

Concept mapping through a hub - coli-conc Pilot Study

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Outline

- **coli-conc /Mapping tool Cocoda**
- **coli-conc Mapping Database samples**
- **Concept Hub Approach**
- **Working Steps in applying Hub approach for a ample of mappings**
- **Concept Hub Examples**
- **Challenges and Lessons learned**
- **Conclusions**

coli-conc

coli-conc is a service of the **Library consortium GBV, Germany**. It offers **an integrated system for the collection, management and mapping of KOS**. It stores:

- metadata of the KOS
- content of individual KOS
- mappings between KOS

It provides

- free and uniform access to KOS and their mappings
- free software to import and export KOS and mapping data
- **A tool for creating and editing mappings** with computer assistance **cocoda**

coli-conc Mapping Database Samples

DDC	RVK
618.12 Krankheiten der Tuben	YM 4600 – YM 4699 Krankheiten der Adnexe:...

DDC	GND
618.12 Krankheiten der Tuben	Eileiterkrankheit
	Eileiterentzündung

RVK	GND
YM 4600 Krankheiten der Adnexe > Allgemeines	Adnexitis
	Eileiterentzündung
	Eileiter
	Gynäkologie

DDC	RVK
152 Sinnenswahrnehmung, Bewegung, Emotionen, physiologische Triebe	CP 2000 Wahrnehmung allgemein
	CP 2500 Wahrnehmung Speziell (z.B. Sehen, Hören)
	CP 3000 Motivation, Gefühl
	CP 3200 Gefühl

DDC	GND
152 Sinneswahrnehmung, Bewegung, Emotionen, physiologische Triebe	Bewegung
152.3 Bewegungen und motorische Funktionen	Bewegung

Psychophysik

RVK	GND
CP 2000 Wahrnehmung allgemein	Wahrnehmung
	Wahrnehmungspsychologie

Issues in the coli-conc mappings

Discrepancies in the

- Quality
- Precision
- Completeness
- Mappings are not typed (exact, broader, narrower, related)
- Mappings among similar concepts are not grouped

Mapping through a Concept Hub

This approach will solve the issues of the coli-conc mappings

We will

- explain the Concept Hub approach to mapping
- describe the process which we applied it to a sample of 50 groups of mappings
- show some examples of the results

Concept Hub Approach to Mapping

Each concept is expressed through a canonical representation

DDC: 386.8 Inland waterway > Ports = Traffic station \sqcap Inland water transport
GND: Binnenhafen = Traffic station \sqcap Inland water transport

