Visuelle Suchsysteme

(Visual Information Seeking Systems)

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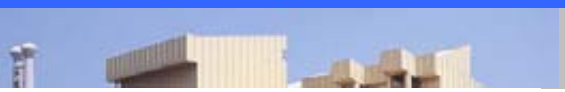


Universität Konstanz

Interaction Design & Information Visualization

MOBILE
INFORMATION VISUALIZATION

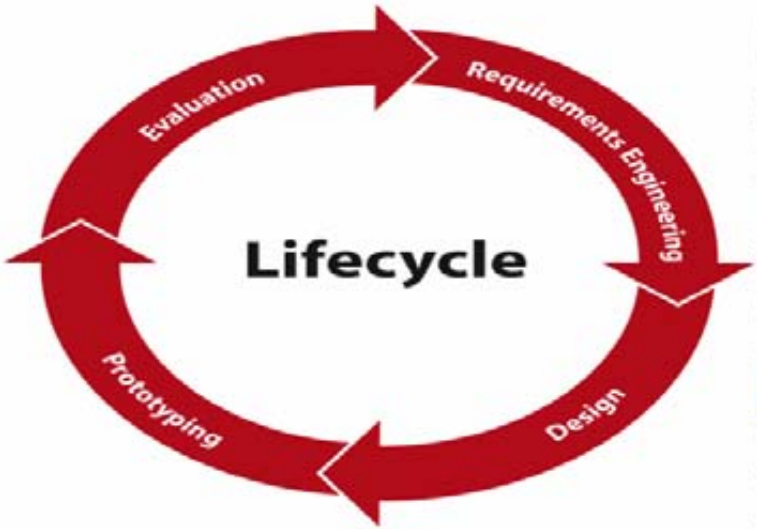
MedioVis

inteHRDis
Interaction Techniques for High Resolution Displays

Zoomable User Interfaces for Small, Medium and Large Devices

MAUSE
Towards the Maturation of Information Technology Usability Evaluation

DROID
Dynamic Remote Operation Incident Detection



MORE
Model-based requirements engineering for automotive information systems

BEST.
Visual Requirements Engineering & Interaction Design

USER
Usability, Satisfaction and User Experience Refinement for Automotive Websites

Usability Engineering Methods & Techniques

Information Engineering

Schwerpunkt:
Analyse, Exploration und Visualisierung großer Informationsräume

Visualisierung

Visual Computing,
Network Analysis,
Digital Libraries,
Information Science

Komplexe Informationsräume
z.B. Web, digitale Bibliotheken, Produkt-, Kunden-, Finanzdaten, Biologische Daten,Wetterdaten, soziale Daten, Personal Information Management

Informations-systeme

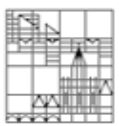
Information Systems Engineering,
Digital Libraries,
Information Science

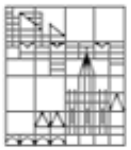
Datenanalyse

Data Mining,
Network Analysis,
Visual Computing,
Information Systems Engineering,
Digital Libraries,
Information Science

Interaktion

Human-Computer Interaction,
Visual Computing,
Network Analysis,
Digital Libraries,
Information Science

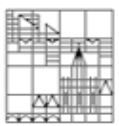




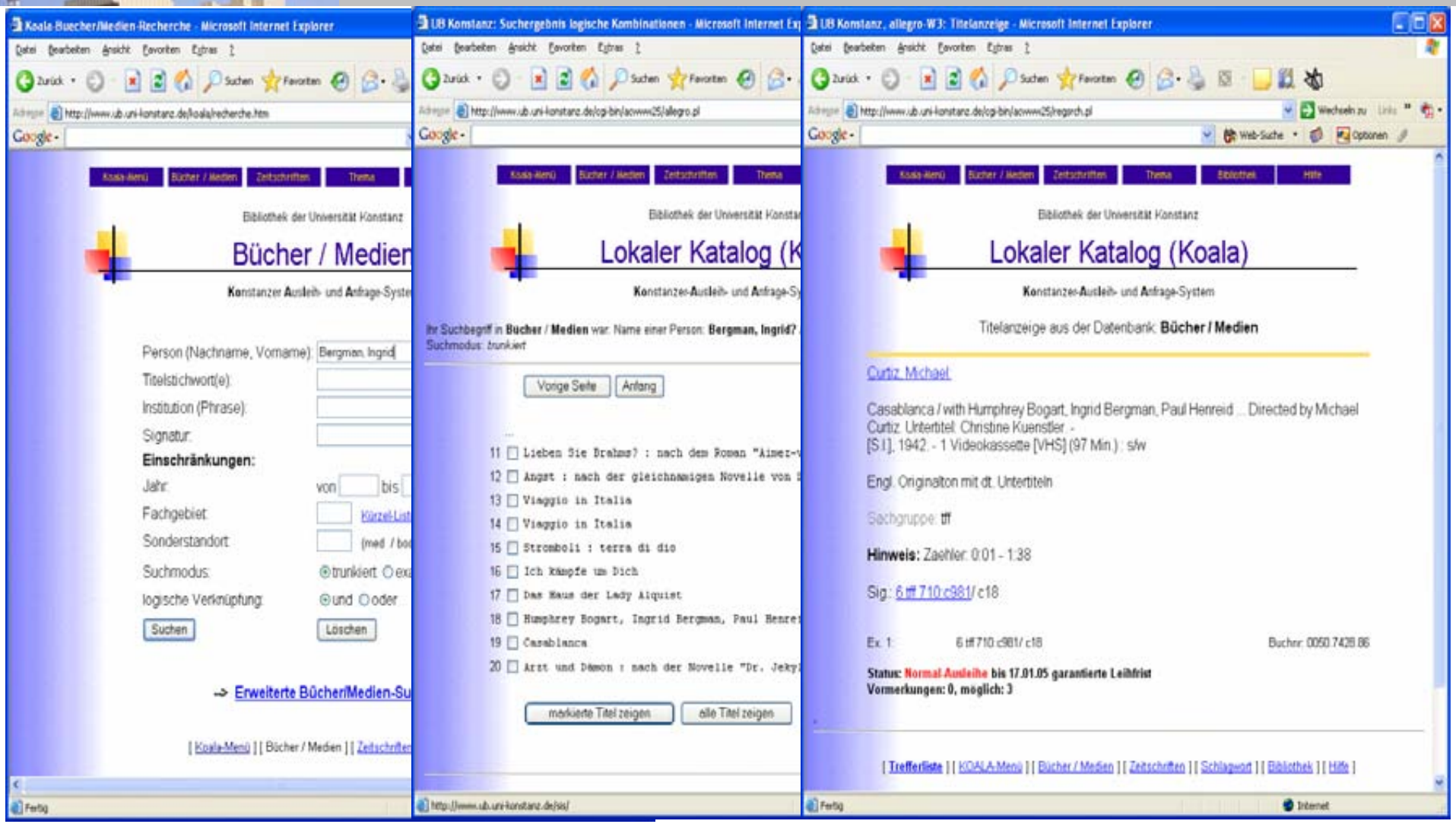
Library Catalog

Ongoing growth of information spaces in terms of

- Quantity (number of entries)
- Dimensionality (amount of metadata per entry)
- Heterogeneity (multimedia content, documents, full texts, …)

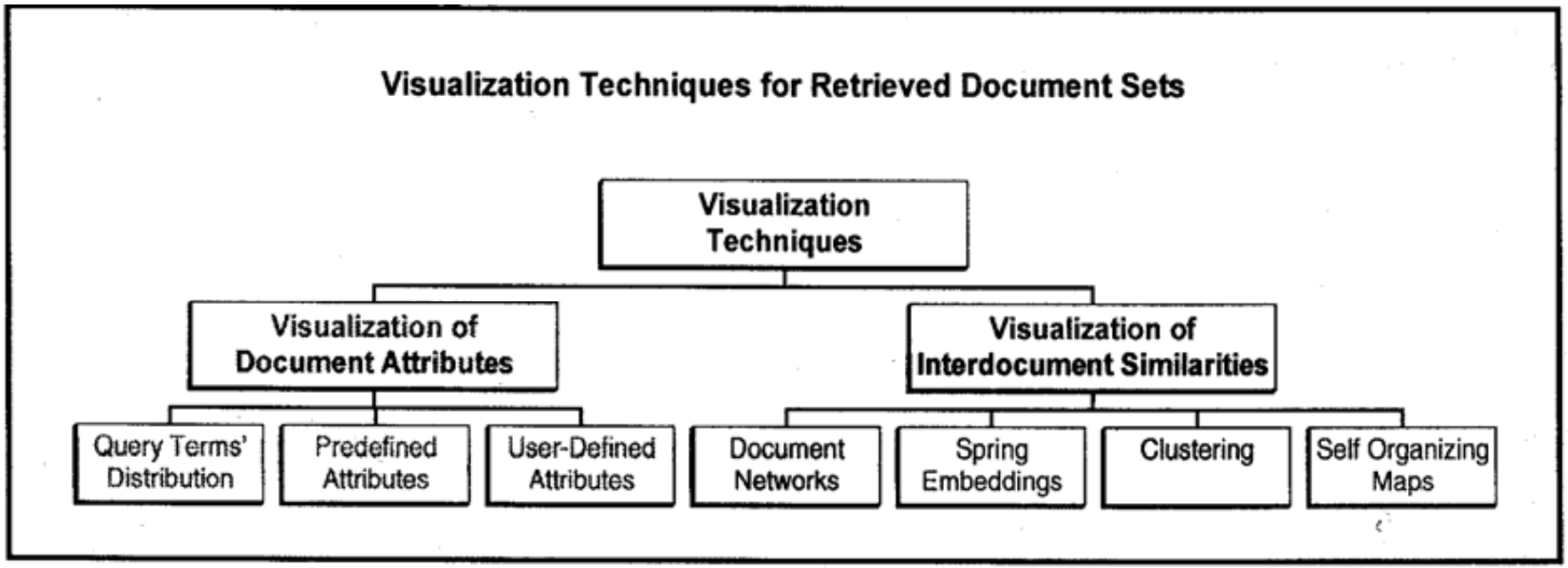


Motivation: Poor Interface of local Library Catalog

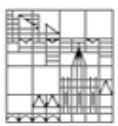


Visual Information Seeking Systems

- **combine** the functionality of **retrieval systems** with the possibilities of **information visualization systems**
- important aspect is their possibility **to visualize a great variety of document attributes** allowing the user **to choose the most appropriate** for his task



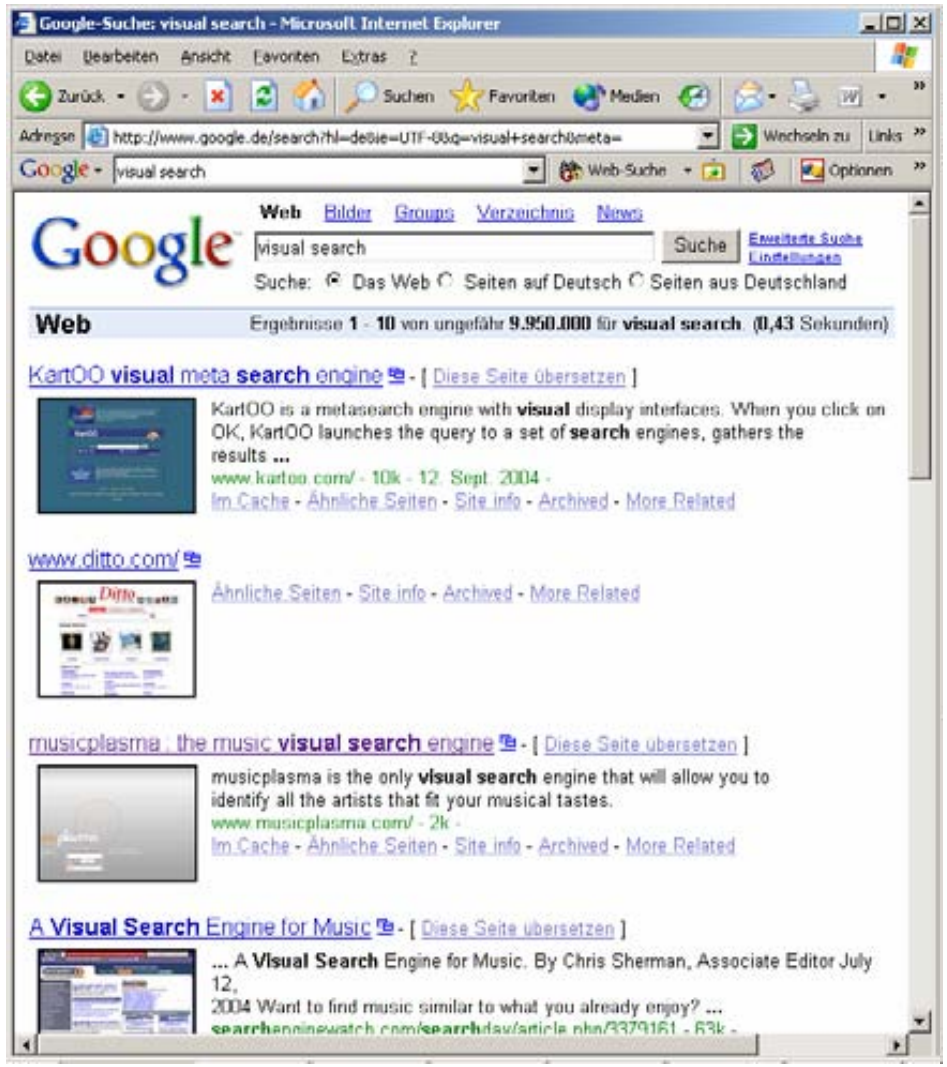
Zamir 1998



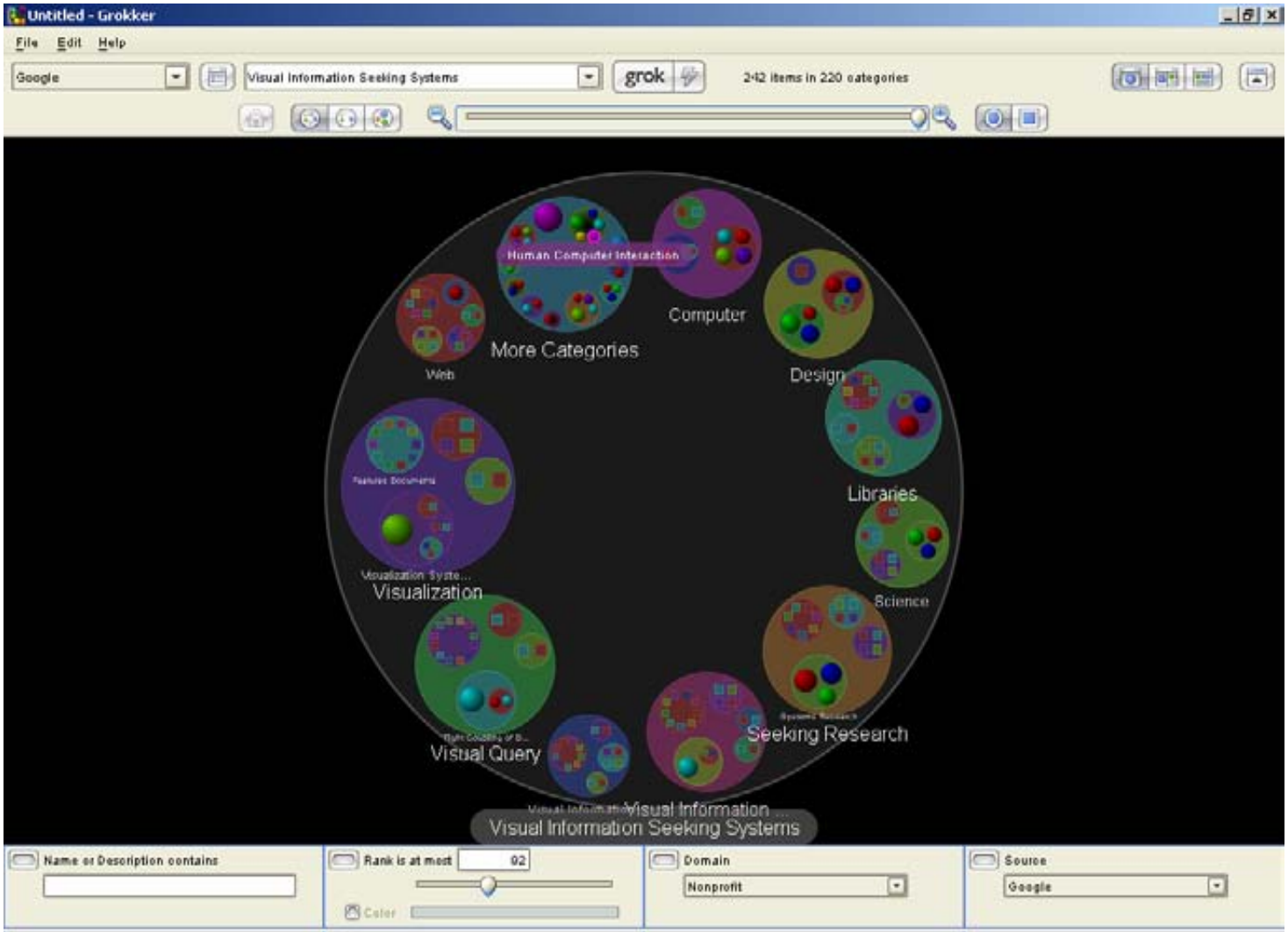
http://hci.uni-konstanz.de/index.php?a=publications Diss Thomas Mann

Visual Information Seeking Systems (VISS)

- VISS support the task „searching and browsing“.
- Key is the enormous capacity for human visual information processing (Ware 2004).
- Presenting information visually and allowing dynamic user control through direct manipulation UI
- Displays of textual and numeric information can be extended to incorporate spatial displays in which related information is clustered in 2-dimensional or higher spaces.

