An information explosion!

What does this mean?

Continued increase in the amount of written information we (personally) have to keep track of.

Why do we have more paper to keep track of?

Because it has become easier to produce!

printing press   typewriter   carbon paper   photocopier   computer

Problem: Need a way of managing the paper so you can find the information when you want it

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What do you use at home?

How is it organised?

Why do you do it that way?

Can you find what you need?

The Wooten Patent Desk (circa 1872)
an early attempt to deal with the problem

Wooten style desks were a breakthrough in organising paper information

Information was organized by size & location

Advantage:

ease of storage
(a place for everything & everything in its place)

Drawbacks:
retrieval difficulties
single-user system (idiosyncratic)
limits on size & shape
upper limit on slots (categories)

Overcoming size limitations
Businesses needed more storage

Pigeon Hole Filing Cabinet   Document Filing Cabinet
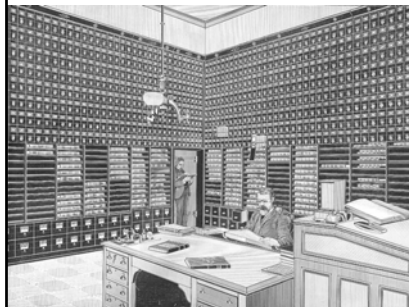Sectional, Elastic or Expansion Filing Cabinet

(Circa 1880-1900)

Information organised spatially

Drawbacks?
multiple users
retrieval (finding the info)

difficult to re-organise if
new categories are added

Document Filing Rooms

All of these methods rely on spatial organisation of information

(even though the information wasn't spatial)

US Dept of Justice, Washington DC, Circa 1895

What do you need to make spatial arrangements work?
a map or catalogue

What else uses a spatial arrangement?

grocery store / supermarket
Location of individual items can
be difficult with large spatial arrangements
need location aids

hardware stores
even more items than a grocery store

often too complex for signs alone
also need specialist advice

libraries

Rely on file catalogues & specialist advisors

Filing specialists were trained and employed to manage office information

Filing systems had to become increasingly standardised: alphabetically, chronologically, or by customer number

Letter Filing Cabinets
Organised alphabetically – not spatially

Still needed specialists to manage the filing and retrieval of information

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Vertical Filing System

A very different information organisation system

The vertical filing system was invented in 1898 by Edwin G. Seibels (1866-1954). One of his original filing cabinets is in the Smithsonian museum. Earliest advertisement 1901

Seibels' vertical filing system revolutionised record-keeping

1. Hierarchical organisational principle based on drawers & folders (built into the design)

2. Flexible categorisation of information; could be chronological within alphabetical within topic

3. Vertical orientation means you don't have to go through layers (as in flat document file – but still have FIFO vs LIFO issues)

4. Potentially unlimited number of categories, levels, and files

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The vertical filing system still has some drawbacks

1. Filing categories require careful thought

2. Can take more time to store information properly

3. Can require considerable space

Specialist filing consultants are still employed

Filing systems are a cognitive tool

Why do we need them?

Limitations of human memory:

Working memory capacity limit

Time & effort required to memorise information

Constructive processes in long-term memory

How are they similar to human memory?

Some info organised by content (not spatially)

Some info organised hierarchically (not spatially)

Filing systems are a cognitive tool

How are they different from human memory?

permanence & accuracy

range of content & categories

ease of cross-referencing

physical size & portability

amount that can be stored

time required to file   time required to retrieve

Depends on what kind of memory

Filing systems are a cognitive tool

We have more than one type of memory system & we rely on more than one type of information management system

Office design example

The office as a cognitive tool

From: chris@xxxx.edu
To: dnorman@ucsd.edu
Subject: My office . . .

You asked me to describe how I organize my office. Here it is:

I've worked pretty hard to make my office environment help me as much as possible.

Much of the office organization is designed to help me find things and remember to do things. I also want to remind myself to work on "important" things, like writing papers, that might easily be pushed aside by less important but more time-critical items. My desk is arranged in an L shape, and I have placed a large calendar on one wall and a large "to-do" list on the other wall. (I also have a special calendar on my door to remind me about the most critical items I have left to do on my major project, which I can read from my desk and see whenever I come in.)

The calendar shows the current month and lists things that I have to do, including meetings, deadlines, and reminders, such as "drop off Chapter 3" or "send E-mail to Executive Committee." I use Post-it Notes, so that I can easily deal with

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Office design example
The office as a cognitive tool

Features of Chris' Office:

To do list (3-4 months)

Calendar (time-critical items) post-its for changes

3-level information system:
desk, file cabinets, & pile cabinet

Look at each feature

Desk – work surface with frequently used materials (tools & references)
drawers for admin-non-intellectual items
easy to file, cleaned annually

Why does she need the desk drawers?

items that don't fit other file categories, garbage collection?