The Hub

Traffic station \sqcap Inland water transport

DDC: 386.8
Inland waterway > Ports

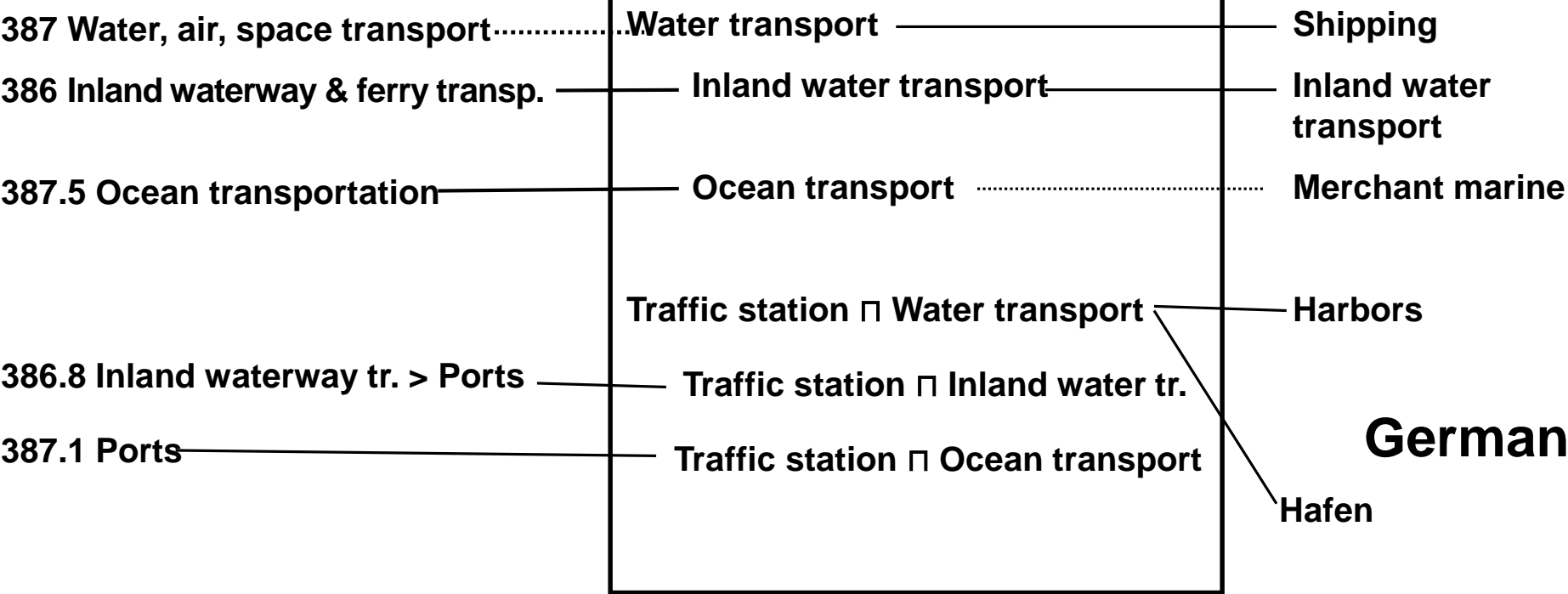
GND: Binnenhafen

Mapping through a Hub

Dewey

Hub

LCSH



German

Concept Hub Approach to Mapping

- Adding a new KOS to the mapping database requires only that each concept in the new KOS be expressed as a combination of elemental concepts.
- The new concepts will be linked to the appropriate combination of elemental concepts (if it exists) or a new combination is added to the hub.
- Every concept in the new KOS will then be mapped to corresponding concepts (if any) in all the KOS that are already in the database.

Our process

- 1 **Sample.** From the coli-conc mapping database we assembled a sample of 50 groups of bilateral mappings around a specific topic including concepts from **DDC**, **RVK**, and **GND**. Each group has an ID.
- 2 **Express all concepts** in the sample through a **combination of elemental concepts** (semantic factoring)
- 3 Analyze the relation between the mappings and the combination of elemental concepts

Express each concept through a combination of elemental concepts

Done for each scheme separately, but here listed in groups

RVK YM 4600 -YM 4699 Krankheiten der Adnexe	=	Disease \sqcap Adnexa Uteri
DDC 618.12 Krankheiten der Tuben	=	Disease \sqcap Fallopian tubes
GND Eileiterkrankheit	=	Disease \sqcap Fallopian tubes
GND Adnexitis	=	Inflammation \sqcap Adnexa Uteri
GND Eileiterentzündung	=	Inflammation \sqcap Fallopian tubes
DDC 340.1 Rechtsphilosophie und Rechtstheorie	=	(Philosophy OR Theory) \sqcap Law
RVK CC 7600 Rechtsphilosophie	=	Philosophy \sqcap Law
GND Rechtsphilosophie	=	Philosophy \sqcap Law

Analyze the relation between the mappings and the combination of elemental concepts

Concepts sorted by group ID

Do the combinations of elemental concepts agree with the mappings?

+	+	04.0	DDC	150.9	Psychologie > Geschichte, Biographische Behandlungen und Biografien (History OR biography) □ Subject discipline □ Psychology subject matter [
+n	+n	04.0	RVK	CM 2000	Geschichte der Psychologie History □ Subject discipline □ Psychology subject matter
-	-	04.0	GND		Historische Psychologie Subject discipline □ Psychology subject matter □ Human development □ Historical time

Note: Disciplines are expressed as *Subject discipline* □ *Topic*

Still looking for a good term that describes the subject matter of Psychology,

Analyze the relation between the mappings and the combination of elemental concepts

Sorted by combinations of elemental concepts.

