The Web May Be Great – But Can We Make It Usable?

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Preamble: Who “We” Are

- Regional high-speed network
- vBNS access point
- Cutting-edge research in network technology
Preamble: Who “We” Are

- “Metacenter Regional Alliance” (NSF)
- Cutting-edge research in advanced Web technology
- Testing facility for usability, desktop interoperability

Academic Partnerships

- Enabling technology for Web interfaces to remote research databases
- Transparent linking of heterogeneous databases
**Federal HPCC Programs**

- Usability engineering for HPC system software and tools
- Web-based access to resources, methods, and collaborators

**Industrial Partnerships**

- Mediation between HPC manufacturers and their user communities
- In-depth studies of how technical programmers use HPC machines
**Is the Web Usable?**

- Traditional measures of usability
  - ease-of-learning
  - ease-of-use
  - productivity
  - satisfaction

- How the Web measures up for professional use
  - ease-of-learning: Excellent (anyone can learn, fast)
  - ease-of-use: Good (some users confuse themselves)
  - productivity: Poor (only a few things are accomplished faster)
  - satisfaction: Weak (user gets lost, tires of flashy graphics)

**Is the Web Just an “Online Library”?**

- Basic document elements are varied
  - Text
  - Images
  - Video clips
  - Audio

- Interaction is simplistic
  - Play video/audio clip
  - Link to another location

- Interaction limited to “serve me some more info”
Is the Web Just an “Online Library”? (cont.)

- Frames and forms create alternatives for navigation
  - Table-of-contents provide shortcuts
  - Glossaries or added frames allow comparison
  - Forms make search mechanisms more flexible

Information flow is still “one-way”

We Don’t Know What Makes Documents Effective

- How do we know Web documents are being used, not just accessed?
- How do we know they're being used effectively, not simply scanned?
- Interactive HTML provides mechanism for collecting usage statistics
  - How long each part of page is viewed
  - Which hyperlinks are pressed
  - How many times the page is printed
Exploiting the Web to Improve Usability

- Why doesn’t the Web make us more productive?

  *What are we doing wrong? (What aren’t we doing right?)*

- Our research focus – *Develop enabling technology so the Web can improve productivity in terms of:*
  - Human efficiency (how quickly and easily results are achieved)
  - Human effectiveness (how well results can be applied to real tasks)

- How can the Web make us more efficient?
  - Mask system idiosyncrasies
  - Reduce level of physical / cognitive effort
  - Minimize opportunities for error

- How can the Web make us more effective?
  - Make learning more engaging
  - Adjust to different levels of user expertise

Using the Web to Mask Idiosyncrasies

- Compiling applications across multiple platforms is not easy
  - difficult to remember variations in compiler options
  - frustrating to determine if and where libraries are installed
  - tedious to find and transfer files across file systems
Using the Web to Mask Idiosyncrasies (cont.)

- Equations currently written / printed via idiosyncratic formats
  - Can’t be converted easily
  - Can’t be edited without the original software
  - Only LaTeX can be auralized
  - Must be converted to image file for Web use
- WebEqEd
  - Dynamically constructs image
  - Editable using browser
  - Printable
  - Convertible to LaTeX, audio formats

Using the Web to Mask Idiosyncrasies (cont.)

- User interacts at a familiar level
  - Option meanings, not site-specific syntax
  - Library functionality, not site-specific location
  - Which tool to use, not how to invoke the tool
- User doesn’t need to track changes
- Error protection
  - Typing is minimized
  - Error-detection-as-you-go
  - History mechanisms minimize user effort
Making Learning More Engaging

- New interactive mechanisms allow user to try-as-you-go
- **WebTerm**
  - Terminal within a browser window
  - Allows direct interaction with remote computers
  - Interoperable with hot buttons in document