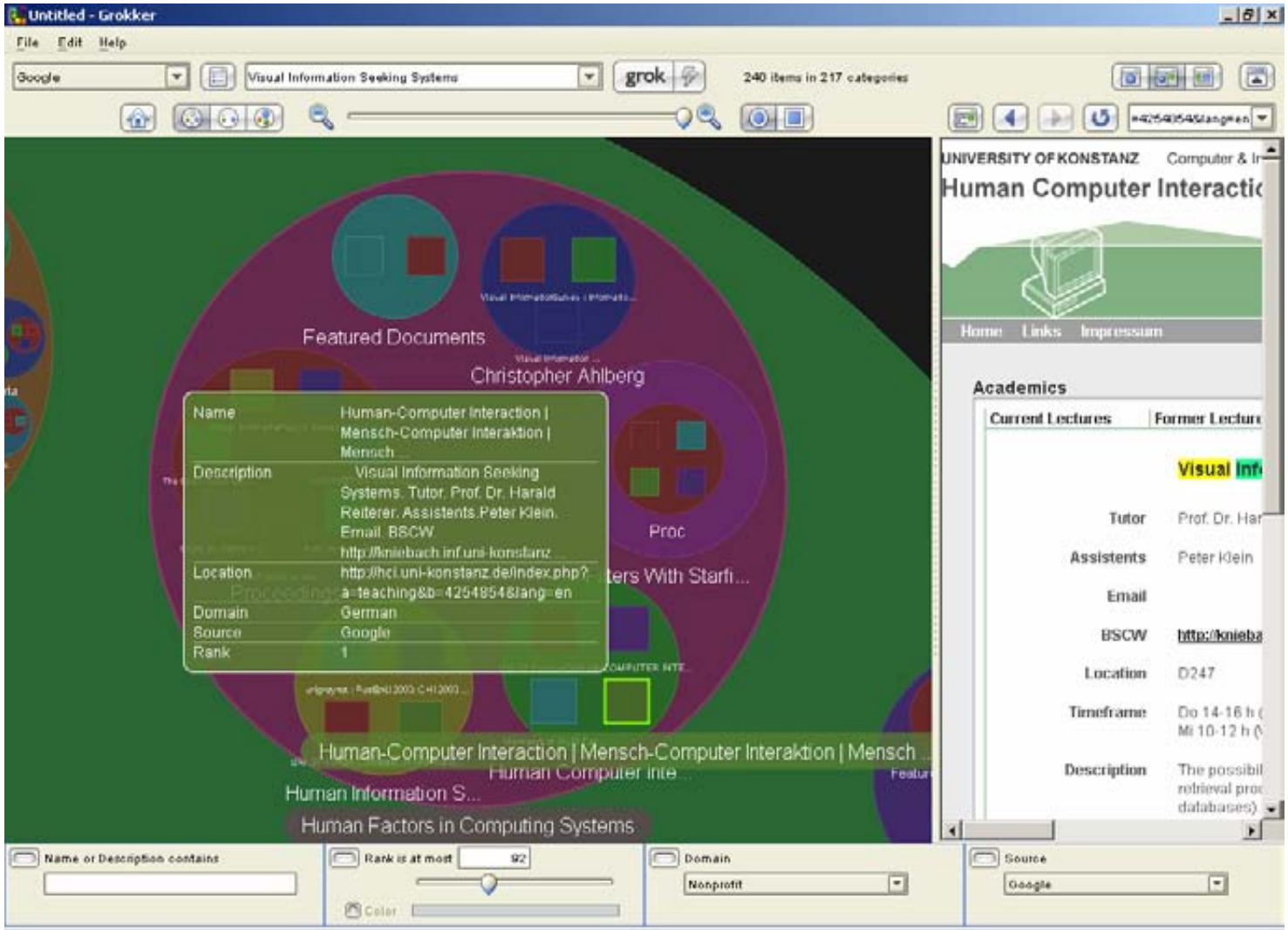


Visual Web Search with Grokker



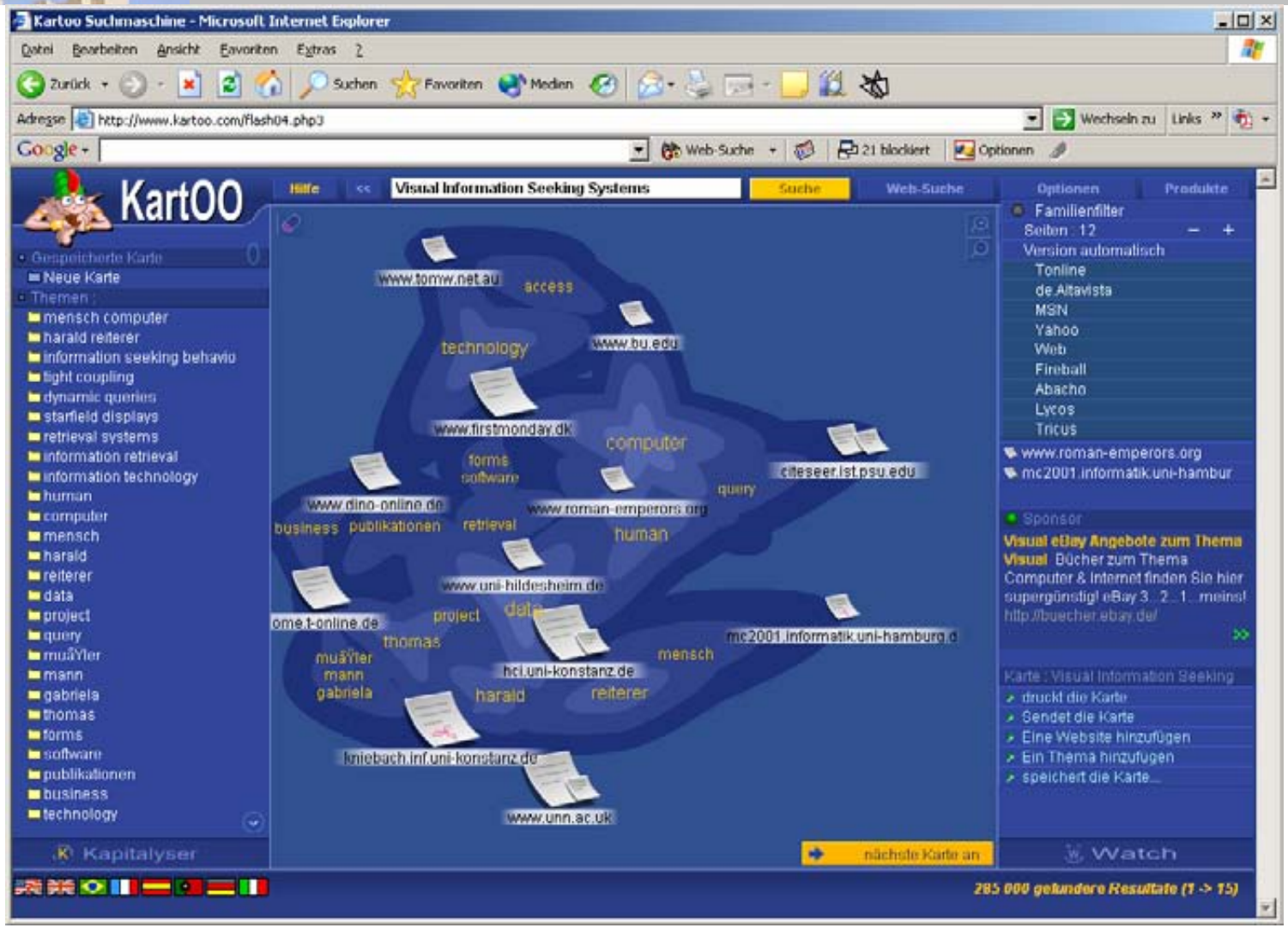
http://www.grokker.com/

Visual Web Search with Grokker



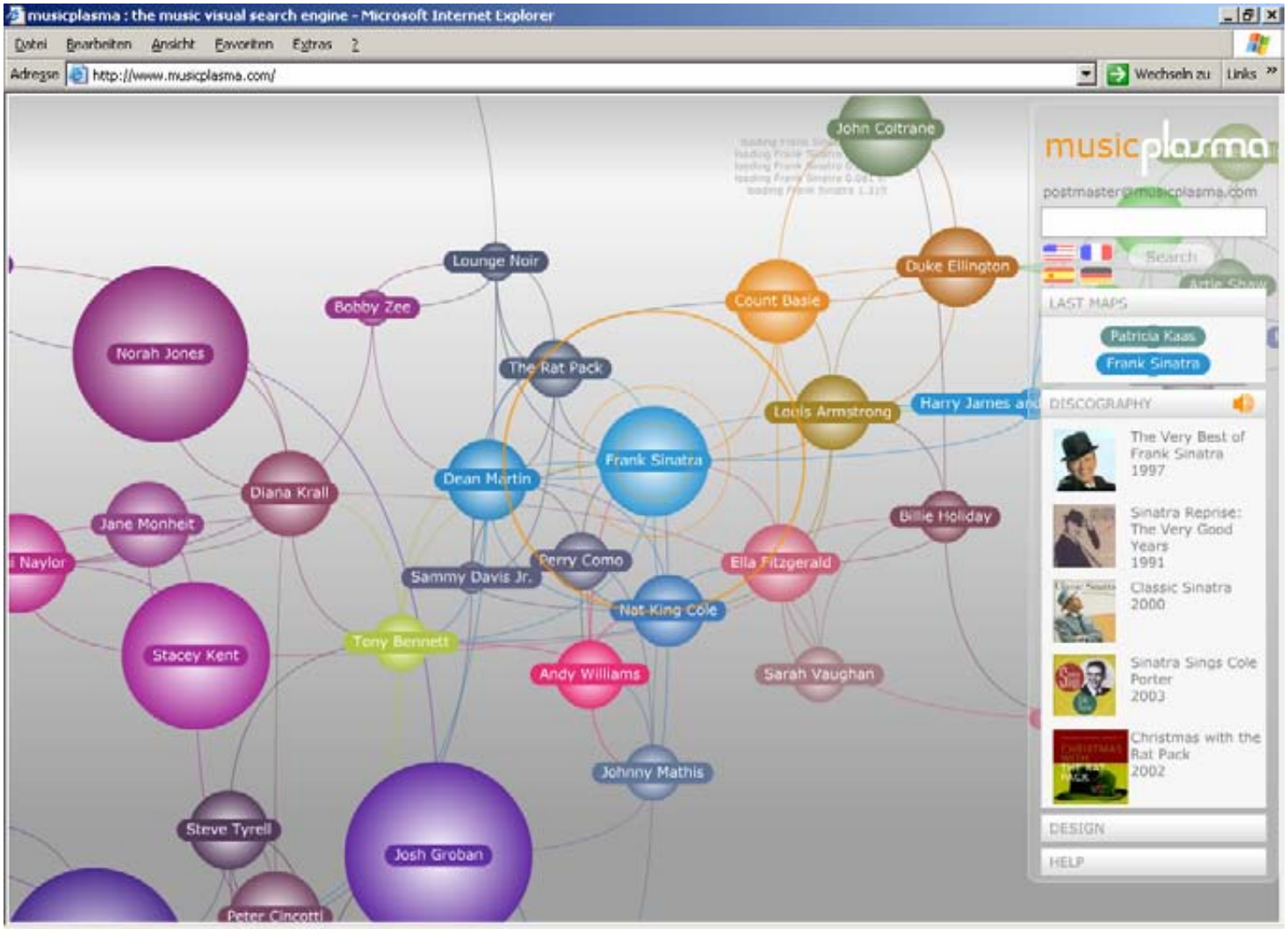
http://www.grokker.com/

Visual Web Search with Kartoo



http://www.kartoo.com/

Visual Music Search with liveplasma

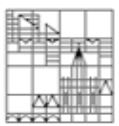


http://www.liveplasma.com/

Steps during Information Seeking

Formulation: Expressing the search	Search form (simple, extended, visual); phrases; variants; size of result set
Initiation of action: launching the search	Search button; dynamic queries
Review of results: reading messages and outcome	Overview, zoom and filter, details on demand; clustering; change sequencing; visualizations
Refinement: formulating the next steps	Meaningful messages; support changing of search parameters; relevance feedback
Use: compiling or disseminating insight	Saving and annotating of results; sending via e-mail; input to other tools

Five-Phase Framework for Textual Search, Shneiderman, Plaisant 2004, p.567



VISS from our HCI group at the University of Konstanz

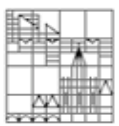
Past:

- INSYDER (VISS for the Web)
- INVISIP (VISS for Geo-Data)
- VisMeB (Visual Metadata Browser)
- ZUIScat (VISS for mobile devices)

Present:

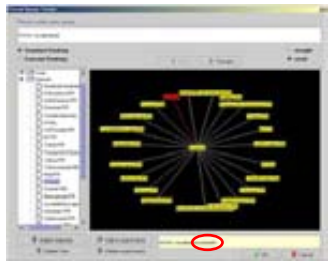
- MedioVis (VISS for digital/multimedia libraries)
- BEST (VISS for automotive websites)

more information: http://hci.uni-konstanz.de

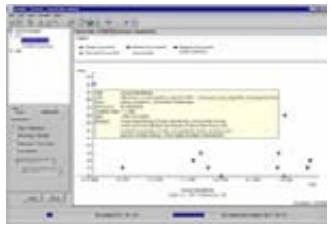


INSYDER – VISS for the Web

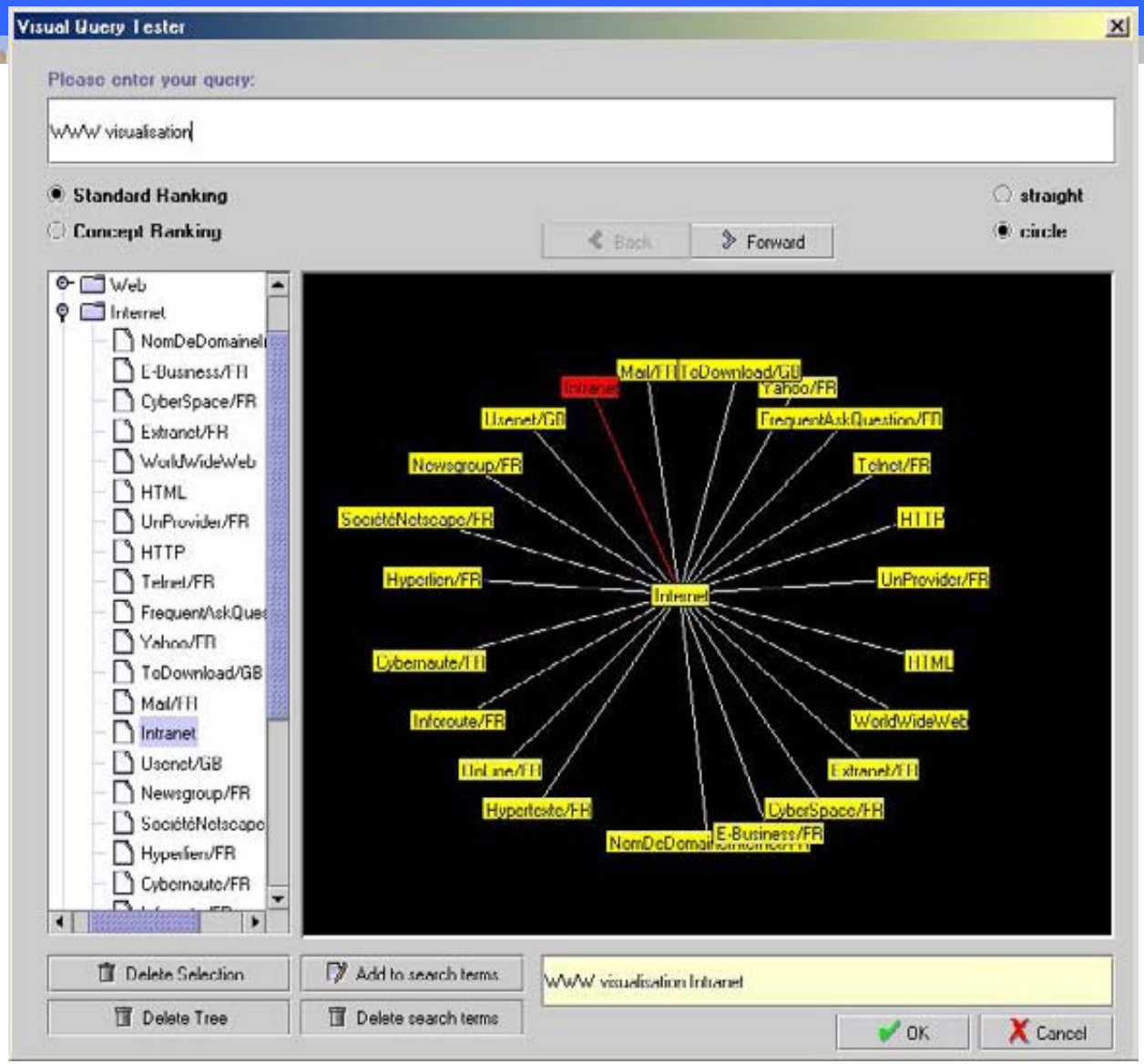
- Comprehensive **visual** support during
  - **formulation of the query** using a visualization of the semantic network (thesaurus)
  - **review of the search results** using multiple synchronized visualizations
  - **refinement of the query** using a visualization of the semantic network (thesaurus)

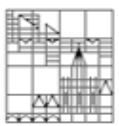


INSYDER Video starten!



