

An Experimental System for Adaptive Services in Information Retrieval

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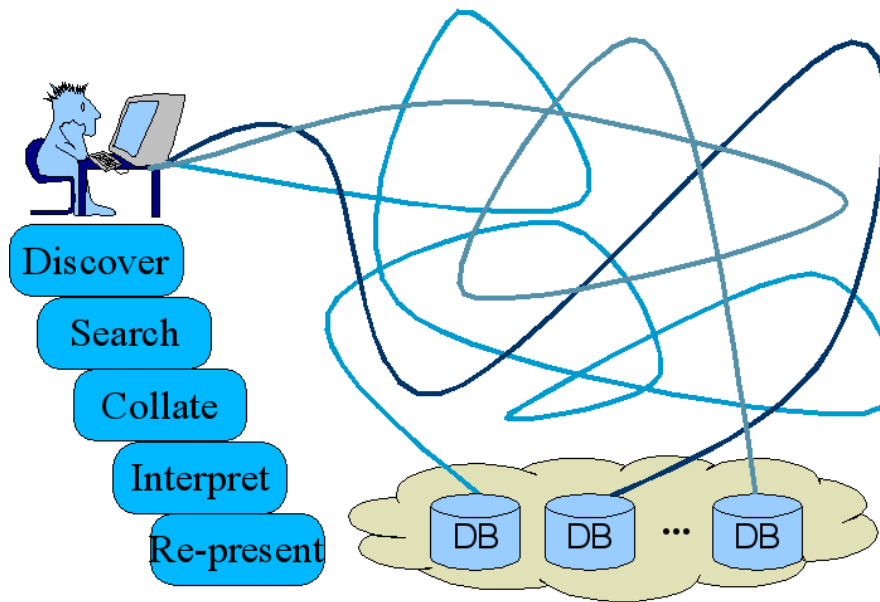
Outline

- Introduction
- Adaptivity
- DAFFODIL
- Adaptation and Personalisation Scenarios
 - Information Retrieval
 - Adaptive Suggestions

Adaptivity

- **Adaptive system services** gather knowledge about the whole computer system, consisting of all running services. The information can be used to optimise processes, enhance quality of service or system security. Focusing just on the data sources, the gathering of knowledge about technical and content aspects, such as access parameters and quality or features of the content, can be used to enhance response time or answer quality.
- **Adaptive content services** focus on the transferred information given by user queries and result documents from a semantic viewpoint. Adaptive knowledge gathered by classical IR functionality can be used to enhance the results for the user.
- **Adaptive user services** allow for adaptivity and personalisation based on a user model (context). The graphical user interface, the presented information as well as other services can be adapted to individual user or groups.

Drawbacks of DLs & IRS (2000 – today)