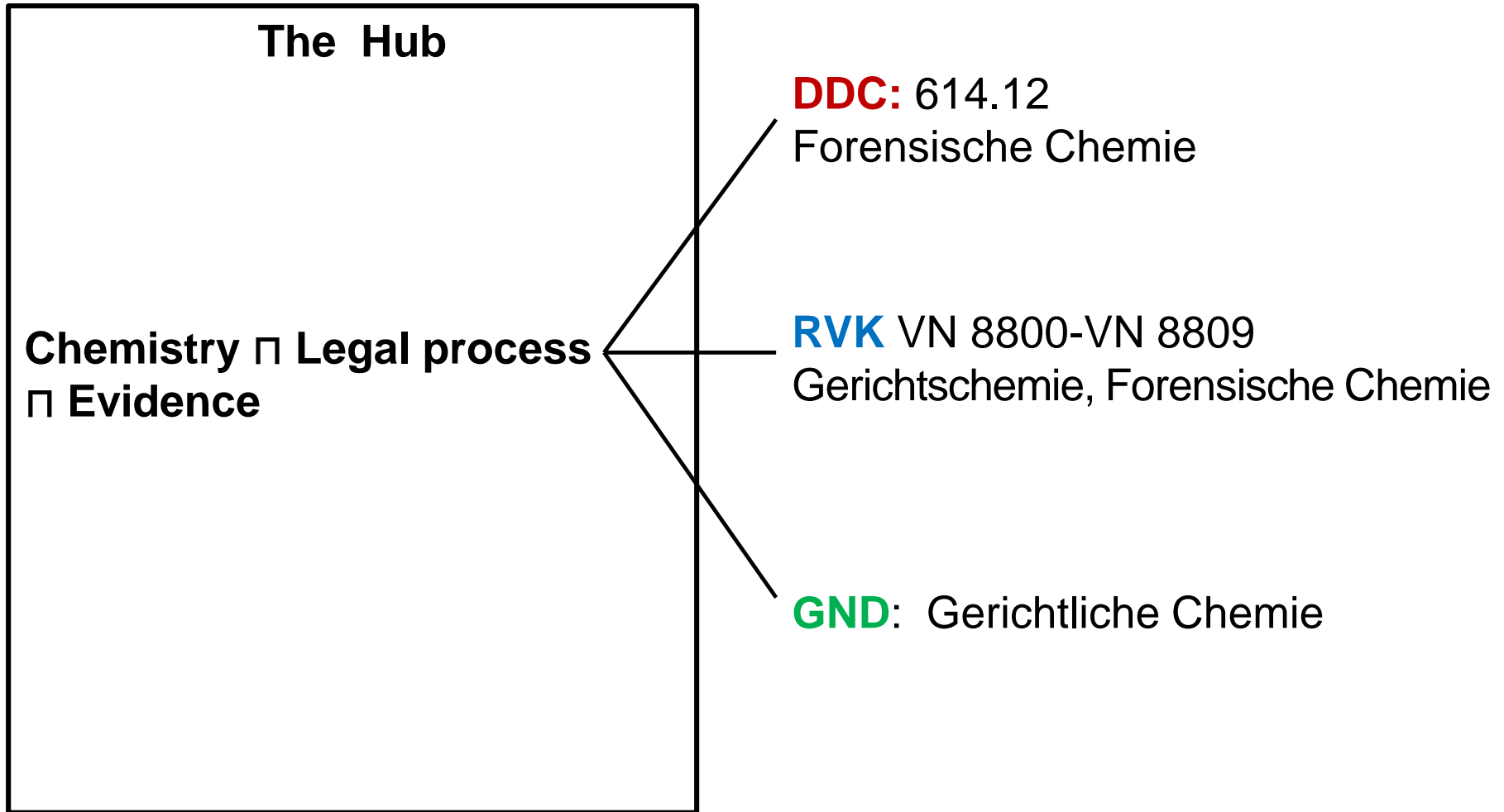
Does linking to combinations of elemental concepts give good mappings?

Under **Chemistry** \square **Legal process** \square **Evidence** the following are grouped

