

Non-textual ranking in digital libraries

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Agenda

- Introduction
- Ranking in DL
- IRM project
- Non-textual ranking in IRM
- Results
- Conclusion & Demo

Background I

Database perspective:

- Large and heterogeneous document sets for subject specific questions
- Various relevant and accessible databases for a topic
- Focus on bibliographic databases (metadata)
 - journal articles
 - monographs

Background II

User perspective:

- Relevant & qualitative documents (relevance ranking)
- Comprehensive search: documents from other fields
- Flexible search systems: alternative search strategies and techniques (e.g. Berrypicking)
- Value-added, e.g. direct access to fulltexts or metrics like citation counts in Google Scholar

Digital Libraries

- Indexing & Abstracting databases
- Library catalogues
- Full texts
- Links to online resources
- Data
- Digital objects
- ...

Ranking

Models:

- Exact match vs. best match (e.g. tf-idf)
- Sorting vs. ranking

Textual vs. non-textual ranking

Ranking: non-textual

Link analysis (PageRank, HITS)

Relevance feedback (user feedback)

Popularity (documents accessed)

Ranking in Digital Libraries



Das Internetportal für wissenschaftliche Information

Startseite

Suchen

Fachzugänge

Mein vascoda

Hilfe / FAQ

English version

SUCHEN

- » [Suchmaske leeren](#)
- » [Hilfe zur Suche](#)
- » [Erweiterte Suche](#)

nach verwandten Begriffen suchen

Suchen in: [\(alles abwählen\)](#)

- [Ingenieur- und Naturwissenschaften](#)
- [Medizin und Biowissenschaften](#)
- [Rechts-, Wirtschafts- und Sozialwissenschaften](#)
- [Geistes- und Kulturwissenschaften](#)
- [Regionen / Kulturräume](#)
- [Fachübergreifende Datenbestände](#)

NAVIGATION AUSBLENDEN

Merkliste [0] [Suchhistorie](#)

142067 Suchergebnisse für: modell

Hinweis auf externe Treffer: mindestens 169235 weitere Ergebnisse in Fachportalen
[\(Fachportale anzeigen\)](#)

Sortieren nach: [Erscheinungsjahr](#) | [Relevanz](#)

- 1. Das französische Modell der Mitarbeiterbeteiligung**

Körner, Marita, 2009

gefunden in: [Fachportal: Fachübergreifende Datenbestände](#) [Datenbank: GVK - Gemeinsamer Verbundkatalog des GBV](#)

- 2. Spatial voting in the 2004 presidential election**

Jessee, Stephen A., 2009

gefunden in: [Fachportal: IREON](#) [Datenbank: World Affairs Online](#)

- 3. PSQ - Perceived Stress Questionnaire (PSYNDEX Tests-Abstract)**

Fliege, H., Rose, M., Arck, P., Levenstein, S. & Klapp, B.F., 2009

Ergebnisse eingrenzen

Erscheinungsjahre

- [2000 \(5394\)](#)
- [2003 \(5220\)](#)
- [2001 \(5172\)](#)
- [1999 \(5137\)](#)

[weitere Erscheinungsjahre](#)

Themen

- [Modell](#)
- [Bundesrepublik](#)
- [Deutschland](#)
- [Modell \(theoretisch\)](#)
- [Modell/Modellfall](#)
- [weitere Themen](#)

Autoren/Urheber

- [Cusack, Thomas R.](#)
- [Esser, Hartmut](#)
- [Schmid, Guenther](#)
- [Eberwein, Wolf-Dieter](#)
- [weitere Autoren/Urheber](#)

Ranking in Digital Libraries



[Subscribe](#) (Full Service) [Register](#) (Limited Service, Free) [Login](#)

Search: The ACM Digital Library The Guide

SEARCH

Searching within **The ACM Digital Library** for: model ([start a new search](#))

Found **139,117** of **264,269**

REFINE YOUR SEARCH

Refine by Keywords

SEARCH

[Discovered Terms](#)

Refine by People

- [Names](#)
- [Institutions](#)
- [Authors](#)
- [Editors](#)
- [Reviewers](#)

Refine by Publications

- [Publication Year](#)
- [Publication Names](#)
- [ACM Publications](#)
- [All Publications](#)
- [Content Formats](#)
- [Publishers](#)

Refine by Conferences

- [Sponsors](#)
- [Events](#)
- [Proceeding Series](#)

ADVANCED SEARCH

[Advanced Search](#)

Search Results

Related Journals

Related Magazines

Related SIGs

Related Conferences

Results 1 - 20 of 139,117

Sort by in

[Save results to a Binder](#)

Result page: [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [next](#) [>>](#)

1 [Symmetry in temporal logic model checking](#)

[Alice Miller](#), [Alastair Donaldson](#), [Muffy Calder](#)

September 2006 **Computing Surveys (CSUR)**, Volume 38 Issue 3

Publisher: ACM [Request Permissions](#)

Full text available: [Pdf](#) (335.90 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Bibliometrics: Downloads (6 Weeks): 61, Downloads (12 Months): 355, Downloads (Overall): 1719, Citation Count: 2

Temporal logic model checking involves checking the state-space of a model of a system to determine whether errors can occur in the system. Often this involves checking symmetrically equivalent areas of the state-space. The use of symmetry reduction ...

Keywords: Model checking, quotient graph, symmetry

2 [Software model checking](#)

[Ranjit Jhala](#), [Rupak Majumdar](#)

October 2009 **Computing Surveys (CSUR)**, Volume 41 Issue 4

Publisher: ACM [Request Permissions](#)

Full text available: [Pdf](#) (815.33 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Bibliometrics: Downloads (6 Weeks): 426, Downloads (12 Months): 426, Downloads (Overall): 426, Citation Count: 0

Ranking in Digital Libraries

[Web](#) [Images](#) [Videos](#) [Maps](#) [Shopping](#) [Groups](#) [Mail](#) [more](#) ▼

philippmayr@googlemail.com

Google scholar [Advanced Scholar Search](#)
[Scholar Preferences](#)

Scholar Results 1 - 50 of about

[Modeltest: testing the **model** of DNA substitution](#) - ► [oxfordjournals.org](#) [PDF]

D Posada, KA Crandall - *Bioinformatics*, 1998 - Oxford Univ Press

All phylogenetic methods make assumptions, whether explicit or implicit, about the process of DNA substitution (Felsenstein, 1988). For example, an assumption common to many phylogenetic methods is a bifurcating ...

