14 IR User Interfaces and Visualization

14.1 Human-Computer interaction

[Shneiderman]: ‘Well designed, effective computer systems generate positive feelings of success, competence, mastery and clarity in the user community. When an interactive interface is well-designed, the interface almost disappears, enabling users to concentrate on their work, exploration, or pleasure.’
Design Principles

• offer information feedback
  e.g. query formulation vs. documents retrieved

• permit easy reversal of actions
  e.g. keep track of choices during search,
  provide browsable info relevant for current stage of search

• reduce working memory load

• provide alternative interfaces for novice and expert users
  (easy to learn v.s. powerful interfaces)
Visualization techniques

- icons
- color highlighting
- brushing and linking
  (connect two or more views of the same data)
- panning and zooming
- focus-plus-context
- magic lenses
  (transformations on the focussed data)
- tree views
- use of animation
14.2 The information access process

goals + tasks

1. start with an information need
2. select a system and a collection to search on
3. formulate a query
4. send the query to the system
5. receive the results in the form of information items
6. scan, evaluate and interpret the results
7. either stop, or
8. reformulate the query and go to step 4.
Alternative models

[Bates] **Berrypicking model:**

1. continuous shift of of information need and queries during search process

2. information need is not satisfied by a single set of documents
   instead: series of selections and bits of information acquired throughout the search

**empirical studies:**

- information seeking consists of a set of interconnected but diverse searches
- search results for a goal trigger new searches
- context of the problem is carried over
- main value of searching is accumulated learning and acquisition of information during the search

Norbert Fuhr
Non-search parts of the information access process

80% fall into

• finding trends
• making comparisons
• aggregating information
• identifying a critical subset
• assessing
• interpreting

20%:

• cross-referencing
• summarizing
• finding evocative visualizations for reports
• miscellaneous
14.3 Starting points

lists of collections

LEXIS-NEXIS source selection screen
Category or directory overviews
based on classification system (e.g. Yahoo!)

MeSHBrowse interface

Norbert Fuhr
Figure 8: Horizontal Cone Tree visualization of a directory hierarchy.
HiBrowse: view category labels hierarchically and according to facets (disease, therapy, groups)
Automatically derived collection overviews

Scatter-Gather clustering retrieval results
Three-dimensional overview based on document clustering

Norbert Fuhr
2D overview created with Kohonen feature map learning algorithm
Examples, dialogs and wizards

retrieval by reformulation  start with example, iterative query reformulation

Interactive dialog  mimic human search intermediary

Wizard  step-by-step shortcut through sequence of menu choices

guided tour  sequence of navigational choices through hypertext links
Automated source selection

1. create resource descriptions

2. resource selection
   - GLOSS (based on vector space model)
   - CORI (based on INQUERY)
   - Decision-theoretic framework (Fuhr/Nottelmann)

3. result fusion
14.4 Query specification

HCI styles:

• command language
• form filling
• menu selection
• direct manipulation
• natural language
Form filling

Database: Current Contents

Author Search: Current Contents database

Author: swanson, d. (e.g., jones, e d)

Options and Limits

Another Author: and (e.g., wilson, r)

Journal Title: and (e.g., daedalus or jama)

Location: and UCBerkeley (all libraries)

Submit Search Back

Send questions, comments, or suggestions to melvyl@www.melvyl.ucop.edu

Melvyl® is a registered trademark of The Regents of the University of California
Graphical approaches to query specification

VQuery Venn diagram visualization

Norbert Fuhr
Filter-flow visualization of Boolean queries

Norbert Fuhr
Block-oriented diagram visualization of Boolean queries starting from natural language query, direct manipulation of blocks

Norbert Fuhr
Magic lens interface for query specification
(lenses act as filters)


14.5  **Context**

place document set in the context of other information types, in order to make it more understandable
relate document set to

- query terms
- collection overviews
- descriptive metadata
- hyperlink structure
- document structure
- other documents

Norbert Fuhr
Document surrogates

• ordering criterion: RSV / attribute value (e.g. date)

• document entry:
  – title
  – metadata (date, source, length

• document summary
  – query-independent
  – query-dependent

• clicking on document icon/title retrieves complete document
Query-dependent document summary


Information Retrieval
... Information Retrieval. Publikationen im Netz. Information Retrieval von C.J. van Rijsbergen (1979) Intelligente Information Retrieval Systeme von A ...
http://www.inf-wiss.uni-konsta ...
Treffer aus der Katalog-Rubrik > Veranstaltungen

Information Retrieval - Wikipedia
http://de.wikipedia.org/wiki/I ...

Information Retrieval
... Information Retrieval. 1995 this conference was merged into HIM ... Jürgen Krause, Christa Womser-Hacker (Eds.): Information Retrieval '93: Von der Modellierung zur Anwendung ...
http://www.informatik.uni-trie ...