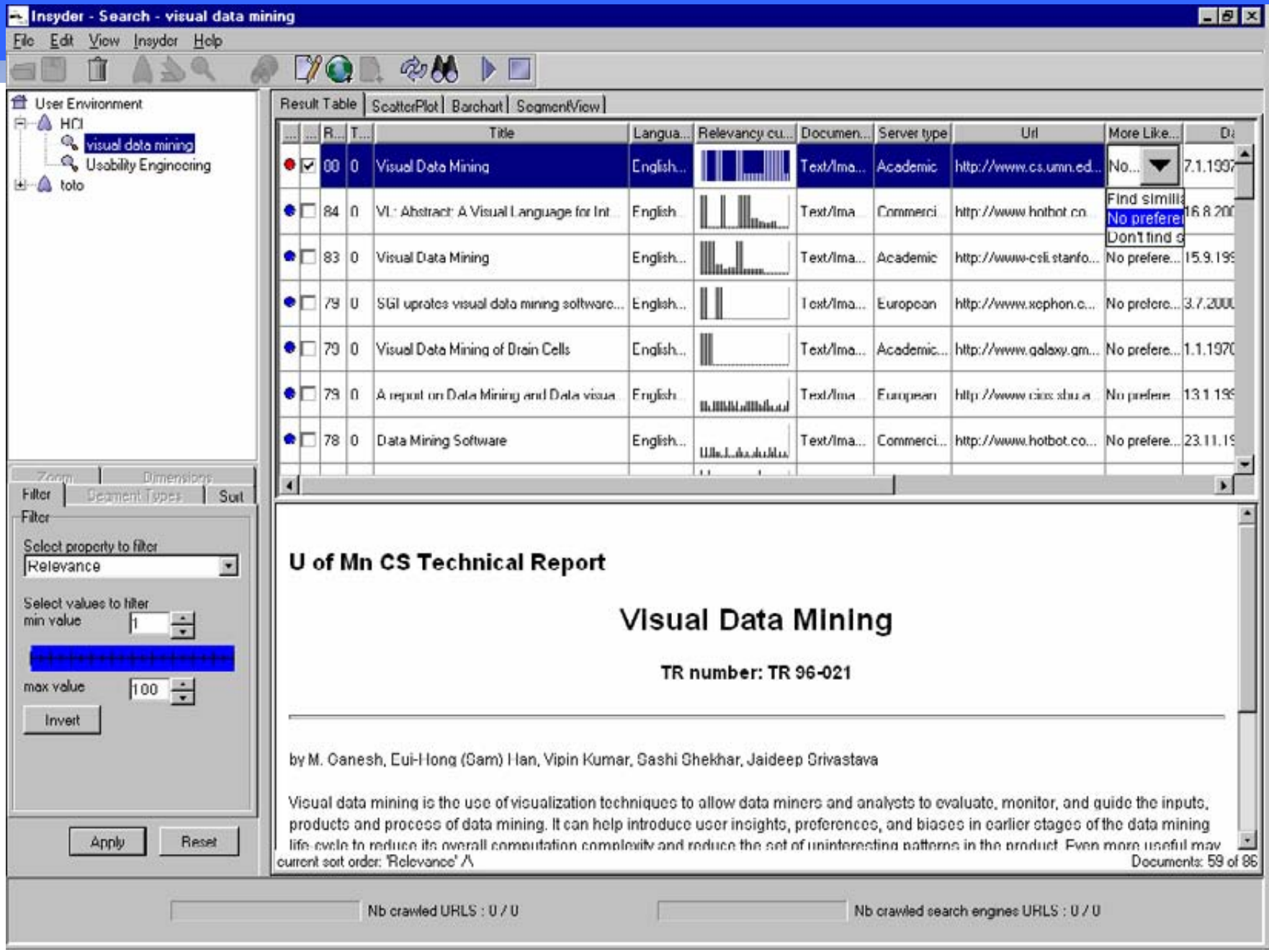
INSYDER – Query Formulation



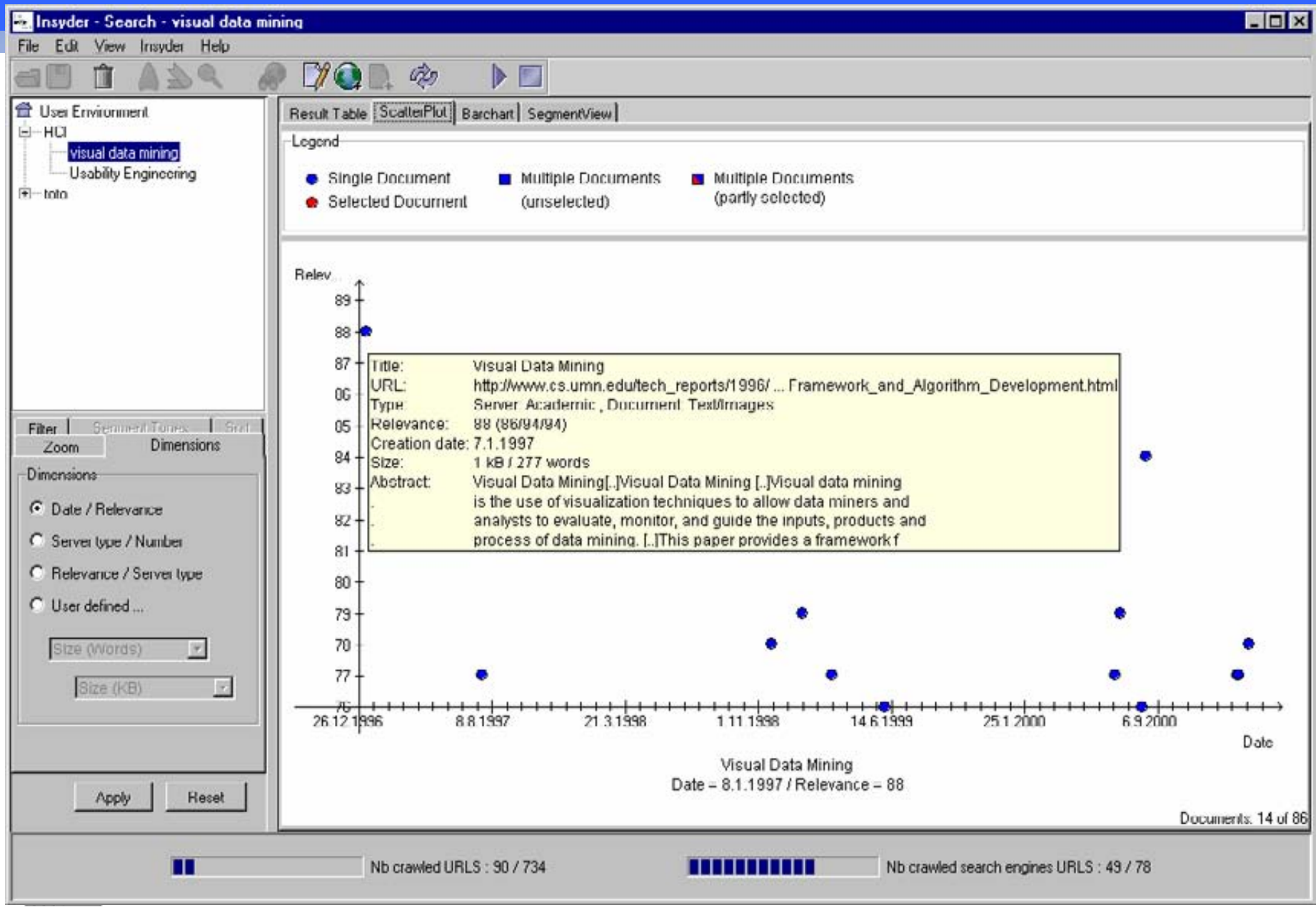


http://hci.uni-konstanz.de/index.php?a=publications Diss Gabriela Mußler

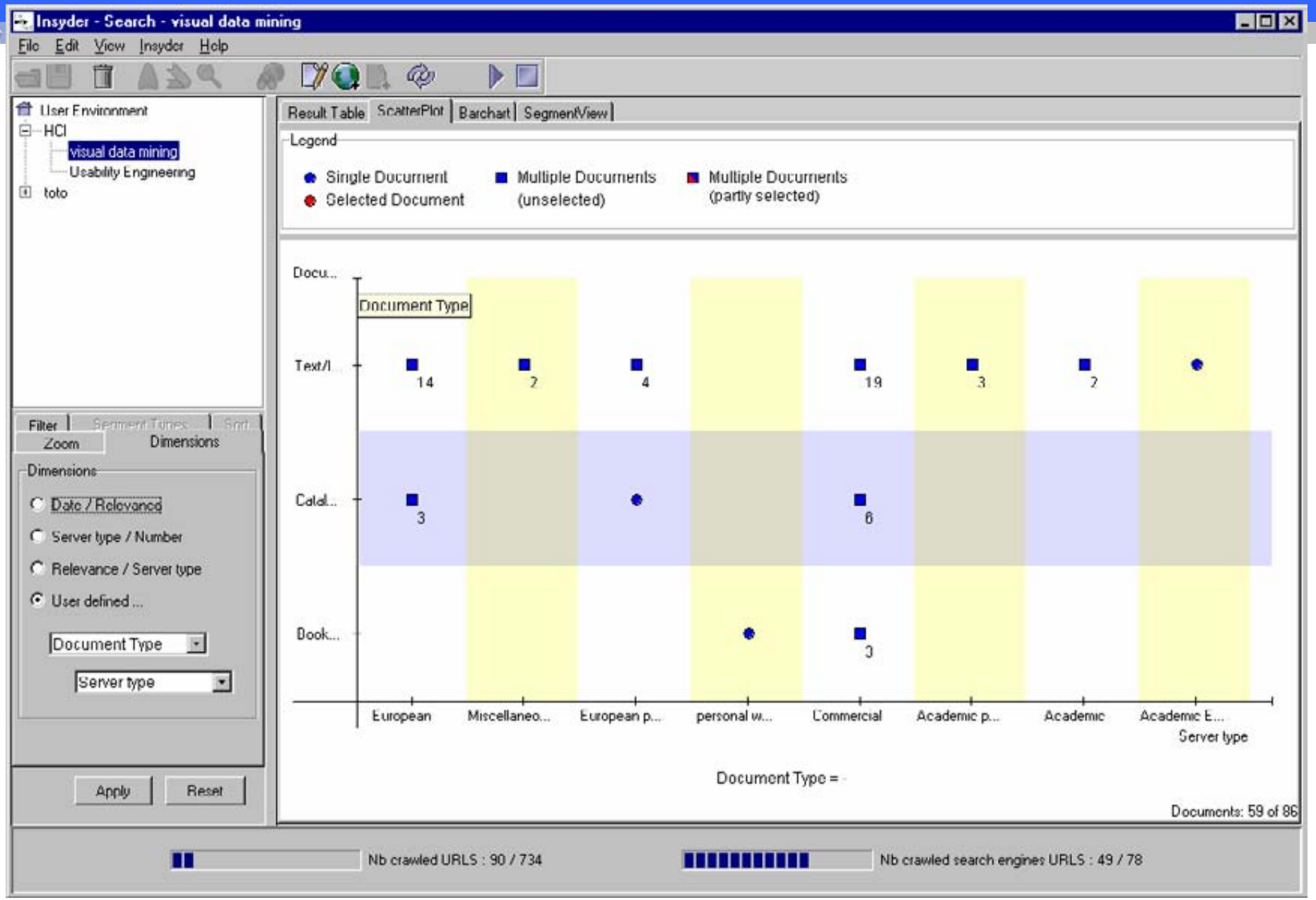
INSYDER - Result Table



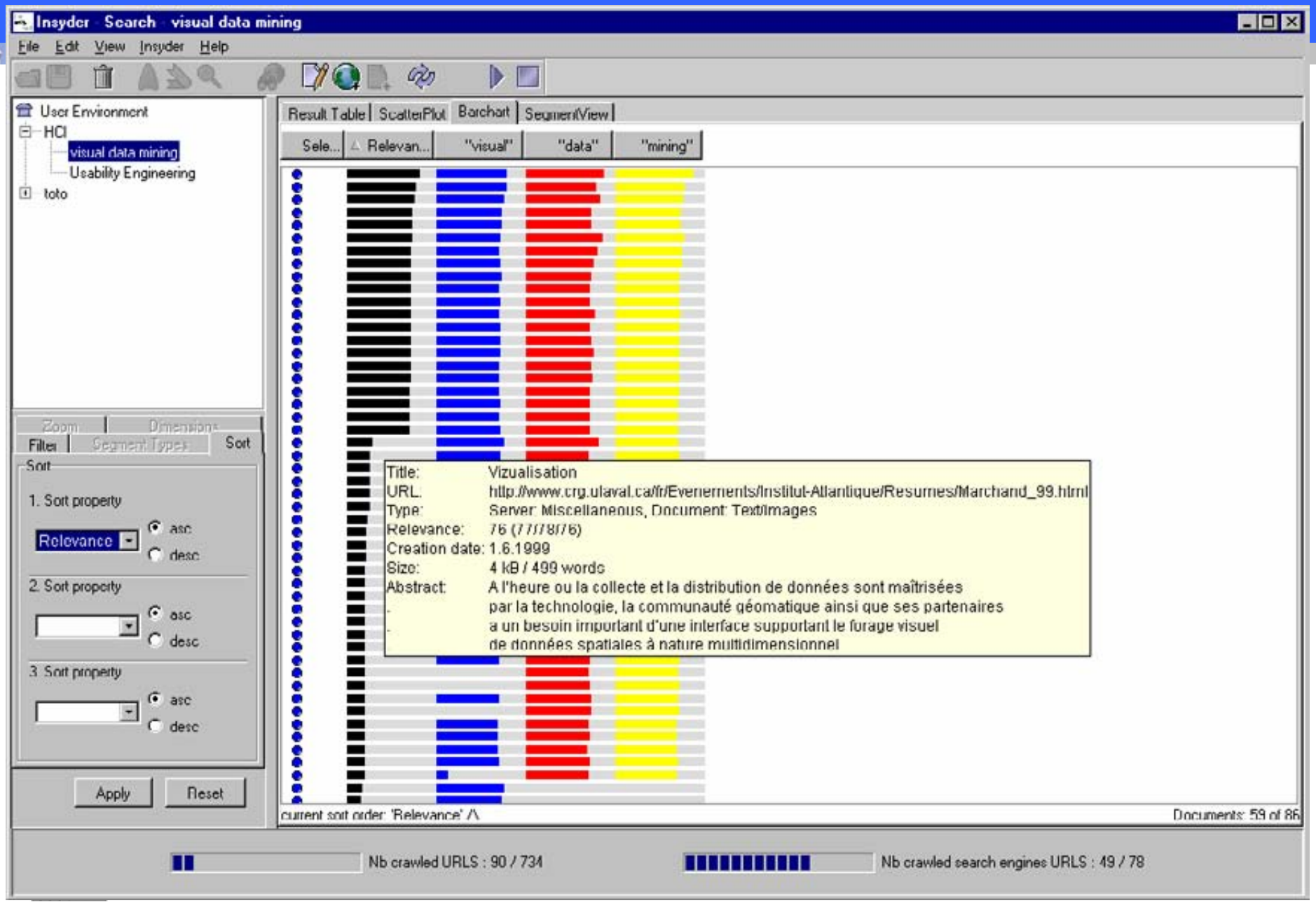
INSYDER – Scatterplot (1)



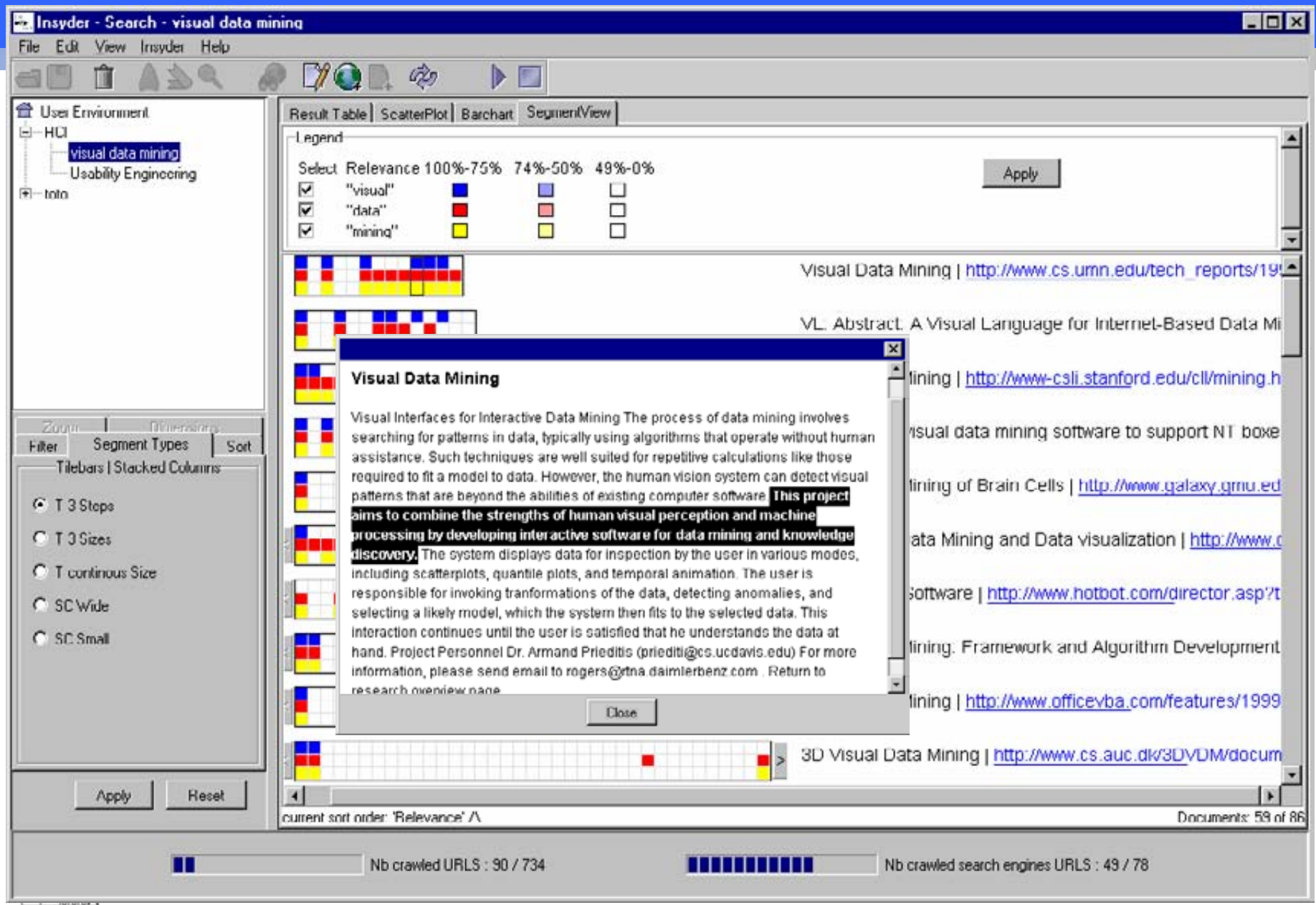
INSYDER – Scatterplot (2)



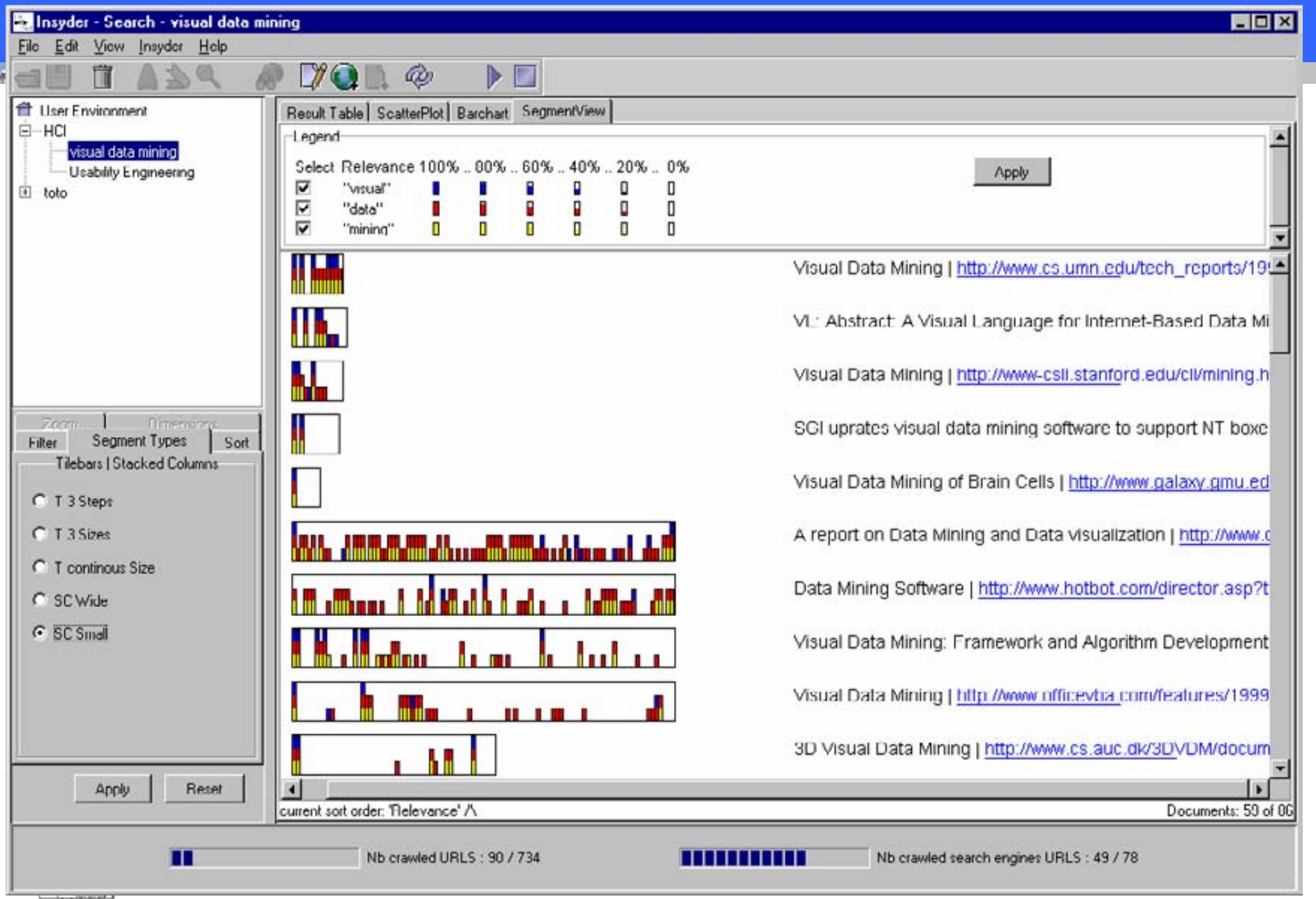
INSYDER - Barcharts



INSYDER - TileBars

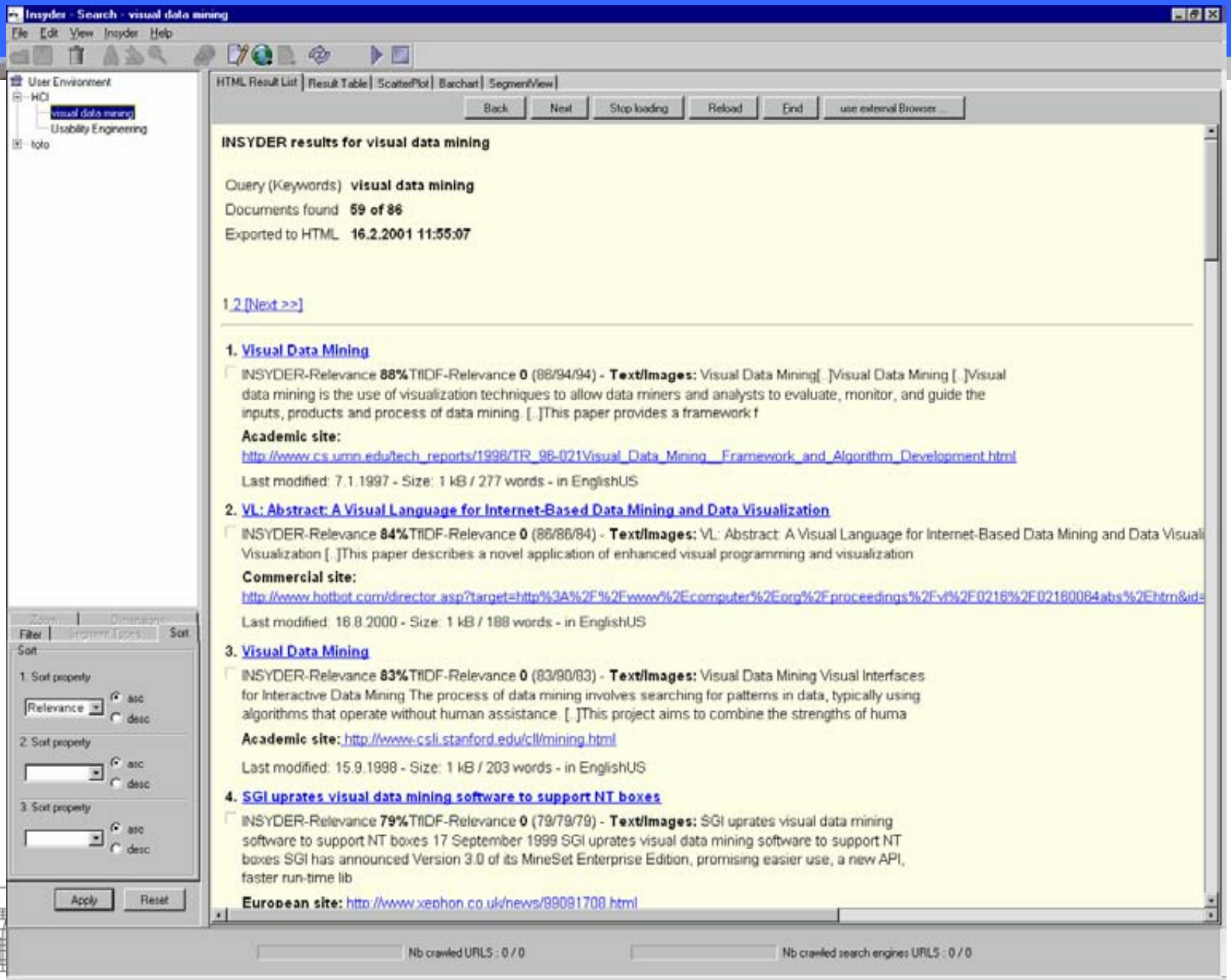


INSYDER - Stacked Columns



INSYDER - List

(integrated as benchmark for evaluation purposes)



