Digital Libraries

Patterns of Use

Week 10

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Two parts:

Integrating information seeking and HCI in the context of:

- Digital Libraries
- The Web

Digital Libraries

What uses do we commonly use the library for?
Accounting for

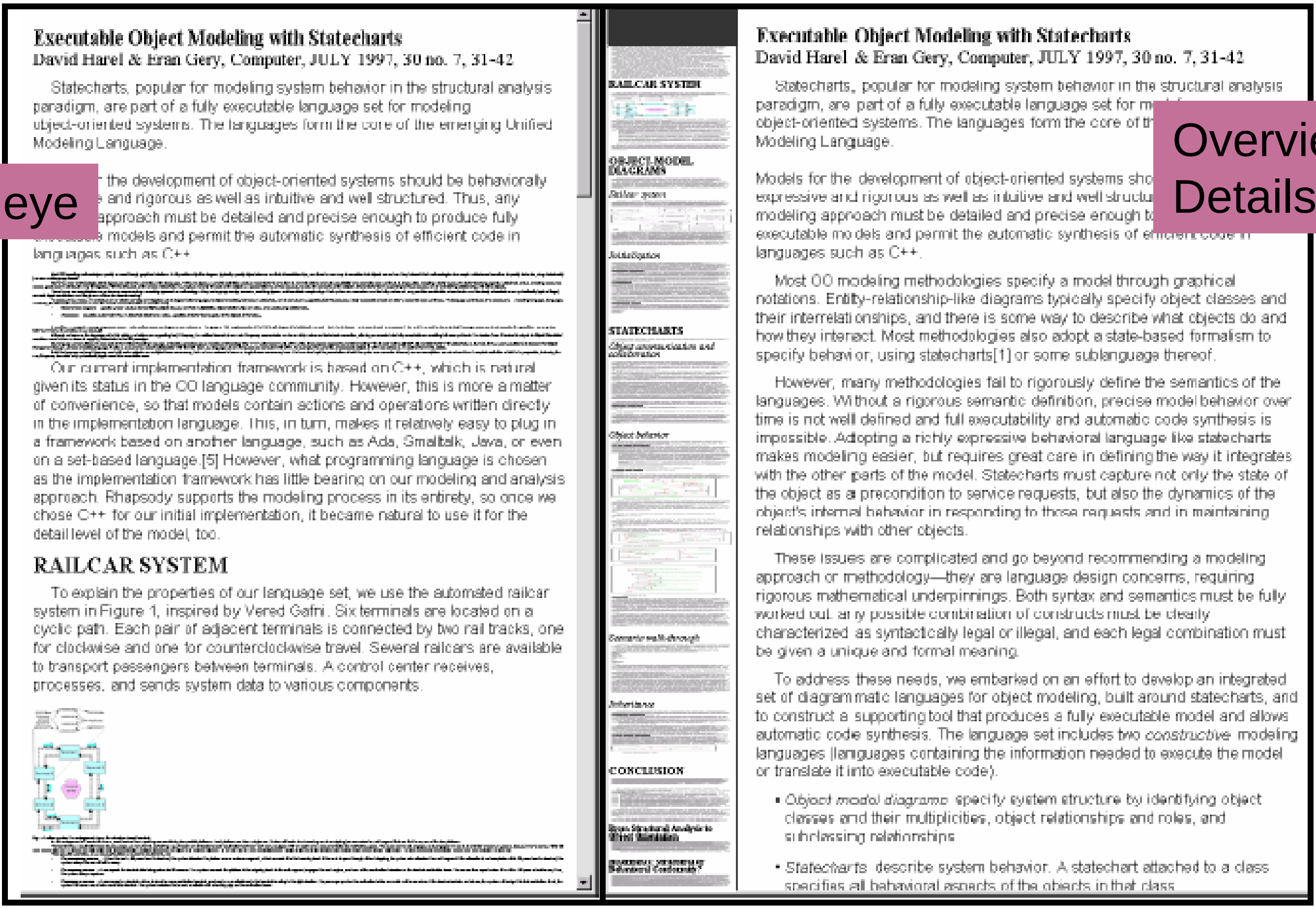
- Different age groups?
- Different professions?
- Public or private access points?

One dimension: expertise

"What better contribution could a scholar make than an article which could ... provide a clear, but vivid argument to the [secondary school student] but which, if unraveled, could provide the rigor demanded by the most crusty specialist?" Crane (of the Perseus DL)

- Question: How do DL designers support this in terms of HCI?
- Answer: Creating different document layers.
  Allow users to "fold" the document to see the only the relevant portions.

