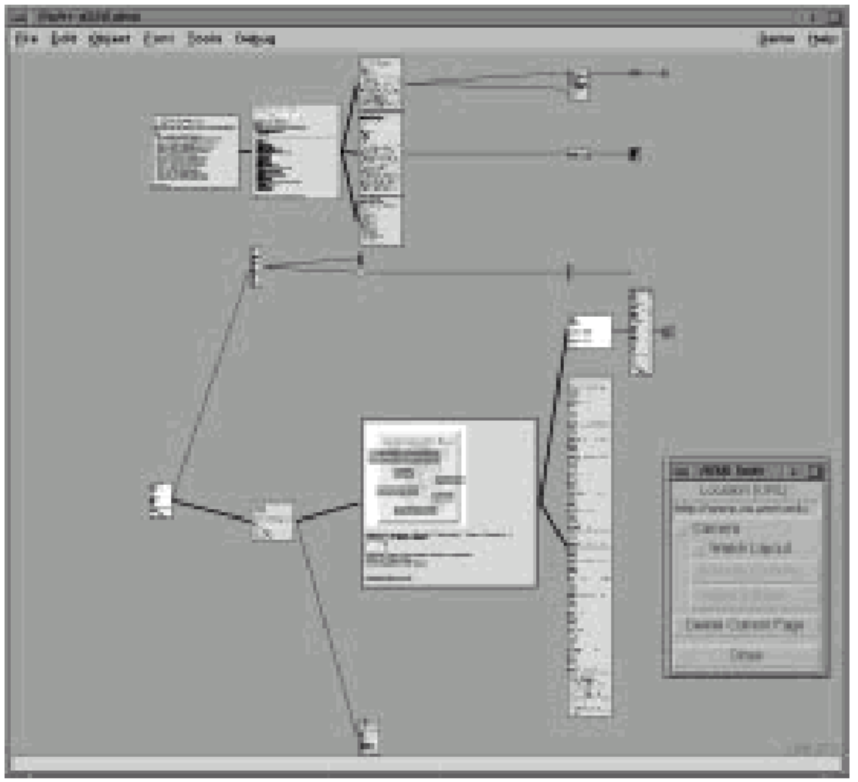


Figure 2: Another view of same web pages.