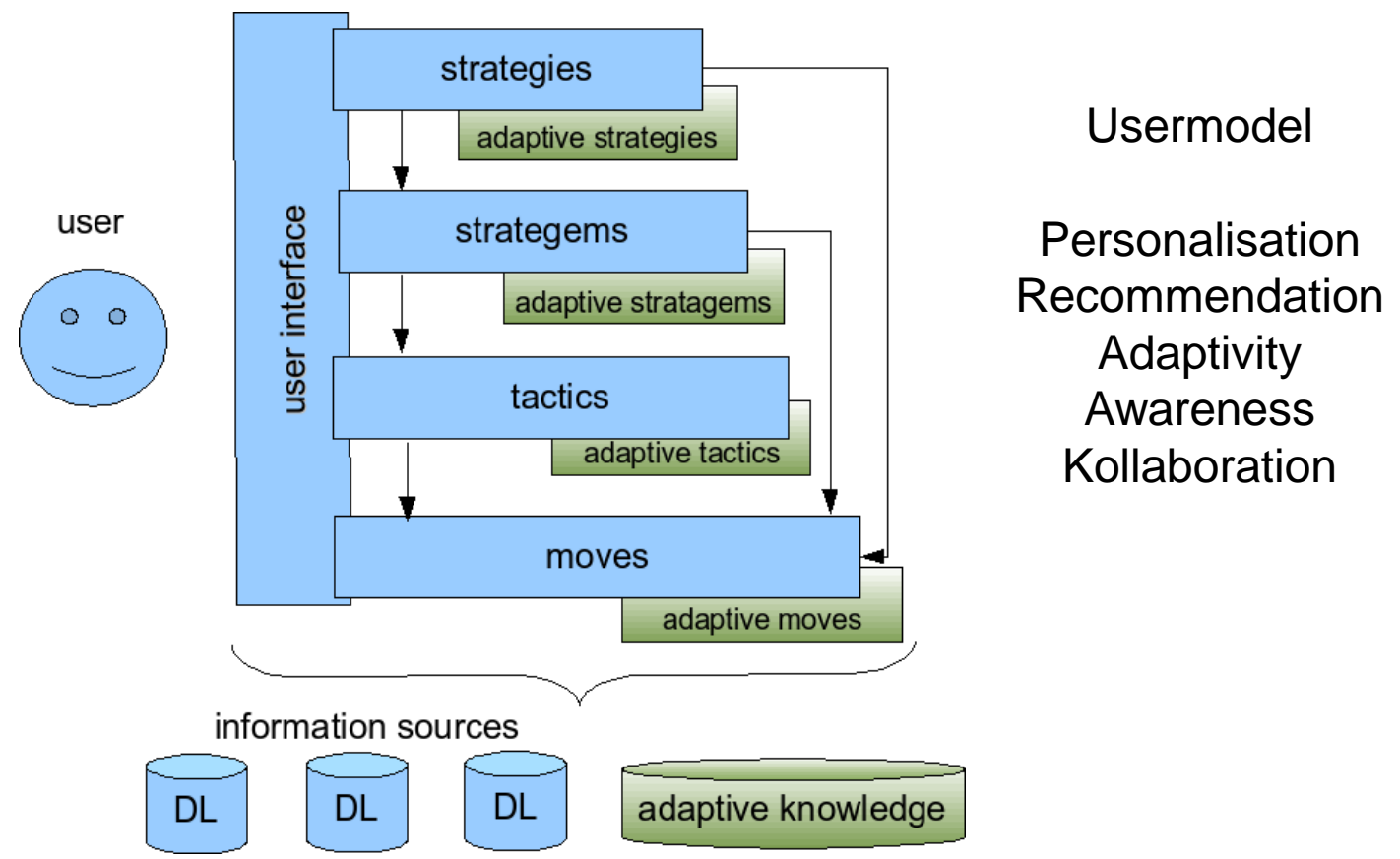
- In **all work-flow phases**
 - Multiple access points
 - Multiple query forms
 - Poor functionality (only S&B)
- Goals:
 - One access point
 - State of the art user interface
 - Flexible and extensible framework
 - Raise efficiency and effectiveness of the user

DAFFODIL Framework: User Interface & Services

The screenshot displays the DAFFODIL Framework user interface, which is divided into several functional areas:

- Search and Query Interface (Left Panel):**
 - Author Networks:** A list of data sources including ArXiv.org, UniDuE - Information Retrieval, CiteSeer, and Springer Online.
 - Query Form:** Fields for Author (Ben Shneiderman), Title, Year, and Free-Text.
 - Results:** A list of 8 search results, each with a relevance score (e.g., 1, 2, 3) and a brief description of the document.
- Browsing Tree (Right Panel):**
 - A hierarchical tree structure showing various categories such as IT-Management, Knowledge, and Matrix factorization methods.
 - Selected items include "Document clustering based on non-negative matrix factorization" and "Document clustering by concept factorization".
- Context Menu (Bottom Panel):**
 - Shows a list of related terms for the selected items, such as "data", "information", "interactive interface", and "user".
 - Includes a "Drag Items from here:" section with a list of related terms and their frequencies (e.g., "56 x information", "44 x user").

