7 Knowledge Organization

Vanda Broughton, Joacim Hansson,
Birger Hjørland & Maria J. López-Huertas

Summary

This chapter deals with the part of the library and information science (LIS) curriculum involving knowledge organizational systems and processes, which is an important core of the LIS discipline; arguably - together with information seeking & retrieval (IS&R) - the central core. Knowledge Organization (KO) contributes to make documents accessible for users whether they browse or search. KO is about providing optimal conditions for the identification and retrieval of documents or parts of documents. The suggestions made in this chapter are based on an analysis of the scientific knowledge about KO as developed until now.

The concept of knowledge organization

Knowledge Organization (KO) in the narrow sense is about knowledge organizing systems (KOS) such as bibliographical records, classification systems (e.g., DDC, LCC and UDC), thesauri, semantic networks and it is about knowledge organizing processes such as classification, document description, "descriptive cataloging", indexing and subject analysis. KO is performed in 'memory institutions' such as libraries, archives, museums, and online databases and on the Internet[1], but also outside such institutions, e.g. in "back-of-the-book indexing" or in so-called "personal information management systems". KOS may be universal (covering all fields of knowledge) or they may be limited to certain domains or document types.

A common way to distinguish between information retrieval (IR) and KO it by emphasizing that KO is about cataloguing, indexing, classification etc., that is: *assigning terms, texts or symbols to records*, while IR is about optimal strategies for searching documents or their representations. The assignment of terms, texts and notations to records (or to the objects themselves as for digital resources), is related to the intellectual or semantic content of the resource and is independent of the format in which the

[1] Each of these memory institutions has their own traditions and principles. There has been a tendency within LIS to concentrate on principles developed for libraries and electronic bibliographical databases which by the way also represent separate traditions). Implicit in the term information science is, however, a generalization that also covers archives and museums, among other institutions. Because the borders between "published documents", archival records and museum objects are blurred on the Internet, it is today very important to consider principles from all kinds of institutions in the curriculum, not just libraries.

information is presented. KO is also concerned with the design of KOS, and with the principles and methodologies for building semantic tools.

In the automated context this differentiation between KO and IR becomes blurred because automatic assignment may be a superfluous step in the retrieval process. Why use, for example, bibliometric methods to construe thesauri, if the bibliometric methods may just as well be applied directly to IR by the end-user?

In differentiating KO and IR it is important to recognize that there exist different approaches to IR as well as to KO and that some approaches (e.g. bibliometric approaches) may be more closely internal related whether applied to IR or to KO compared to other approaches (such as facet-analysis or domain-analysis).

The basic functions of KO in the context of LIS are:

- Facilitate searches in, among others, catalogues and bibliographies (IR-function)
- Providing information about documents of importance for the users' decisions to borrow the documents (e.g. in the form of abstracts and notes) as well as information about how to obtain a given document. (Document information function)
- Shelf arrangements and other kinds of linear ordering (ordering function).[2]

Each of these functions may be met by the same KOS or by different KOS. Shelf-arrangement is a narrow function[3], which puts major constrains on a given system, why the most challenging functions are related to IR and document information. It is important that each of those functions be considered in their own right. Many advanced tools are able to facilitate IR far beyond the traditional systems constrained by their shelving purposes.

Traditional KOS, e.g. classifications and thesauri are often used for organizing and searching printed media. Often this is used as an excuse for doing research on such systems. This may be the case in the following quote:

> "Today it is beginning to seem as if all information is available in full text. However, this is not true, nor will it be true in the immediate future. Vast numbers of legacy documents remain, and converting these to searchable text is an expensive, long-term proposition. Furthermore, many documents are still being

[2] KOS have a part to play in any linear order e.g. in lists in catalogues and bibliographies, and in the display of search results. These might be in digital as well as print formats. Directory style displays and browsing structures for online resources also make use of KOS.

[3] Mills (2004, p. 544-545) writes: “Shelf order. This is scarcely ever mentioned in the literature on retrieval, being treated very much as a poor relation, if not a terminally ill one. This is most unfortunate, since it is the very first index to the resources of the library for the great majority of library users and in many cases the main or even only one. Although this level of retrieval may be regarded as small beer and not deserving much attention, the special demands it makes because of its limitation to a single, linear order has had an important effect on the development of the theory of library classification”.

> produced only in printed form. Therefore, thesauri and indexing will continue to have a place at least for awhile in facilitating access to documents for which electronic text is not available. Their long-run value, however, depends on integration with full-text search" (Milstead, 1998).