[Cited by 8479](#) - [Related articles](#) - [BL Direct](#) - [All 21 versions](#)

[PDF] ► [Estimating the dimension of a **model**](#)

G Schwarz - *The annals of statistics*, 1978 - jstor.org

The Annals of Statistics 1978, Vol. 6, No. 2, 461-464 ESTIMATING THE DIMENSION OF A MODEL1 By Gideon Schwarz Hebrew University The problem of selecting one of a number of **models** of different dimensions is treated by finding its Bayes ...

[Cited by 9802](#) - [Related articles](#) - [All 17 versions](#)

[A new look at the statistical **model** identification](#)

H Akaike - *IEEE transactions on automatic control*, 1974 - ieeexplore.ieee.org

Abstract The history of the development of statistical hypothesis testing in time series analysis is reviewed briefly and it is pointed out that the hypothesis testing procedure is not adequately defined as the procedure for ...

[Cited by 10158](#) - [Related articles](#) - [All 8 versions](#)

[MrBayes 3: Bayesian phylogenetic inference under mixed **models**](#) - ► [oxfordjournals.org](#) [PDF]

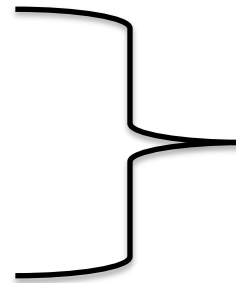
F Ronquist, JP Huelsenbeck - *Bioinformatics*, 2003 - Oxford Univ Press

... invoked constraint on **model** complexity is the assumption of data homogeneity. ... For instance, a change in a codon **model** is counted as one change per three sites. ...

[Cited by 3802](#) - [Related articles](#) - [BL Direct](#) - [All 20 versions](#)

Non-textual ranking in DL

- Link analysis (PageRank, HITS)
- Relevance feedback (user feedback)
- Popularity (documents accessed)



are problematic
in DL

BUT we have:

- High quality metadata
- Controlled vocabularies
- Maintained (curated) collections

Project IRM

Value Added Services for IR Systems

Major problem areas of scholarly IR systems (Krause 2007):

1. search term vagueness
2. information overload by large result sets

IRM services → structural attributes of the science system :

- (1) Search Term Recommender: more appropriate terms from controlled vocabulary (co-word analysis)
- **(2a) Bradfordizing: re-ranking by core journals (bibliometrics)**
- **(2b) Author Centrality: re-ranking by centrality in co-authorship networks (network analysis)**

Search Term Recommender (Petras 2006)

Term:

Total hits: 35817

[<< previous 10 documents](#)

11. Zeghal, Malika : *Political Islam: Essays from Middle East Report* (1998)
12. Halliday, Fred : *Islam and the myth of confrontation : religion and politics in the Middle East* (1996)
13. Jung, Dietrich : *State and Islam in the Middle East* (2002)
14. Tripp, Charles : *Islam and the State in the Middle East* (1995)
15. Zeghal, Malika : *Political Islam and the United States. A Study of U.S. Policy towards Islamist Movements in the Middle East* (2002)
16. Sedova, Tatiana : *The History of Political Thought. Vol. I: The Ancient Middle East, Antiquity, China, India, Islam; Vol. II: From the Middle Ages up to the Contemporary Period* (2007)
17. Boroujerdi, Mehrzad : *Rethinking Middle East Politics* (1996)
18. Lewis, Bernard : *The Middle East and the West* (1964)
19. Assar, Khairallah : *Islamic Activism: Its Genesis and Problems in the Middle East* (1998)
20. Vawda, Shahid : *Recognizing Islam: Religion and Society in the Modern Middle East* (1996)

[next 10 documents >>](#)

Search Term Service: recommending strongly associated terms from controlled vocabulary

[North Africa](#) [Middle East](#) [Religious Fundamentalism](#) [Church State Relationship](#) [Middle Class](#) [East and West](#) [Religion Politics Relationship](#) [Islam](#) [Eastern Europe](#)

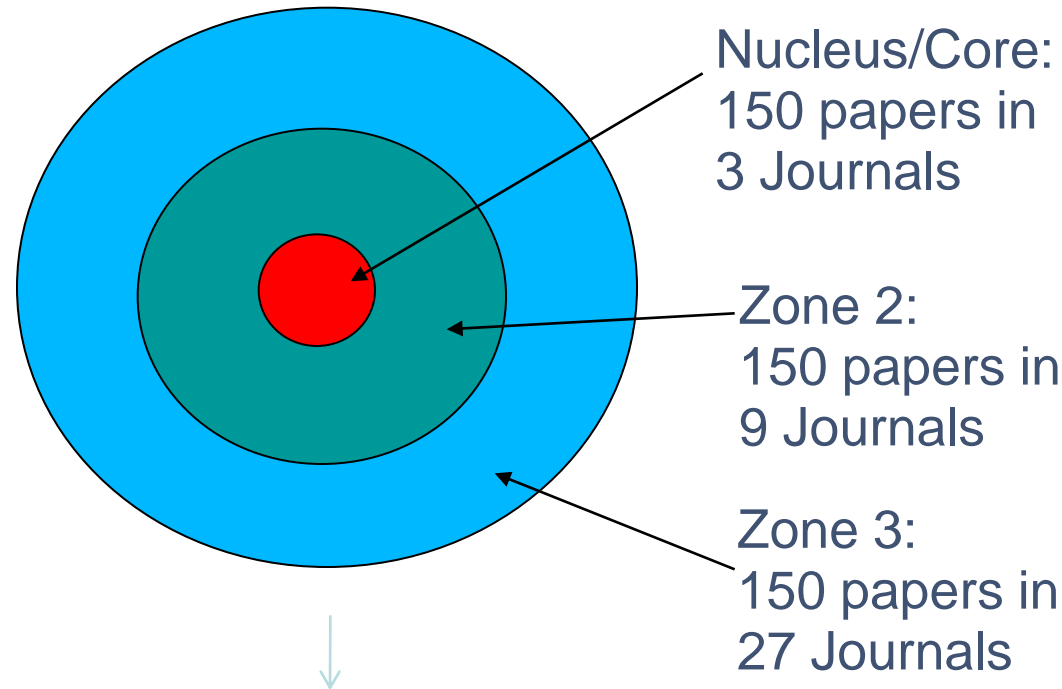
- [Identity Politics](#) [0.42082307]
- [Global Local Relationship](#) [0.099800274]
- [Family Law](#) [0.09460669]
- [Islamic Law](#) [0.80168325]
- [North Africa](#) [0.9664904]
- [Middle Eastern Cultural Groups](#) [0.3781718]
- [Arab Countries](#) [0.4309877]
- [New Middle Class](#) [0.2219114]
- [Geopolitics](#) [0.7974555]
- [Far East](#) [0.5375288]
- [Middle Range Theories](#) [0.84455264]
- [Middle East](#) [1.0]