INVISIP – VISS for a Geo Metadata Database

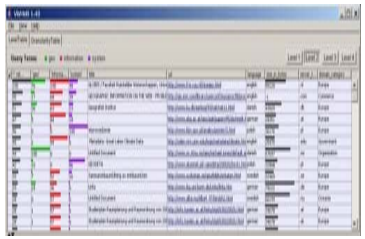
Query

Server

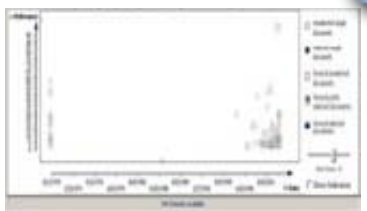
Web Documents

Geo Metadata

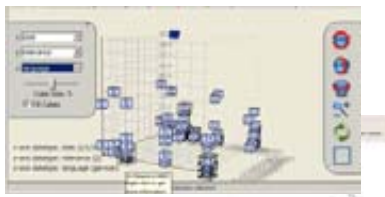
Visualization

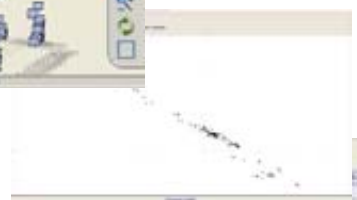


Tightly  **Coupled**

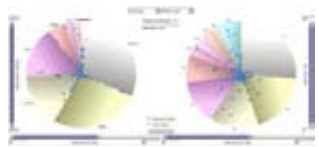


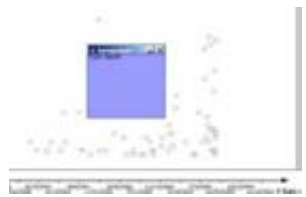
Alternative Views:



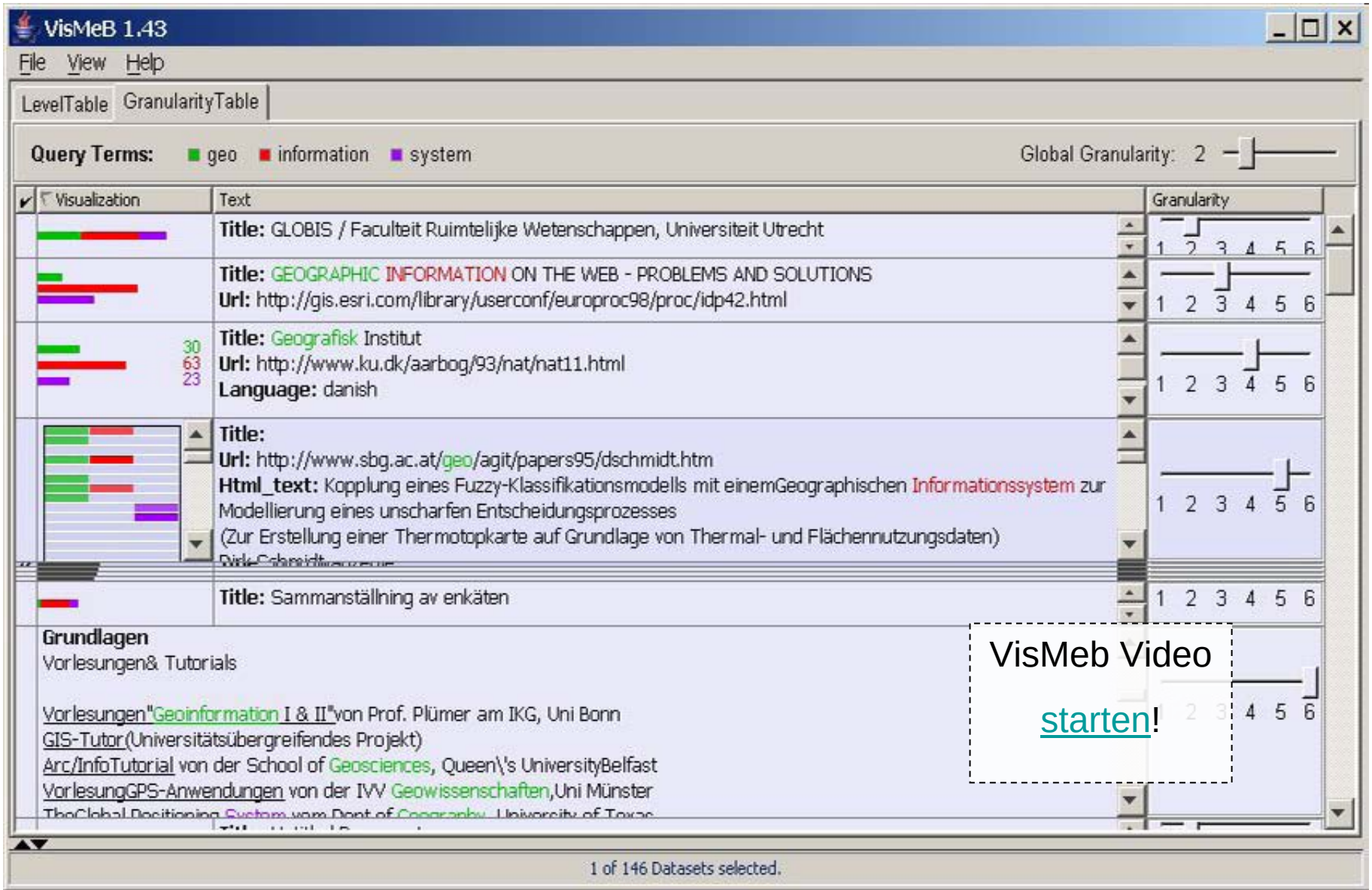


Filter

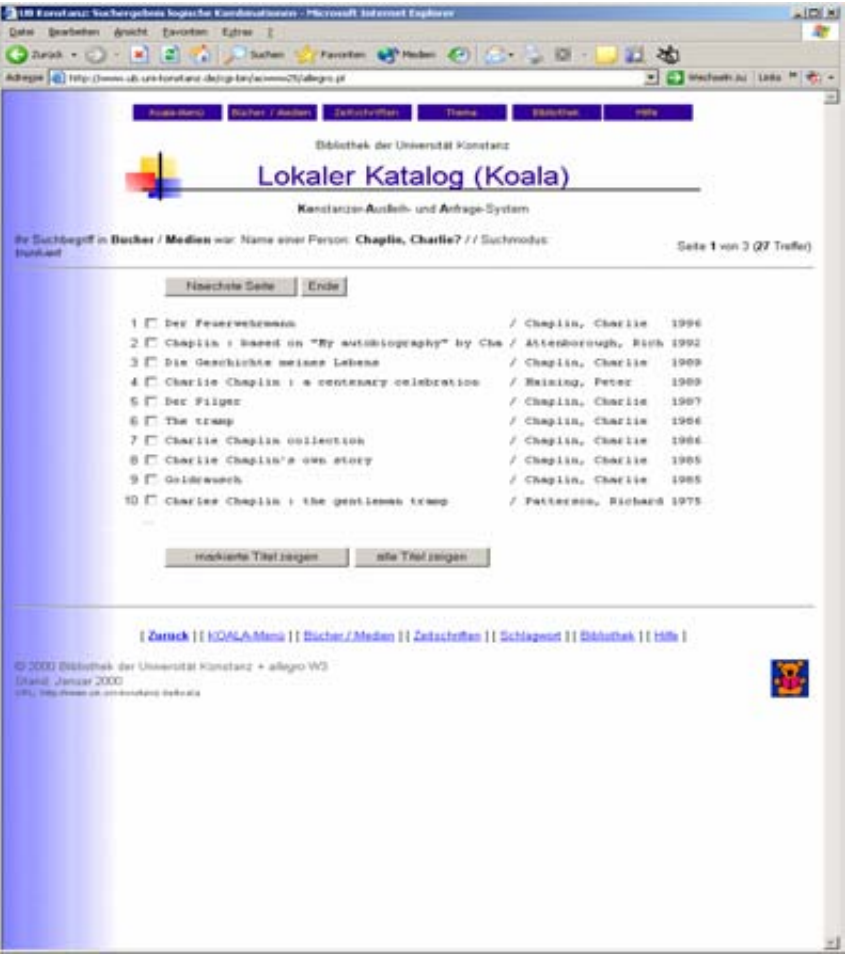




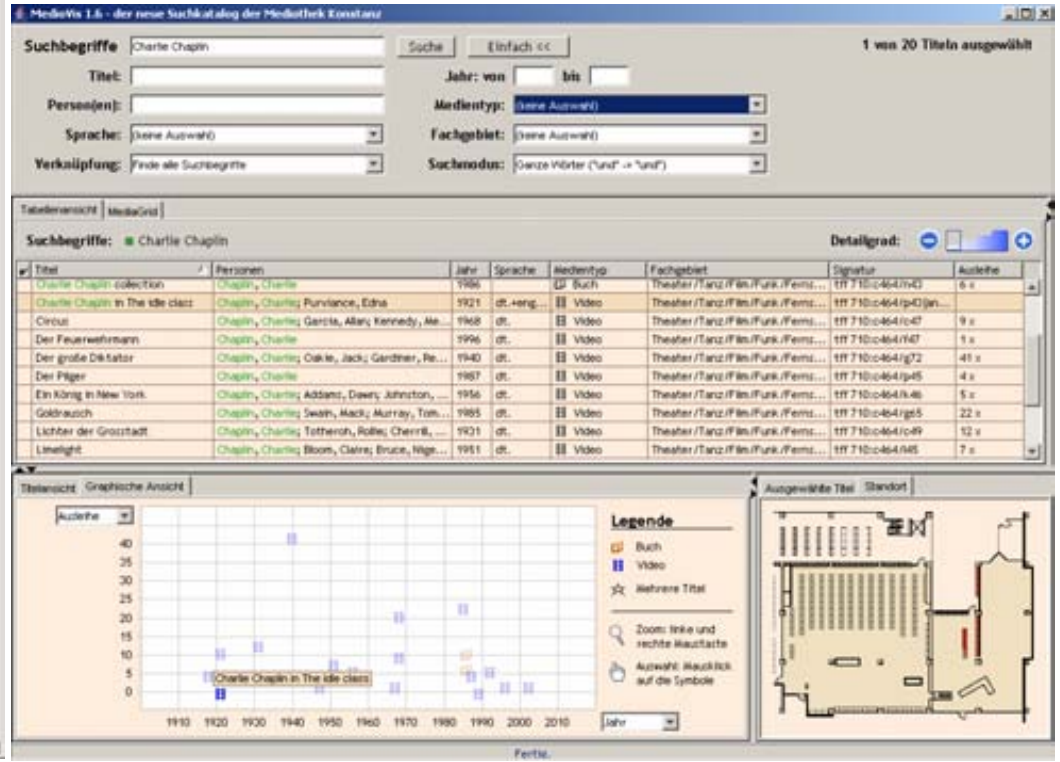
INVISIP VisMeB - Visual Metadata Browser



MedioVis – VISS for the Mediothek of the Uni KN



traditional system “KOALA”: Searching and Browsing is separated, long textual lists



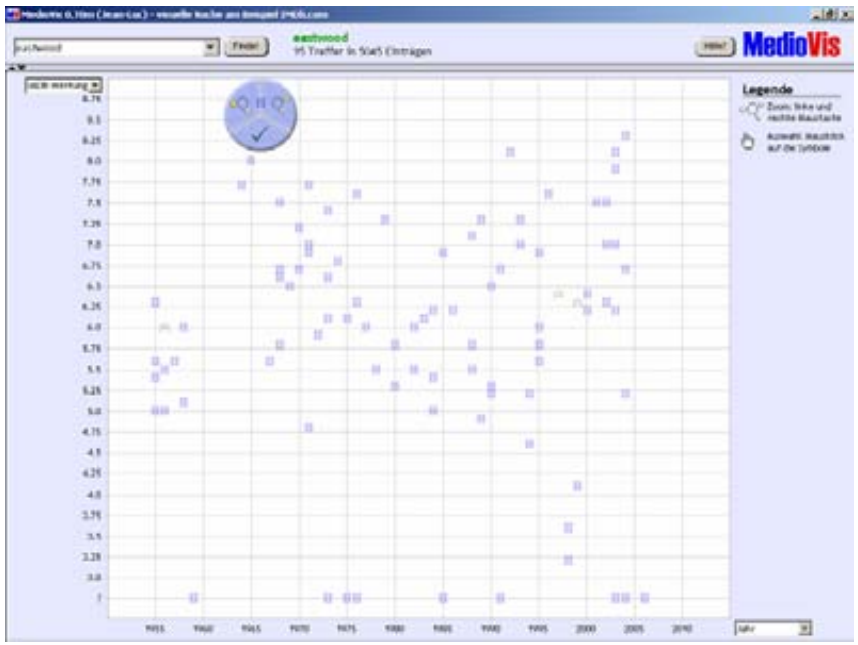
MedioVis: Search and Browsing integrated, different visual views

MedioVis – VISS for the Mediothek of the Uni KN

MedioVis

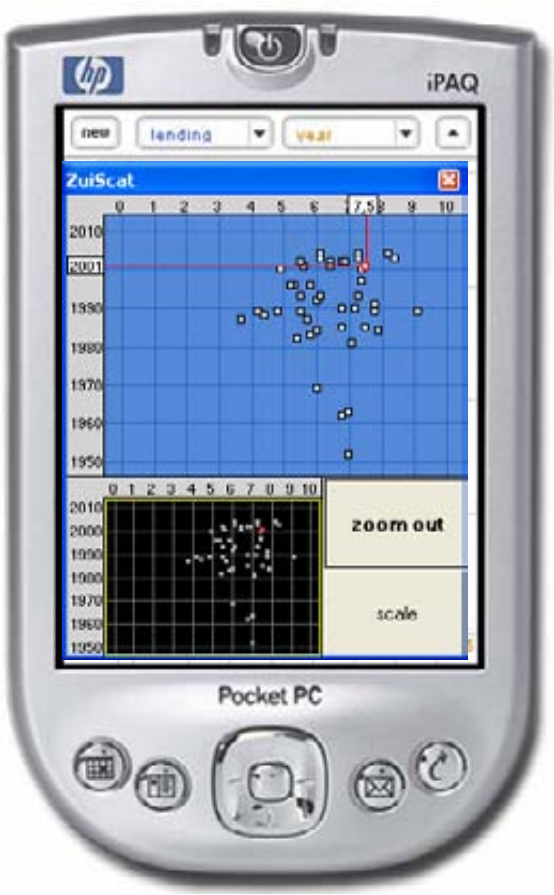
Hier MedioVis
Demonstrationsvideo starten

HyperGrid

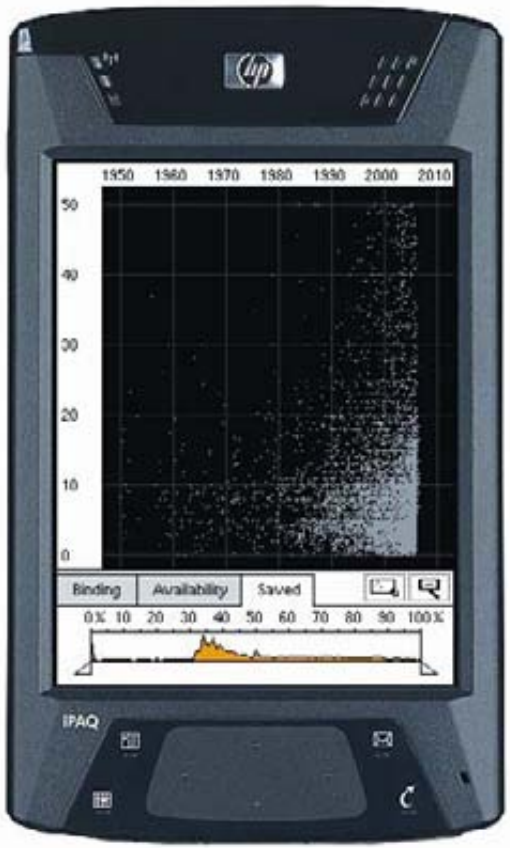


Zoomable Scatterplot

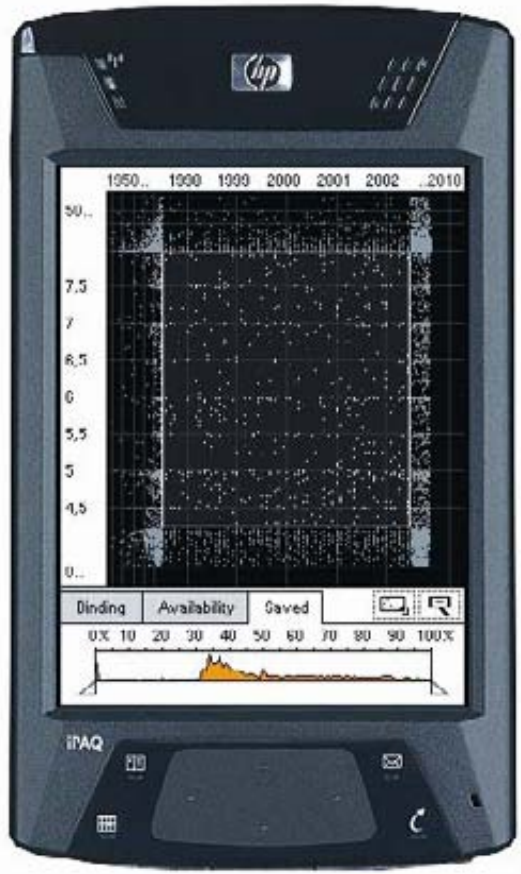
ZUIScat (VISS for mobile devices)



**ZuiScat –
Overview & Detail**



**ZuiScat –
Details only**



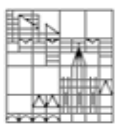
**ZuiScat –
Fish Eye**

MOBILE
INFORMATION VISUALIZATION

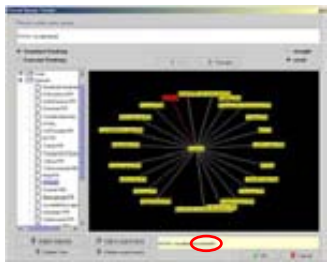
User Interface Design Principles for VISS

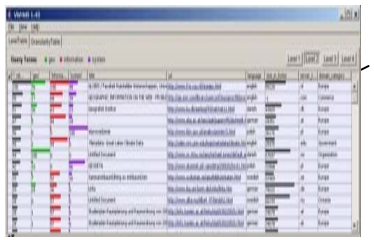
- What user interface design principles for VISS have the potential
  - to reduce the users anxiety about the flood of information,
  - find needles in haystacks,
  - support exploratory browsing to develop intuition,
  - find patterns and exceptions, and
  - even make browsing fun?