37	DDC	614.12	Forensische Chemie
37	RVK	VN 8800-VN 8809	Gerichtschemie, Forensische Chemie
37	GND		Gerichtliche Chemie

Mapping through Hub Examples

Hub Example 0

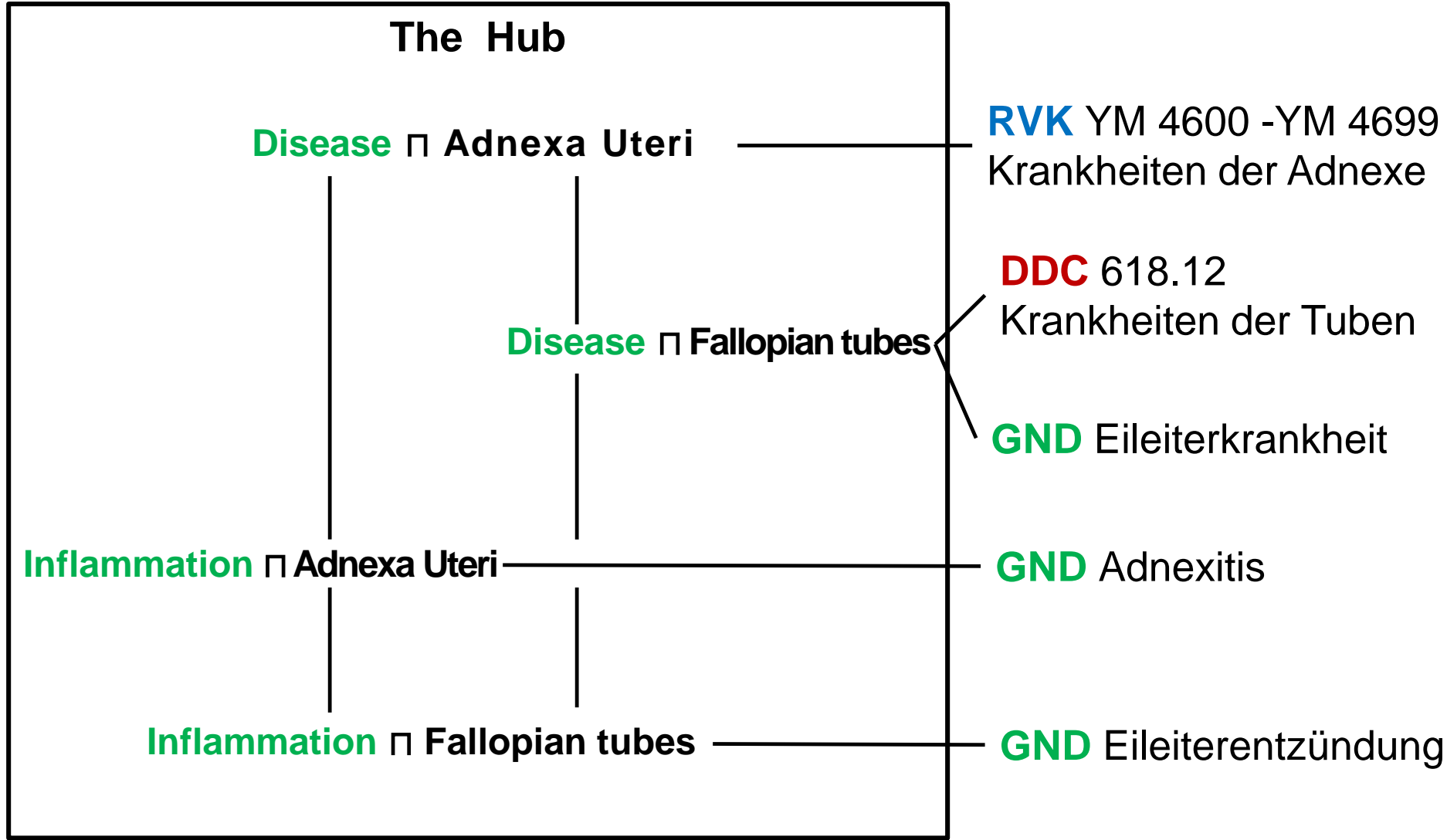


DDC	RVK
618.12 Krankheiten der Tuben	YM 4600 – YM 4699 Krankheiten der Adnexe:...

DDC	GND
618.12 Krankheiten der Tuben	Eileiterkrankheit
	Eileiterentzündung

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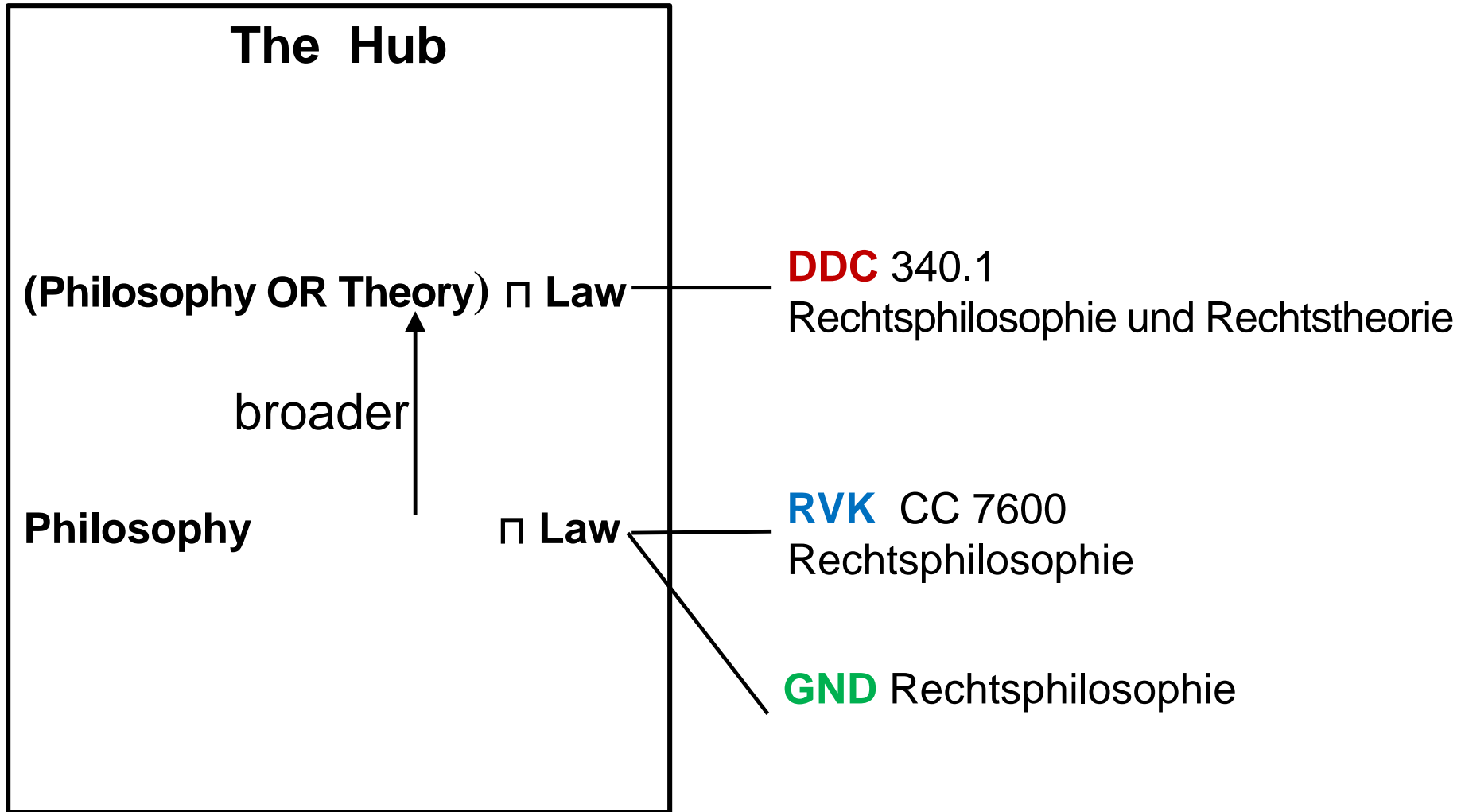
Hub Example 1