Information Retrieval
University of Duisburg, Information Systems. ... Information Retrieval. Fachgebiet: Informationssysteme ... Fuhr:93c. Titel: Information Retrieval. Autor(en): Fuhr, N ...
http://www.is.informatik.uni-d ...

Norbert Fuhr
Example of ranked list of titles + surrogate info
Query term hits within document content

• highlighting

• KWIC
  (keyword in context)

• TileBars

• SeeSoft
Highlighting

Sheffield July 29
27th Annual International ACM SIGIR Conference Workshop on Peer-to-Peer Information Retrieval

SIGIR is the major international forum for the presentation of new research results and the demonstration of new systems and techniques in the broad field of information retrieval.

This SIGIR workshop on Peer-to-Peer Information Retrieval focus on new methods of resource representation, resource selection, and data fusion in peer-to-peer networks. The workshop particularly encourages papers that address heterogeneous peer-to-peer networks, as well as papers about methods that cope with partial and uncertain information. However, more broadly, papers are solicited on any topic related to information retrieval in peer-to-peer networks.

Highlighting in Google

Norbert Fuhr
KWIC: keyword in context

KWIC is an acronym for Keyword In Context, the most common format for concordance lines.

KWIC is an acronym for...
IR user interfaces and visualization

[Image of TileBars interface]

- FR88513–0157
  AP: Groups Seek $1 Billion a Year for Aging Research
- SJMN: WOMEN'S HEALTH LEGISLATION PROPOSED
  AP: Older Athletes Run For Science
- FR: Committee Meetings
- FR: October Advisory Committees; Meetings
- FR88120–0046
  FR: Chronic Disease Burden and Prevention Models; Program
  AP: Survey Says Experts Split on Diversion of Funds for AIDS
- FR: Consolidated Delegations of Authority for Policy Development
- SJMN: RESEARCH FOR BREAST CANCER IS STUCK IN P
SeeSoft: locations of characters within text

Norbert Fuhr
Query term hits between documents

InfoCrystal results display

Norbert Fuhr
Eibl: Grafisches Design zur Ergebnisanzeige

Eingabefeld

Definition eines Suchkriteriums
Definition eines zweiten Suchkriteriums

Definition eines dritten Suchkriteriums
Probabilistisches Retrieval
Probabilistisches Retrieval mit manueller Umgewichtung

Norbert Fuhr
Evaluierungsergebnisse

Norbert Fuhr
VIBE retrieval results display
SuperBook: context via table of contents

Norbert Fuhr
Problems with SuperBook:

• Users wander off by following links
  – SB uses automatic linking to any other occurrence of the same word in the hypertext
  – more discriminating links required

• Users form better mental models when a hierarchical structure is given
Evaluation of Superbook:

- comparison with paper and standard online information access
- comparison based on set of tasks: browsing topics of interest, citation searching, searching for question answering, browsing for writing summary
- results:
  - SB users faster in searching tasks when search terms occur in text
  - SB not faster when terms occur neither in the document text nor in the tables of contents
Categories for results set context

DynaCat interface for viewing category labels that correspond to query types

Norbert Fuhr
Using hyperlinks to organize retrieval results

Cha-Cha: Super-Book on the Web based on link structure of web site (shortest paths from root)
Mapuccio: graphical depiction of link structure (between retrieved pages)
# 14.6 Tables

![Image of Envision Query Window and Envision Graphic View: Query #2.1]

The image shows the Envision Query Window and Envision Graphic View: Query #2.1. The query is for the best 75 items found, focusing on topics such as "human-computer interaction." The table below illustrates some of the retrieved items with their authors, year of publication, and relevance ranking.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Relevance Rank</th>
<th>Est. Relevance</th>
<th>Icon Size</th>
<th>Icon Shape</th>
<th>Est. Rel.</th>
<th>Not Relevant</th>
<th>Most Relevant</th>
<th>User Rating</th>
<th>Not Useful</th>
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<tbody>
<tr>
<td>Card, Stuart K.</td>
<td>44</td>
<td>67</td>
<td>Uniform</td>
<td>Item Type</td>
<td>1</td>
<td>7</td>
<td>11</td>
<td>3</td>
<td>12</td>
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<td>Carroll, John M.</td>
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<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Entin, Elieen B.</td>
<td>43</td>
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<tr>
<td>Fuchs, Harry</td>
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<td>31</td>
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<td>Hartson, H. R.</td>
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<tr>
<td>Henderson, D. Austin</td>
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<td></td>
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<tr>
<td>Hill, Ralph B.</td>
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<td>57</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