Adaptive Framework & Concepts



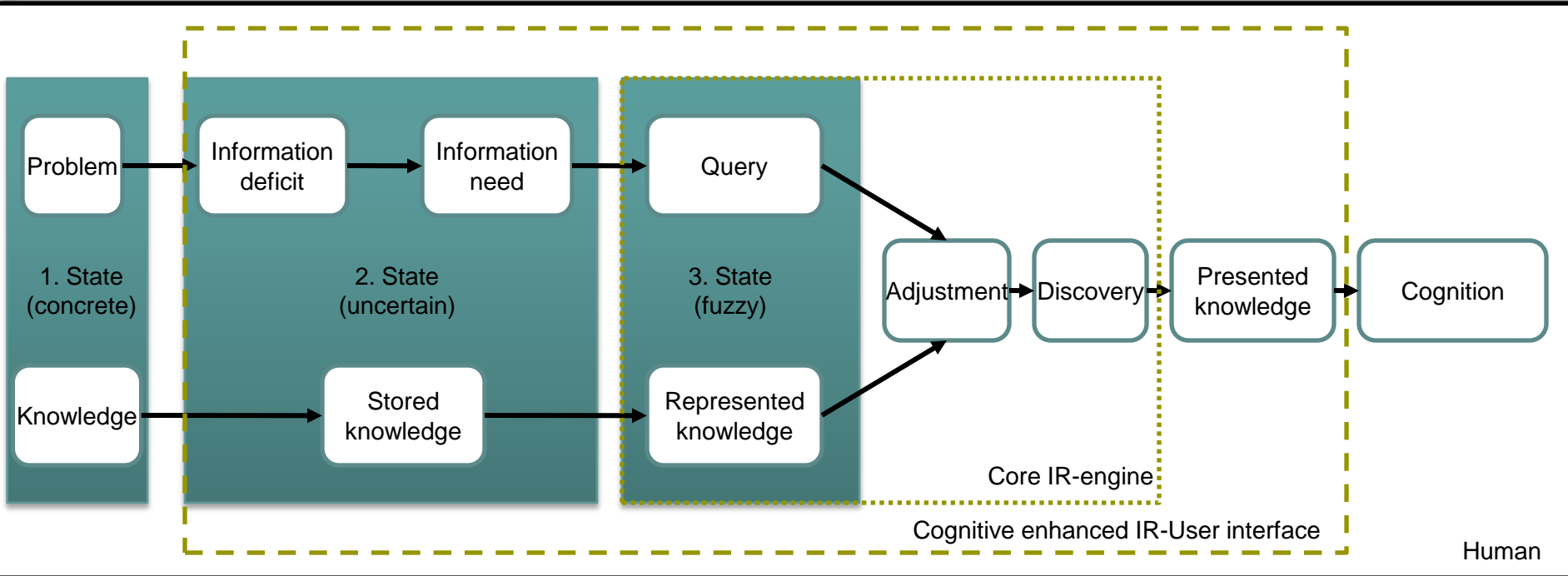
Statistics/History of DAFFODIL

- DAFFODIL started in 2000 as national funded project @ University of Dortmund in the IR group of Norbert Fuhr
- 2 PhDs, more to come, > 14 Master/Bachelor thesis,
- > 14 Publications in JCDL, ECDL, etc.
- Lives on unfunded in teaching, projects and as evaluation framework now at Duisburg-Essen and Distance University of Hagen