We find that it is important not to consider knowledge organization as an academic discipline to be related to the pre-digital environment. Of course shelve arrangement and manual KO will still occur, but it is too limited and it is too defensive to leave the digital challenge to other fields such as computer science. Approaches to KO should be evaluated on the same conditions. The most important condition to consider KO is as tools for coping with the digital environment. If, for example, thesauri are not suited to such tasks, they should only occupy a limited place in the curriculum.

Another quotation from the same source is:

> "The explosive growth of Web search engines, with their primitive algorithms, has had some rather unfortunate effects, to my mind. Some of these engines appear to have been developed by people who saw a need, but who had not the vaguest idea that there was already a history of development of tools to fulfil similar needs. There is little evidence that some of these developers had ever used either Dialog or a library catalog. " (Milstead, 1998).

We believe that it is wrong to reproach the developers of Internet search engines that they have not considers the theory of library classification. There is not doubt, in our minds, that the search engines are gigantic successes and that it is us that have to proof that traditional KOS have a role to play in the digital environment. In other words the search engines must be considered one approach to KO among others, and the relative benefits and drawbacks of different approaches have to be demonstrated scientifically, not by professional wishful thinking.

In the teaching of KO it is important to include a historical and theoretical perspective on the development of KO within LIS as well as in an interdisciplinary perspective. Interdisciplinary developments are important to consider because important concepts, theories and findings do not follow disciplinary borders, why true progress must be interdisciplinary based.

It is not easy to outline the different approaches to KO because what is considered to belong to KO or not depend on the theoretical perspective. Also the field has been very much driven by new technologies and other influences which cross different theoretical perspectives. Below a historical outline of approaches to KO is presented. It is recognized that other interpretations are possible and should be encouraged.

Approaches/Traditions in knowledge organization

1. The traditional classification systems used in libraries and databases, including DDC and UDC[4] still plays an important practical role in libraries and still influences the teaching and study of KO. The DDC system was published in its first edition in 1876. The question is, however, what kind of approach to KO such systems can be said to represent?

   As opposed to the facet analytical tradition mentioned below there is no evident theoretical approach in enumerated library classification systems. There are important differences between different systems such as DDC, UDC and LC, but these differences will not be dealt with in this place. The DDC system is very popular and has, for example, in 2001 been introduced by the *Danish State Library* in Århus[5]. This decision was probably taken because most books purchased to this library are already DDC classified by *the Library of Congress*. From a library administrative point of view this is a dream[6]. Its main advantage may be that it is a standard, not a system optimized to any particular collection, domain or user group. Because of this fact it is probably not as much the users dream as are other systems. [7] While the library administrator may prefer KOS that are identical from one library to another, the user may prefer systems that correspond with how a given subject is presented to him in educational programs, in textbooks, and in other domain-specific KOS.

   > Example: Dewey (2003, p. xliii) writes: "A work may include multiple subjects treated separately from the viewpoint of a single discipline. Use the following guidelines in determining the best placement of the work: (A). Class a work dealing with interrelated subjects with the subject that is being acted upon. This is called the rule of application, and takes precedence over any other rule. For instance, class an analytic work dealing with Shakespeare's influence on Keats with Keats. Similarly, class a work on the influence of the Great Depression on 20th century American art with American Art. . . .".
   >
   > Such a decision makes it difficult for people seeking information, for example, on broader influences of Shakespeare, relative the Great Depression. It may be a suitable principle for universal system which has to function for shelf-arrangement. It is based on the assumption that works have inherent subjects, not that subjects are determined by the questions the users put to them. [8]

---

[4] There are important differences between systems such as DDC, UDC and LCC that are not considered here even if one might claim that they represent tree different approaches to KO.

[5] About reasons to prefer the DDC system see, for example, Shorten; Seikel & Ahrberg (2005). About reasons not to choose DDC see, for example, Hansson, 1997.

[6] It is thought provoking that the field we now term LIS was termed *library economy* in the first edition of the DDC and that this was not related to classification in philosophy.

[7] This does not imply, of course, that these systems do not consider the user's needs. If they did not, they would not be usable. In many cases, however, they do not model relations between subjects, as these are perceived by contemporary experts but prefer to stay the established standard relation of subjects.