The X-Axis shows the year range from 1983 to 1987. The Y-Axis includes labels such as "Card, Stuart K." and "Envision Item Summary: Query #2.1. The Envision search results display has been cited by Norbert Fuhr.
**TableLens visualization** (for structured data)

Norbert Fuhr
Perspective Wall
14.7 Using relevance judgments

Example UI for relevance feedback

how to handle docs shown before?
users often reluctant to give RF—
'more like this' in Web search engines

Norbert Fuhr
User control over relevance feedback:

Control: No relevance feedback

Opaque: Users give relevance judgments, see revised ranking

Transparent: Users see how system reformulates the query, + revised rankings

Penetrable: Users may modify the query reformulated by the system, then see resulting ranking

evaluation:
penetrable > opaque, transparent > control
Fetching relevant information in the background

- assistants / recommender agents
- learn (persistent) user profile based on relevance judgments when browsing Web pages,
  annotate links in new Web pages according to estimated relevance
- Letizia: recommendations for further actions (follow links)
- Butterfly: prefetching of potentially relevant information
Group relevance judgments

social recommendation approach:

1. find users with similar interests (relevance judgments)
2. recommend documents not seen yet, but judged positively by similar users
14.8 Interface support for the search process

Interfaces for string matching

Mozilla’s string matching interface
Example: string matching over a list (Netscape)
combination of search formulation and search results

- re-use same window: result may belong to former query
- new window: user has to reorganize windows
- stacked windows
Window management

divide functionality into different views (displayed simultaneously):
monolithic (tiled windows) vs. flexible (Overlapping windows)

• overlapping windows: much user activity for moving between functionally related windows

• workspace: grouping of functionally related windows

• multiple virtual workspaces: 3D spatial metaphor, with virtual doors in between

• persistent sessions
Example diagrams of monolithic layouts
The DLITE interface

Norbert Fuhr
• queries, sources, documents and groups of retrieved docs as objects

• query formulation = creation of query object

• submit query = move query object to collections

• tool-tips

• animation (e.g. for indicating illegal operations)
The Butterfly interface (browsing citations)

Norbert Fuhr
The SketchTrieve interface

Norbert Fuhr
Retaining search history

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Datenbank</th>
<th>Suchfrage</th>
<th>Treffer</th>
<th>Titelliste (Suchfragen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>INSPI</td>
<td>MULTIMEDIA AND RETRIEVAL</td>
<td>6935</td>
<td>Anzeige</td>
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<tr>
<td>2.</td>
<td>INSPI</td>
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<td>5057</td>
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<td>3.</td>
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<td>USER SAME INTERFACE</td>
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<td>4.</td>
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<td>2 AND 3</td>
<td>346</td>
<td>Anzeige</td>
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<td>5.</td>
<td>INSPI</td>
<td>&quot;USER INTERFACE&quot;</td>
<td>15363</td>
<td>Anzeige</td>
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<tr>
<td>6.</td>
<td>INSPI</td>
<td>&quot;MULTIMEDIA RETRIEVAL&quot;</td>
<td>156</td>
<td>Anzeige</td>
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<tr>
<td>7.</td>
<td>INSPI</td>
<td>5 AND 6</td>
<td>8</td>
<td>Anzeige</td>
</tr>
</tbody>
</table>

Suchbegriff eingeben
oder Suchschrittverknüpfung eingeben mit AND (einschränkend), OR (erweitern), NOT (ausschließen)

Search history in INSPEC

Norbert Fuhr
VISAGE interaction history visualization

Norbert Fuhr
Integrating Scanning, selection, and querying

Query history revision in the Melvyl bibliographic catalog

Norbert Fuhr
The Cat-a-Cone interface for integrating category and text scanning

Norbert Fuhr
An interface for a starting point for searching over category labels

Norbert Fuhr
14.9 WOB-Modell

Integration verschiedener Modi durch kontextsensitive Durchlässigkeit und
dynamische Anpassung
graphische Darstellung + formale Sprache integriert, mit beliebiger
Wechselmöglichkeit

Verwendung strikter Objektorientierung mittels Werkzeugmetapher
Alle Komponenten als Werkzeuge repräsentiert, mit konsistentem
Interaktionsverhalten (z.B. Drag and Drop), mittels Kontextmenü einstellbar

Weitgehende Visualisierung mittels Visual Formalisms
z.B. Formulare so gestalten, daß logische Verknüpfungen der Felder
selbsterklärend (Tabellenkalkulation)
Iterative Retrievalstrategien
Weitersuchen von allen Ergebnisdarstellungen: Browsen, Verfeinerung, Relevance Feedback, auch in anderen Modi

Komplexitätsreduktion
Vorauswahl mittels Filter
z.B. Auswahl der DB, Sprache, Dokumenttyp

Diverse Retrievalmodelle werden unterstützt
Boolesches Retrieval + Best Match
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