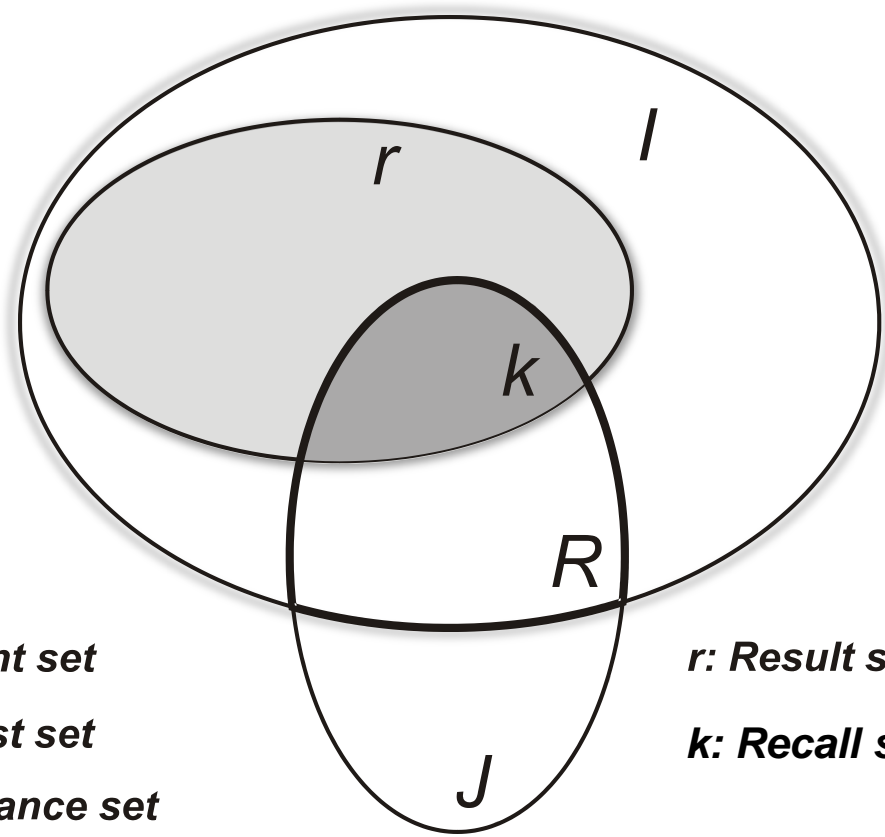
Adaptive Scenarios

- Cognitive enhanced model for IR (beginning)
- Adaptive suggestions (first evaluations)

Cognitive enhanced model of information retrieval



Dialogue State after initial explorative query



I: Content set
J: Interest set
R: Relevance set

r: Result set
k: Recall set

Anfrage

Autor: belkin
 Titel:
 Jahr:
 Freitext:

Zurücksetzen Cache Suchen

Treffer: 51 Sortieren nach: Eintreffen

Ergebnis filtern

Resultate

- Ross Wilkinson; Nicholas Belkin; Susan Dumais; Jean Scholtz**
 Evaluating interactive information retrieval systems: opportunities and challenges (2004) from HCIBIB.
- C. Cool; J. P. Callan; N. J. Belkin; W. B. Croft**
 The Effect of Multiple Query Representations on Information Retrieval Systems (1993) from HCIBIB.
- M.-C. Tang; C. Cool; J.-Y. Kim; H.-J. Lee; N. J. Belkin; X.-J. Yuan; D. Keller**
 Query length in interactive information retrieval (2003) from HCIBIB.
- Nicholas J. Belkin; Juergen Koenemann; Colleen Cool**
 On the Potential Utility of Negative Relevance Feedback in Interactive Information Retrieval (1996) from HCIBIB.
- Xiaojun Yuan; Nicholas J. Belkin**
 Supporting multiple information-seeking strategies in a single system from BibDB; HCIBIB. (2007)
- P. G. Marchetti; S. Vazzana; N. J. Belkin; R. Panero**
 BRAQUE: An Interface to Support Browsing and Interactive Query Formulation (1993) from HCIBIB.
- N. J. Belkin**
 On the Nature and Function of Explanation in Intelligent Information Retrieval (1988) from BibDB; HCIBIB.
- Nicholas J. Belkin; Gene Golovchinsky**
 Innovation and Evaluation in Information Exploration Interfaces (1998) from HCIBIB.