[8] In other words: The principle is based on the positivist assumption that the subject of a document is a kind of fact, which the classifier may directly observe, as opposed to the pragmatic assumption that the subject

If this interpretation is correct then are opportunities for scholarly study and further development of this system limited, why the teaching in library school tends to be limited to historical studies and practical matters. This is consistent with the well known fact that new systems based on research or new theoretical principles have extremely difficult conditions in penetrating into the library sector[9]. [10]

Advanced research and teaching of knowledge organization should aim at provide optimal solutions to some group of users or to some kind of ideal goal, why it is a dilemma of such research and teaching to choose between what subject relations are considered important in discourses outside of LIS and what is considered administratively practical within LIS. In other words: It is dangerous for knowledge organization as an academic field to be limited in outlook by conservative "pragmatic[11]" considerations.

2. A distinct approach to KO is the facet-analytical approach founded by Ranganathan and further developed by *the British Classification Research Group* and the editors of *the Bliss Classification system (2nd ed.)*. This is one approach, still alive, and also applied in the digital environment. It is the most distinct and "pure" theoretical approach to KO, but not by implication necessarily the most important one. Principles from this tradition have increasingly influenced the development of classification systems, also old systems such as the DDC[12]. The strength in this approach is it logical principles and the way it provide structures in KOS (classifications as well as thesauri, for example).

   Mills (2004, p. 541) writes that he does not see faceted classification as a particular kind of library classification but as the only viable form enabling the locating and relating of information to be optimally predictable. . . .The continued existence of the library as a highly organized information store is assumed." And on p. 547: "The development of logically structured classifications covering the whole of knowledge is still unique in the field of LIS. These provide detailed maps of knowledge to assist in the searching of stores of records and can be used as the basis of, or valuable supplements to, numerous other retrieval languages".

---

of document should be determined by considered which interpretation is most fruitful for the users - or for the goal of system doing the classification.

[9] *Bliss Bibliographic Classification, 2nd*. is, for example, recognized for being a modern and advanced classification system developed in the facet analytic research tradition. It is not much used in practice, which is an indication of the limited possibilities for improving library classification systems

[10] Nonetheless there have been two important theoretical principles associated with library classification schemes. Founding figures like Cutter, Bliss and Richardsson found that the organization of books in libraries should be based on orders discovered by the sciences. Book classification should reflect knowledge organization, hence the name. However, this view of knowledge must be seen as rather positivist in that it was supposed that knowledge presented itself as facts. This may be the main difference between this approach and the domain-analytic approach. The other important principle is *the principle of literary warrant*, that decisions about classes and relations should be based on the literature. This provides the empirical basis for the classification systems.

[11] This use of the word "pragmatic" is not synonym with the philosophical understanding of pragmatism, which we find important. See 'Pragmatism' in Hjørland & Nicolaisen (2005).

[12] Cf., Miksa (1998).

We find it necessary to recommend not to consider this tradition in KO alone in LIS-education, but to consider it in the context of other approaches, such at those presented here.

3. Both the traditional classification systems (like UDC) and the facet-analytic method came under attack from the information retrieval tradition (IR), which was founded in the 1950'ties with experimental traditions like Cranfield (later continued in the TREC-experiments and with the development of Internet search engines). The Cranfield experiments found that classification systems like UDC and facet-analytic systems were less efficient that free-text searches or low level indexing systems ("UNITERM"). Although KOS such as thesauri and descriptors are children of the IR-tradition, the main tendency has been to question the value of traditional classification and facet analysis and human indexing all together. It has more or less implicit worked with the assumption that algorithm working on textual representations (best full text representations) may fully substitute human indexing as well as algorithms constructed on the basis of human interpretations[13].

   If one does not question the results obtained in this approach it implies the end of knowledge organization as a research field to be substituted by IR. This is the reason why it is important to consider IR as one among other approaches to KO in order to identify its relative strengths and weaknesses.[14]

4. User oriented / cognitive views have been influential in *Library and Information Science* in the last decades. However, more so in information seeking studies than within KO. One of the specific examples on systems designed on the basis of user studies and cognitive studies is "The Bookhouse" made by Annelise Mark Pejtersen's[15]. This system represents in many different ways a pioneering work. However, the theoretical basis for constructing KOS from a user-oriented or cognitive point of view is unclear hand has been critized. [16]

   Fidel & Pejtersen (2004) argues for what is termed the "Cognitive Work Analysis framework" and writes that ". . . Secondly, while guidelines about useful methods and research questions can be developed for a particular work domain, these cannot be automatically generalized to another domain". In this way their view is related to the domain-analytic view presented below. What may still be different is whether the classical principle of "literary warrant" (perhaps implicitly) is replaced with empirical user studies.

5. Bibliometric approaches. Some attempts have been made to combine bibliometrics with more traditional approaches to knowledge organization and to

---

[13] What is termed "text categorization" is a machine-learning approach involving manually categorizing a number of documents to pre-defined categories. This technique is an example in which human classification and machine classification is combined.