DDC	RVK
340.1 Rechtsphilosophie und Rechtstheorie	CC 7600 Rechtsphilosophie
	CC 7800 Rechtstheorie
	BR 1500 – BR 1560 Rechtstheorie, Rechtsphilosophie, Naturrecht
	NT 1000 Rechtsphilosophie

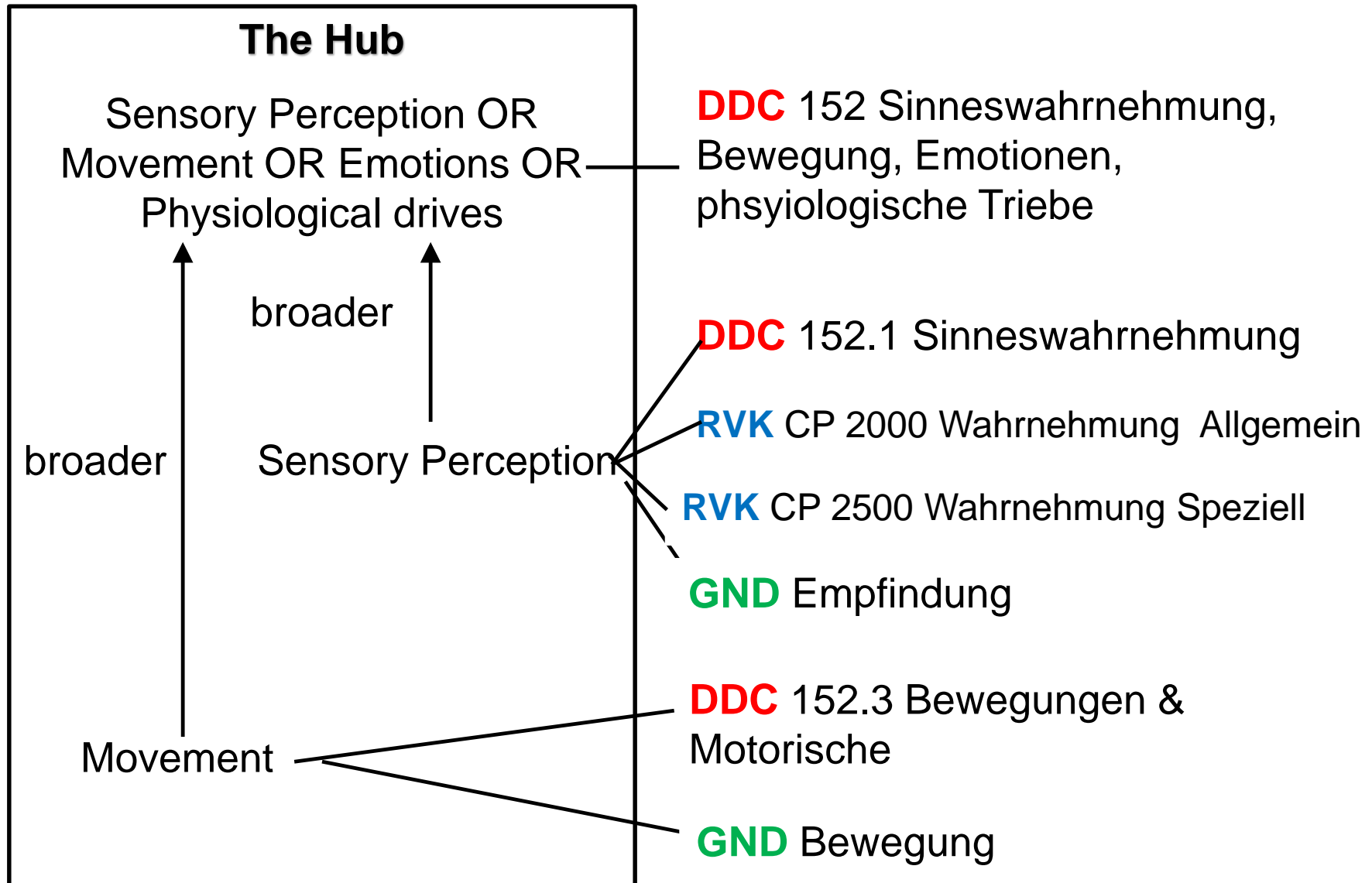
DDC	GND
340.1 Rechtsphilosophie und Rechtstheorie	Rechtsphilosophie
	Rechtstheorie
	Rechtsschule