(Ahlberg, Shneiderman 1994)



Related Research Disciplines





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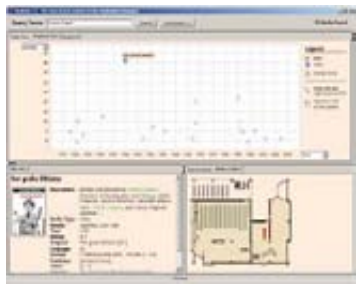
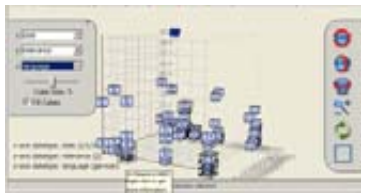
Human-Computer Interaction (HCI) & Usability Engineering (UE)

Knowledge Management (KM)

VISS

Information Visualization (InfoVis)

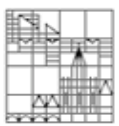
Design (e.g. Screen Design, Computational Design)

Information Retrieval (IR) & Data Mining (DM)

Business Intelligence (BI) & Data Warehouse (DWH)

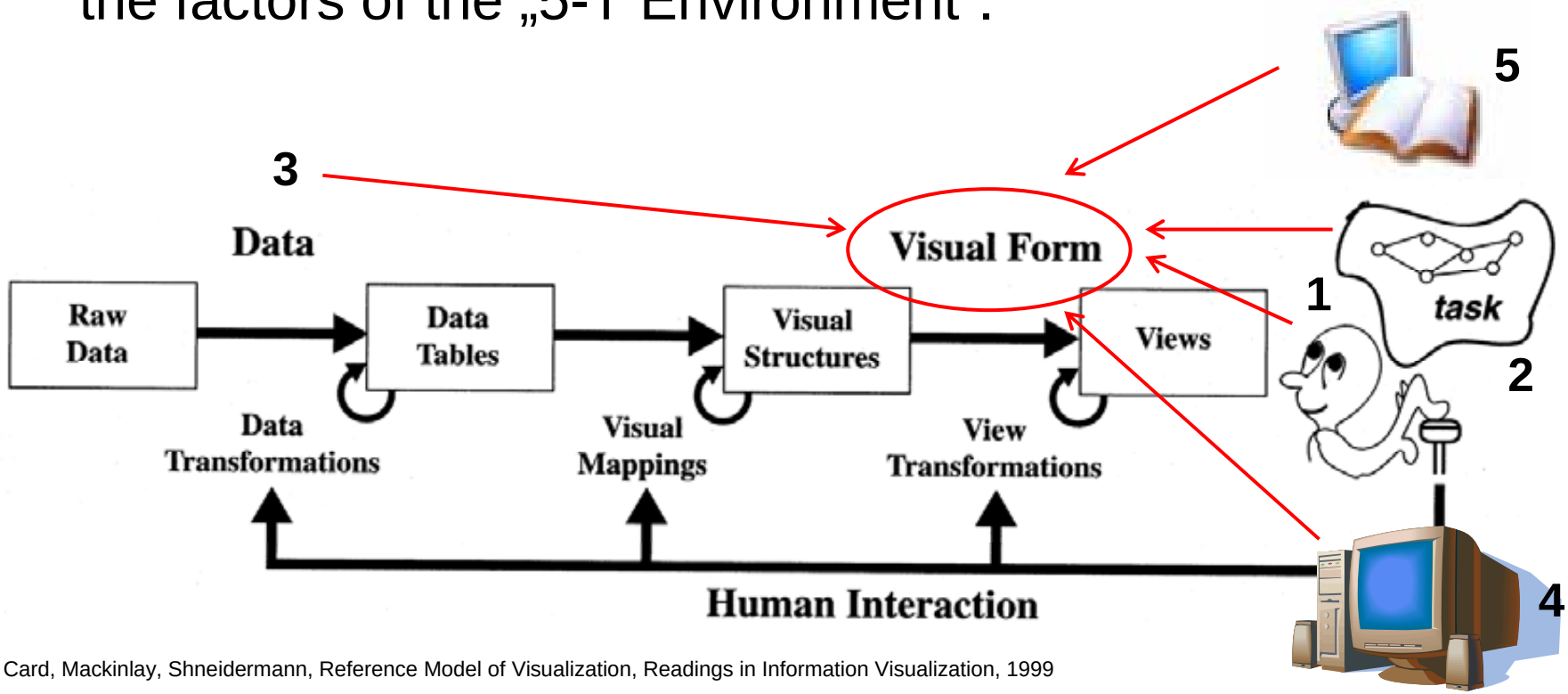
User Interface Design Principles for VISS

1. Design an **easy to use** system that supports the user's work in an effective and efficient manner. UE
2. Design an **easy to learn** system that shows the user the possibilities of its use during the interaction with it. HCI
3. Offer support during the **formulation of the query** to allow the user to express the right information needs. IR + InfoVis
4. Offer a quick and insightful **overview** about all search results to find the "needles in the haystack". InfoVis
5. Offer the right **amount of information** in the **context** where the user need it. InfoVis
6. Present **different aspects** of interest at the **same time** to compare them or to get more information at a glance. InfoVis
7. Offer possibilities to **restrict** the amount of **information** to selected topics of interest. InfoVis
8. Offer **customization** and **individualization** possibilities. HCI
9. Design an information space that offers a rich representation of **information from different information sources** in an **integrated fashion**.
10. Put visual information seeking in a **broader context** (knowledge work).



Design an easy to use system that supports the user's work in an effective and efficient manner.

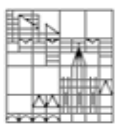
- Follow an **User-Centered Design** approach:
  Start with an analysis of the context of use considering the factors of the „5-T Environment".



Card, Mackinlay, Shneidermann, Reference Model of Visualization, Readings in Information Visualization, 1999

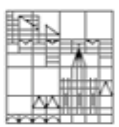
Context of Use influencing the Success of Visualizations

- Five factors are influencing the usefulness of a given visualization – "**5T-Environment**" (Mann, Reiterer 2000):
  1. **Target user group**: e.g. interpersonal differences in information perception and processing, which influences for example the way people think in spatial dimensions or abstraction
  2. **Tasks to be done**: e.g. knowledge worker: monitor, detect, search, extract information, fuse different sources, find schema, recode information into schema, organize, compare, simulate, decide, distribute
  3. **Type and number of data**: e.g. text or numeric data; hierarchy in the data; number of documents or data items
  4. **Technical possibilities**: e.g. size of monitor, memory size, processor power, available input/output devices
  5. **Training**: to find the right balance between learnability and efficiency or between simplicity versus power; long term benefits must out weight the amount of training



User-Centered Design

- User-Centered Design makes use of the following **Usability Engineering techniques**:
  - Factors of “5-T Environment” have to be considered during **Requirements Engineering** using techniques like **contextual task analysis** and **user profiles**
  - **Prototyping** of different visualization ideas offers a rich design space
  - Formative and summative **evaluation** techniques during the whole development process to “proof the concepts”
  - **Iterative** process model (e.g. Usability Engineering Lifecycle) allows the consideration of the evaluation results



Prototyping, Evaluation, Iteration

INSYDER final Java System
Evaluation

1. Redesign with Paper Mock-Up (INVISIP)
Evaluations

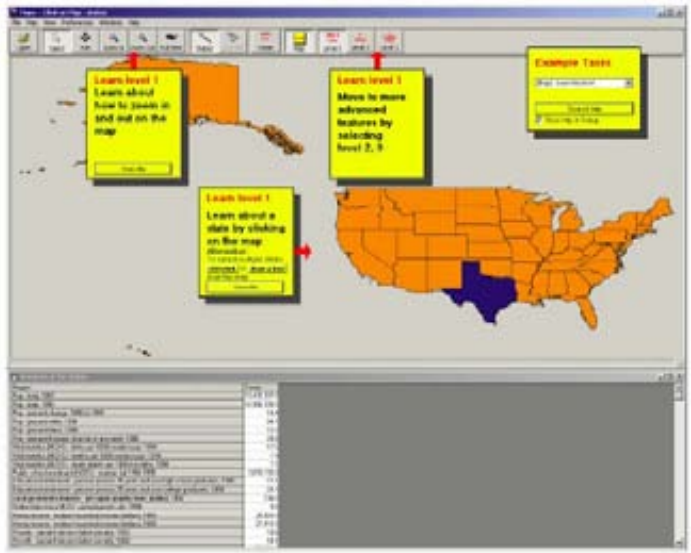
2. Redesign with HTML Prototype (INVISIP)
Evaluations

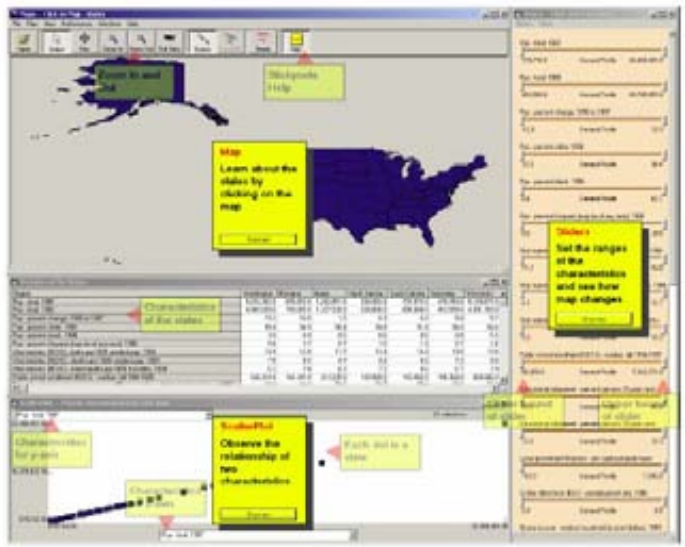
3. Redesign with Java System (INVISIP)
Evaluations

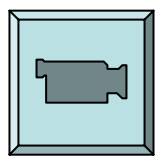
4. Redesign with Java System (MedioVis)
Evaluations

Design an easy to learn system that shows the user the possibilities of its use during the interaction with it.

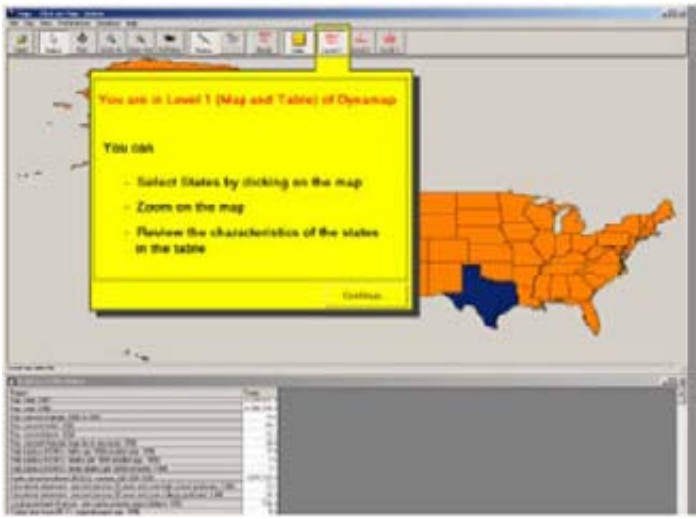
- Proposed design solution (MedioVis):
  - „**Multi-layered“ interface** combined with an **Integrated Initial Guidance help** approach using the metaphor of „sticky notes“, allowing users to use the interface or run automated demonstrations while reading the sticky notes overlaid on the interface (Shneiderman 2003, Kang et al. 2003).

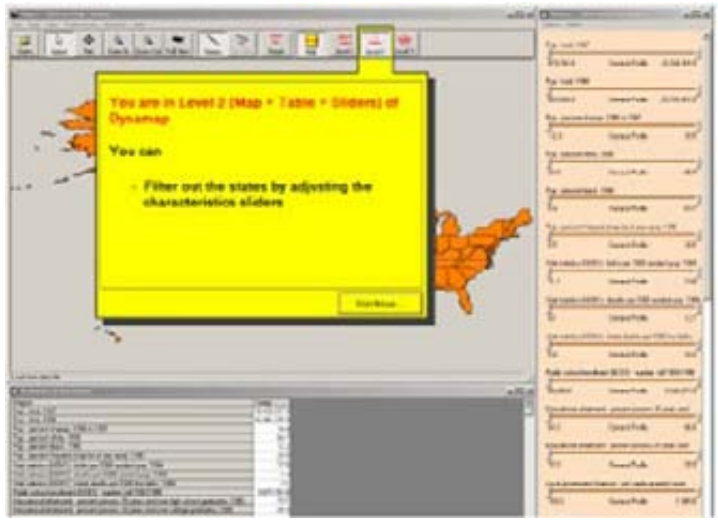


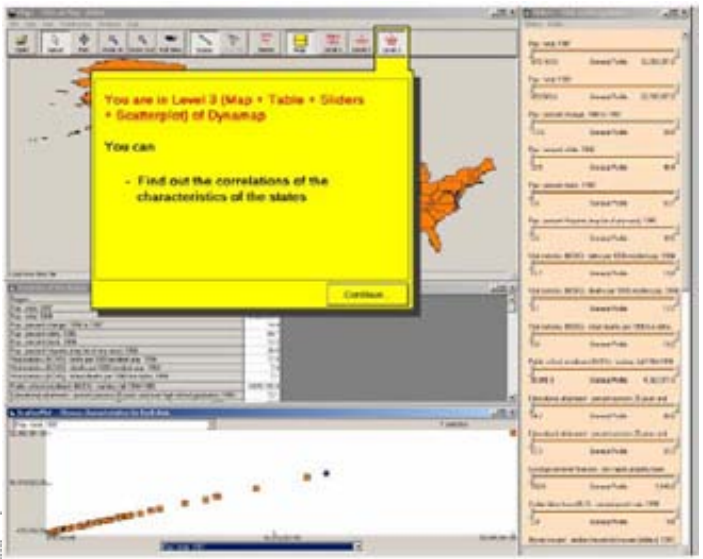


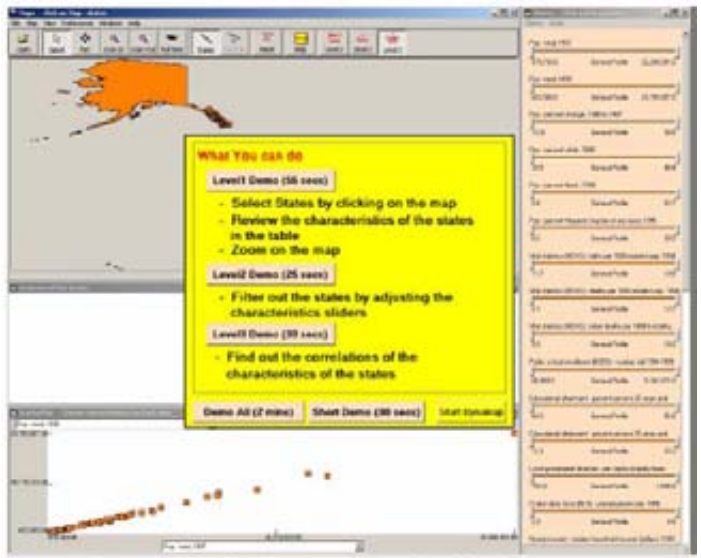


Design an easy to learn system that shows the user the possibilities of its use during the interaction with it.



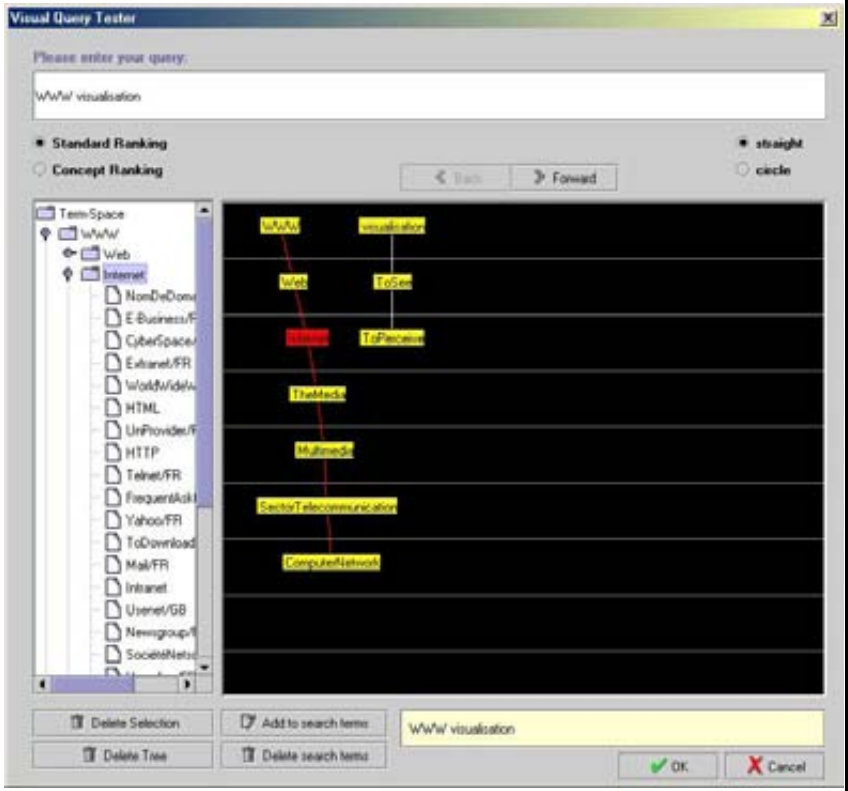


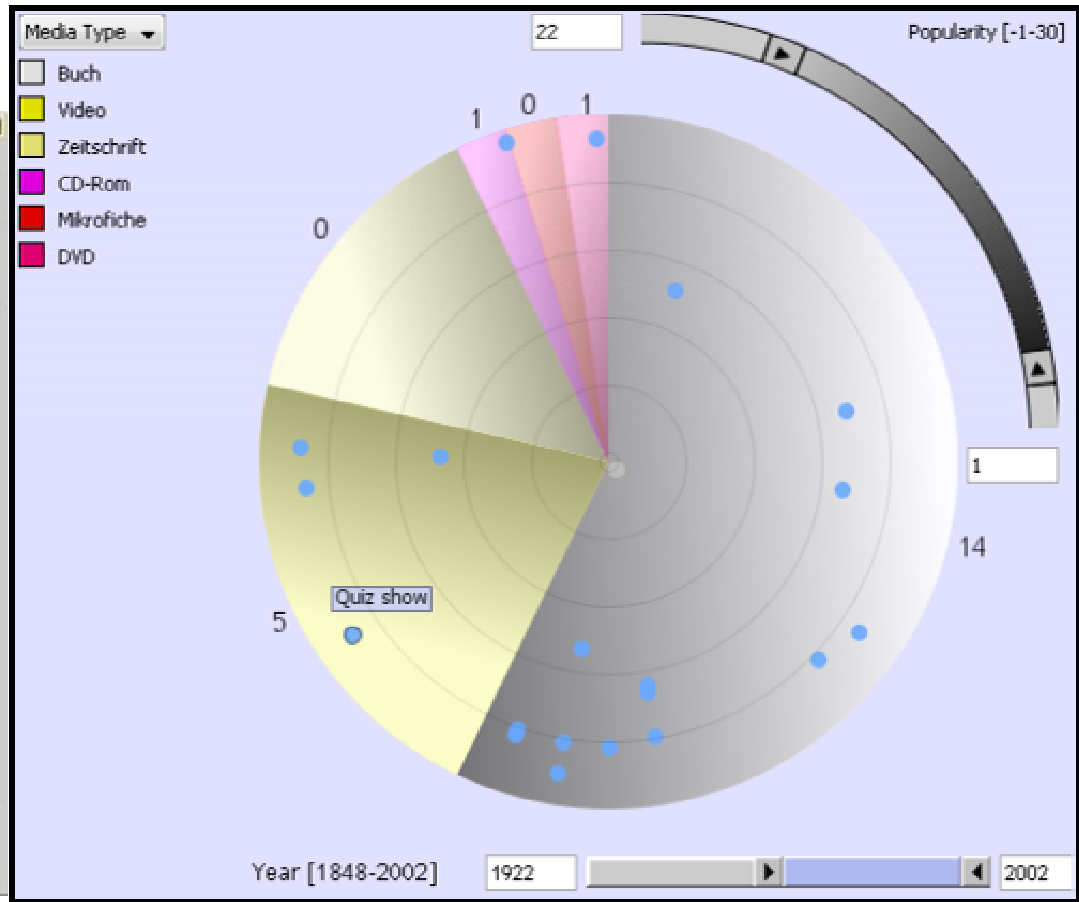




Offer support during the formulation of the query to allow the user to express the right information needs.

