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Intra- and interdisciplinary cross-concordances for information retrieval

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8th NKOS Workshop at the 13th ECDL Conference
Corfu, Greece, 01. October 2009

Leibniz Gemeinschaft

KoMoHe Project (2004-2007)

KoMoHe (Competence Center Modeling and Treatment of Semantic Heterogeneity)

Goals:

- Models for searching heterogeneous collections
- Development, organization & management of cross-walks between controlled vocabularies
- IR evaluation of the mappings (effectiveness of intellectual mapping)

Relations

- Equivalence
- Narrower Term
- Broader Term
- Related Term
- Null: no mapping

KOS 1	Relation	KOS 2
Library	=	Bibliothéque
Library	>	Special library
Thesaurus	<	KOS
Hacker	^	Computers + Security
Virus	0	

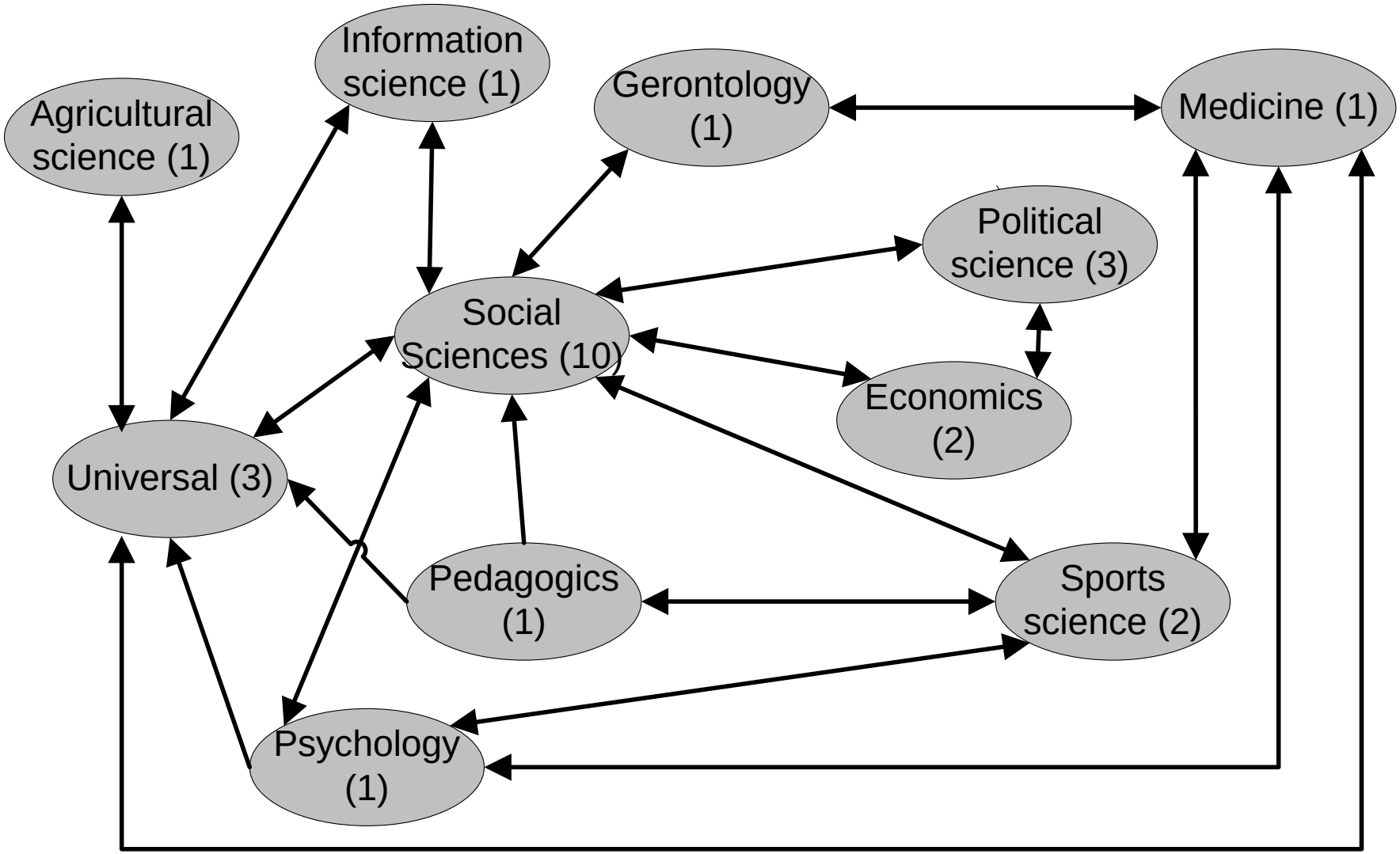
manually created, directed relations between controlled terms of two knowledge organization systems (KOS)