Fisheye



Executable Object Modeling with Statecharts

David Harel & Eran Gery, Computer, JULY 1997, 30 no. 7, 31-42

Statecharts, popular for modeling system behavior in the structural analysis paradigm, are part of a fully executable language set for modeling object-oriented systems. The languages form the core of the emerging Unified Modeling Language.

r the development of object-oriented systems should be behaviorally e and rigorous as well as intuitive and well structured. Thus, any approach must be detailed and precise enough to produce fully models and permit the automatic synthesis of efficient code in languages such as C++

Our current implementation framework is based on C++, which is natural given its status in the OO language community. However, this is more a matter of convenience, so that models contain actions and operations written directly in the implementation language. This, in turn, makes it relatively easy to plug in a framework based on another language, such as Ada, Smalltalk, Java, or even on a set-based language.[5] However, what programming language is chosen as the implementation framework has little bearing on our modeling and analysis approach. Rhapsody supports the modeling process in its entirety, so once we chose C++ for our initial implementation, it became natural to use it for the detail level of the model, too.

RAILCAR SYSTEM

To explain the properties of our language set, we use the automated railcar system in Figure 1, inspired by Vered Gafni. Six terminals are located on a cyclic path. Each pair of adjacent terminals is connected by two rail tracks, one for clockwise and one for counterclockwise travel. Several railcars are available to transport passengers between terminals. A control center receives, processes, and sends system data to various components.

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Statecharts, popular for modeling system behavior in the structural analysis paradigm, are part of a fully executable language set for m object-oriented systems. The languages form the core of th Modeling Language.

Models for the development of object-oriented systems sho expressive and rigorous as well as intuitive and well structu modeling approach must be detailed and precise enough to executable models and permit the automatic synthesis of efficient code in languages such as C++.

Most OO modeling methodologies specify a model through graphical notations. Entity-relationship-like diagrams typically specify object classes and their interrelationships, and there is some way to describe what objects do and how they interact. Most methodologies also adopt a state-based formalism to specify behavior, using statecharts[1] or some sublanguage thereof.

However, many methodologies fail to rigorously define the semantics of the languages. Without a rigorous semantic definition, precise model behavior over time is not well defined and full executability and automatic code synthesis is impossible. Adopting a richly expressive behavioral language like statecharts makes modeling easier, but requires great care in defining the way it integrates with the other parts of the model. Statecharts must capture not only the state of the object as a precondition to service requests, but also the dynamics of the object's internal behavior in responding to those requests and in maintaining relationships with other objects.

These issues are complicated and go beyond recommending a modeling approach or methodology—they are language design concerns, requiring rigorous mathematical underpinnings. Both syntax and semantics must be fully worked out: any possible combination of constructs must be clearly characterized as syntactically legal or illegal, and each legal combination must be given a unique and formal meaning.

To address these needs, we embarked on an effort to develop an integrated set of diagrammatic languages for object modeling, built around statecharts, and to construct a supporting tool that produces a fully executable model and allows automatic code synthesis. The language set includes two *constructive* modeling languages (languages containing the information needed to execute the model or translate it into executable code).

- *Object model diagrams* specify system structure by identifying object classes and their multiplicities, object relationships and roles, and subclassing relationships
- *Statecharts* describe system behavior. A statechart attached to a class specifies all behavioral aspects of the objects in that class

Overview + Details

- Overview + Details shown as best (Hornbaek & Frokjaer 01)
  - Fisheye distortion unsatisfactory
  - Shown better for QA but not for whole document understanding

The scientific article

How ***do*** we use articles?

Answer these in groups:

- Do we use scientific articles as a whole? Or specific *components*?
- How do *you* (personally) determine the relevance of an article?
- When do you decide to read an article?
- (Harder) What parts of an article do you use, and for what purpose / task?
- How do you categorize or label the articles that you read?

Typical critical reading patterns:

1. Read the title and the abstract

   If you still don't know what this paper is about, then this is a poorly-written paper.

2. Read the conclusion

   Are you now sure you know what this paper is about? If not, throw it away.