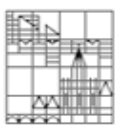
- Design solution (INSYDER and INVISIP):
  - **Visual Query** or **Dynamic Queries** help users to specify their information need more precisely using interactive query refinement techniques based upon visualization.

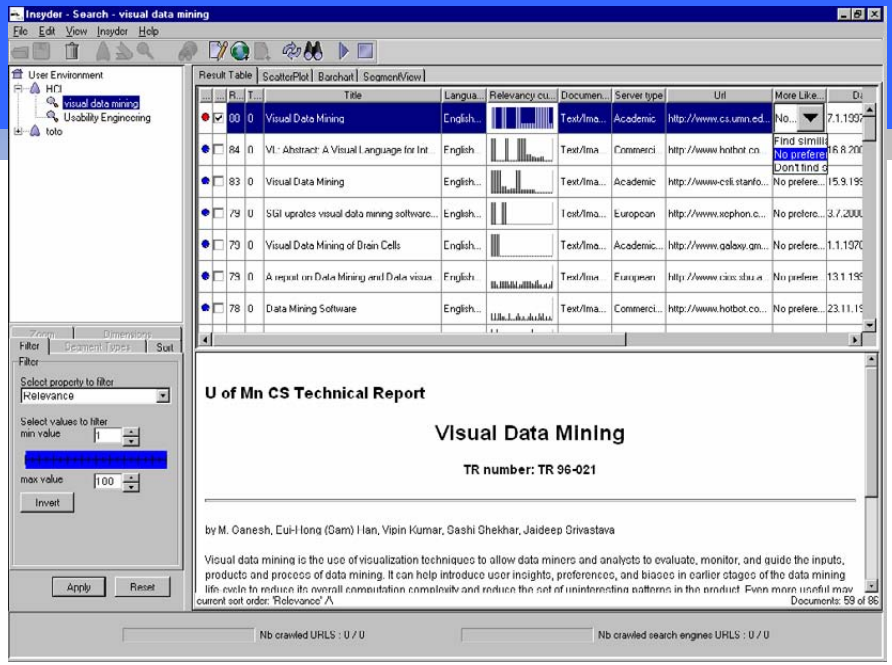


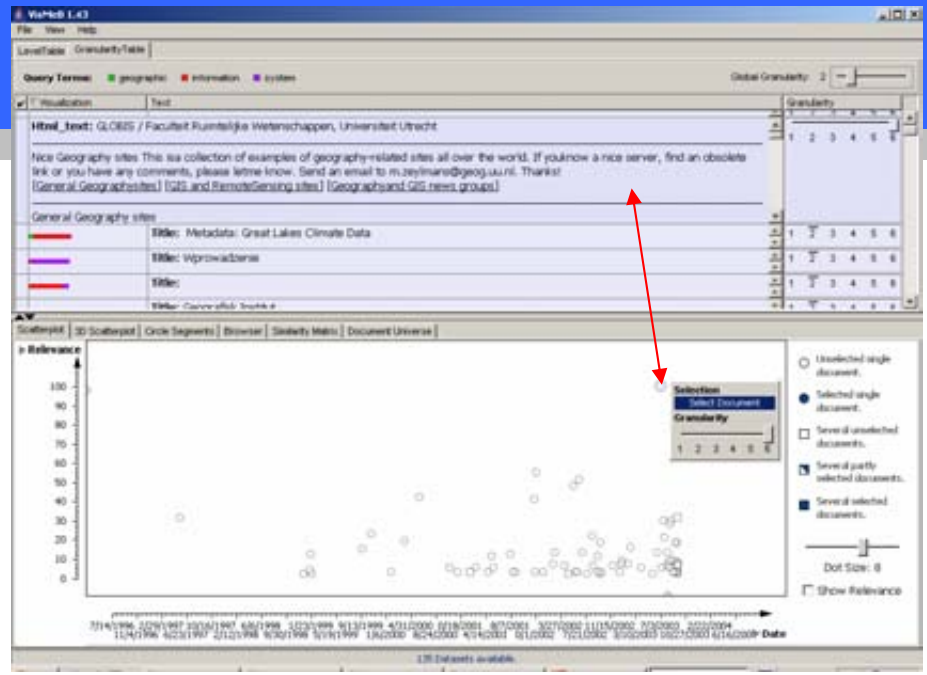


Offer a quick and insightful overview about all search results to find the “needles in the haystack”.

- Follow the visual-information-seeking mantra: “Overview first, zoom and filter, then details on demand.” (Shneiderman 1998)
- Design solutions (INSYDER, INVISIP, MedioVis):
  - **Scatterplot** with zoom and filter functionality for overview
  - **Table** for details on demand




Insyder - Search - visual data mining
File Edit View Insyder Help
User Environment
HCI
visual data mining
Usability Engineering
toto
Result Table
ScatterPlot
Barchart
SegmentView
Title
Visual Data Mining
Visual Data Mining and Data visua
Data Mining Software
Filter
Select property to filter
Relevance
Select values to filter
min value
max value
Invert
Apply
Reset
U of Mn CS Technical Report
Visual Data MIning
TR number: TR 96-021
by M. Ganesh, Eui-Hong (Sam) Han, Vipin Kumar, Sashi Shekhar, Jaideep Srivastava
Visual data mining is the use of visualization techniques to allow data miners and analysts to evaluate, monitor, and guide the inputs, products and process of data mining. It can help introduce user insights, preferences, and biases in earlier stages of the data mining
Nb crawled URLS : 0 / 0
Nb crawled search engines URLS : 0 / 0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General Geography sites
Title: Metadata: Great Lakes Climate Data
Title: Wprowadzenie
Scatterplot
Relevance
Selection
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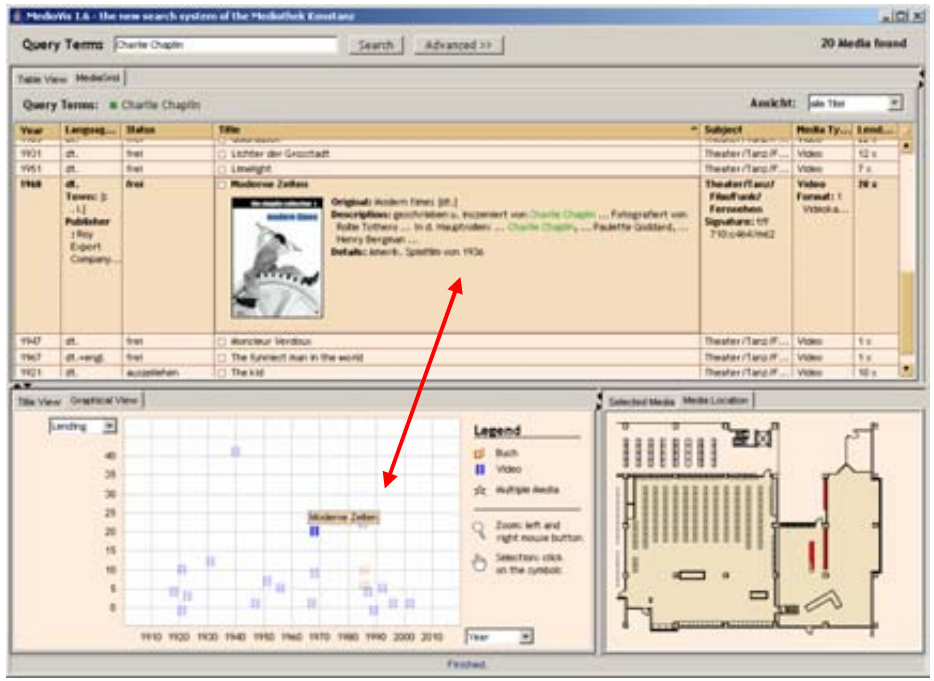
Query Terms
Charlie Chaplin
Search
Advanced >>
20 Media found
Ansicht:
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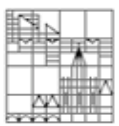
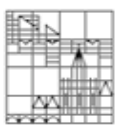
Video
Zoom: left and right mouse button
Selection: click on the symbol
Year



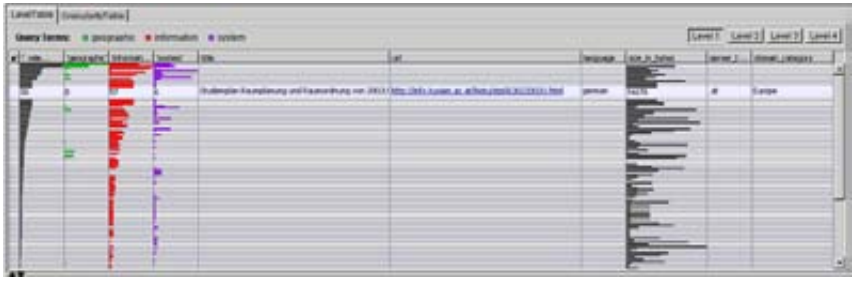
Offer the right amount of information in the context where the user need it.

- Design solutions (INVISIP and MedioVis):
  - Focus & Context techniques based on **Zoomable User Interfaces** (ZUI) offering **semantic zooming**:
    - **TableZoom**: the whole table moves to another level of detail
    - **RowZoom**: single rows can change their level of detail independently
    - **CellZoom**: single cells can be viewed in different levels of detail

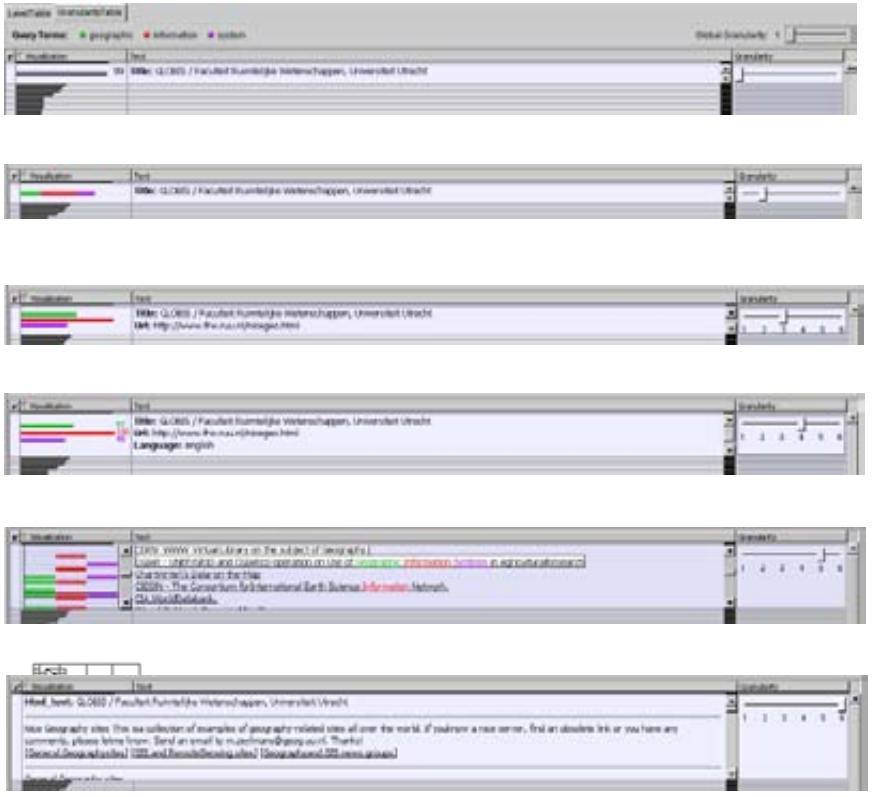


TableZoom, RowZoom, CellZoom

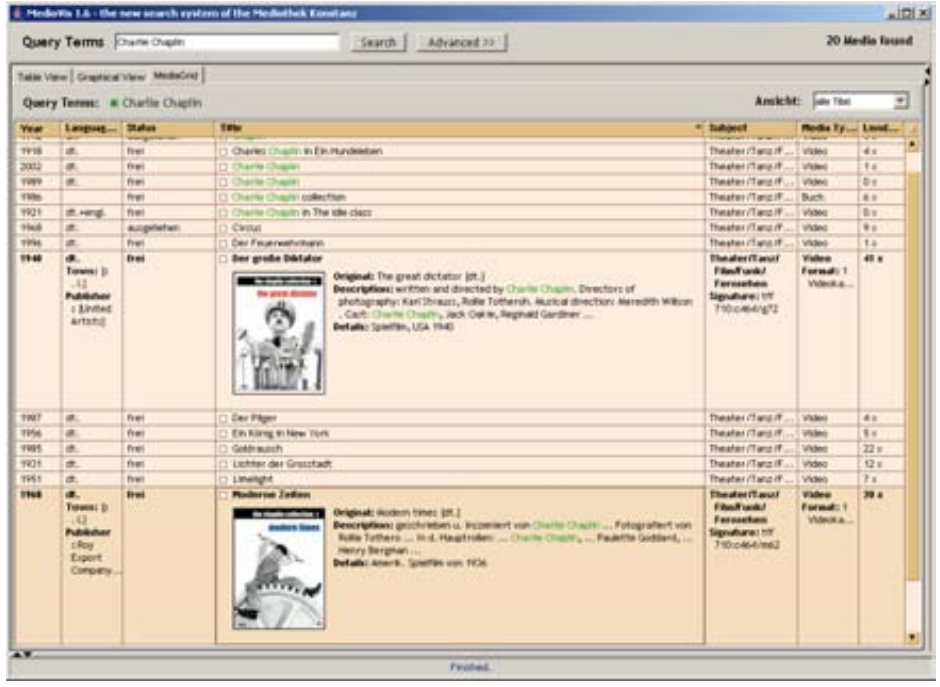
TableZoom



RowZoom



CellZoom

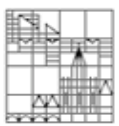


Offer the right amount of information in the context where the user need it.

- Proposed design solution:
  - Semantic zoom based on ideas of **Zoom Navigation** (Rüger 1998):
    - Combines the Degree of Interest (DOI) of the Fisheye View (Furnas 1981) with an Aspect of Interest (AOI)
    - AOI could be based on the analysis of user interaction logs to draw conclusions of the desired information

	Aspects AOI		
Level of Detail **DOI**	Title		
	Abstract		
	Year of origin	Names of actors	Poster

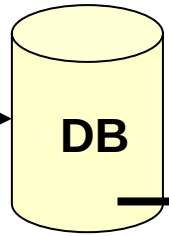
Representation Matrix for MedioVis

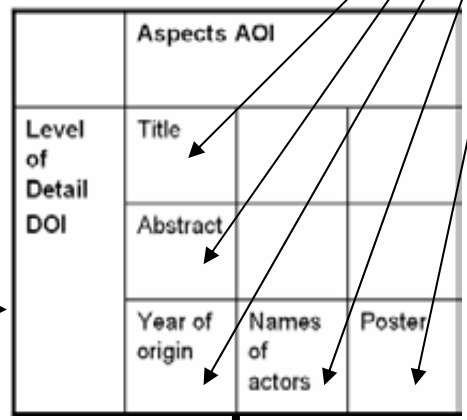


AOI based on DROID

„How often? How long? Last time visited?“ for each aspect

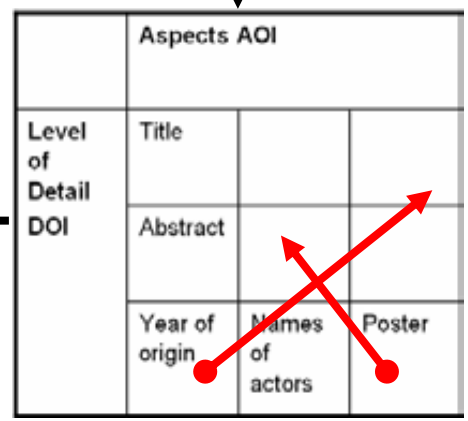
AOI (aspect) = f (N, t1, t2)



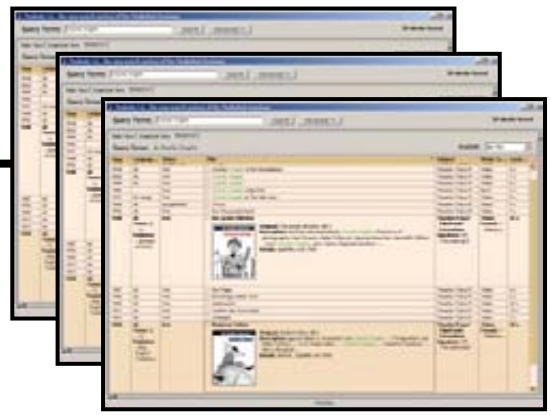


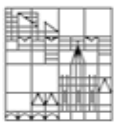
DROID framework records specific interactions of each user and stores them in a database.

Rearrange representation matrix



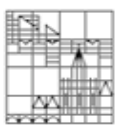
Individualized ZUIs



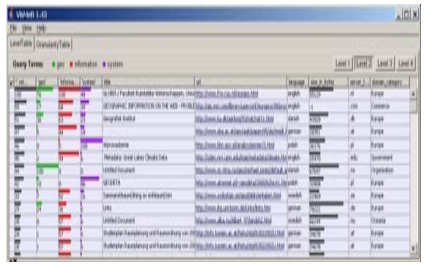


Present different aspects of interest at the same time to compare them or to get more information at a glance.