What aspect of human memory does this remind you of?

Look at each feature

File cabinets: Three cabinets, but four systems
 Copies of papers (chronologically organised)
 Old (historical) records
 Current work files (discontinued)
 Projects started but not finished
  (rarely used)

Why does she need these different categories?

What aspect of human memory does this remind you of?

Look at each feature

Pile cabinet: Active projects

Widely used – broad range of styles

Why did this replace "current work" files?
needed to remember to work on them
Why not a file cabinet or drawer?
out of sight & ease of storage/retrieval
How is it organized?
spatial & non-hierarchical

Virtual pile cabinets for your computer files

**A 'Pile' Metaphor for Supporting
Casual Organization of Information**

Richard Mander, Gitta Salomon and Yin Yin Wong

Human Interface Group, Advanced Technology
Apple Computer, Inc.
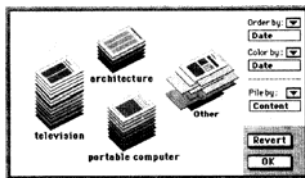
Look at each feature
*What hasn't Chris told us much about?
What isn't working?*

Inbox – how to prioritise the work

	Urgent	Non-urgent
Important	**1**	**2**
Not important	**3...**	

my four-level cognitive tool

What aspect of human cognition does this remind you of?

The office as a cognitive tool

attention   **storage**

retrieval

Info management trade-offs:
 ease of storage vs ease of retrieval
 task management vs distraction & information overload
 need for long term storage vs frequency of use
  (& forgetting due to disuse)

Can we use technology to deal with these problems?

Is there a better method for organising & storing information?

Memex: Non-hierarchical information system

Vannevar Bush, "*As We May Think*" (1945)

Memex system to organise microfilmed information and retrieve it *without leaving the desk*

"...when one of these items is in view, the other can be instantly recalled merely by tapping a button"
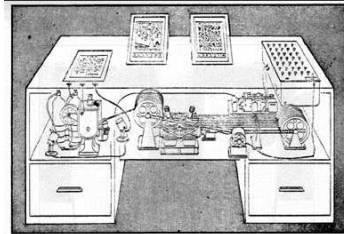
Key feature was "Associative Indexing" linking information sources together and save a trail of connections: "*The process of tying two items together is the important thing*"

Memex: Non-hierarchical information system

Vannevar Bush

Director of the US Office of Scientific Research and Development

Director of the US National Advisory Committee for Aeronautics (pre-NASA)

"*As We May Think*" (1945)

"tools change our way of doing, and expand the horizons before us"

Predicted microphotography, personal computers, EFTPOS, on-line literature, hypertext & many other technology advances

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How do we computers to organise & store information?

All of these computer systems use a desktop/office/filing cabinet metaphor as a representation (for ease of use)

File Manager

As a result, they have most of the same limitations as paper-based systems (maybe more?)

How does the information get in the computer?
Type it in or scan it...
Don't forget to back-up your data!

Office computers have given us a new information tool:
the Database

"*A structured collection of records or data that is stored in a computer so that a program can consult it to answer queries*"

| Flat file database	Hierarchical database	Network database	Relational database
Two-dimensional array of data elements; rows & columns	Tree structure efficient & flexible but little or no cross-referencing	Like hierarchical model, but each element can have multiple "parents"	Entries with attributes that can be searched & linked using relational operators

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Hierarchical database

Organised collection of files
Each file contains records
Each record contains individual pieces of information (fields)

Relational database

Contains linked tables
Each table contains records with several data fields
A relational query filters information, finds ones that meet criteria or arranges them in a particular order

Provides method of cross-referencing & creates new knowledge by finding relationships

Hypertext: another method of cross-referencing & finding relationships in data

Selecting a word in a piece of text and the focus immediately shifts to another document or page dealing with that word

Vannevar Bush's original concept for the Memex

The internet is a distributed relational database connected by hyperlinks (hypertext markup language or html)

"The Internet is not a thing, a place, a single technology, or a mode of governance. It is an agreement"
John Gage, Sun Microsystems

Domains and connections of the world wide web. Colors represent .edu, .gov, .com, etc. domains

The internet (cyberspace)
offers nearly unlimited size & formats
for information but searching & organising
results of searches can still be difficult
need search engines, bots, & avatars

The surface features of the search results
can affect how the information is processed

Information Display
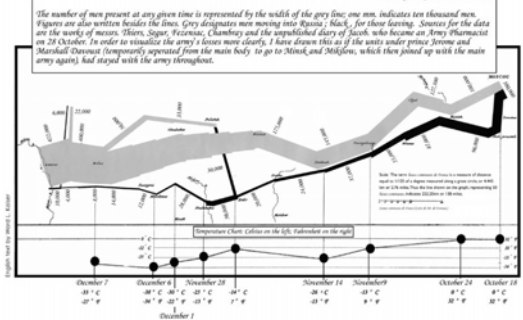
Figure S8. Minard's map of Napoleon's Russian campaign.
This graphic has been translated from French to English and modified to most effectively display the temperature data.