[14] Of course traditional classification systems may still be needed for shef-arrangement, but this is a rather narrow issue, which cannot in my opinion justify the existence of the larger research field of KO. Users are increasingly relying on Internet search Engines to find information, also information from libraries, why library KO compete with other providers of subject access and descriptive access to documents.

[15] Pejtersen (1989a+b, 1992).

[16] Criticism of the cognitive view includes Frohmann (1990).

information retrieval. Kessler (1965), Salton (1971), Rees-Potter (1989, 1991), Pao & Worthen (1989), Pao (1993) and recently Schneider (2004) have done research in this field and, for exampled, investigated whether thesauri can be constructed on the basis of citation-relations between documents. If such studies are considered seriously must bibliometrics be considered as one among other approaches to KO, the relative merits of which must be further investigated. By implication should maps like the ones produced by White & McCain (1998) also be considered a kind of KOS.

As is the case with the IR-tradition, the question of whether or not bibliometrics is a part of KO cannot be answered a priory but depends on whether efficient KOS can or cannot be produced by bibliometric means. In other words: Given the existing knowledge, serious studies in KO cannot ignore bibliometrics, which add an essential dimension for the theoretical understanding of KO as well as some specific tools for practical KO.

6. The domain analytic approach. Domain analysis is an attempt to provide relevant subject knowledge within the domain of LIS in a way that strengthens the core LIS perspectives and competencies. Knowledge organizing systems and processes are understood from a study of the domain that is being organized. The way domains are being analyzed is mainly by studying the actors in the domain (sociologically) and the theoretical assumptions put forward by these actors (epistemologically).

   An important example of a domain-analytic approach to KO is made in Arts by Ørom (2003). Ørom considers different "paradigms" or "epistemologies" in arts and demonstrates how these paradigms have influenced major KOS such as UDC, DDC, LC and *the Arts and Architecture Thesaurus*.

   Given systems are thus always more or less based on a certain view of the domain being organized. It follows that the construction, evaluation and use of a KOS should be based on a reflective consideration of such views. In other words: It becomes important to consider different epistemologies, both at a general level and at a domain specific level.

   An example of a thesis written by a graduate student in knowledge organization is Abrahamsen (2003). This is about the music domain. Although the papers are very different there are enough similarities between Ørom (2003) and Abrahamsen (2003) to provide an idea of what the domain-analytic approach to knowledge organization is when it is generalized from a specific domain.

   The domain analytic approach is an important theoretical addition to the other approaches mentioned. It is also an approach that preserves the librarians' core qualifications and identity compared with computer science. A librarian or an information specialist who knows something about the domain of, say, arts, has better qualifications to help users, to classify and index literature and to search and select information. It should be possible within a few teaching hours to provide knowledge about a domain such as arts corresponding to the content of Ørom (2003). Although no amount of knowledge is never enough, such an amount will clearly provide an important foundation. The domain analytic approach does not substitute LIS knowledge with ordinary subject knowledge,

and much knowledge from the other approaches should be integrated in this approach.

7. Other approaches. Many other approaches have been suggested. Among them semiotic approaches, "critical-hermeneutical" approaches, discourse-analytic approaches and genre-based approaches. They are not going to be discussed further at this place, but the above mentioned approaches can be seen as belonging to the same family to which also the domain-analytic approach belongs. What should be mentioned as an important trend is, however, an emphasis on document representationen, document typology and description, mark up languages, document architectures etc. Dahlström & Gunnarsson (2000); Francke (2005); Frohmann (2004_{a+b}) and others may be considered part this approach.

What units or entities are being organized?

The term "knowledge organization" implies that what is being organized is *knowledge*. This term goes back to founding figures in the field. Bliss (1929) is perhaps the most important work contributing to establishing the name of the field. His view, along with people like Cutter, Richardson and & Sayers argued for the term *knowledge organization* in LIS because they believed that book classification should follow scientific progress in different domains.

Many other terms, concepts and units have, however, been suggested. Anderson (2003) in a short paragraph introduces at least seven different terms:

> "The description (indexing) and organization (classification) for retrieval of messages representing knowledge, texts by which knowledge is recorded and documents in which texts are embedded. Knowledge itself resides in minds and brains of living creatures. Its organization for retrieval via short- and long-term memory is a principal topic of cognitive science. Library and information science deals with the description and organization of the artifacts (messages, texts, documents) by which knowledge (including feelings, emotions, desires) is represented and shared with others. These knowledge resources are often called information resources as well. Thus 'knowledge organization' in the context of library and information science is a short form of 'knowledge resources organization'. This is often called 'information organization'". (Anderson, 2003, p. 471; underlining added). [17]

Some authors (e.g., Salton, 1968; Svenonius, 2000 and Taylor, 1999) prefer to term the field information organization while some (e.g. Smiraglia, 2001) find that what is being organized in knowledge organization are works.