Reducing Level of Physical / Cognitive Effort

- Traditional access to remote databases required use of Structured Query Language (SQL)

```sql
SELECT  Taxa.genus, Taxa.species, Taxa.authority, 
        Taxa.subtaxtype, Taxa.subtaxname, 
        Taxa.subtaxauth, Taxa.taxanum, 
        mgd_1..Link_phrases.phrase 
FROM     Taxa, mgd_1..Link_phrases 
WHERE    upper(germs..Taxa.isidia ) like upper('no') 
        AND upper(germs..Taxa.perithecia) like upper('yes') 
        AND upper(germs..Taxa.lifeform) like upper('under substrate surface') 
        AND upper(germs..Taxa.uppercolorlobe) like upper('grayish-green') 
        AND upper(germs..Taxa.surfacetexture) like upper('smooth') 
        AND upper(germs..Taxa.algae) like upper('green') 
        AND upper(germs..Taxa.sporetype) like upper('septate') 
        AND upper(germs..Taxa.areasolate) like upper('cracked surface on substrate') 
        AND mgd_1..Link_phrases.phrase_abbrev = "detpic" 
ORDER BY Taxa.genus
```
Reducing Physical / Cognitive Effort (cont)

- Web forms eliminate need for SQL
- Most forms require that user know how database is organized
- HyperSQL
  - Based on “recognition” rather than “recall”
  - Adds menus, lists, button bar elements
  - Can limit number of query responses
  - Developed for and with scientists

Adjusting to Different User Levels

- Lichen Synoptic Key
  - Interface for professional biologists
  - Eliminates all typing
  - Interface built with HyperSQL
  - Reflects database updates immediately
  - Improves on traditional dichotomous key
  - Frees user from rigid process
  - Accommodates uncertainty
Adjusting to Different User Levels (cont.)

- **LichenLand**
  - Second “personality” for same database
  - Allows beginners to explore and learn
    - Select by picture or scientific term
    - Point-and-click access to explanatory info
    - Eliminates possibility of error
    - Shows that almost anyone can “key out” a lichen

Minimizing Opportunities for Error

- **QueryDesigner**
  - Builds on user experiences with HyperSQL
  - Provides point-and-click graphical tool for constructing HyperSQL interfaces
  - Makes forms creation as error-free as queries are
  - Runs within a browser window
**Minimizing Opportunities for Error (cont)**

- QueryDesigner “analyzes” remote database
  - Identifies DB organization
  - Constructs diagram (editable)
  - Determines which records are linked to which others
  - Displays “meta-information” provided by DB owner

**Challenges Ahead**

- The Web is a moving target
  - Rapid evolution of server / browser support
  - Document providers assume that all browsers are similar
  - “Unsuspected” inconsistencies mean user doesn't see what developer thinks!
- Web technology assumes that the user has a question to pose
  - Users may have no particular question in mind
  - Users may be posing the “wrong” questions
- How can we make it possible to explore unfamiliar information?
  - Make data accessible for unanticipated uses
  - Expose data richness and interrelationships
Interrelating Information from Different Sources

- Oregon Coalition for Interdisciplinary Databases
  - Project will link research databases from many disciplines:
    - forestry
    - geosciences
    - ecology
    - botany
    - plant pathology
    - entomology
    - wildlife management
    - fisheries
    - microbiology
    - government and census data
  - Navigation via dynamic point-and-click maps

Facilitating Use of Immense “Data Mines”

- New project with Naval Oceanographic Laboratory to open Ocean Floor Survey data
  - Data were previously classified
  - Ocean floor topography, temperatures, currents, etc.
- Too large-scale for interactive browsing
  - Data cover entire globe
  - Almost 50 years of continuous data tracking
  - Will soon reach a petabyte in size
- HyperSQL will help user navigate meta-data, rather than the data themselves
  - Learn what data are available for specific needs
  - Estimate data size (and time required to download)
  - Play “what if” to find reasonable bounds on area, time, resolution
  - Corresponding data then downloaded via simple operation
Conclusions

- Usability engineering can be applied effectively to Web technology
  - Let users set the priorities
  - Accommodate user habits and preferences
  - Focus on improving productivity and satisfaction

- Must involve users when developing new technology
  - New disciplines bring new perspectives as well as new types of problems
  - Many of our best ideas came from motivated users!

- Results of collaborations with users are innovative and exciting