Bradfordizing (White 1981, Mayr 2009)

Bradford Law of Scattering (Bradford 1948): idealized example for 450 articles

| Journal | No. of papers |
|---|---------------|
| Scientometrics | 1413 |
| Journal of the American Society for Information Science | 218 |
| Nauchno Tekhnicheskaya Informatsiya | 110 |
| Revista Espanola de Documentacion Cientifica | 96 |
| Journal of Information Science | 87 |
| Information Processing and Management | 79 |
| Journal of Documentation | 75 |
| Annals of Library Science and Documentation | 66 |

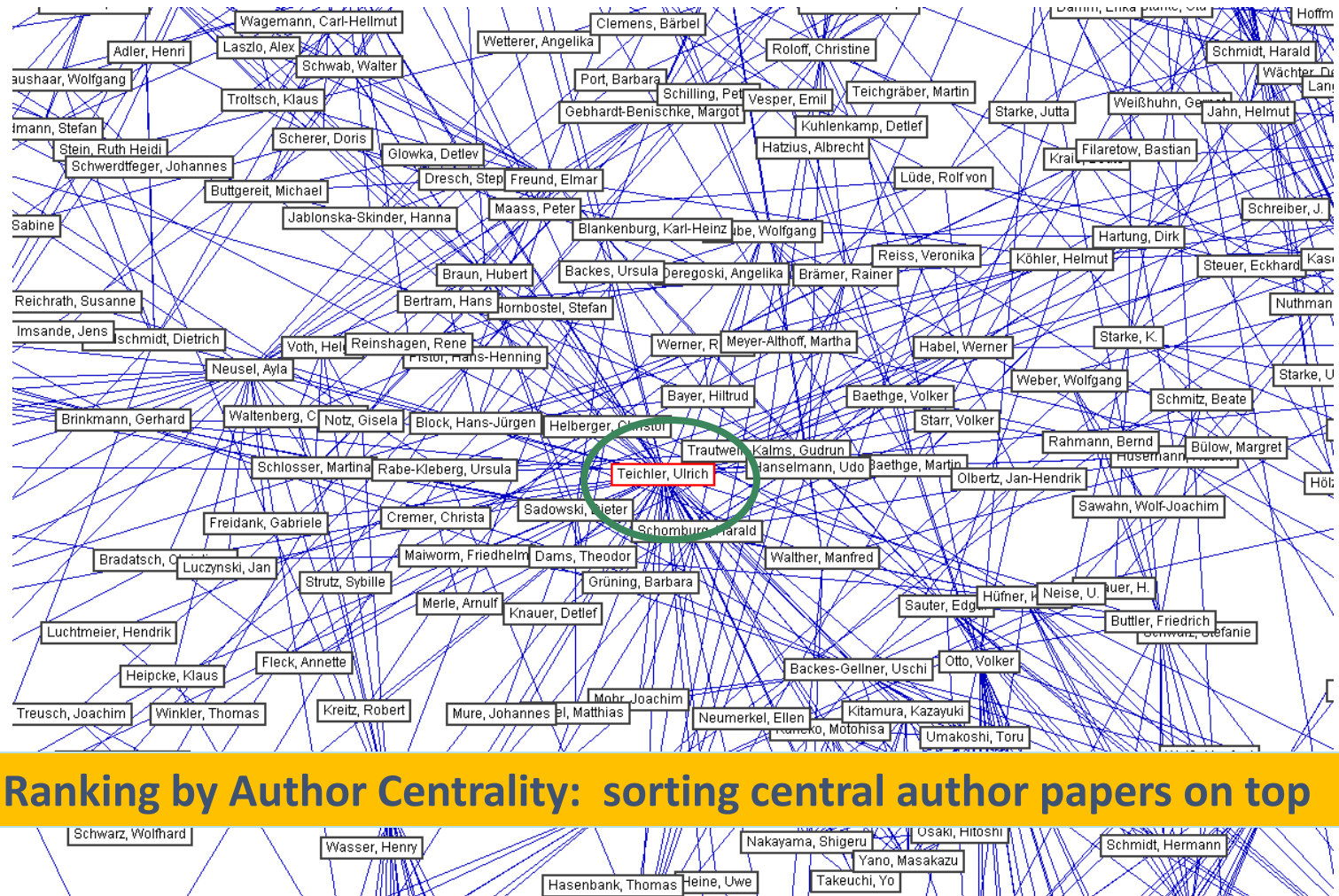
bradfordized list of journals in informetrics