Cross-concordances

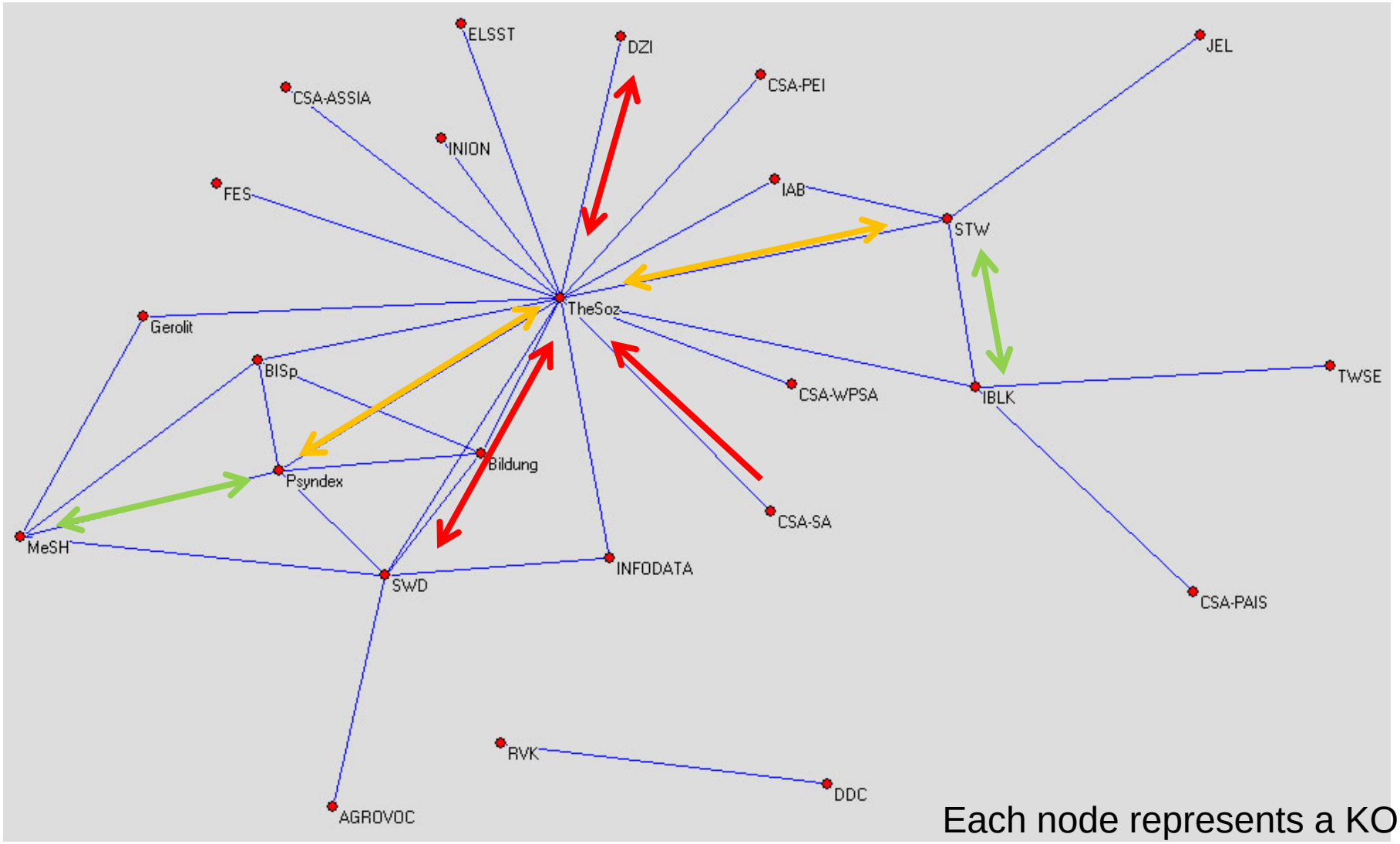
- 25 Vocabularies in 64 cross-concordances
  - Thesauri (16)
  - Descriptor lists (4)
  - Classifications (3)
  - Subject heading lists (2)