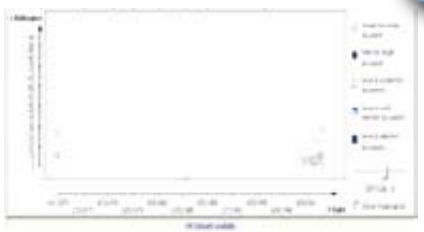
- Design solution (INSYDER, INVISIP and MedioVis):
  - Use of **Multiple Coordinated Views** (MCV) following the eight design rules of (Baldonado et al. 2000):
    - Rule of Diversity
    - Rule of Complementarity
    - Rule of Decomposition
    - Rule of Parsimony
    - Rule of Space/Time Resource Optimization
    - Rule of Self-Evidence
    - Rule of Consistency
    - Rule of Attention Management



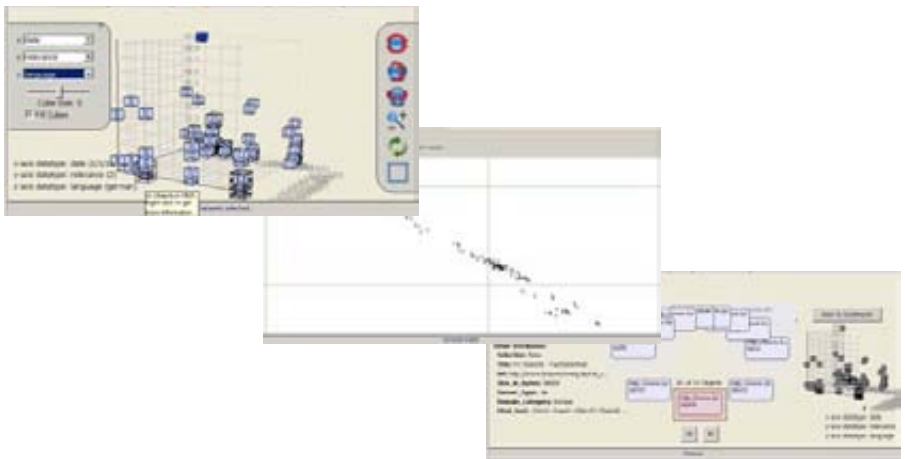
Multiple Coordinated Views (INVISP)

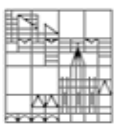


Tightly  **Coupled**

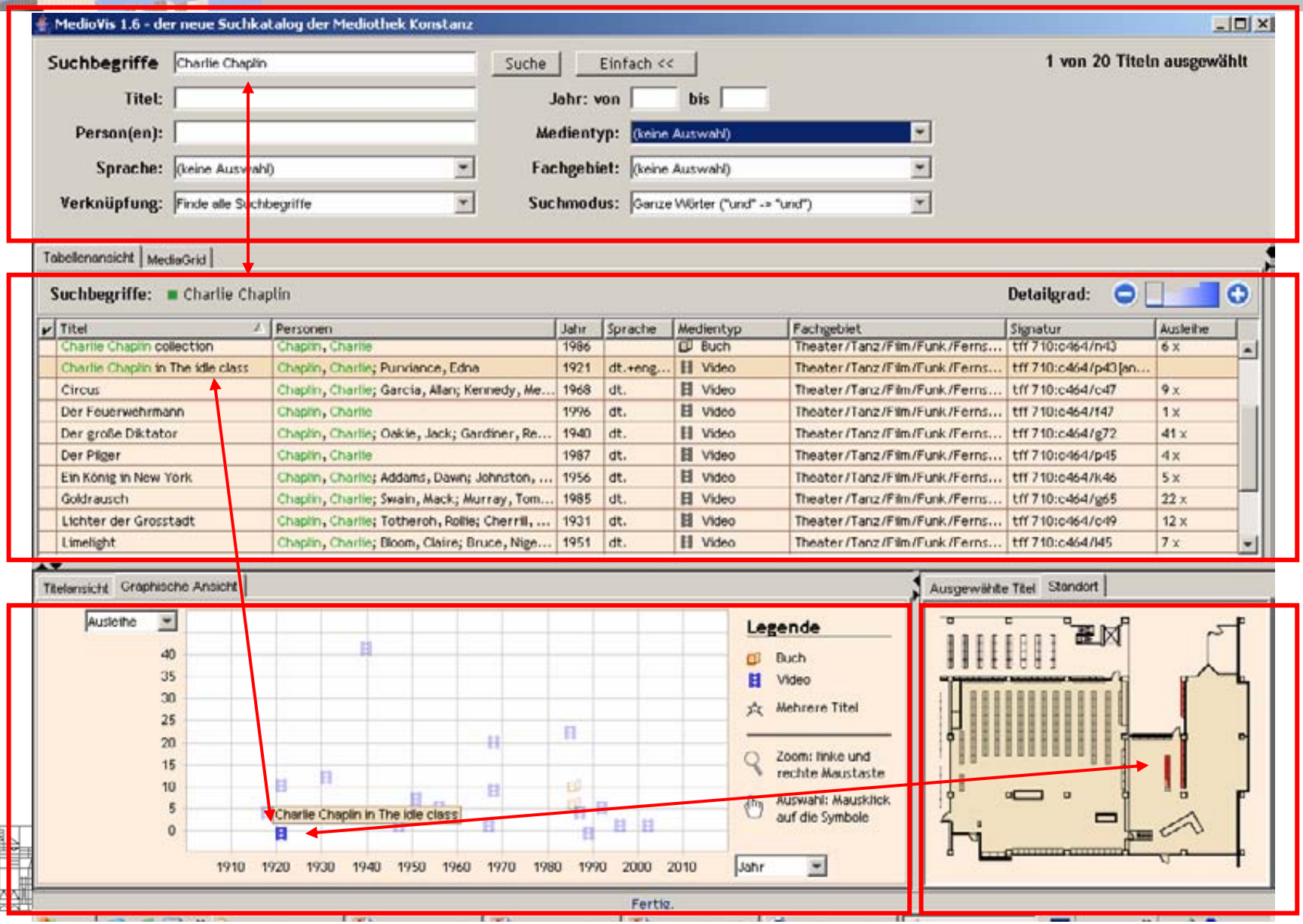


Alternative Views:



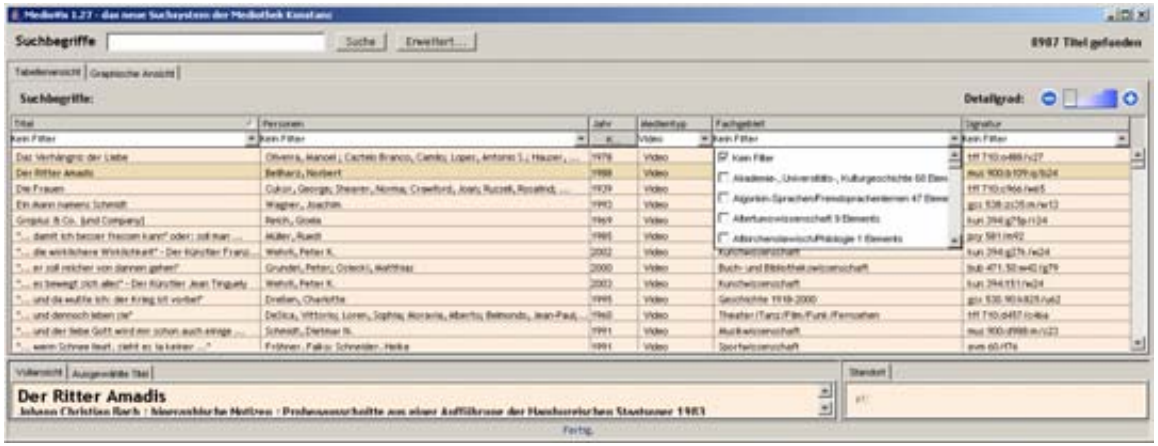


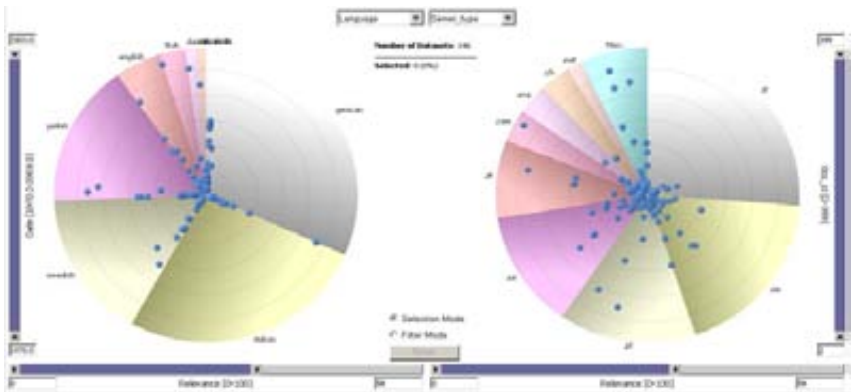
Multiple Coordinated Views (MedioVis)

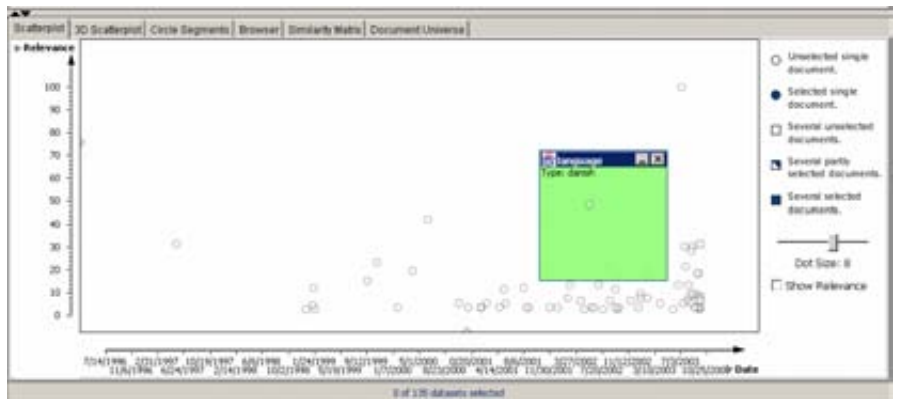


Offer possibilities to restrict the amount of information to selected topics of interest.

- Design solutions:
  - **TableFilter**, **Moveable Filter**, **CSV Filter and Dynamic Queries**

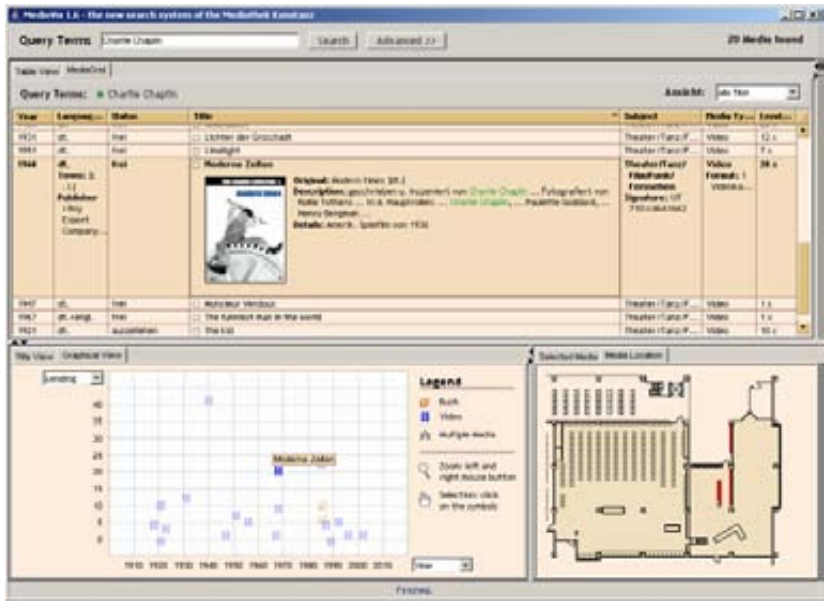


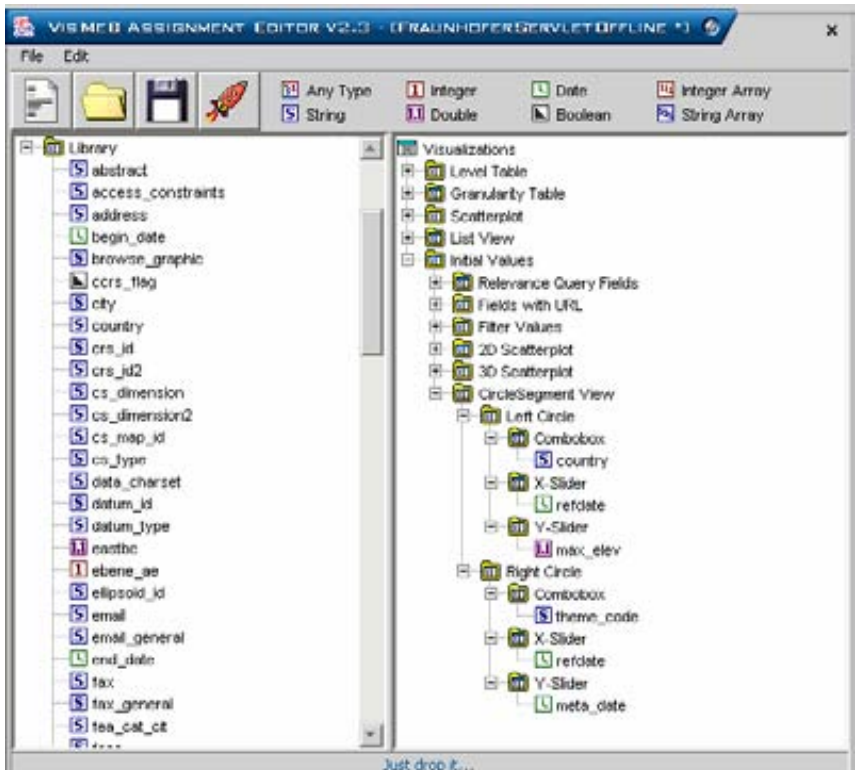




Offer customization and individualization possibilities.

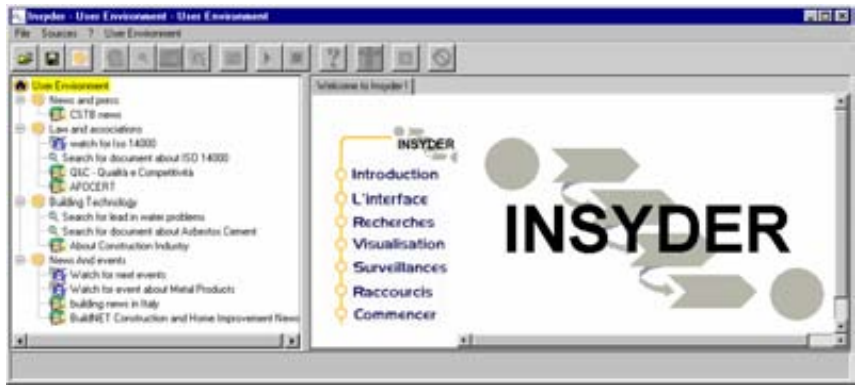
- Offer the possibility to customize the system reflecting the user's personal needs.
- Design solutions (INVISIP, MedioVis):
  - **Assignment tool** allows individual configuration of the visualizations
  - **MCV** could be **customized by the user**





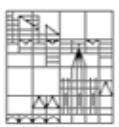
Offer customization and individualization possibilities.

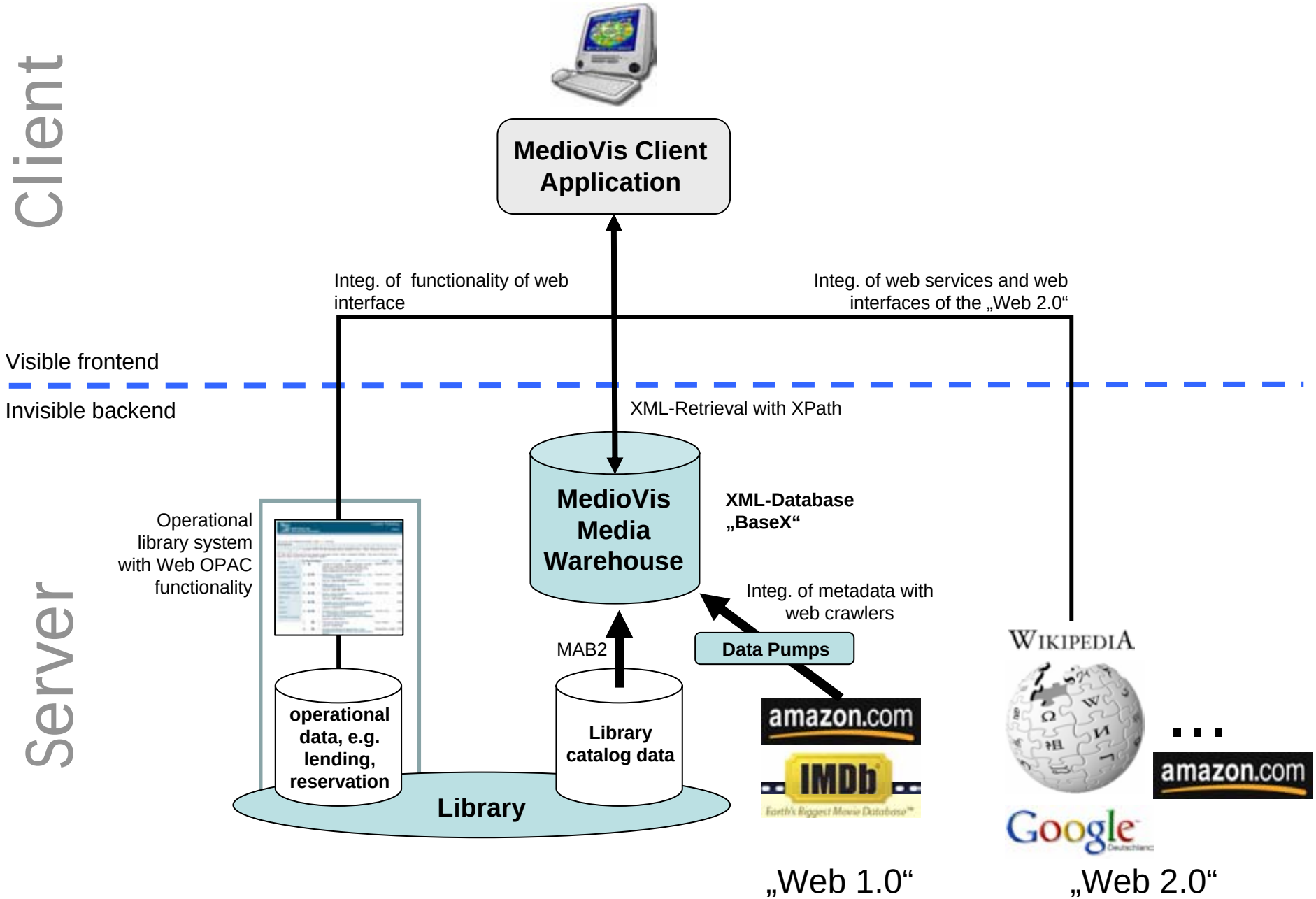
- Design an information workspace that allows the user to keep and manage his information needs, search results, etc. for later use.
- Design solution (INSYDER):
  - **User Environment** stores different Spheres of Interest (SOI)
  - SOI are available for the main functions: Search, Watch, and Bookmark / News
  - Country- and industry-branch-specific predefined SOIs with selected bookmarks, collections of starting points like search engines and URL-lists, specific thesauri to improve the relevance ranking of the semantic analysis module, or rule files to classify hits by user definable host-types.



Design an information space that offers a rich representation of information from different information sources in an integrated fashion.

- Proposed design solution (MedioVis):
  - **Media Warehouse** offers an „added value“ by providing a comprehensive collection of all relevant data from various sources, e.g.
    - MAB2 catalog providing basic information
    - Metadata from online databases/ websites (covers, posters, plot summary)
    - Geographical information, ground plan/maps (e.g. for orientation or origin information)
    - Digitized content (audio clips, trailers, full-texts, video streams)

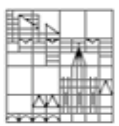



Client
MedioVis Client Application
Integ. of functionality of web interface
Integ. of web services and web interfaces of the „Web 2.0“
Visible frontend
Invisible backend
XML-Retrieval with XPath
MedioVis Media Warehouse
XML-Database „BaseX“
Server
Operational library system with Web OPAC functionality
operational data, e.g. lending, reservation
Library
Library catalog data
MAB2
Integ. of metadata with web crawlers
Data Pumps
amazon.com
IMDb
Earth's Biggest Movie Database™
WIKIPEDIA
Google
amazon.com
„Web 1.0“
„Web 2.0“

Put visual information seeking in a broader context.