3. Read the introduction
4. Read the section headings
5. Read tables and graphs and captions

Usage lifecycle of an article

- Being found as relevant
- Assessing relevance
- Document surrogate
- “Information finding”
  - Browsing for exploration
  - Searching for specific bits
- Conveying knowledge not easily rendered in words

Being found as relevant

- Advanced features of search not often used
  - “Just to be safe”, use full text
  - Common and well-understood UI (legacy effect)
  - When features failed, users often don’t try them again
  - Features thus need:
    - To be properly introduced / understood (scaffolding)
    - To have well-understood error messages

Searching for specific bits

One-shot queries rare:

- Tip of the larger iceberg of an information seeking pattern

- I look for specific surface tensions, experimental measurements
- Looking for best efficiency of electric motors.
  - Ended up reading tons of documents for electric motor
- I sometimes want to look specifically at other’s methods and theories
- I often need multiple copies of a specific piece, like a table, for class
- I need to keep up to date on my research area

Browsing

- Why do people browse?
  - Semi-directed / Undirected learning
  - Initial Exploration

- Collection Evaluation
  - What's in this collection? Is it relevant to my objectives?
- Subject Exploration
  - How well does this collection cover my area of interest?
- Query Exploration
  - What kind of queries will succeed in this area? How can I access this collection?

Using the article

- Reading has different purposes too:
  - General Learning
  - Identification
  - Skimming
  - Answer questions
  - Defend position
  - Cross-Reference
  - Editing or critical review

Using the article (2)

- Biased to particular user and task
  - Current researcher’s work as “lens” to view the work
  - Different workflow for different users
    - Beginning researchers
    - Seasoned veterans
    - E.g., when to do annotation? Read references?
- Writing goes hand in hand with reading:
  - Three levels: Creating, note-taking and annotation
  - Annotation serves not so much to add to an article:
    - But to extract / filter important nuggets from an article (e.g., highlighting)
    - Adding a “document layer” to be used to view the document
    - Also inter-document annotation (e.g., labeling)

Using Multiple DLs

- Question: What’s the most common failure when using multiple DLs?
  - A: different layout of UI
  - B: different query operators
  - C: authorization problems
  - D: different materials in collection

- Same problem in heterogeneous data integration

  What’s a possible solution?

Public or Private?

- Question: Easier to do information seeking in a public or private place?
  - Need good support of note taking, annotation
  - Access to customization
  - Hardware support
  - Information professions support

Teh tarik break time

- Yay! See you later...

Patterns of use on the web

- How do people use query the web?
- How do they use the web browser?
- How can we build a better web browser?

Web query types (revisited)

What features best for web searches?

- Discriminate using *Mutual Information* for 2+ word queries

  P(x,y) / P(x) P(y) – collocation corrected for chance

  High MI corresponds to navigational task

- Navigational (Known item, Home page finding)
  - Relevant pages are mostly entry (root) pages
  - Anchor text and URL information

- Informational (Topic relevance)
  - Relevant pages are mostly nested pages
  - Content information (e.g., TF × IDF)

User behavior

- Users tend not to use monitoring steps
  - Sign up for email alerts, create a channel

- Even in a formal search mode
  - Users use simple keyword search, not advanced
  - Don’t revise their queries often (75% of all searches)
  - Don’t access help