applied to monographs: publisher as sorting criterion

Ranking by Bradfordizing: sorting the core journal papers / core books on top

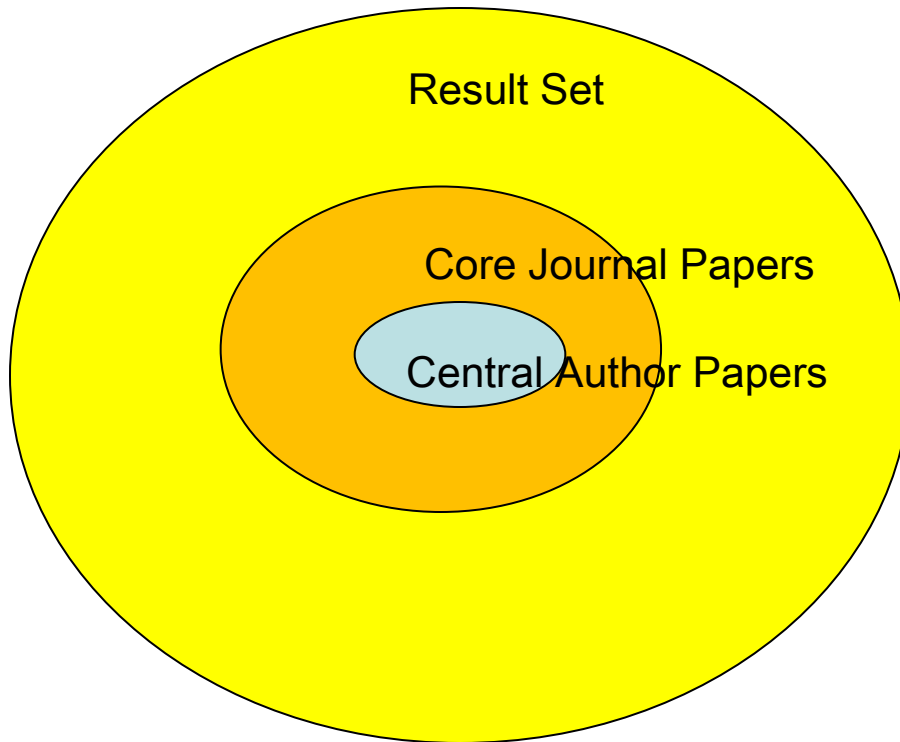
Author Centrality (Mutschke 2001, 2004)



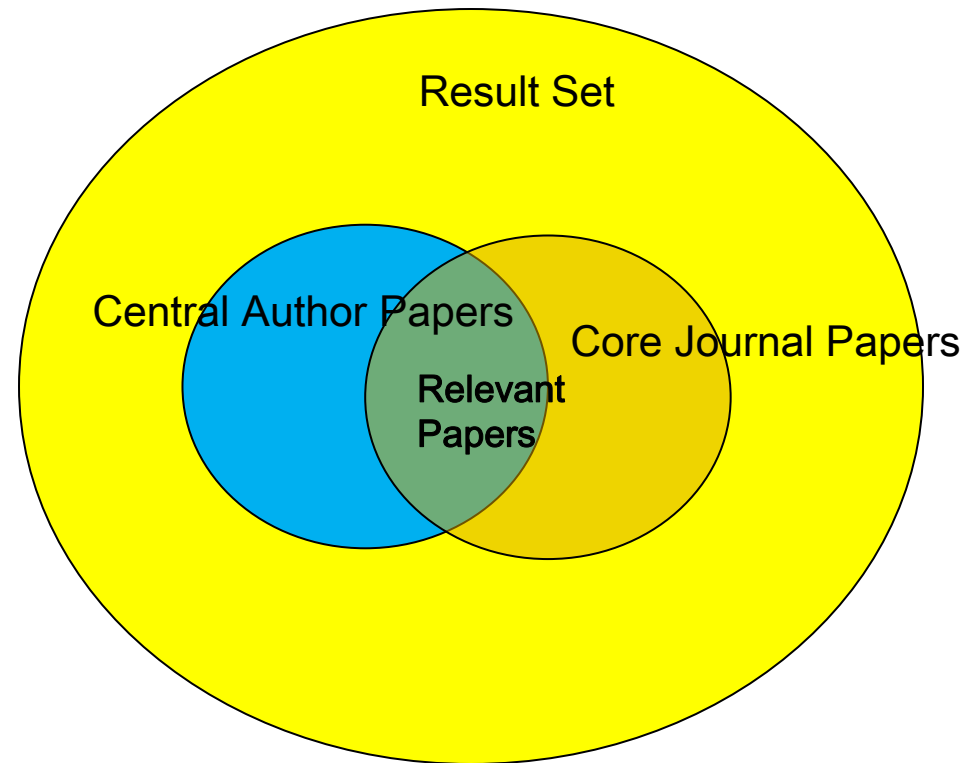
Ranking by Author Centrality: sorting central author papers on top

Scenarios for combined ranking services

iterative use :



simultaneous use:



Combination Matrix

| Combination | Author Centrality | Bradfordizing | STR |
|--------------------|--------------------------|----------------------|------------|
| 0 | - | - | - |
| 1 | 1 | - | - |
| 2 | - | 1 | - |
| 3 | - | - | 1 |
| 4 | 1 | 2 | - |
| 5 | 1 | 1 | - |
| 6 | 2 | 1 | - |
| 7 | 2 | - | 1 |
| 8 | - | 2 | 1 |
| 9 | 2 | 3 | 1 |
| 10 | 3 | 2 | 1 |
| 11 | 2 | 2 | 1 |

(number = order; same number in a row = simultaneous use)

Main Research Issue:

Contribution to retrieval quality and usability

- Precision:
 - Do central authors (core journals) provide **more relevant** hits?
 - Do highly associated cowords have any **positive effects**?
- Value-adding effects:
 - Do central authors (core journals) provide **OTHER** relevant hits?
 - Do cword-relationships provide OTHER relevant search terms?
- Mashup effects:
 - Do **combinations of the services** enhance the effects?