---

[17] A more comprehensive list of units is presented in *Lifeboat for Knowledge Organiation*, http://www.db.dk/bh/lifeboat_ko/HISTORY%20&%20THEORY/units_in_knowledge_organization.htm

Sometimes the use of different terms for the field has not theoretical implications, but is just a question of fads in terminology. Such a loose use of scientific terms is not healthy from a scientific and educational point of view. We should aim at a clear terminology in which different terms are only used if they mean different things, and the people using the terms should argue why they consider the terms they use the best choice. In cataloguing theory, for example, important arguments have been brought forward for considering a work as the organizing unit. It should be an educational goal to teach the students such different views as well as important arguments which have been raised for and against them.

Two things are important to consider in relation to teaching units. The first one is that different approaches to KO implicitly or explicitly operate with different units. The implication is that the teaching of units cannot be separated from a historical and theoretical perspective. The second thing is that a given terminology may not reflect the units, which are actually used. The term "information retrieval" implies that what is retrieved is "information". The overwhelming amount of studies using this term are, however, retrieving bibliographical references (which may or may not inform the user in the way they were intended), why "document retrieval" may be a better choice. When considering terminology we should consider what concretely is being applied in KO.

Based on such considerations, the following units may be related to the former presented approaches to KO in the following way:

1. The classification systems used in libraries and databases, including DDC and UDC	Concretely are documents the units organized, but the term "knowledge organization" implies a more abstract ambition to base classification on scientific and scholarly knowledge.
2. the facet-analytical approach	"Ideas". This approach removes itself somewhat from the empirical basis of documents and introduces logical principles for KO which are mainly based on rational intuition.
3. The information retrieval tradition	Concretely are words, co-word relations and word-document-relations the units. However, "information" is the claimed unit.
4. User oriented views	Individual, cognitive structures
5. Bibliometric approaches	Documents and citation patterns between documents.
6. The domain analytic approach	"Knowledge" is replaced with "knowledge claims" (documented knowledge claims) or works. (What are organized are not eternal truths, but works with claims which are substantiated from one or another epistemological perspective).

In conclusion: The educational goal in KO should be to educate the student to be able to know that what is considered units or entities in KO has changed in the history of the field. Different kinds of units are related to different theoretical outlooks and have theoretical implications.

Kinds of Knowledge Organizing Systems (KOS)

In the narrow meaning (within LIS) the kind of KOS, which are considered include:

- Enumerative classification systems a la Dewey, UDC and LCC
- Facet analytic systems a la Bliss 2nd ed.
- Subject headings like LCSH
- Systems based on free text searches
- Thesaurus based systems
- Bibliometric maps
- Algorithms in search engines
- Archival systems (based on the principle of provenance)
- Ontologies,
- Semantic networks
- "Topic maps"[18]
- etc. [19] [20]

These systems may all be regarded as kinds of semantic tools providing selection of concepts and information about their semantic relations. Students in KO should learn about the similarities as well as the differences between different kinds of KOS such as those listed above.

In the broader meaning KOS include the way knowledge is organized in society, e.g. the organizational structure of universities, institutes for higher education and research, the structure of scientific disciplines and the social division of labour. Also encyclopedias and libraries are examples of this broader meaning of KOS. The UNISIST model (cf., Fjordback Søndergaard; Andersen & Hjørland, 2003) is an important model of KOS, which relates KOS in the narrow sense with KOS in the broader sense.

---

[18] http://www.xml.com/pub/a/2002/09/11/topicmaps.html

[19] Libraries themselves as well as encyclopedias, specialized journals and the system of primary, secondary and tertiary information sources may also be considered examples of KOS. The teaching of KO should ask whether these systems are based on the same or other fundamental principles? It is the basic principles and functions, which define and delimit KOS. In archival science is the principle of provenance an important principle in KO.

[20] Hodge (2000) also mentions *Authority Files, Glossaries, Dictionaries and Gazetteers* (A gazetteer is a list of place-names as the index in an Atlas) . It is of course important an important goal for research in KO to make a well-argued taxonomy of different kinds of KOS.