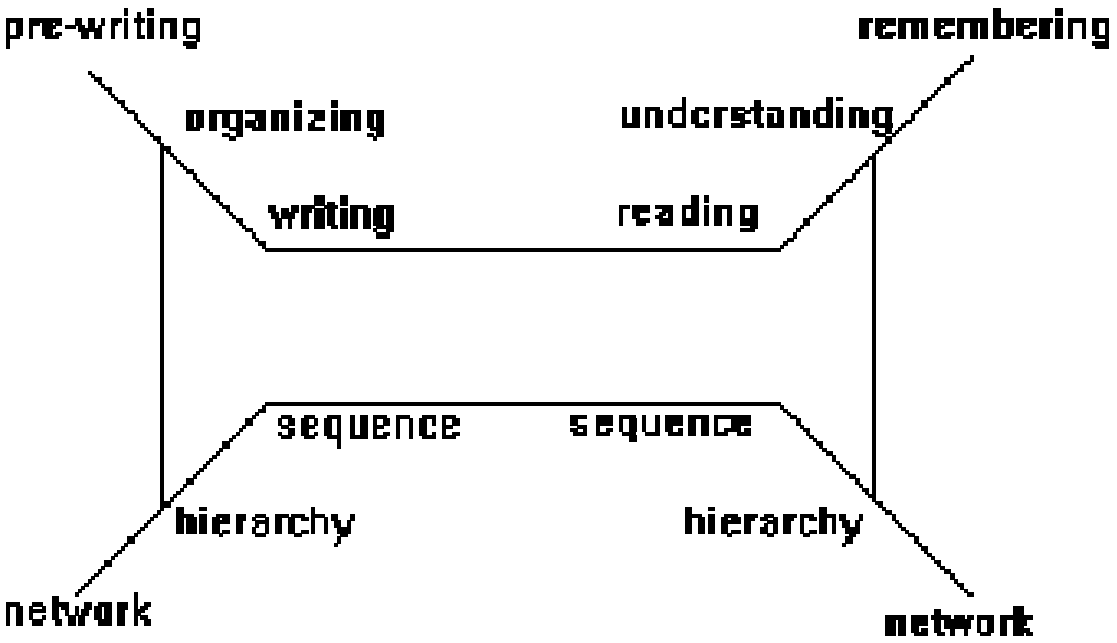
Reading and Writing Models

- Reading/comprehending:
  - Reading done at four levels:
    - Lexical (determine definition for each word)
    - Syntactic (subject, action and object of a sentence are determined)
    - Semantic (meaning of the sentence)
    - Pragmatic (involves interpreting the sentence in relation to the reader's knowledge of self and of the world)
  - Reading usually progresses in a "forward" fashion but may require some back and forth, following links etc
  - Understanding happens first at a local level – microstructures -- local coherence
  - Then macrostructures at a more global level are understood -- global coherence

Reading and Writing Models

- Writing:
  - When we design a text, we don't usually just write a block of text
  - We write bits, link them, draw an outline and add links, reorganize, revise etc…. very constrained by the linear nature of paper
  - A good author always keeps the reading model in mind
  - Different phases:
    - Exploring
    - Organizing
    - Encoding

Cognitive Framework for Written Communication



Smith et al. 1987

Cognitive Issues for Designing Hyperdocuments

- “Comprehension is often characterized as the construction of a mental model that represents the objects and semantic relations described in a text”
- Therefore, the readability of a document can be defined as the mental effort spent on the process of trying to understand a document

Cognitive Issues for Designing Hyperdocuments

- We look at two sets of influence that can affect readability:
  - *coherence* as positive influence
  - *cognitive overhead* as negative influence
- A document is coherent if a reader can construct a mental model from it that corresponds to facts and relations in a possible world
- "Cognitive overhead is the additional effort and concentration necessary to maintain several tasks or trails at any one time"