CBS/BBC broadcast of Kennedy assassination coverage, 1963

MSNBC coverage of 9/11/2001

Newsmap image 17 April 2007   http://www.marumushi.com/apps/newsmap

Newsmap is a type of Treemap

Two-dimensional representation of a tree hierarchy or relational search result
Allows simultaneous comparison across multiple levels
Organisational structure can be changed easily

Top 100 songs in the iTunes music service. The map updates every 24 hours by reading current data from Apple's iTunes XML feed

http://www.hivegroup.com/demos
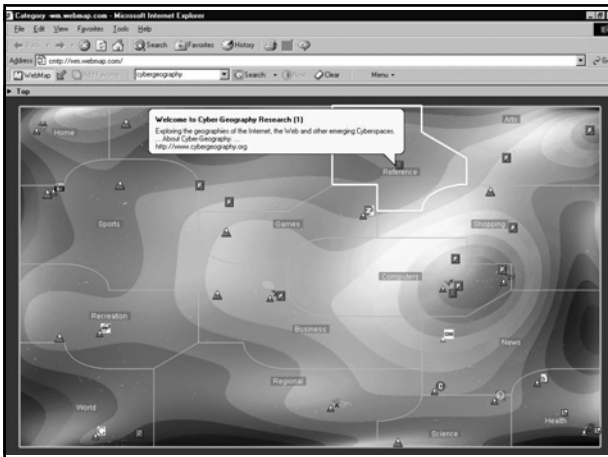
Alternative Information Systems

The Pond

A tool for collaboration

"In the Pond design we try to move away from the conventional ideas of desktop metaphors and the established notions of how information systems are accessed and manipulated. Instead, concepts from areas such as bio-ecosystems, fishing, fluid mechanics, roulette wheels and jukeboxes have been our inspiration."

Future Challenges

"Today our society and our social institutions are being reshaped by the rapid advances in information technology: computers, telecommunications, and networks….This technology allows us to form and sustain communities for work, play, and learning in ways unimaginable just a decade ago."
James Duderstadt, President Emeritus, University of Michigan, 1999

"I wonder at times if we are not like the dinosaurs, looking up at the sky at the approaching asteroid and wondering whether it has an implication for our future."
Frank Rhodes, President Emeritus, Cornell University, 1998

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3 Future Challenges For Knowledge Systems

Communications and computer technology
has been increasing *one hundredfold* every decade

What are the implications of this increase?

How can universities use this increase in communication and computation?

1. Library – repository of existing knowledge

2. Scholarship – creating new knowledge

3. Teaching – transmitting knowledge

Future Challenge #1

Library: Repository of existing knowledge
Virtual access – do we need a physical library, or is on-line access preferable?

Should an on-line library be the same as a physical library (a virtual library) or can a digital library be more?

How do we organise & navigate all the different types of information available?
(spatial organisation won't work – Multimedia info ?)

Do we need librarians? What will they do?

What does the Wikipedia experience tell us?

Library: Repository of existing knowledge

What does the Wikipedia experience tell us?

Nupedia –web-based encyclopedia, articles written by experts (w/ PhDs) & licenced as free content. Funded by Jimmy Wales of bomis.com. Nupedia had extensive peer review process, only 24 articles completed the process, discontinued after Sept 2003

Wikipedia started as a feeder project for Nupedia
Goal is to produce free encyclopedias in all languages based on a neutral point of view, anyone can contribute or edit self-policed for accuracy, vandalism, etc.
By Sept 2004 Wikipedia had 1m articles in > 100 languages
By March 2006, English Wikipedia hit 1m articles

Can a Wiki (organised & policed by users) ever be considered authoritative?

Library: Repository of existing knowledge

What kind of an interface do we need for a virtual library?

Library: Repository of existing knowledge

*How do we organise & navigate all the different types of information available?*
(spatial organisation won't work – Multimedia info ?)

