Expanding Library Services in the Digital Age: The Search for [Almost] Equilibrium

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Outline

- Technology in context
- Change
- Complexity
- Variety
- DLs as extensions of PLs
- New augmentations
Technology in Context

• Technology demands attention (e.g., Moore’s Law).
• Hype can hurt when resources are limited.
• People first, content second, technology third.
• The Internet is more about communication than information.

*Focus on people.*
Digital Library Design Space

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Technology Requirements

• **Infrastructure**
  – high-speed networks, mass storage, CPUs
  – ubiquitous access (home, car, office)

• **Access**
  – indexing and search
  – overviews and previews

• **Interfaces**
  – GUI (graphical user interface)
  – multiple modes, mobile

• **Software engineering**
  – rapid prototyping, iterative design
  – interoperability and federated architectures
Change

• Today’s IT change is not unprecedented.
• People are energy and time conscious.
• Technology changes quickly, people and institutions change slowly.

Attend to organizational change

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## Storage

<table>
<thead>
<tr>
<th>Year</th>
<th>Storage Medium</th>
<th>Capacity (cci)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000 BC</td>
<td>Clay Tablets</td>
<td>1 character/cubic inch</td>
</tr>
<tr>
<td>1450 AD</td>
<td>Printed Page</td>
<td>500 cci</td>
</tr>
<tr>
<td>1990's</td>
<td>Optical Disc</td>
<td>125,000,000,000 cci</td>
</tr>
</tbody>
</table>

Today: 1000 300-page books on CD-ROM
# Computation

<table>
<thead>
<tr>
<th>Year</th>
<th>Device</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000 BC</td>
<td>Abacus</td>
<td>2-4 instructions per second (ips)</td>
</tr>
<tr>
<td>1945 AD</td>
<td>Computer</td>
<td>100's ips</td>
</tr>
<tr>
<td>1960's</td>
<td>Computer</td>
<td>100,000's ips</td>
</tr>
<tr>
<td>1970's</td>
<td>Computer</td>
<td>1,000,000's ips (MFLOPS)</td>
</tr>
<tr>
<td>1980's</td>
<td>Computer</td>
<td>10,000,000's ips</td>
</tr>
<tr>
<td>1990's</td>
<td>Computer</td>
<td>1,000,000,000's ips (GFLOPS)</td>
</tr>
</tbody>
</table>
Transmission of Information

4000 BC  Messenger  .01 words per minute (wpm)

1844 AD  Telegraph  50-60 wpm

1980's  Cable/Fiber  1,000,000,000 wpm (GBPS)

1990's  Fiber  100,000,000,000 wpm

"Within a decade or so we will be able to send all human knowledge past your house in a few seconds".
Eric Sumner, 1990  (President IEEE)
Human Processing

4000 BC  Written Language  300 words per minute (wpm)

Today  Written Language  300 wpm

4000 BC  Visual Images  100,000,000 "bits per glance"

Today  Visual Images  100,000,000 "bits per glance"

4000 BC  Spoken Language  120 wpm

Today  Spoken Language  120 wpm

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Fundamental IS Concepts

• Appraisal
• Relevance
• Authorship
• Document
• Classification
• Diffusion/publication
• Information needs
• Search process (strategies)
  * Reuse/sharing
  * Representation and data structure
  * Design (both representation and mechanisms)

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Key Library Functions

- Collection Development
- Preservation
- Access
  - cataloging
  - reference
- Manage
  - processes
  - resources

There are PEOPLE in digital libraries.

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Complexity

- Human systems (including libraries) are inherently complex.
- “Perhaps networks just at the phase transition, just poised between order and chaos, are best able to carry out ordered yet flexible behaviors.” Kauffman, p. 90.
- The surprises in complex systems are not predictable.

*Pay attention, be flexible, collaborate, trust human behavior-- Humans are good at adaptation; pattern matching.*
Variety

• On the edge of chaos?
  – High variety
    • Hyperpersonalization
    • Universal access
  – Standardization
    • efficiencies of scale
    • classification aims to reduce variety

• $H$: The closer to basic infrastructure, the better the opportunity for reduced variety; the closer to the individual, the better the opportunity for increased variety.
Compare

• Wall Mart
  – wide product range
  – wide audience
  – high volume
  – price and efficiency

• Travel Agent
  – wide product range
  – narrow audience
  – low volume
  – service

• Nordstrom
  – specialized product range
  – narrow audience
  – lower volume
  – service, atmosphere

• Travelocity
  – narrow product range
  – broader audience
  – high volume
  – price, convenience
## Compare

<table>
<thead>
<tr>
<th>Local Bookstore</th>
<th>Borders</th>
<th>Amazon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow product range</td>
<td>Wider product range</td>
<td>Widest product range</td>
</tr>
<tr>
<td>Narrow audience</td>
<td>Wider audience</td>
<td>Widest audience</td>
</tr>
<tr>
<td>Low volume</td>
<td>Higher volume</td>
<td>Highest volume</td>
</tr>
<tr>
<td>Service, atmosphere, convenience</td>
<td>Price, atmosphere</td>
<td>Convenience, price, recommendations</td>
</tr>
</tbody>
</table>

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Compare

- **Research Library**
  - Wide product range (comprehensive)
  - Narrow audience (geographically bound)
  - High volume
  - Reference Service (but not 24/7), depth

- **Digital Library**
  - Narrow product range (so far)
  - Broad audience? (global)
  - High volume
  - Convenience (24/7)

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Evolution and Extinction

• Horse and buggy vs automobile
• automobile + airplane
• Radio + TV
• Newspapers + Broadcast news

Hypothesis: Services and Information are additive.

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DL extensions

- DLs support broader, faster access
- DLs leverage automated backend processing
- New wine in old bottles
  - brokering expertise
  - validate/select quality
  - preservation (e.g., public keys as well as works)
  - configuration management

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Library Augmentations

• New types of reuse and sharing
• Patron Contributions
• Virtual communities and collaboratories
• Direct support for creation and use (entire information life cycle)
• Collaborative filtering, cataloging, question answering
• Open-source libraries
Sharium

- A virtual workspace with rich content and powerful tools where people can work independently or collaborate with each other to learn and solve information problems. A collaborative problem solving environment.
  - Organized around resources and tools
  - Encourages contributions and participation
  - Is sustainable

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Current model of technological support for types of learning

- Formal Learning (K-12 and College)
- Informal Learning
- Professional Learning

Technology

Information Resources

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Digital libraries lead to integrated resources and types of learning

Informal Learning

Formal Learning
(K-12 and College)

Professional Learning

Digital Libraries
(Information Resources + Technology)

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Current model of technological support for types of libraries

- Public Library
- Academic Library
- Special Library

Technology
OPACs, Z39.50, MARC, etc

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Shared Digital Libraries Lead to Integrated Resources and Services (Federation)

Academic Library

Public Library

Special Library

Digital Libraries

(Information Resources + Technology)

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Summary

• Focus on people.
• Broaden services to all aspects of information life cycle.
• Coordinate physical and digital library resources AND inform users.
• Standardize on infrastructure and customize on client support and service.
• Be flexible and look for new augmentations.
Personal Pointers


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