Hub Example 2



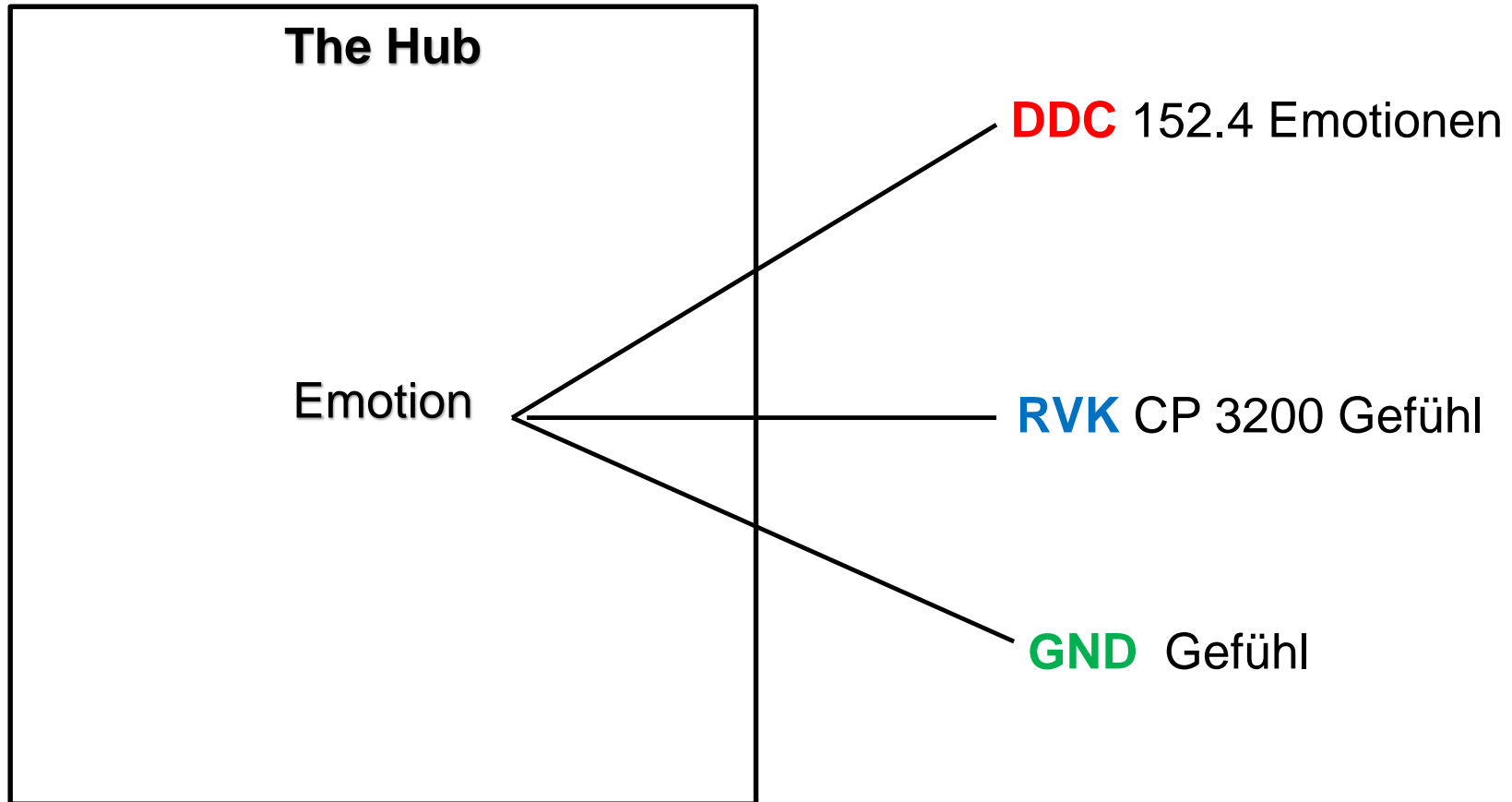
DDC	RVK
152 Sinneswahrnehmung, Bewegung, Emotionen, physiologische Triebe	CP 2000 Wahrnehmung allgemein
	CP 2500 Wahrnehmung Speziell (z.B. Sehen, Hören)
	CP 3000 Motivation, Gefühl
	CP 3200 Gefühl
DDC	GND
152 Sinneswahrnehmung, Bewegung, Emotionen, physiologische Triebe	Bewegung
	Psychophysik
152.3	Bewegungen und motorische Funktionen
RVK	GND
CP 2000 Wahrnehmung allgemein	Wahrnehmung
	Wahrnehmungspsychologie