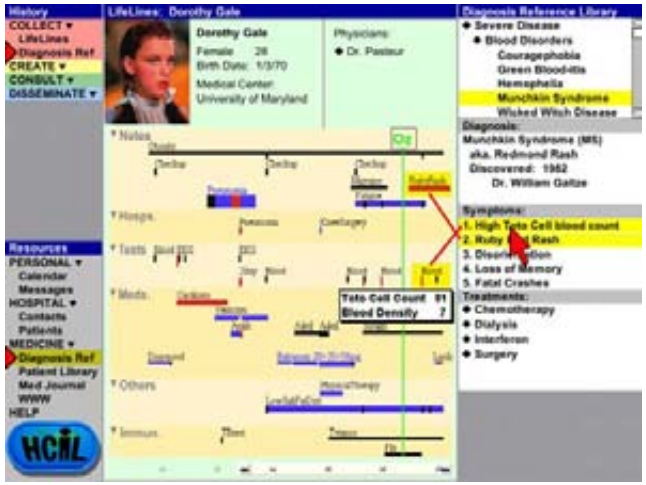
Collect	Learning from previous works stored in libraries, on the Web, etc. Searching and browsing digital libraries, the Web, etc. Visualizing data and processes to understand and discover relationships
Relate	Consulting with peers and mentors for intellectual and emotional support
Create	Explore, compose, evaluate possible solutions Thinking by free association to make new combinations of ideas (brainstorming, lateral thinking) Exploring solutions – what-if tools and simulation models Composing artifacts and performances step by step Reviewing and replaying session histories to support reflection
Donate	Disseminating the results to gain recognition and contribute to libraries, the Web, etc.

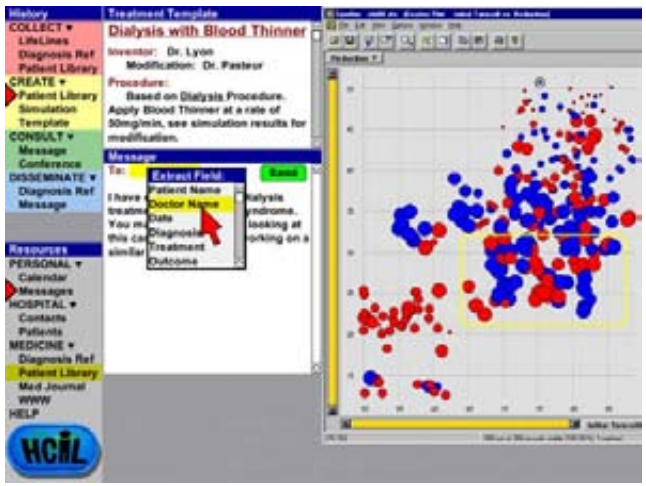
Framework for Mega-Creativity (Shneiderman 2002, p.214)



Put visual information seeking in a broader context

- **Genex** is a framework for an integrated set of software tools that support creativity in science, medicine, the arts, and beyond.
- A **medical scenario** shows how a physician might treat a patient by collecting information from databases using information visualization tools, exploring innovative treatment plans, consulting with specialists, and disseminating the refined treatment plan to relevant people. The playful scenario begins when Dorothy Gale returns from the Emerald City in the Land of Oz with a mysterious ruby red rash. (www.cs.umd.edu/hcil/pubs/presentations/genex/index.shtml)



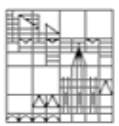


Start video of Genex!

MedioVis - InfoVis 2007 Contest

A Visual Explorer for Motion Picture Data

Sebastian Rexhausen
Mischa Demarmels
Hans-Christian Jetter
Mathias Heilig
Jens Gerken
Harald Reiterer
firstname.lastname@uni-konstanz.de



University of Konstanz
Human-Computer Interaction Group
http://hci.uni-konstanz.de/Blockbuster

Portal | Sacramento | new | Favorites

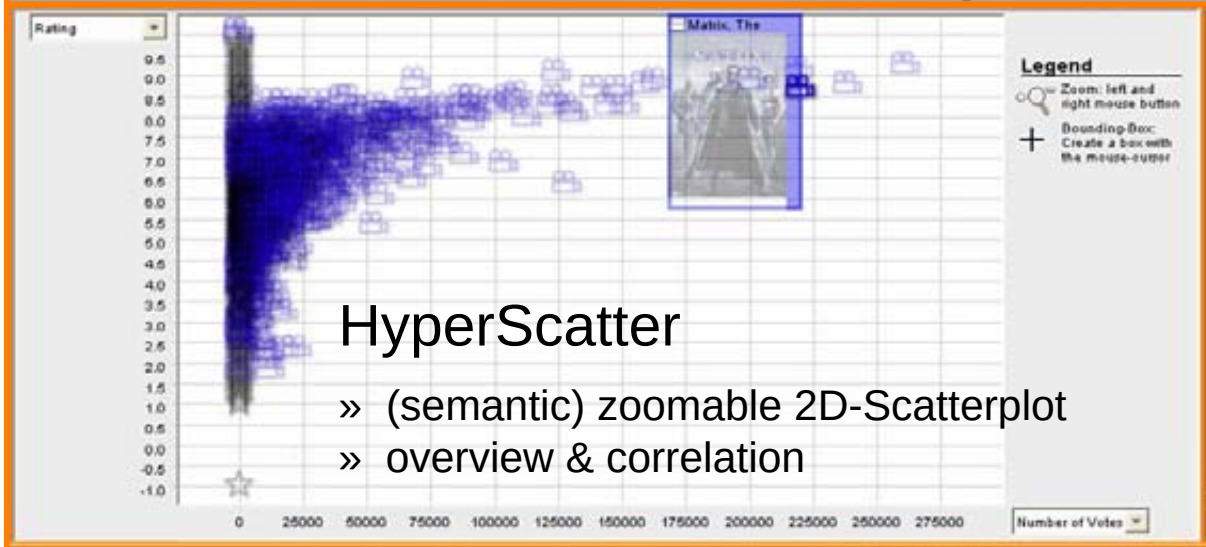
Sacramento | Find!

Sacramento 2301 Hits in 65,863 Items

Search | Processing | Visualizations | Layout

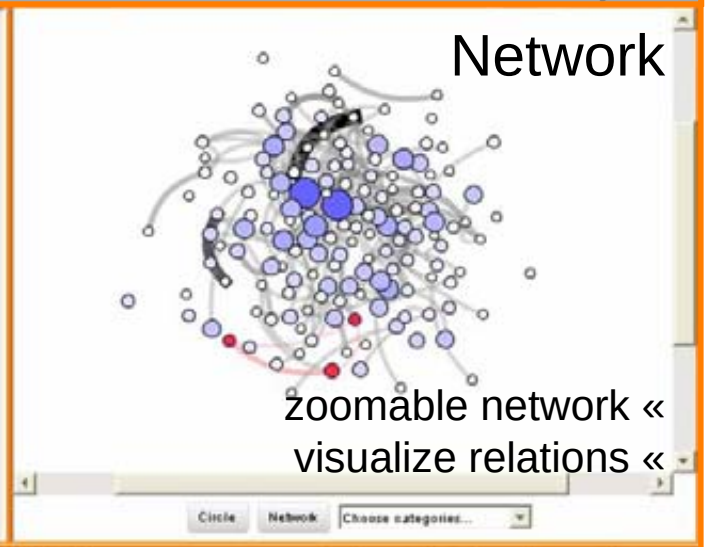
Select all | Remove | Add | E-Mail | Print

HyperGrid | Scatterplot | Bargrams | Network



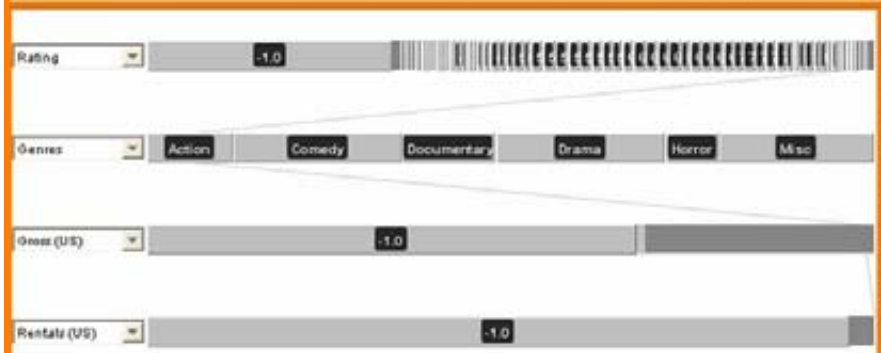
HyperScatter

» (semantic) zoomable 2D-Scatterplot
» overview & correlation



Network

zoomable network «
visualize relations «

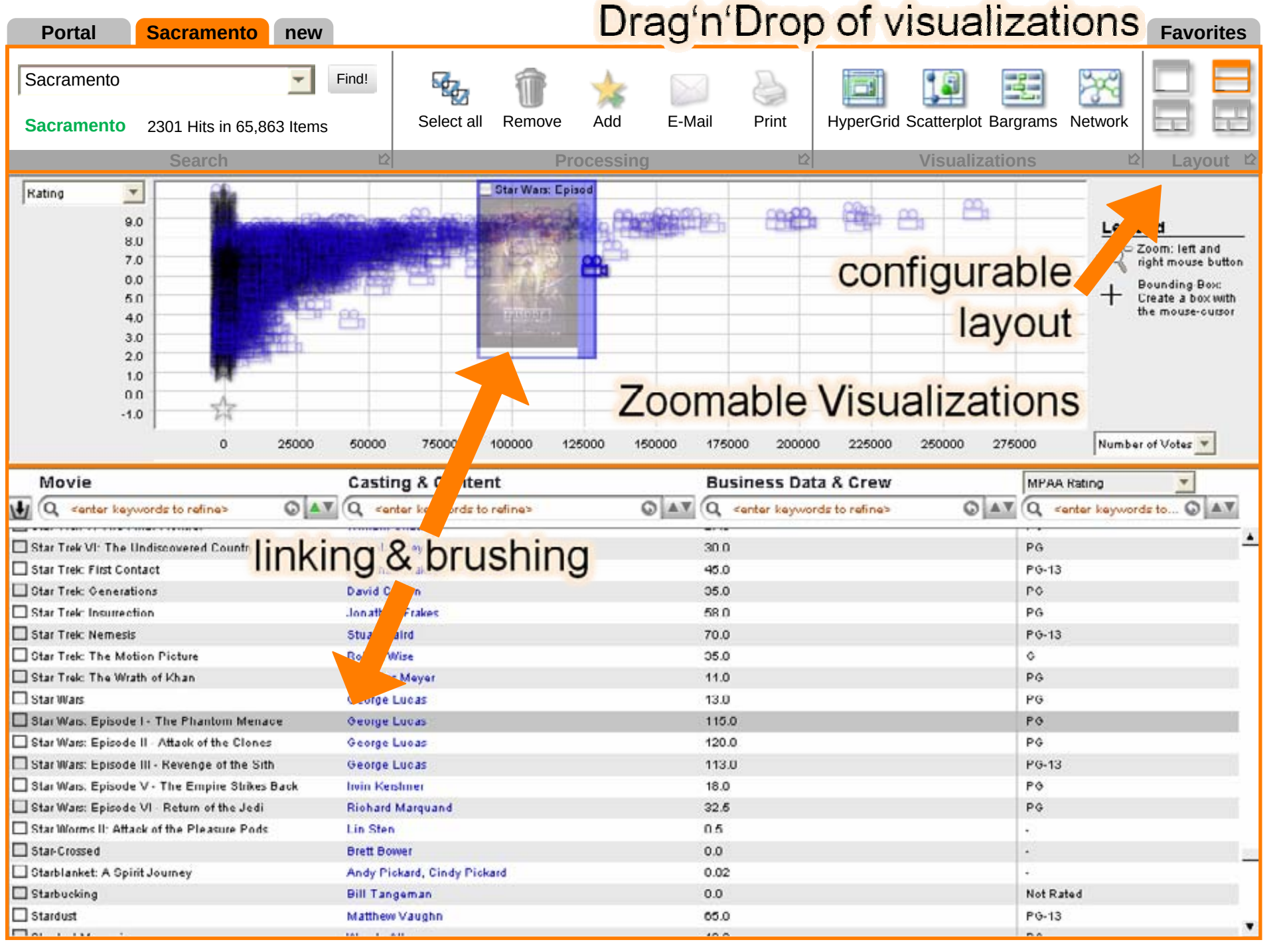


Parallel Bargrams

» Bargrams + Parallel Coordinates
» correlation, distribution & filtering

HyperGrid

zoomable table «
relating, sorting, comparing & browsing «


Portal
Sacramento
new
Drag'n'Drop of visualizations
Favorites
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Find!
Sacramento
2301 Hits in 65,863 Items
Select all
Remove
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E-Mail
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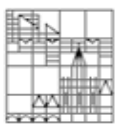
HyperGrid
Scatterplot
Bargrams
Network
Search
Processing
Visualizations
Layout
Rating
Star Wars: Episod
configurable layout
Zoomable Visualizations
Zoom: left and right mouse button
Bounding Box: Create a box with the mouse-cursor
Number of Votes
linking & brushing
Movie
Business Data & Crew
MPAA Rating
Star Trek VI: The Undiscovered Countr 30.0 PG
Star Trek: First Contact 46.0 PG-13
Star Trek: Generations 35.0 PG
Star Trek: Insurrection 58.0 PG
Star Trek: Nemesis 70.0 PG-13
Star Trek: The Motion Picture 35.0 G
Star Trek: The Wrath of Khan 11.0 PG
Star Wars 13.0 PG
Star Wars: Episode I - The Phantom Menace George Lucas 115.0 PG
Star Wars: Episode II - Attack of the Clones George Lucas 120.0 PG
Star Wars: Episode III - Revenge of the Sith George Lucas 113.0 PG-13
Star Wars: Episode V - The Empire Strikes Back Irvin Kershner 18.0 PG
Star Wars: Episode VI - Return of the Jedi Richard Marquand 32.5 PG
Star Worms II: Attack of the Pleasure Pods Lin Sten 0.5 -
Star-Crossed Brett Bower 0.0 -
Starblanket: A Spirit Journey Andy Pickard, Cindy Pickard 0.02 -
Starbucking Bill Tangeman 0.0 Not Rated
Stardust Matthew Vaughn 65.0 PG-13

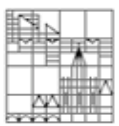
Knowledge Media Workbench for Digital Libraries

- **Knowledge Media Workbench** as a couple of **creativity support tools** for users of Digital Libraries:
  - **Visual information seeking** with search, watch, bookmark, news functions
  - **Information Workspace** to store different spheres of interest and knowledge artifacts
  - **Media Warehouse** that fuses different sources and offers integration of data to support data sharing accomplished by providing compatible data types and file formats
  - **Media Editors** (e.g. word processors, presentation graphics, spreadsheets, slide presentation, photo/movie editing) to create and present new knowledge artifacts; offer integration of actions and consistent terminology; support higher level of actions like „collect-explore-visualize“ or „annotate-consult-revise“
  - **History Tool** for reviewing and replaying session histories
  - **E-mail, Website, CSCW** functionality
  - **Zoomable User Interfaces** (ZUI) offering multiple coordinated views
  - …



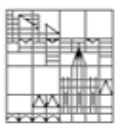
Design Principles for a Knowledge Media Workbench

1. Offer comprehensive **visual support** for all activities of creative work.
2. Support **searching and browsing** of digital libraries, the Web, etc.
3. Offers the user a **rich representation of information (multimedia) from different information sources** in an integrated fashion.
4. Allow the user **to keep and manage his information needs, search results, knowledge artifacts, etc**. for later use.
5. Support **the creation of knowledge artifacts**.
6. **Support reflection** based on the interaction history.
7. Offer a variety of possibilities to **disseminate knowledge artifacts**.
8. Offer smooth **integration across windows**.



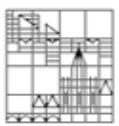
Conclusion & Outlook

- Conclusion:
  - There is some empirical evidence (based on user tests) that the presented design principles lead to better design solutions … but we need more design principles + design solutions, and more empirical tests!
- Outlook:
  - Development of a comprehensive “Style Guide” or “**UI Design Patterns Collection**” for VISS and KMS.
  - Development of a **Knowledge Media Workbench** to support creative work.

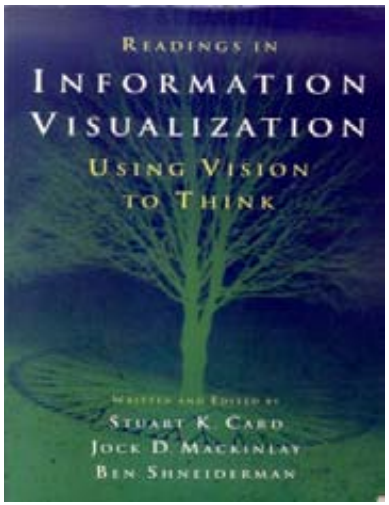


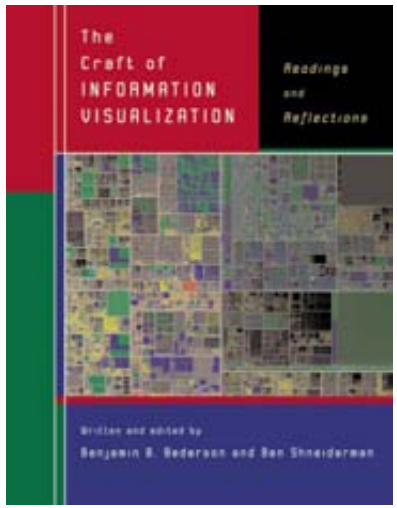
Publications of HCI Group

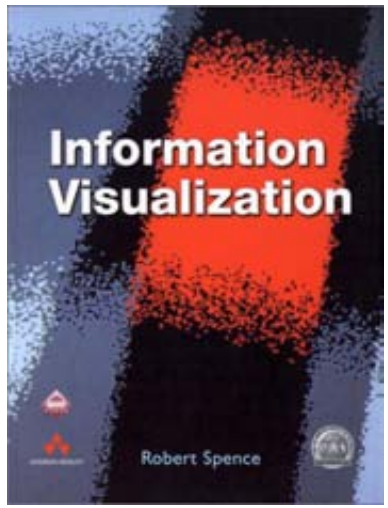
- http://hci.uni-konstanz.de/index.php?a=publications&lang=de

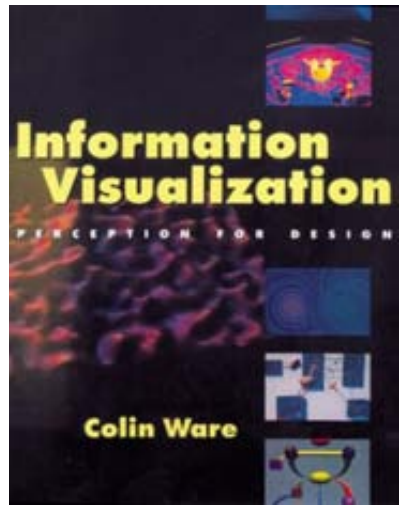


More on Information Visualization…









Zusatzmaterial: Slides „Grundlagen der Datenvisualisierung“:

VSS_Skript_WS0607_Zusatzfolien_Grundlagen_Datenvisualisierung_WS0607.ppt

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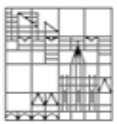

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