*How is a digital library different from a database?*

Traditional relational database searches are not probabilistic, they use specific structures, known relationships (links), or keywords (metadata)

A digital library search could use inexact matching (probabilistic, clustering, pathfinder & MDS scaling) based on contents of text

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Author-link search results -- PFNet algorithm
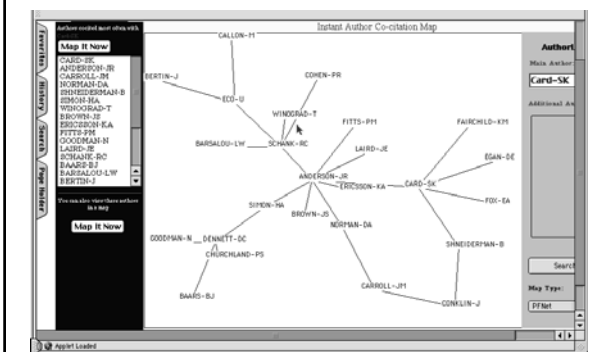
Library search of research on botulinum toxin research between 1945 and 2002 (PFNet algorithm)

Medical appl...   ...arch

Gene studies   ...ge research

Botulism disease

C-2 & C3 toxins
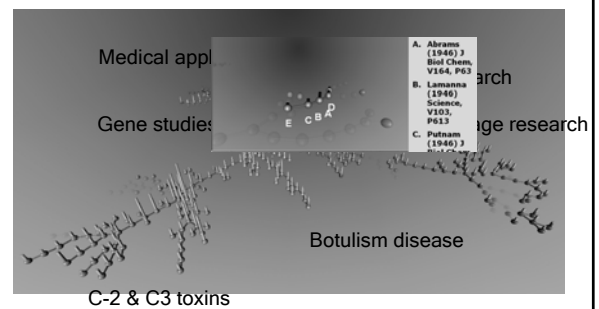
Future Challenge #2

Scholarship: Creation of new knowledge

Data integration (data mining)
Solving complex dynamic equations
(modeling weather)
Simulation of complex physical phenomenon

Collaboratories – distributed teams of researchers working on topics
Goals are expanded access, structural transformation (multidisciplinary), new kinds of science, increased output

http://www.scienceofcollaboratories.org/Resources/colisting.php

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Future Challenge #3

Teaching: Transmitting knowledge

Knowledge is the medium & product of a university

E-learning, Distance learning & Virtual Universities

Teaching: Transmitting knowledge

Self-paced instruction can be very convenient

But is learning a solitary activity?
Does class size matter?
How big is too big – how small is too small?
Is lecturing the best learning format?

asynchronous vs synchronous learning

Does synchronicity of participants matter?
Is video conferencing the answer?
Can we do better than distance education?
Does cyberspace offer other opportunities?

Teaching: Transmitting knowledge

Would you go to a school for avatars?

Is this better than email?

Avatars: a representation of yourself that you can "send" anywhere to interact with others

Better than a conference call?

Why not just videoconference?

Can we use the technology to change the quality of social interactions?

What are the issues?
Does it matter what the avatar is being used for?

Anthony & Lawson, 2002

Avatars can do things and go places that we can't

Anyone can be rendered as an avatar

Avatars can even be who we aren't

Massive Multiplayer Online Role Playing Games (MMORPGs)

There, Second Life, EverQuest, Guild Wars, Hattrick, Lineage, Maplestory, Runescape, Star Wars Galaxies, World of Warcraft

The Sims On-line (TSO)

Peter Ludlow, philosophy professor, University of Michigan entered TSO as an "investigative reporter" and published Alphaville Herald – documented "scammers" (who steal simoleans) & interviewed "Evangeline" who ran an on-line brothel in TSO.

Ludlow was banned from the game "*The only thing that makes any sense to me at all is they don't care what's going on in the game...They just don't want people to know what's going on.*"

The Sim Mafia subsequently appeared inside TSO
"*Our job is to basically take those complaints from the normal citizens of the game, who can't go to EA because EA won't do anything about it*" (thesimmafia.com)

Massive Multiplayer Online Role Playing Games (MMORPGs)

number of active players

Guild Wars – 3,000,000
Hattrick – 934,000
Lineage – 1,300,000
Maplestory – 2,000,000
Runescape – 1,000,000
World of Warcraft – 8,500,000
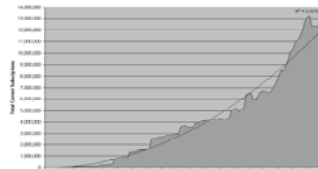
8.7% of male and 23.2% of female players have had an online wedding

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Discussion: Design a better university

goals: learner-centred, affordable, lifelong learning, interactive/collaborative, diverse, intelligent & adaptive

do you agree with these goals?

are there additional goals?

how do we use the knowledge systems information we've discussed to meet these goals?