- 380,000 mapped terms
- 465,000 relations
- 205,000 equivalence relations
- 13 German, 8 English, 1 Russian, 3 multilingual

Disciplines



Net of Cross-concordances



Each node represents a KOS

Objectives

- Translate search terms into other terminologies
- Increase diversity of documents from different databases
- Improve search experience without effort for searcher
- Test the effect for IR in different disciplines (social science and others)

Main questions

- What is examined?
  - the quality of the mappings
  - or the quality of the associated search
- Can we enable distributed search with the subject access tools over several information systems?
  - In one discipline
  - Between at least two disciplines
- Is the impact of terminology mapping on recall and precision measurable?
- The mappings are helpful to whom?

Information Retrieval Test

Question: How effective are the mappings in an actual search? Does the application of term mappings improve search over a non-transformed subject (i.e. controlled vocabulary) search?

Information Retrieval Tests

- Thesauri mappings only
- Only equivalence relations
- Real queries (~6 per tested cross-concordance)
- Databases: 80,000 – 16 mio. documents
- Test 1 (CT → TT): 13 Cross-concordances
- Test 2 (FT → FT+TT): 8 Cross-concordances

Vocabulary	Discipline	Database	Documents in DB
TheSoz – Thesaurus Sozialwissenschaften (GESIS-IZ)	Social Sciences	SOLIS	345,086
DZI – Thesaurus des Deutschen Instituts für soziale Fragen	Social Sciences	SoLit	151,925
SWD – Schlagwortnormdatei	General (Social Sciences Excerpt)	USB Köln Sowi OPAC	72,729
CSA – Thesaurus of Sociological Indexing Terms (Cambridge Scientific Abstracts)	Social Sciences	CSA Sociological Abstracts	294,875
Psyndex - Psyndex Terms	Psychology	Psyndex (ZPID)	Ca. 200,000
STW – Standard Thesaurus Wirtschaft	Economics	Econis (ZBW Kiel)	Ca. 3,000,000
IBLK - Thesaurus Internationale Beziehungen und Länderkunde (Euro-Thesaurus)	Political Science	World Affairs Online WAO (SWP Berlin)	643,420
Mesh – Medical Subject Headings	Medicine	Medline (Dimdi)	Ca. 16,800,000