Evaluation Design

- precision in existing evaluation data:
 - Clef 2003-2007: 125 topics; 65,297 SOLIS documents
 - KoMoHe 2007: 39 topics; 31,155 SOLIS documents
- plausibility tests:
 - author centrality / journal coreness ↔ precision
 - Bradfordizing ↔ author centrality
- precision tests with users (Online-Assessment-Tool)
- usability tests with users (acceptance)

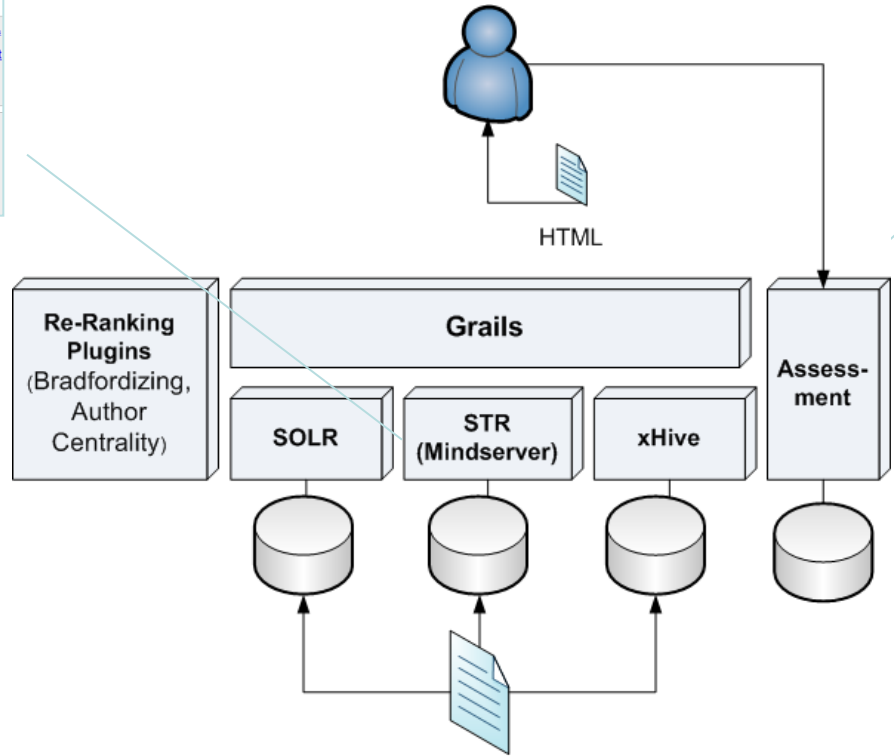
Prototype Architecture

Turn: Politics and Islam in the Middle East

Total hits: 35817

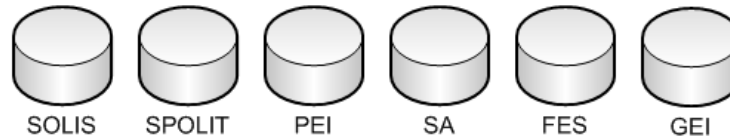
North Africa Middle East Relations
Fundamentalism Church State
Relationship Middle Class East
and West Religion Politics
Relationship Islam Eastern
Europe

- 11. Zoghbi-Ashkan, Political Islam: Essays from Middle East Report (1998)
- 12. Pridemore Fred, Islam and the myth of fundamentalism: religion and politics in the Middle East (1998)
- 13. Long, Charles, State and Islam in the Middle East (2002)
- 14. Trip, Charles, Islam and the State in the Middle East (1995)
- 15. Zoghbi-Ashkan, Political Islam and the United States: A Study of U.S. Policy towards Islamist Movements in the Middle East (2002)
- 16. Sadoun, Tahar, The History of Political Thought: Vol. 7: The Ancient Middle East, Antiquity, China, India, Islam, Vol. 8: From the Middle Ages up to the Contemporary Period (2007)
- 17. Brinkmann, Margarete, Rebuilding Middle East Politics (1999)
- 18. Lewis, Bernard, The Middle East and the West (1994)
- 19. Akbar, Chagdar, Islamic Activism: Its Causes and Problems in the Middle East (1999)
- 20. Vawda, Shafiq, Recognizing Islam: Religion and Society in the Modern Middle East (1998)



Screenshot of a search results page showing a list of documents with columns for AUTHOR, DATE, and PUBLICATION YEAR. The first entry is 'Forschungsbildung des Kontextes' by 'Gendy, Peter' published in '2007'.

2,235,769 documents from



Motivation: non-textual approaches in DL

- Larger document sets for subject specific searches need to be concentrated again (compensation, structuring)
- Exploring alternative ranking approaches which can provide insights in document spaces and enhance retrieval
- Plausibility that the nucleus of a literature or central authors provide an utility for users searching large document spaces

Bradfordizing

Basis: Bradford Law of Scattering

Approach: Usage of the **document distributions (scattering)** in scientific journal and monograph publications.

Core journals on research topics -> bibliometric approach

- Identification of „core journals“ and core publishers
- ISSN and ISBN as identifiers

Author Centrality

Basis: Graph theory, network analysis

Approach: Usage of the interaction (communication) pattern -> coauthorship relations in a research community

- Identification of „experts“
- Identification of networked, „central“ persons
- Different centrality measures