The broader perspective of KOS is important to include in LIS education. Just to mention one example. Traditional systems such as the DDC are based on disciplines:

> "[A] work on water may be classed with many disciplines, such as metaphysics, religion, economics, commerce, physics, chemistry, geology, oceanography, meteorology, and history. No other feature of the DDC is more basic than this: that it scatters subjects by discipline" (Dewey, 1979, p. xxxi).

When this is the case it seems rather obvious that research in KO should relate to research on the development and dynamics of disciplines (see, e.g., Stichweh, 2001).

Another example on the value of the broad perspective is provided by Hansson (1999), who shows how the Swedish classification system SAB must be understood from a cultural-political perspective at the time it was established.

Although the broad perspective is important, there is a danger that the teaching of broader perspectives of KO and KOS do not provide specific insight on how to construe, evaluate and use KOS. Any concern with broader perspectives should be justified by demonstrating consequences for KO in the narrow sense.

Theoretical foundation of knowledge organization

KOS in the narrow sense of the word are semantic tools. They consist of words and concepts and semantic relations. A theory of KOS shall therefore explain how terms and concepts should be selected and defined and how their semantic relations should be defined and selected.

Concept theory should be introduced in the education of librarians and information professionals. There are different concept theories, which are related to more general epistemological views. In teaching LIS concepts should be considered from the pragmatic perspective: What difference does it make for the users whether we apply one or another theory of concepts? What difference does it make whether we define a particular concept one way or another?

Concerning semantic relations a set of important relations should be introduced and their utility for the users should be examined. Some important kinds of semantic relations include:

- Active relation: A semantic relation between two concepts, one of which expresses the performance of an operation or process affecting the other.
- Antonymy (A is the opposite of B; e.g. cold is the opposite of warm)
- Associative relation: (A is mentally associated with B by somebody). Often are associative relations just unspecified relations. In thesauri are antonyms, for example, usually not specified but may be listed, along with terms representing other kinds of relations, under the label "associative relations".

- Causal relation: A is the cause of B. For example: Scurvy is caused by lack of vitamin C.
- Homonym. Two concepts, A and B, are expressed by the same symbol. Example: Both a financial institution and a edge of a river are expressed by the word 'bank' (the word has two senses).
- Hyponymous relationships (hyponym-hyperonym), generic relation, genus-species relation: a hierarchical subordinate relation. (A is kind of B; A is subordinate to B; A is narrower than B; B is broader than A).
- Locative relation: A semantic relation in which a concept indicates a location of a thing designated by another concept. A is located in B; example: Minorities in Denmark.
- Meronymy, partitive relation (part-whole relation): a relationship between the whole and its parts (A is part of B) A meronym is the name of a constituent part of, the substance of, or a member of something. Meronymy is opposite to holonymy (B has A as part of itself). (A is narrower than B; B is broader than A).
- Related term. A term that is semantically related to another term. In thesauri are related terms often coded RT and use for other kinds of semantic relations than synonymity (USE; UF), homonymity (separated by paranthetical qualifier) , generic relations and partitative relations (BT; NT). Related terms may, for example express antagonistic relations, active/passive relations, causal relations, locative relations, paradigmatic relations.
- Synonymy (A denotes the same as B; A is equivalent with B).
- Temporal relation: A semantic relation in which a concept indicates a time or period of an event designated by another concept. Example: Second World War, 1939-1945.

Concepts and semantics should be related to the concept of “literary warrant” (or other kinds of warrant). The principle of literary warrant implies that decisions to include a class in a classification, to define a class (or concept) and to relate classes/concepts should be based on the scholarly literature. Although this principle is widely accepted and followed (e.g. in the DDC), it is not often discussed how this should be done concretely. Often there is conflicting evidence in the literature about the meaning of terms and their relations to other terms. How should decisions then be made?

To establish the basis of a KOS is not a simple task. The point of view of domain-analysis is that in every field of knowledge exist different views, approaches, “paradigms” or whatever you prefer to name them. Each of those views operates with different theories, concepts and semantic relations. The implication is that we in knowledge organization often have to face different views on how the domain should be organized. A good paper about this is Ørom (2003) in the field of Arts. He demonstrates that different KOS (like DDC, UDC and so on) reflect different views of art. Although some kinds of KOS (e.g. thesauri) are more flexible and easier to adapt to different views, there are no way to escape the condition that all KOS have some kind of “bias” toward one or another view. Bias in structure of KOS should, however, often be considered a

good thing in that it reflects the interests and concerns of the collection and the user group, and gives them priority.