Table 4. Vocabularies and databases in the KoMoHe IR test

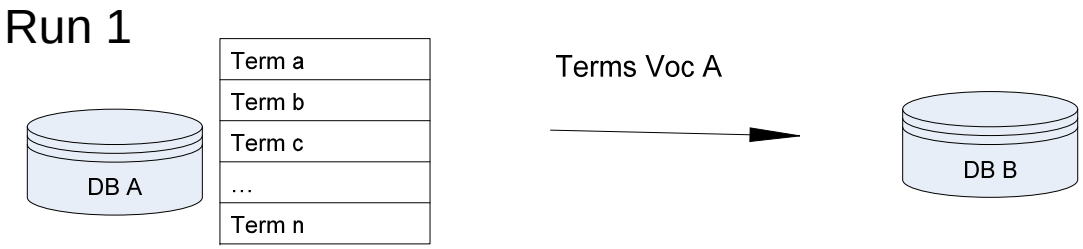
Mayr & Petras, 2008

Steps

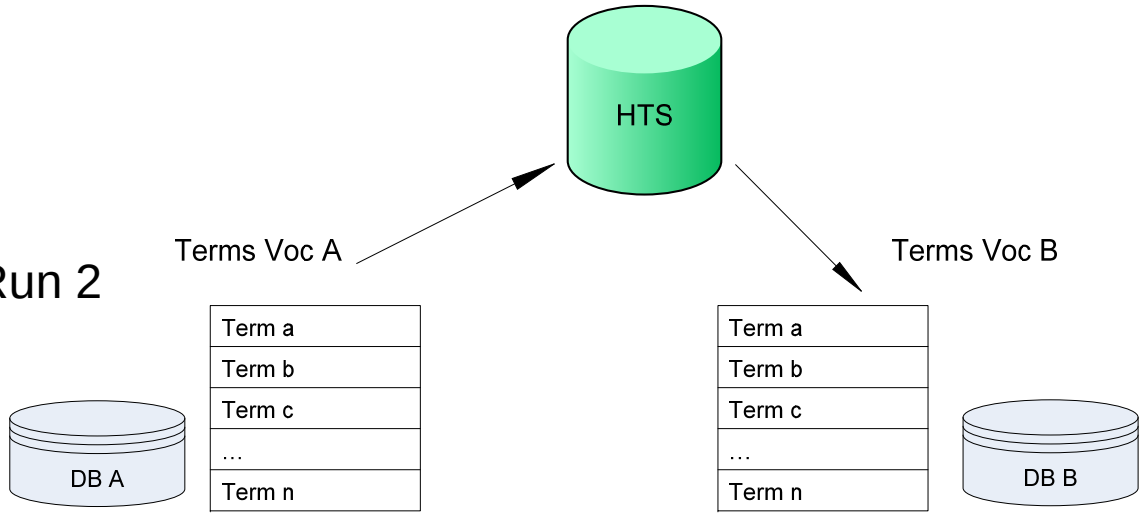
- Requesting recent research topics from our partners (social science and others)
- Intellectually translating the topics into controlled term searches in a KOS A
- Automatically translating the controlled terms via HTS into the controlled terms of a KOS B
- Retrieving documents from two runs
  1. Controlled term (CT) search (KOS A) in database B
  2. Translated term (TT) search (KOS B) in database B

Information Retrieval Test CT-TT

Scenario CT



Scenario TT



HTS (Heterogeneity Service) ~ Web service providing the mappings

Information Retrieval Tests

Test 1

Intradisciplinary:

Social sc. – Social sc.

TheSoz – DZI
DZI – TheSoz
TheSoz – SWD
SWD – TheSoz
CSA – TheSoz

- 5 concordances
- 3 databases
- 35 topics

Test 2

Interdisciplinary:

Social sc. – Psychology
Social sc. – Economics

TheSoz – Psyndex
Psyndex – TheSoz
TheSoz – STW
STW – TheSoz

- 4 concordances
- 3 databases
- 19 topics

Test 3

Interdisciplinary:

Int. Relations – Economics
Medical sc. – Psychology

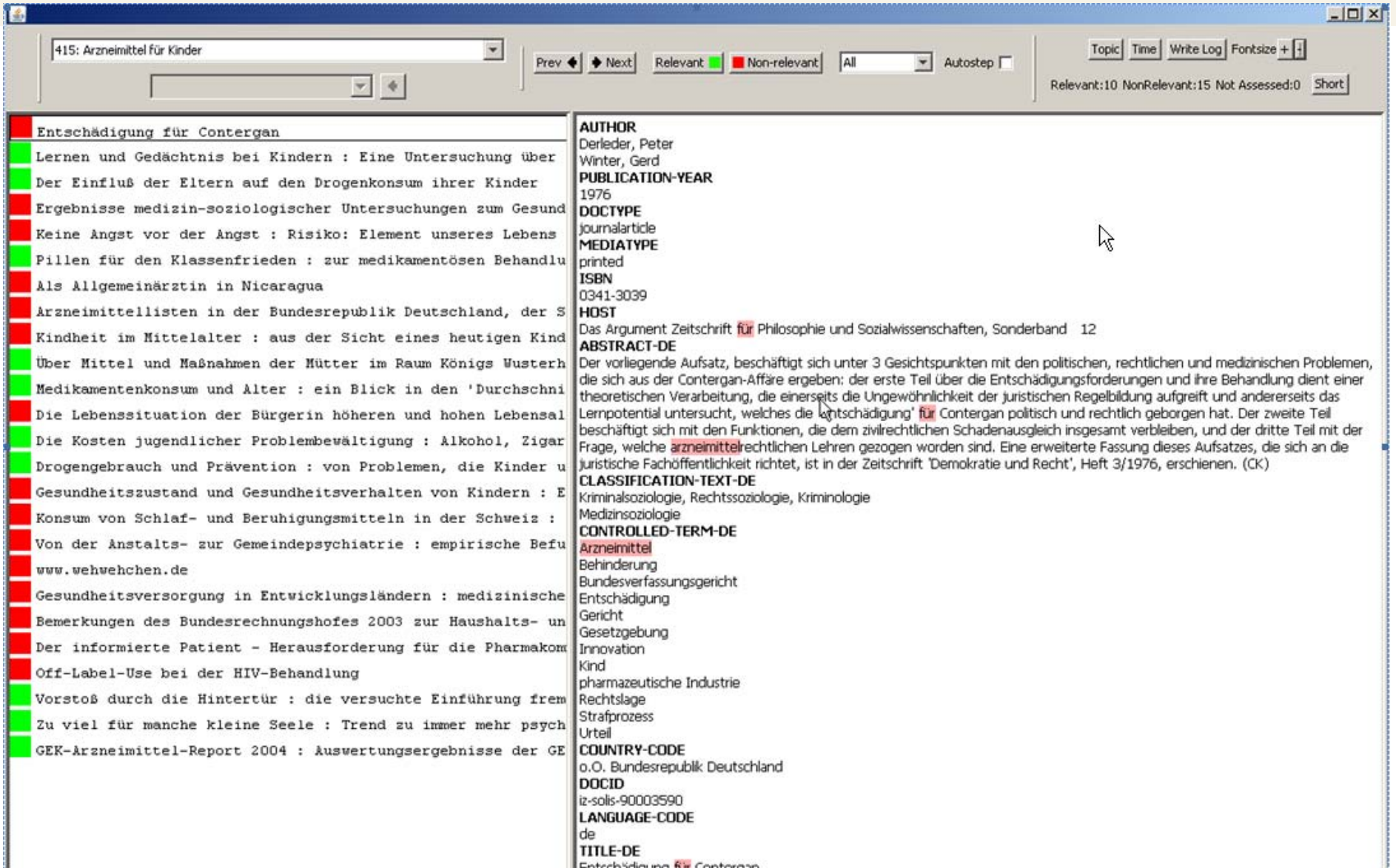
IBLK – STW
STW – IBLK
Mesh – Psyndex
Psyndex – Mesh

- 4 concordances
- 4 databases
- 28 topics

Methodology

- Downloading the documents for both runs (CT, TT), cutt-off: 1,000 docs
- Pooling both runs (CT, TT) for each topic
- Importing the documents into a assessment tool
- Relevance assessment of the documents by experts
- Analysis of the assessment data
  - Retrieved: average number of retrieved documents (across all search types)
  - Relevant: average number of relevant retrieved documents (across all search types)
  - Rel_ret: average number of relevant retrieved documents for a particular search type
  - Recall: proportion of relevant retrieved documents out of all relevant documents (averaged across all queries of one search type)
  - Precision: proportion of relevant retrieved documents out of all retrieved documents (averaged across all queries of one search type)