Hub Example 3a



DDC	RVK
152.4 Emotionen	CZ 1330 Neuropsychologie der Emotionen
DDC	GND
152.4 Emotionen	Affekt
	Empfindung
	Gefühl
RVK	GND
CP 3200 Gefühl	Gefühl

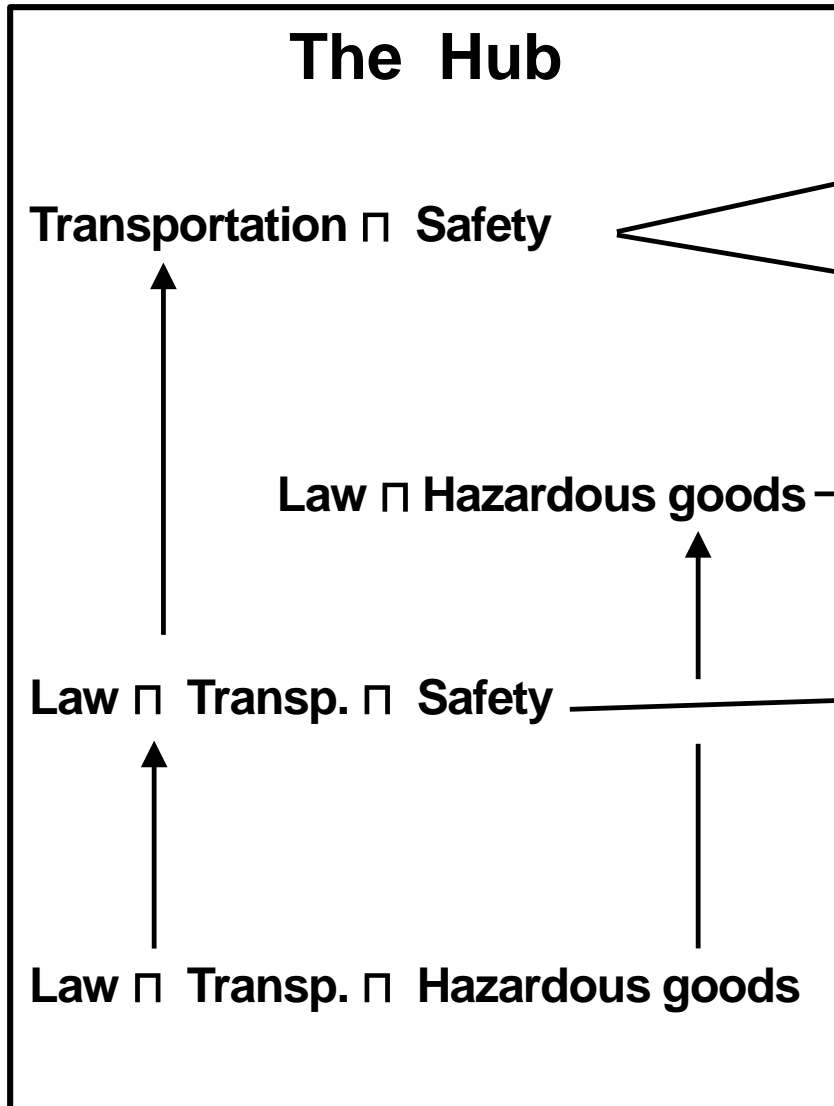
Hub Example 3b



DDC	RVK
343.09322 Gefahrstoffe	PN 808 Gefährlicher Stoff
	PS 3906 Immissionsschutz, Naturschutz, Tierschutz, Abfallschutz, Land- und Umweltschutz, Altlasten, Gefahrenstoffrecht