Results

Results: Bradfordizing

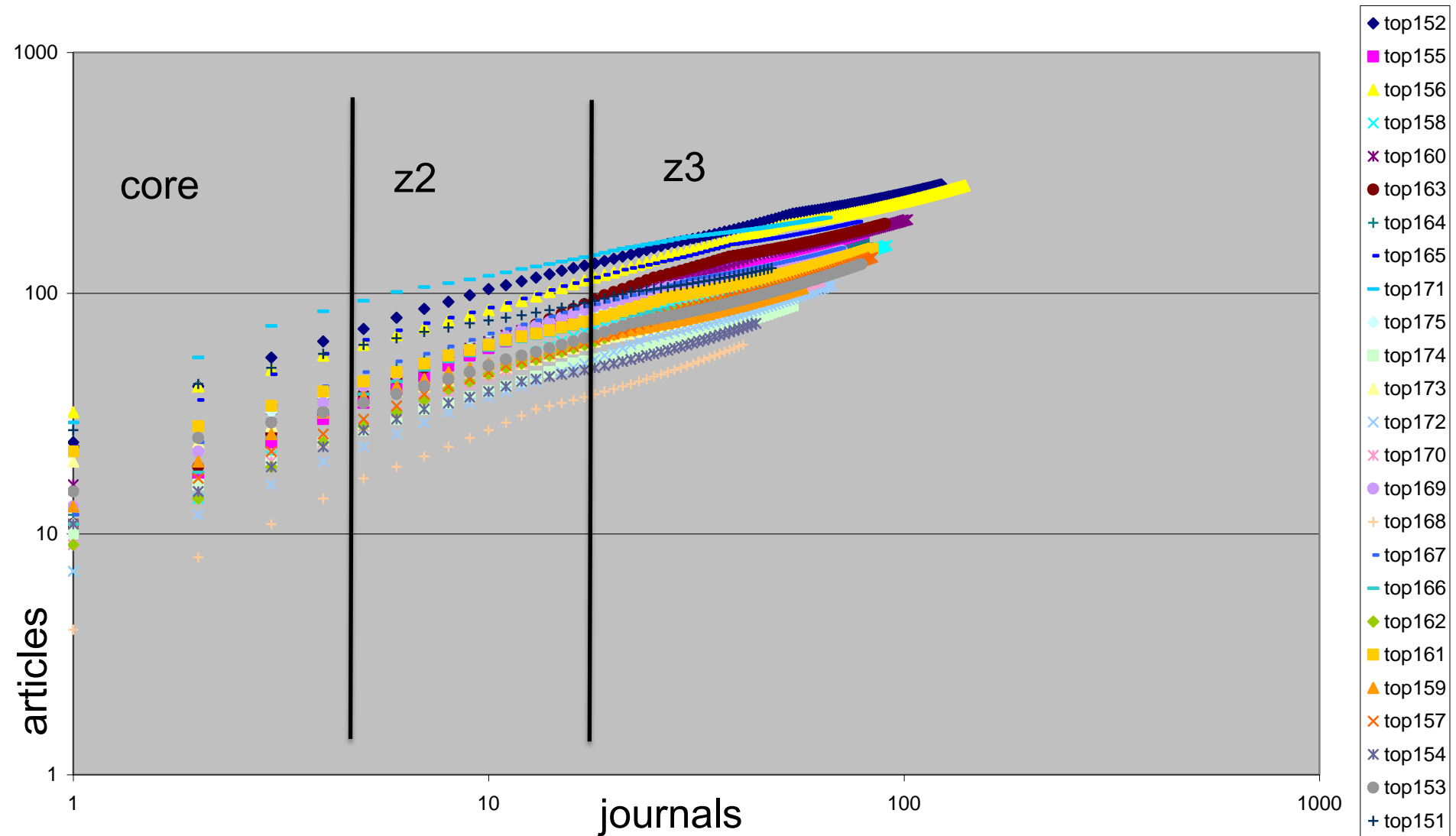
Bradford distributions appear in all subject domains and also for queries in databases. It follows that Bradfordizing can be used for re-sorting results, generally for topic specific queries in bibliographic databases.

| topic | core | core-j | z2 | z2-j | z3 | z3-j |
|-------|------|--------|------|------|----|------|
| 1 | 45 | 3 | 46 | 11 | 52 | 42 |
| 2 | 85 | 6 | 88 | 20 | 87 | 63 |
| 3 | 72 | 9 | 66 | 19 | 72 | 55 |
| 4 | 99 | 6 | 97 | 15 | 92 | 61 |
| 5 | 66 | 2 | 71 | 14 | 65 | 50 |
| | | | | | | |
| | 73,4 | 5,2 | 73,6 | 15,8 | 74 | 54,2 |

Example:
Articles and journals in the three zones (core, z2, z3) for 5 topics

SOLIS database (German literature)

CLEF topics 2006



Results: Bradfordizing

- Results from qualitative interviews with information professionals
- 1. Spontaneous naming of core journal can be difficult
 - no naming of core journals for 50% of the topics
 - high plausibility of the bradfordized journals
- 2. Majority attest a positive relevance effect for core journals
- Highest value-added can be expected for novice researchers, students in a scientific field
- Perhaps the zone 3 (periphery, long tail) is most valuable for seniors in a field

Results: Bradfordizing

| CLEF article | Verbesserung core zu Z3 in % | Verbesserung core zu Z2 in % | Verbesserung Z2 zu Z3 in % | Verbesserung core zu base-line in % |
|--------------|------------------------------|------------------------------|----------------------------|-------------------------------------|
| 2003 | 86,56 (*) | 34,57 (*) | 38,63 (*) | 32,65 (*) |
| 2004 | 69,23 (*) | 22,45 | 38,20 | 26,25 (*) |
| 2005 | 78,03 (*) | 29,05 (*) | 37,95 (*) | 29,52 (*) |
| 2006 | 17,63 | 7,66 | 9,27 | 8,46 |
| 2007 | 28,18 (*) | 8,31 | 18,35 | 11,77 |
| | 55,93 (*) | 20,41 (*) | 28,48 (*) | 21,73 (*) |

Vergleich der durchschnittl. Precision zwischen den Zonen ergibt:

- Core relevanter als Zone 2 und Zone 3
- Zone 2 relevanter als Zone 3
- Meist signifikante Verbesserungen (t-Test, Wilcoxon)