Professionals in KO should be able to "read" such bias (at least in some domains). This can be done if students work within a domain in which they are interested or have special knowledge. This perspective also invites to collaboration between specialists in KO and, for example, cultural studies. Many schools of LIS have specialists in literature, art, music and other fields, and KO should not be developed or taught in isolation from such people.

KO in different domains

The teaching of knowledge organization should include examples of KOS from Science & Technology, Social Sciences, Arts & Humanities and other fields. Papers such as Ørom (2003) and Abrahamsen (2003) could, for example, be used to demonstrate problems and realities in the organization of knowledge in arts and music. A book like Ereshefsky (2000) may be used to illustrate problems in KO within biology etc.

References

Abrahamsen, K. T. (2003). Indexing of Musical Genres. An Epistemological Perspective. *Knowledge Organization, 30*(3/4), 144-169.

Adkisson, H. P. (2005). Use of faceted classification. IN: *Web design practices*: www.webdesignpractices.com/navigation/facets.html (Visited 05-09-15).

Anderson, J. D. (2003). Organization of knowledge. IN: *International Encyclopedia of Information and Library Science. 2nd*. ed. Ed. by John Feather & Paul Sturges. London: Routledge (pp. 471-490).

Bliss, H. E. (1929).*The organization of knowledge and the system of the sciences*. With an introduction by John Dewey. New York: Henry Holt and Co.

Broughton, V. (1999). Notational expressivity; the case for and against the representation of internal subject structure in notational coding. *Knowledge Organization*, 26(3), 140-148.

Broughton, V. (2002). Faceted classification as a basis for knowledge organization in a digital environment: the bliss bibliographic classification as a model for vocabulary management and the creation of multidimensional knowledge structures. *The New Review of Hypermedia and Multimedia***,** 7(1), 67-102.

Dahlström, M. & Gunnarsson, M. (2000). Document Architecture draws a circle: on document architecture and its relation to library and information science and research. *Information Research, 5*(2). http://informationr.net/ir/5-2/paper70.html

Dewey, M. (1979). *Dewey Decimal Classification and relative index* (19th ed., Vol. 1). Albany, NY: Forest Press.
Ereshefsky, M. (2000).The Poverty of the Linnaean Hierarchy : A Philosophical Study of Biological Taxonomy. Cambridge: Cambridge University Press.

Fidel, R. & Pejtersen, A. M. (2004). From information behaviour research to the design of information systems: the Cognitive Work Analysis framework. *Information Research*, **10**(1) paper 210. Available at http://InformationR.net/ir/10-1/paper210.html

Fjordback Søndergaard, T.; Andersen, J. & Hjørland, B. (2003). Documents and the communication of scientific and scholarly information. Revising and updating the UNISIST model. Journal of Documentation, 59(3), 278-320.
http://www.db.dk/bh/UNISIST.pdf

Francke, H. (2005). Whats in a name? Contextualizing the Document concept. *Literary and Linguistic Computing, 20*(1), 61-69.

Frohmann, B. (1990). Rules of Indexing: A Critique of Mentalism in Information Retrieval Theory. *Journal of Documentation,* 46(2), 81-101.

Frohmann, B. (2004a). *Deflating information. From science studies to documentation*. Toronto: University of Toronto Press.

Frohmann, B. (2004b). Documentation redux: Prolegomena to (another) philosophy of information. *Library Trends, 52*(3), 387-407.

Garshoel, L. M. (2002). *What Are Topic Maps*?
http://www.xml.com/pub/a/2002/09/11/topicmaps.html

Hansson, J. (1997). Why public libraries in Sweden did not choose Dewey. *Knowledge Organization,* 24(3), 145-153.
Hansson, J. (1999). *Klassifikation, bibliotek och samhälle : en kritisk hermeneutisk studie av "Klassifikationssystem för svenska bibliotek"*. Borås: Valfrid. (Skrifter från Valfrid; 19). (English summary, click).

Hansson, J. (2004). The social legitimacy of Library and Information Studies: reconsidering the institutional paradigm. IN: *Aware and Responsible : papers of the Nordic-International colloquium on social and cultural awareness and responibility in library, information and documentation studies.* Ed. Boyd Rayward. Lanham, Md: Scarecrow Press, p. 49-69.