DDC	GND
343.09322 Gefahrstoffe	Gefahrgutbeförderungsrecht

Hub Example 4



RVK ZO 3700 Technik > Verkehr
> Verkehrssicherheit

GND: Verkehrssicherheit

RVK: PN 808 Recht > ... >
Gefährlicher Stoff

DDC 343.0938 Recht > ... >
Verkehrssicherheit

DDC 343.09322 Recht > ... >
Güterverkehr > Gefahrstoffe

GND: Fahrgutbeförderungsrecht

Challenges and Lessons Learned 1

To express a concept through a combination of elemental concepts you first need to understand the concept

- **Hierarchical context:**

RVK CM 5000 Informationstheorie, Kybernetik **is really**

RVK CM 5000 Psychologie > Allgemeines. Geschichte und Methodik > Informationstheorie, Kybernetik

DDC 343.0938 Verkehrssicherheit **is really**

DDC 343.0938 Recht > ... > Verkehrssicherheit

...

- **Ambiguity:** DDC 610.82 Women in Medicine
- **Domain knowledge:**

Adnexe is Adnexa Uteri which consists of Ovaries and Fallopian tubes

Challenges and Lessons Learned 2

Classes often pack multiple concepts together

DDC 152 Sensory perception, movement, emotions, physiological drives

RVK XC 2800 – XC 2899 Arzt und Patient, Medizinische Ethik Vivisektion

Mapping and expression through elemental concepts work better for single topics, which may exist as narrower classes

Challenges and Lessons Learned 3

Expressing a concept through a combination of elemental concepts is hard

Need a universal classification of elemental concepts

To build, use sources such as UDC facets

Requires creative abstraction

Need guidelines

Precise representation requires full description logic

RVK CM 2000 History of psychology =

[is] [agent] History \sqcap [patient] {[agent] Subject discipline \sqcap [patient] Psychology subject matter}

GND Historical psychology =

[is] [agent] Subject discipline \sqcap [patient] {Human development \sqcap Historical time}

Challenges and Lessons Learned 4

Practical consideration

- **Effort needed** for expressing concepts as combinations of elementary concepts
Use intelligent compute -assisted methods
- Effort can also be cut by **incrementally assembling a large database of words and phrases** in multiple languages **with a corresponding description logic formula** (or several description logic formulas, each corresponding to a different meaning).
- **Consistency between several people expressing concepts through combinations of elemental concepts** will be a major issue. Poor consistency produces poor mappings

Conclusions

- **The Concept Hub approach to mapping seems promising.**
- **Requires considerable investment** of resources, especially for the building of the universal classification of elemental concepts.
- However, after that **mapping would be more efficient.**
- **Adding new KOS becomes progressively** easier as more knowledge can be used for computer assistance
- The **mapping database is small** as compared to storing many bilateral mappings
- **Mappings are easier to find and can be presented more clearly.**

References

Balakrishnan, J., Voss, J., Soergel, D. (2018). **Towards integrated systems for KOS management, mapping, and access. Coli-conc and its collaborative computer-assisted KOS mapping tool Cocoda.** 15th International ISKO Conference- Challenges and opportunities for Knowledge Organization in the digital age. 9-11 July. Porto, Portugal

Soergel, Dagobert. (2017). **The principle of compositionality and entity-relationship modelling: faceted classification in a broader context.** International UDC Seminar 2017, Faceted Classification Today: Theory, Technology, and End Users. 14-15 September. London, UK.

Perry, J. W.; Kent, A. (1958). **Tools for machine literature searching: semantic code dictionary, equipment, procedures** New York: Interscience Publishers. 1958

Soergel, Dagobert (2010)/.

Conceptual foundations for semantic mapping and semantic search. Semantic mapping through a conceptual hub

Proceedings of the Cologne Conference in Interoperability and Semantics in Knowledge Organization July 19th - 20th, 2010. Edited by Felix Boteram, Winfried Gödert and Jessica Hubrich. Würzburg: ERGON, 2011, pp.13-16

(=BIBLIOTHECA ACADEMICA, Reihe Informations- und Bibliothekswissenschaften, Band 1.

Thank you

Questions?

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