• niedrigere Verbesserungen bei KoMoHe

• kontinuierliche Verschiebung der Relevanz

→ relevance related distributions

| KoMoHe article | Verbesserung core zu Z3 in % | Verbesserung core zu Z2 in % | Verbesserung Z2 zu Z3 in % | Verbesserung core zu base-line in % |
|----------------|------------------------------|------------------------------|----------------------------|-------------------------------------|
| Test1 | 18,82 | 11,75 | 6,32 | 9,84 |
| Test2 | 11,58 | 6,16 | 5,11 | 6,12 |
| Test3 | 19,32 (*) | 8,67 (*) | 9,80 (*) | 9,00 (*) |
| | 16,57 (*) | 8,86 | 7,08 (*) | 8,32 (*) |

* Significant based on the Wilcoxon signed-rank test and the paired t-Test

Results: Author centrality

Qualitative
Evaluationen

➤ Nutzer-evaluierte Anwendungen (Jugendinstitut 1997, ASI-Tagung 2003)

Retrievaltest

| Query | Ergebnismenge sortiert nach | | | Information. Mehrwert |
|------------------------------------|--------------------------------|-------------|-------------|--------------------------|
| | <i>PY</i> | <i>IDF</i> | <i>ACL</i> | <i>ACL</i> |
| Jugend – Gewalt | 0.25 | 0.60 | 0.55 | 92 |
| Rechtsextremismus – Ostdeutschland | 0.35 | 0.45 | 0.60 | 122 |
| Frau – Personalpolitik | 0.35 | 0.60 | 0.65 | 100 |
| Widerstand – Drittes Reich | 0.40 | 0.65 | 0.95 | 138 |
| Zwangsarbeit – II. Weltkrieg | 0.55 | 0.65 | 0.70 | 92 |
| Eliten – BRD | 0.40 | 0.70 | 0.85 | 107 |
| Armut – Stadt | 0.30 | 0.35 | 0.55 | 157 |
| Arbeiterbewegung – 19./20. Jahrh. | 0.55 | 0.55 | 0.90 | 164 |
| Wertewandel – Jugend | 0.40 | 0.50 | 0.30 | 50 |
| Terrorismus - Demokratie | 0.20 | 0.35 | 0.60 | 129 |
| Durchschnitt | 0.38 | 0.54 | 0.67 | 115 |

PY = Erscheinungsjahr, IDF = Inverse Dokumenthäufigkeit, ACL = Autor-Closeness

Ergebnisse
(Hypothesen)

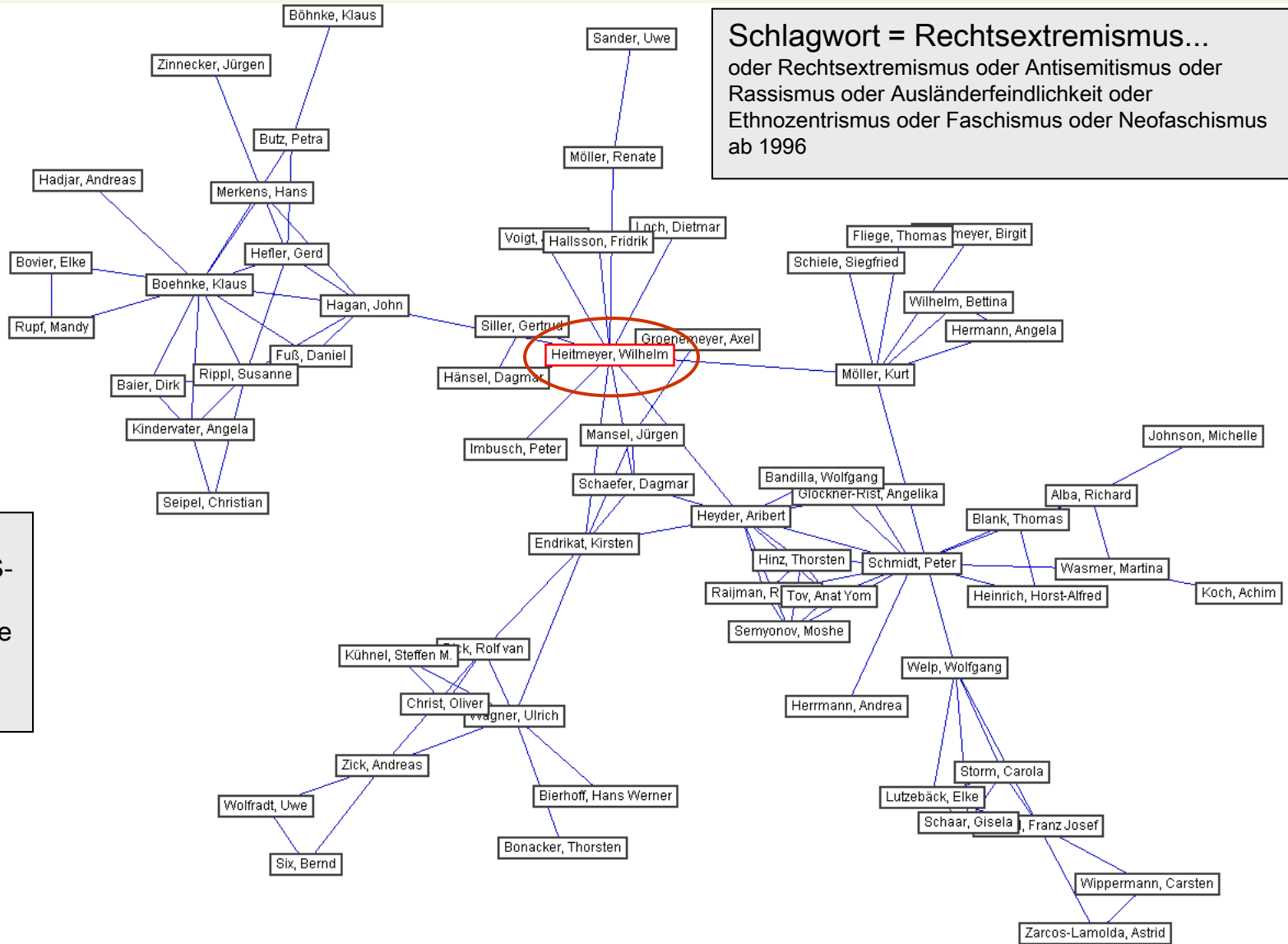
Rankings nach Autorenzentralität:

- ◆ höhere Precision als traditionelle Rankings [?]
- ◆ hoher informationeller Mehrwert (andere Dokumente) [?]