A spreadsheet approach to information visualization ([translate](#))

Autor(en)

- [John Riedl](#)
- [Joseph A. Konstan](#)
- [Ed Huai-hsin Chi](#)
- [Phillip Barry](#)

Konferenz

- [INFOVIS 1997](#)

Jahr: 1997
Monat: oct

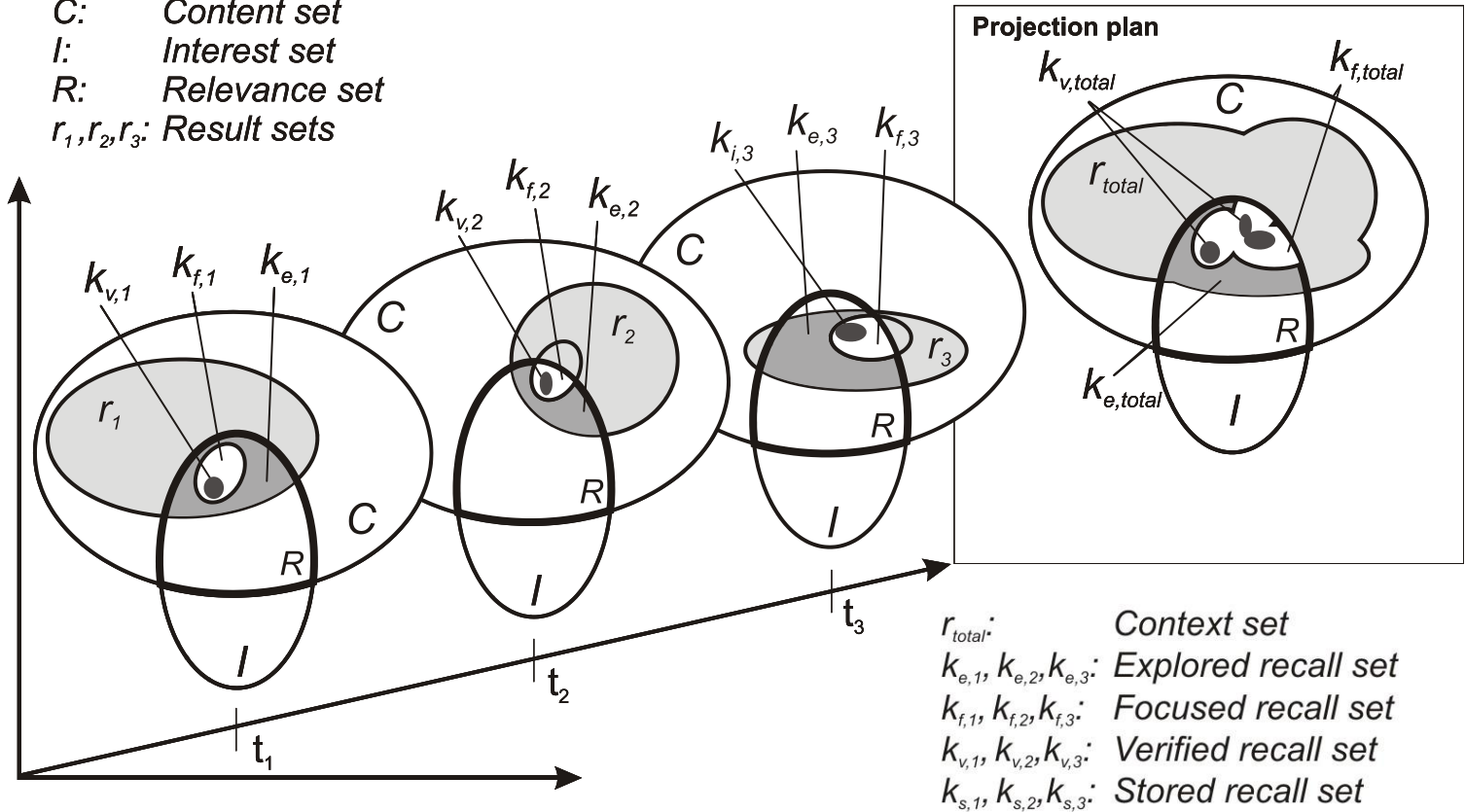
h to Info

... hat die folgenden externen Links:

- teseer.ist.psu.edu
- teseer.ist.psu.edu
- auch vorbei bei [Scholar Google](#)

Sequence of separate queries

C: Content set
I: Interest set
R: Relevance set
 r_1, r_2, r_3 : Result sets



Challenges

The search process is a sequence of activities

- Information behaviour
- Similar searches
- Implicit relevance feedback

Further efficiency and effectiveness



Adaptive Scenarios

- Cognitive enhanced model for IR
- Adaptive suggestions

Why adaptive suggestions?

- Users often *lack procedural search knowledge*
- DL & IR systems tend to provide many *low-level search actions*
- Users rarely able to *choose best action* to further search
- Searching often *haphazard and unplanned*
- Advanced capabilities and features remain mostly unexploited

Why adaptive suggestions?

- Provide many tools and possible user actions
- Users often overwhelmed by possibilities, only a few tools are commonly used
- Confirmed by several user studies and interviews

The screenshot displays a search interface titled 'Author Networks'. It includes a 'Data Sources' panel with checked items like 'Achilles - Computer S', 'ArXiv.org', and 'UniDuE - Information'. A 'Query' section has fields for 'Author:', 'Title:', 'Year:', and 'Free-Text:' (containing 'digital lib'). Below the query are 'Reset Query' and 'Cache' buttons. The 'Hits: 732' and 'Sort by: incoming' are shown. A 'Filter results:' field is present. The results list includes authors like 'N. Fuhr' and 'T. Wata'. A 'Related Terms' popup shows terms like 'american library association' and 'computer science technical reports'. At the bottom right, a circular author network visualization shows connections between authors.

Typical problem



Use the context menu on these terms:

abstracts algorithm algorithms analysis application applications approach approach
 association association rules based based text biological biomedical
 biomedical literature classification clustering combining concept data data mining
 database databases decision developed development discovery document
 documents documents domain efficient expansion extraction framework gene
 identification important information information extraction information retrieval
 integration intelligence knowledge language language processing large learning
 literature management method methodology methods **mining**
 mining approach mining information mining techniques mining text mining models
 multi natural natural language network neural ontologies ontology paper patterns
 performance phrase present processing protein related relations research results
 retrieval rules rules text science science technology search semantic structured
text
 study system technical techniques technologies technology term **text**
 text data **text mining** text mining text texts textual thesis this tool

- 6 ■■■■■ Katherine J. Don; **Text mining** in a dig (2004) from DBLP2; A
- 7 ■■■■■ Eleazar Eskin; Eug **Combining Text Min** (2004) from DBLP2; A
- 8 ■■■■■ Peter van den Bra **Belief Revision and T** (2003) from DBLP2; Acniiies.
- 9 ■■■■■ Hsinchun Chen **Knowledge Management Systems: A Text Mining** Perspective

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 mining approach mining information mining techniques mining text mining models
 multi natural natural language network neural ontologies ontology paper patterns
 performance phrase present processing protein related relations research results
 retrieval rules rules text science science technology search semantic structured
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 multi natural natural language network neural ontologies ontology paper patterns
 performance phrase present processing protein related relations research results
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Suggestion system for DAFFODIL