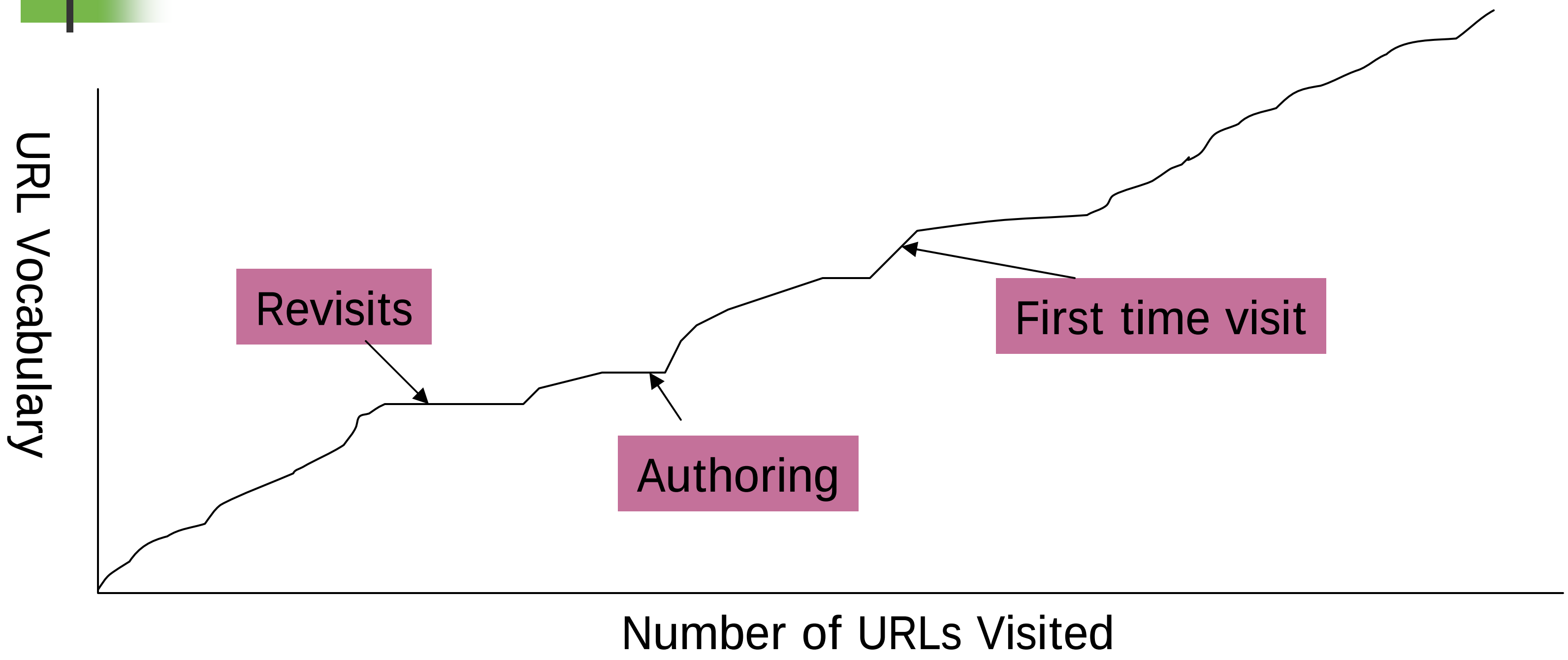
- Users don’t seem to have strongly repetitive patterns within a cluster of pages
  - No consistent paths
  - Longest repeated sequence analysis fails

- Larger volume of queries
  - Higher percentage of repetition
  - Caching is a good strategy

Page navigation types

- ~40% by following hyperlinks
- ~20-50% by back button navigation
- 11% new window
- 10% other (pop-ups count here)
    - Should be counted in hyperlink following
- 2.5% by bookmarks
- 0.8% by history

URL Vocabulary



- Observed linear growth, not power law
  - Why?

Modes of web browsing

Tauscher and Greenberg (1997):

- *First time visit*: new URLs observed
- *Revisits*: reading in depth (e.g., course notes), flicking to previous page(s)
- *Authoring of pages*: `reload` heavily used
- *Using web-based applications*: form submissions
- *Hub-and-spoke*: central page ⇒ specific page and back
- *Guided Tour*: Viewing a many-page article

Scenario

- You went to a website this afternoon to do some fact-finding for a project that you're working on.

  After going through many sites, some reading you're currently doing reminds of a link that would be useful to visit on a page that you visited sometime in the last hour or two.

  How would you go about finding it?

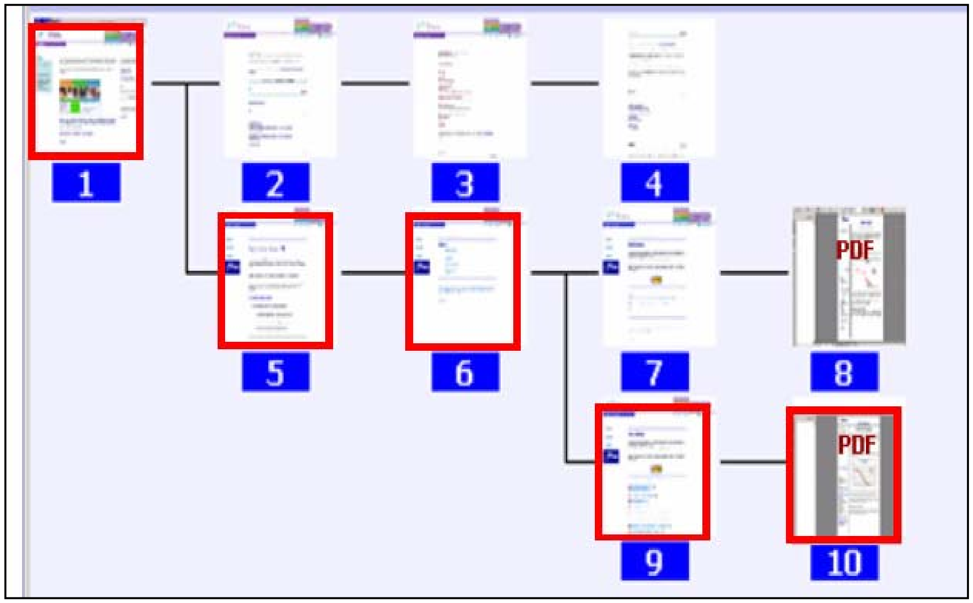
  Your answers:

The Button

- Takes you to the previous page
  - With a reverse-order of chronological pages; i.e. a stack
  - Extremely simple and easy to use
- How would you improve upon this?
- A UI feature of web browsers that have made it into operating systems

Temporal model of revisiting

- Promote a previously visited page to the top of the stack if:
  - I go back to visit it and
  - I take a different hyperlink from there



The navigation hub

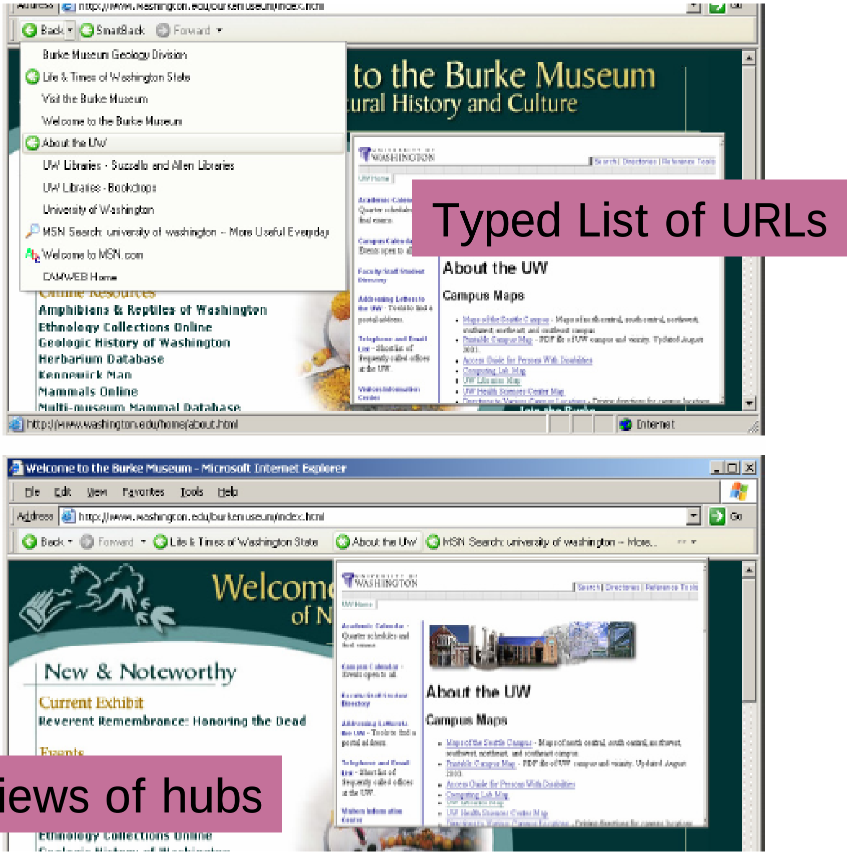
- Hub: a page that was promoted in the previous algorithm
- Study shows hubs revisited 1.8 times

- Ideally, predict which pages would be revisited

Algorithm for finding hubs

- Safari Browser: Search Engine and typed URLs as hubs
- Previous revisit of a page indicates hub
  - Even across sessions ("new window" commands)
  - Points to per-user customization

- SmartBack



Back
SmartBack
Forward
Burke Museum Geology Division
Life & Times of Washington State
Visit the Burke Museum
Welcome to the Burke Museum
About the UW
UW Libraries - Suzzallo and Allen Libraries
UW Libraries - Bookstops
University of Washington
MSN Search: university of washington - More Useful Everyday
Welcome to MSN.com
CAMWEB Home
to the Burke Museum
ural History and Culture
About the UW
Campus Maps
http://www.washington.edu/home/about.html
Internet
Welcome to the Burke Museum - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://www.washington.edu/burkemuseum/index.html
Back Forward Life & Times of Washington State About the UW MSN Search: university of washington - More...
New & Noteworthy
Current Exhibit
Reverent Remembrance: Honoring the Dead
Ethnology Collections Online

Typed List of URLs

Previews of hubs

To think about

- Traditional use studies are very comprehensive
  - But with new IT, new conclusions yet to be drawn

- What DL use patterns have correlations in the Web? What patterns are unique to the web? To the DL?
- How do ***you*** think web browsers and DL interfaces can be improved in the near future?