Hjørland, B. (Ed.). (2005). *Lifeboat for knowledge organization.* http://www.db.dk/bh/lifeboat_ko/home.htm

Hjørland, B. & Nicolaisen, J. (Eds.). (2005). *The epistemological lifeboat. Epistemology and Philosophy of Science for Information Scientists*. http://www.db.dk/jni/lifeboat/home.htm

Line, M. B. (2005). Librarianship as it is practised: a failure of intellect, imagination and initiative. *Interlending & Document Supply, 33*(2), 109-113. (Editorial).

Lopez-Huertas, M. J. & Contreras, E. J. (2004). Spanish research in knowledge organization (1992-2001). *Knowledge Organization, 31*(3), 136-150.

Miksa, F. L. (1998), *The DDC, the Universe of Knowledge, and the Postmodern Library*. Albany, NY: Forest Press.

Mills, J. (2004). Faceted classification and logical division in information retrieval. *Library Trends, 52*(3), 541-570.

Milstead, J. L. (1998). *Use of Thesauri in the Full-Text Environment.Based on a paper presented at the 34th Clinic on Library Applications of Data Processing. http://www.bayside-indexing.com/Milstead/useof.htm*

Kessler, M. M. (1965). Comparison of the results of bibliographic coupling and analytic subject indexing. *American Documentation, 16*(3), 223-233.

Pao, M. L. (1993): Term and Citation Retrieval: A Field Study. *Information Processing & Management*, 29(1), 95 – 112.

Pao, M. L. & Worthen, D. B. (1989). Retrieval effectiveness by semantic and pragmatic relevance. J*ournal of the American, 29*(1), 95-112.
Society for Information Science, 40(4), 226-235.

Pejtersen, A. M. (1989a). The BOOK House: *Modeling user needs and search strategies as a basis for system design*. Roskilde, Risø National Laboratory. (Risø report M-2794).

Pejtersen, A. M. (1989b). A Library System for Information Retrieval Based on a Cognitive Task Analysis and Supported by an Icon-Interface. *ACM SIGIR Forum*, 40-47.

Pejtersen, A.. M. (1992). The Book House. An icon based database system for fiction retrieval in public libraries. In Cronin, B. (Ed). The marketing of library and information services 2. (pp. 572-591). London, Aslib.

Rees-Potter, L. K. (1989). Dynamic thesaural systems: a bibliometric study of terminological and conceptual change in sociology and economics with application to the

design of dynamic thesaural systems. *Information Processing & Management, 25*(6), 677-691.

Rees-Potter, L. K. (1991). Dynamic thesauri: the cognitive function. Tools for knowledge organisation and the human interface. Proceedings of the 1st International ISKO Conference, Darmstadt, 14-17 August 1990. Part 2, 1991, 145-150.

Salton, G. (1968): *Automatic Information Organization and Retrieval*. New York: McGraw-Hill.

Salton, G. (1971). Automatic indexing using bibliographic citations. J*ournal of Documentation, 27*(2), 98-110.

Small, H.(1973). Co-citation in the relationship between two documents. *Journal of the American Society for Information Science, 24*, 256-269.

Schneider, J. W. (2004). *Verification of bibliometric methods' applicability for thesaurus construction*. Aalborg: Royal School of Library and Information Science. (Ph.d-dissertation). Available at: http://biblis.db.dk/archimages/199.pdf

Shorten ,J.; Seikel, M. & Ahrberg, J. H. (2005). Why Do You Still Use Dewey? Academic Libraries That Continue with the Dewey Decimal Classification. *Library Resources & Technical Services* (LRTS), 49(2), 123-133.

Smiraglia, R. P. (2001)**.** *The nature of a work. Implications for the Organization of Knowledge*. Lanham, Md.: Scarecrow Press.

Stichweh, R. (2001). Scientific Disciplines, History of. IN: Smelser, N. J. & Baltes, P. B. (eds.). International Encyclopedia of the Social and Behavioral Sciences. Oxford: Elsevier Science (pp. 13727-13731).

Svenonius, E. (2000). *The Intellectual Foundation of Information Organization*. Cambridge, Massachusetts: The MIT Press.

Taylor, A. G. (1999). *The Organization of information.* Englewood, Colorado: Libraries Unlimited.

Wellisch, H. H. (2000). *Glossary of terminology in abstracting, classification, indexing, and thesaurus construction. 2nd.* ed. Medford : Information Today, Inc.

White, H. D., & McCain, K. W. (1998). Visualizing a discipline: An author co-citation analysis of information science, 1972-1995. J*ournal of the American Society for Information Science, 49*(4), 327-355.

Ørom, A. (2003). Knowledge Organization in the domain of Art Studies – History, Transition and Conceptual Changes. *Knowledge Organization, 30*(3/4), 128-143.