Evaluation of Author Centrality on CLEF Data

- moderate positive relationship between rate of networking and precision
- precision of TF-IDF rankings (0.60) significantly higher than author centrality based rankings (0.31) – BUT:
- very little overlap of documents on top of the ranking lists: 90% of relevant hits provided by author centrality did not appear on top of TF-IDF rankings
→ added precision of 28%

- author centrality seems to favor OTHER relevant documents than traditional rankings
- value-adding effect:
other view to the information space



Schlagwort = Rechtsextremismus...
 oder Rechtsextremismus oder Antisemitismus oder
 Rassismus oder Ausländerfeindlichkeit oder
 Ethnozentrismus oder Faschismus oder Neofaschismus
 ab 1996

2833
 SOLIS/FORIS-
 Nachweise
 1851 vernetzte
 Akteure
 (65 Giant)

Conclusion

- Methods are non-textual
 - Scientometric/bibliometric approach
 - Network analysis
- The methods can successfully be applied (holds true in different domains, databases and document types)
- A value-added can be demonstrated (significant precision improvement)
- Users are intuitively and empirically satisfied
- High plausibility of the methods

Demo

The IRM Show Case - Powered by Grails

Term:

Bradfordizing Automatic query expansion with STR Debug

Total hits: 1125

1. Luhmann, Niklas (1988): *Organisation* in **Mikropolitik Rationalität, Macht und Spiele in Organisationen** (3-531-12018-2) [toggle abstract](#)
2. (1997): *Art & Language & Luhmann* in **Passagen Kunst** (3-85165-272-X) [toggle abstract](#)
3. Luhmann, Niklas (1997): *Weltkunst* in **Soziologie der Kunst Produzenten, Vermittler und Rezipienten** (3-531-13009-9) [toggle abstract](#)
4. Luhmann, Niklas (1978): *Komplexität* in **Schriftenreihe des Agrarwirtschaftlichen Institutes des Bundesministeriums für Land- und Forstwirtschaft Bd. 35 Handlungssysteme** (3-531-21404-7) [toggle abstract](#)
5. Luhmann, Niklas (2008): *Rechtssoziologie* (978-3-531-15872-3) [toggle abstract](#)
6. Luhmann, Niklas (1990): *Sthenographie* in **Materialität der Zeichen. Reihe A Bd. 3 Beobachter Konvergenz der Erkenntnistheorien?** (3-7705-2526-4) [toggle abstract](#)
7. Gensicke, Dietmar (2008): *Luhmann* in **Grundwissen Philosophie** (978-3-15-020321-7) [toggle abstract](#)
8. Luhmann, Niklas (1975): *Macht*
9. Luhmann, Niklas (1968): *Gesellschaft* in **Sowjetsystem und demokratische Gesellschaft eine vergleichende Enzyklopädie. Bd. 2: Diplomatie bis Identität**
10. Luhmann, Niklas (1976): *Komplexität* in **Historisches Wörterbuch der Philosophie Bd. 4**

[next 10 documents >>](#)

[Autopoiesis](#) [Begriffsbildung](#)

[Erkenntnistheorie](#)

[Exklusion](#) [Feldtheorie](#) [Funktionalismus](#)
[Gedächtnis](#)

[Gesellschaftstheorie](#)

[Habermas, J.](#) [Handlungstheorie](#)

[Individualität](#) [Individuum](#) [Interaktion](#)

[Kommunikation](#)

[Kommunikationsmedien](#)

[Komplexität](#) [Konstruktivismus](#)

[Kontingenz](#) [Kritik](#)

[Luhmann, N.](#) [Philosophie](#)

[Rational-Choice-Theorie](#) [Selbstreferenz](#)

[Selbststeuerung](#) [Sinn](#)

[Soziologie](#) [System](#)

[Systemtheorie](#) [Theologie](#)

Demo

The IRM Show Case - Powered by Grails

Term:

Bradfordizing Automatic query expansion with STR Debug

Total hits: 520

1. Luhmann, Niklas (2008): *Beyond Barbarism* in **Soziale Systeme** 2008, 14, 1, 38-46. (0948-423X) [toggle abstract](#)
2. Luhmann, Niklas (1996): *Die Sinnform Religion* in **Soziale Systeme Zeitschrift für soziologische Theorie Jg. 2 H. 1** (0948-423X) [toggle abstract](#)
3. Luhmann, Niklas (1996): *Zeit und Gedächtnis* in **Soziale Systeme Zeitschrift für soziologische Theorie Jg. 2 H. 2** (0948-423X) [toggle abstract](#)
4. Luhmann, Niklas (1995): *Kausalität im Süden* in **Soziale Systeme Zeitschrift für soziologische Theorie Jg. 1 H. 1** (0948-423X) [toggle abstract](#)
5. Kurtz, Thomas (2003): *Niklas Luhmann and Pedagogy* in **Soziale Systeme** 2003, 9, 1, 183-193. (0948-423X) [toggle abstract](#)
6. Esser, Hartmut, Luhmann, Niklas (1996): *Individualismus und Systemdenken in der Soziologie* in **Soziale Systeme Zeitschrift für soziologische Theorie Jg. 2 H. 1** (0948-423X) [toggle abstract](#)
7. Rasch, William (1997): *The limit of modernity : Luhmann and Lyotard on exclusion* in **Soziale Systeme Zeitschrift für soziologische Theorie Jg. 3 H. 2** (0948-423X) [toggle abstract](#)
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Demo

Link zum Prototyp

<http://multiweb.gesis.org/GrailsSTR/testSTR/index>

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