Assessment of the documents: by experts



Information Retrieval Tests - Results

- CT → TT (Improvements in %)

	Recall = Hitrate	Precision = Accuracy
Intradisciplinary	+39%	+34%
Interdisciplinary	+136%	+68%

- FT → FT+TT (Improvements in %)

	Recall = Hitrate	Precision = Accuracy
Intradisciplinary	+20%	-12%
Interdisciplinary	+24%	-24%

Detailled results can be found in Mayr & Petras, 2008

Discussion

- Overlap and more identical terms in intradisciplinary mappings
  - Mapping in one discipline is simpler: just one expert
  - Lesser effect on search
  - Automatic mapping may be more useful in intradisciplinary sets: mainly syntactic matching
- Language plays a major role
  - we had just one bilingual mapping in the test
- Restrictions of the study: no real users or interactions, only thesauri, KOS in German

Summary

Why are cross-concordances in one discipline less effective for IR?

- Amount of identical terms are significantly higher in one discipline (one language)
- No effective transformation possible for IR, if you have identical terms

Mapping projects should more often perform IR tests to measure the effect of their mappings.

Conclusion

- Cross-concordances improve subject search with controlled terms & free-text search: larger measurable effects on interdisciplinary mappings
- Only 24% relations utilized (equivalence)
- Potential:
  - Other relations
  - STR → CT translation
- More mappings which are not evaluated
- Mappings are used e.g. in portals like sowiport, vascoda, ireon, … and other projects

Next steps

- Visualization of the terminology network
- Combined evaluation with other value-added services (search term recommendation)
- Conversion to SKOS
- Evaluation of other disciplines
- Evaluation of indirect term transformation (term – switching term – end term)

Publications

Mayr, Philipp; Petras, Vivien (2008): Cross-concordances: terminology mapping and its effectiveness for information retrieval. In: 74th IFLA World Library and Information Congress. Québec, Canada- http://www.ifla.org/IV/ifla74/papers/129-Mayr_Petras-en.pdf