Cognitive Issues for Designing Hyperdocuments

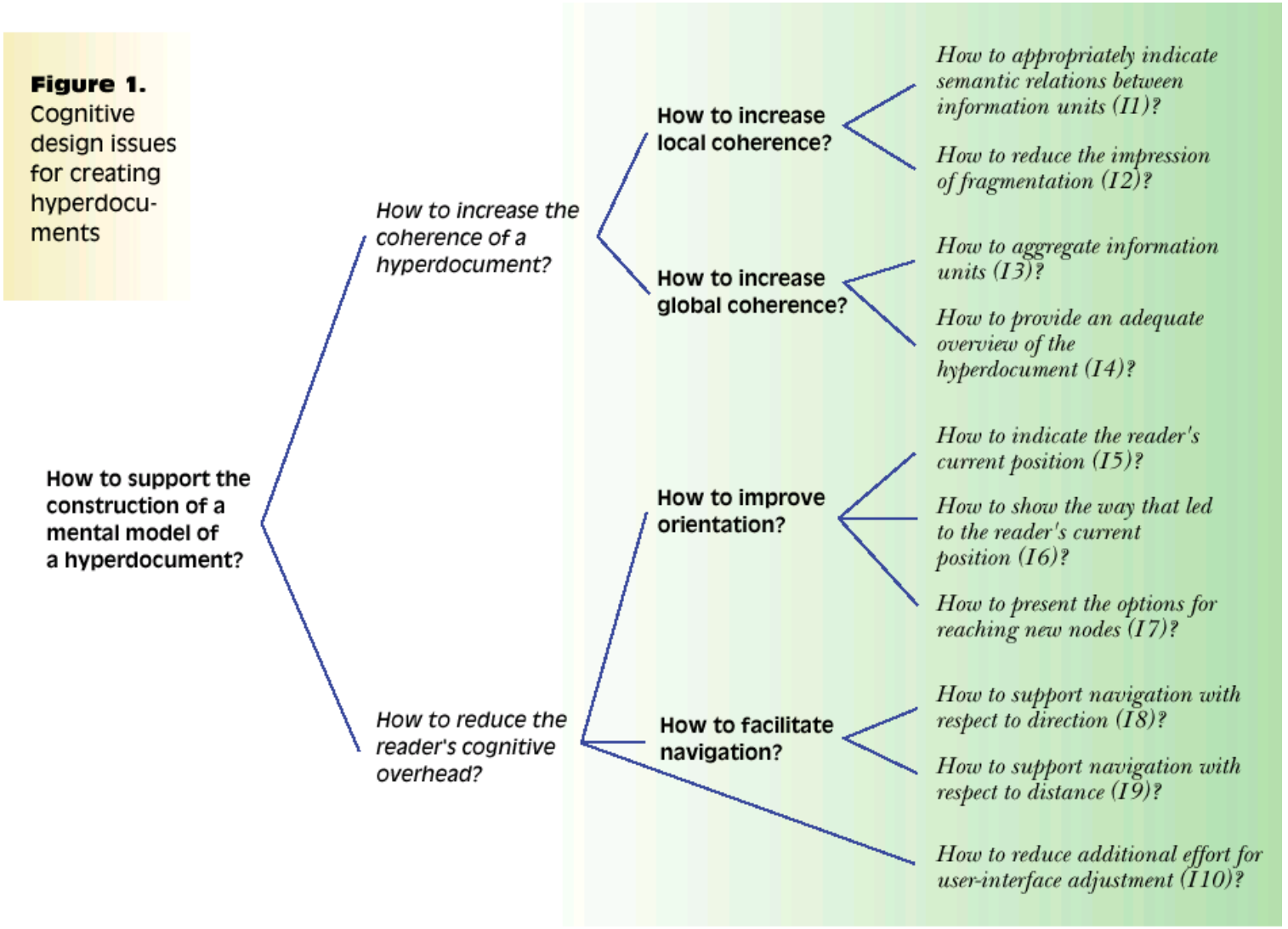


Figure 1. Cognitive design issues for creating hyperdocuments

Design Principles

Table 1. Design principles and their relation to cognitive design issues.
Issues marked by "+" are of primary concern for the principle.

Principles	Design issues addressed
P1: Use typed link labels	I1+ I2
P2: Indicate equivalencies between information units	I1 I2+
P3: Preserve the context of information units	I1 I2+
P4: Use higher order information units	I3+
P5: Visualize the structure of the document	I1 I2 I4+ I8 I9
P6: Include cues into the visualization of structure which show the reader's current position, the way that led to this position and navigational options for moving on	I5+ I6+ I7+
P7: Provide a set of complementary navigation facilities which cover aspects of direction and distance	I8+ I9+
P8: Use a stable screen layout with windows of fixed position and default size	I10+

Discussion Topic

- Xanadu and Ted Nelson -- How does his vision compare to the reality we have today with the web….

"It has always been much more ambitious, proposing an entire form of literature where links do not break as versions change; where documents may be closely compared side by side and closely annotated; where it is possible to see the origins of every quotation; and in which there is a valid copyright system-- a literary, legal and business arrangement-- for frictionless, non-negotiated quotation at any time and in any amount. The Web trivialized this original Xanadu model, vastly but incorrectly simplifying these problems to a world of fragile ever-breaking one-way links, with no recognition of change or copyright, and no support for multiple versions or principled re-use. Fonts and glitz, rather than content connective structure, prevail."

References

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- Introduction to hypertext, see:

  http://www.isg.sfu.ca/~duchier/misc/hypertext_review/chapter1.html
- Zoomable web browsers:
  http://www.cs.umd.edu/hcil/pad++/papers/spie-96-webbrowser/spie-96-webbrowser.pdf
- Xanadu project, by Ted Nelson