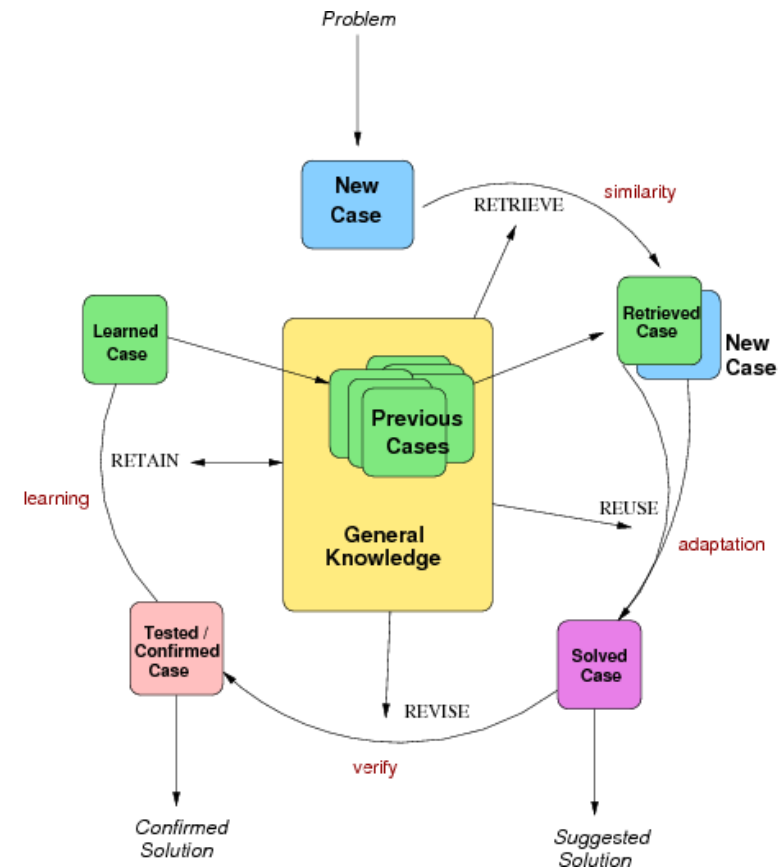
- Observe user situation
- Finds promising suggestions using case-based reasoning
 - Search situations are cases, suggestions are solutions
 - Suggestions are ranked in reverse order of case similarity
- Adapts suggestions to current user situation
- Learns and adapts from successful use of suggestions (user feedback)

Useful strategic advice

- Gain new query terms by extracting terms from result
- Visualize co-author relationships for extracted authors
- Browse proceedings of related conferences
- Use a thesaurus to find related, broader, narrower query terms
- Restrict or broaden query based on result terms and result size
- Vary spelling of a search term (color/colour)
- ...
- In general:
 - All proposed moves and tactics in work from Bates and Fidel