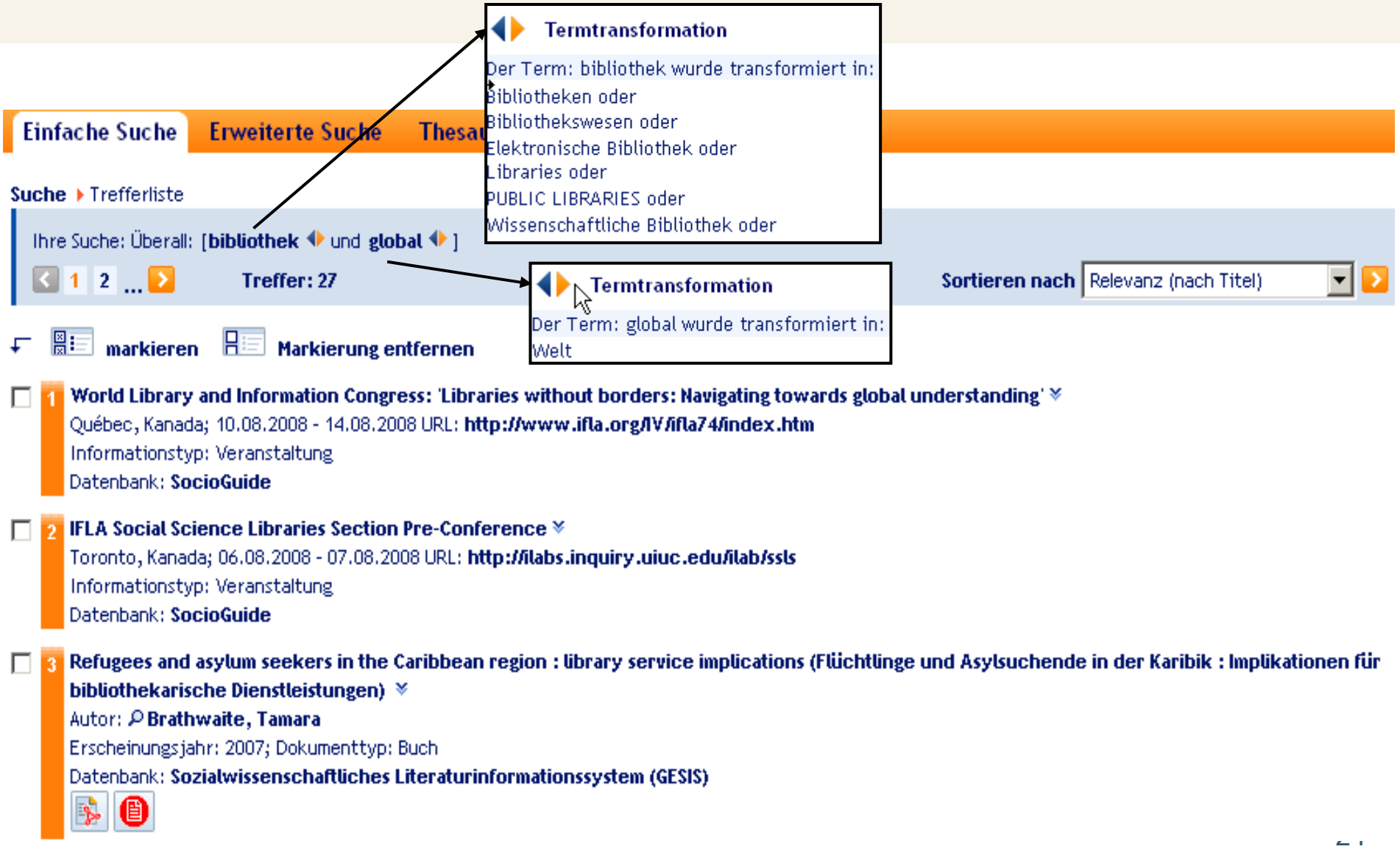
Mayr, Philipp; Mutschke, Peter; Petras, Vivien (2008): Reducing semantic complexity in distributed Digital Libraries: treatment of term vagueness and document re-ranking. In: Library Review. 57 (2008) 3. pp. 213-224. http://arxiv.org/abs/0712.2449

Indirect term transformations

10	**Thesoz - Gerolit -MESH**		
11	**Startterm**	**Switching Term**	**Endterm**
12	Allergie	Allergische Erkrankungen	Hypersensitivity
13	älterer Arbeitnehmer	Ältere Erwerbstätige	Middle Aged + Employment
14	Alterssoziologie	Soziologische Gerontologie	Sociology + Geriatrics
15	Anomie	Abweichendes Verhalten	Behavioral Symptoms
16	Arbeitnehmer	Erwerbstätige	Employment
17	Arbeitspsychologie	Arbeitswissenschaft	Human Engineering
18	Ausbildungsstand	Bildungsstand	Educational Status
19	Autonomie	Selbständigkeit	Personal Autonomy
20	Behindertenwerkstätte	Beschützende Werkstätte	Sheltered Workshops
21	Beratungsgremium	Beirat	Advisory Committees
22	Berufsmobilität	Berufliche Mobilität	Career Mobility
23	Berufstätigkeit	Erwerbstätigkeit	Employment
24	Beschäftigungstherapeut	Ergotherapeuten	Occupational Therapy/MA
25	Bildungsniveau	Bildungsstand	Educational Status
26	Bildungsprogramm	Bildungsplanung	Education + Public Policy
27	biographische Methode	Biographische Analyse	Biography
28	Eigenarbeit	Schattenwirtschaft	Economics
29	Einsparung	Sparmaßnahmen	Cost Savings
30	Einwanderung	Migration	Emigration and Immigration
31	Emotionalität	Emotionen	Emotions

Social sciences – gerontology – medicine

Sowiport Search



KoMoHe Project

http://www.gesis.org/en/research/information_technology/komohe.htm

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