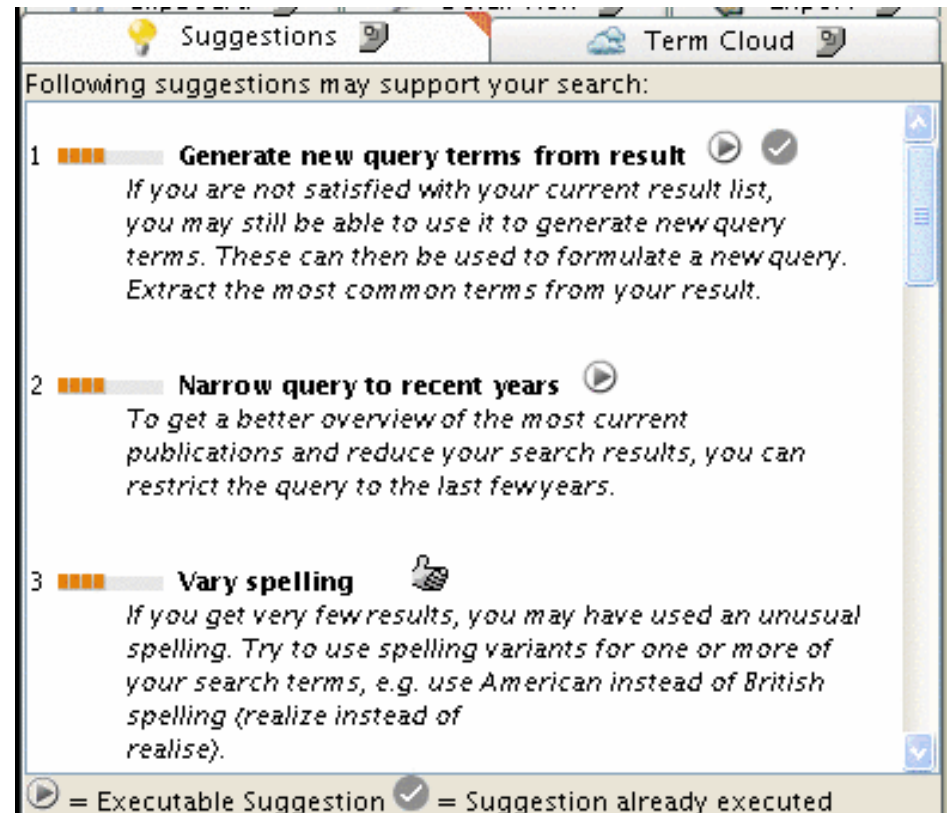
Reasoning service – finding suggestions

- Uses Case-Based Reasoning
- Each search situation is a case, strategic suggestion are solutions
- Initial case base with iconic cases for each suggestion









Suggestion Tool – adapting and presenting help

- Availability indicated by unobtrusive button
- Suggestions resented in ranked list
- Descriptive title, explanation and score bar
- Adapted to current situation where possible
- Execute one or more suggestion and judge them
- Icons indicate status of suggestion (executable, used, useful)



The screenshot shows a web browser window with a 'Suggestions' panel. The panel title is 'Suggestions' and it includes a 'Term Cloud' button. Below the title, it says 'Following suggestions may support your search:'. There are three suggestions listed, each with a score bar (four orange squares) and a status icon (play button or checkmark).

- 1** **Generate new query terms from result**  
If you are not satisfied with your current result list, you may still be able to use it to generate new query terms. These can then be used to formulate a new query. Extract the most common terms from your result.
- 2** **Narrow query to recent years** 
To get a better overview of the most current publications and reduce your search results, you can restrict the query to the last few years.
- 3** **Vary spelling** 
If you get very few results, you may have used an unusual spelling. Try to use spelling variants for one or more of your search terms, e.g. use American instead of British spelling (realize instead of realise).

Legend:  = Executable Suggestion  = Suggestion already executed

Evaluation results on adaptive suggestions regarding usefulness

- Suggestions were found useful (mode and median: 6).
 - 10 out of 12 participants employed new tactics and stratagems.
 - All planned to use these in future searches.
- Search novices and casual users found suggestions on advanced tools most useful
- Experienced users liked extraction of terms, authors, . . . From results
- Might have used tactics on their own, but advice helped them avoid trial-and-error

Summary & Outlook

- Adaptivity in IR
- DAFFODIL framework
- Examples adaptivity
 - Cognitive enhanced IR
 - Adaptive Suggestions
- Implement cognitive enhanced IR and relevance feedback using all possible event informations

Publications

- Claus-Peter Klas, Sascha Kriewel, Norbert Fuhr: An Experimental Framework for Interactive Information Retrieval and Digital Libraries Evaluation. DELOS Conference 2007: 147-156
- Sascha Kriewel, Norbert Fuhr: Adaptive Search Suggestions for Digital Libraries. ICADL 2007: 220-229
- Paul Landwich, Tobias Vogel, Claus-Peter Klas, Matthias Hemmje (2008).
 - Supporting Patent Retrieval in the Context of Innovation-Processes by Means of Information Visualisation. In: Proc. of ECKM 2008