Brief Communication: What is Knowledge Organization?†

Ingetraut Dahlberg

Am Hirtenberg 13, 64732 Bad König, Germany, <ingetraut.dahlberg@t-Online.de>

Ingetraut Dahlberg started work on thesauri and classification in the early sixties. She developed her concept theory in 1972 together with her work on the establishment of a universal classification system of knowledge fields, the *Information Coding Classification*, published in 1982. In 1974, she founded the journal *International Classification,* now known as *Knowledge Organization*, and was its editor for 23 years. She also founded the German Society for Classification in 1977 and chaired it until 1986. In 1989, the International Society for Knowledge Organization was founded, and she served as its president until 1996. In 1980, she founded the INDEKS Verlag, which was taken over by Ergon Verlag in 1997.

Dahlberg, Ingetraut. **Brief Communication: What is Knowledge Organization?** *Knowledge Organization. 41(1)*, 85-91. 27 references.

Abstract: As an introduction, the circumstances leading to the foundation of the *International Society for Knowledge Organization (ISKO)* are outlined and the prerequisites for the formal and conceptual description of the scope of knowledge organization (KO) are laid out, followed by the explanation of the scheme as used in the bibliography of KO. An overview is provided of the tasks and activities of this discipline; thereafter and in conclusion an urgent appeal is made to ISKO and to all active scientific societies with a view to establishing KO as an autonomous scientific discipline within the science of science, as well as an indication is given of urgently required tasks.

Received and Accepted 28 June 2013

Keywords: knowledge, knowledge organization, concepts, classification, ISKO

† This paper had been requested by Peter Ohly to be given on the occasion of the German ISKO General Assembly on July 5, 2012. It has been revised in the meantime to be included in the next proceedings volume among the papers of the Potsdam ISKO Conference, March 19-20, 2013. The English translation was finalized in cooperation with Prof. Dr. Herbert Eisele, France.

1.0 How it all came about

On February 12, 1977, a group from the registered *Society for Documentation* (including Martin Scheele and Robert Fugmann) founded the *Society for Classification* in Frankfurt in order to promote required research on the philosophical and system-relevant fundaments of the methodological domain of librarians and documentalists. The founding assembly protocol mentions only one mathematician, author of a book on automatic classification (Bock 1974). Twelve years later, half of the now 200 members appeared to be mathematicians or statistically-oriented people who took over, which led to the departure of those less interested in statistics to constitute a new body exclusively dedicated to concept-oriented research—going also international[1].

So on July 22th 1989, ISKO, the *International Society for Knowledge Organization*, was set up. Its name resulted from a compromise, since there is no appropriate English equivalent for "Wissensordnung," which mattered to us. However, the title of a book on *The Organization of Knowledge and the System of the Sciences* (Bliss 1929) led us to hope that the German alternate term "Wissensorganisation" allowed in English the innovative "Knowledge Organization," which to our great surprise found universal acceptance. In the meantime this brilliant term has become so hackneyed that now, almost 25 years later, the question seems to arise what actually to understand thereby. In order to qualify for the title of this paper it may be proper to return to the roots, viz. to the customary notion of classification, which covers a variety of meanings. Indeed, this polyseme refers: 1) to "classis facere" (arrange in classes); 2) as well as to

assigning to a class, i.e. the attribution of classes to real objects (referents), that which is generally understood by classifying. Moreover, the term comprises also the result of 1), i.e. the classification system 3) and the result of 2) i.e. the classified object 4). In addition, "classification" also qualifies 5) a didactic discipline (subject of study).

In German, it is possible to associate "knowledge" (meaning of course "generally accepted knowledge") with "organization" since "organization" includes objects, whereas in some other languages "organization" refers primarily to corporate bodies. This notwithstanding, the conjunct finally met general acceptance.

"Generally accepted knowledge" carries the seal of science, resulting from verifiable dicta or else from intersubjective agreement in form of generally accepted definitions as opposed to subjective knowledge acquired by experience or learning. In the latter meaning, knowledge serves as a kind of spiritual warrant, which means that reminiscence depends on remembered data, which fact explains why people differ in opinion on identical phenomena, for each relies on different angles of vision and items of recollection. Generally speaking, the smaller the shared basis of experience AND education, the more difficult the understanding. Our knowledge condenses itself in concepts by their informative content. Concepts are therefore knowledge units and form the elements of systems of knowledge (Wissensordnungen) (cf. infra).

2.0 First prerequisite: concepts as elements of systems of knowledge

True understanding of concepts has been jeopardized hitherto by the ignorance of their very nature, viz. that they form the constituents of any knowledge organization that also leads to the formation of classes. The linguistic aspect hinders most colleagues from perceiving the indispensable analytical aspect of concept formation and concept apprehension. Therefore, a handy concept theory is needed. My endeavours to expose such a theory in a number of publications (e.g. Dahlberg 1974a,1979, 1987, 2009) and make it plausible have been vain so far to my great regret. I nevertheless venture again to show how to define knowledge units hereafter.

Take any object, concrete or abstract, and figure out its essential characteristics by formulating "is"-statements. The synthesis of all thus determined characteristics under a name or a code depicts the object's content in an abbreviated form and leads to designate the respective object. The definition of a concept is therefore the resumé of content-determinant characteristics. I have often pictured this in a triangle: on top respective referent, left corner the characteristics, right corner its name or designation. The truth-proof of this method depends obviously on how far it conforms to general acceptation, including the coincidence with extant definitions in dictionaries and encyclopedias.

The most substantial or essential characteristics indicates the hierarchical relationship of an object, e.g. a wardrobe is a piece of furniture; a swan is a large water-bird; a computer is a data-processing machine, thus bringing out in the first relative place respective hyperonyms, i.e. the higher class concepts (piece of furniture, water-bird, data-processor). There are also characteristics which specify a given case etc., so as to discover the respective hyponym (lower-class concept), which can also be represented otherwise, leading down the whole range of the conceptual hierarchy till to the individualizing characteristics of space and time. When Kant speaks of analytical or synthetic judgements, he refers to relative implicit characteristics of a hierarchy as against the specifying characteristics of a sub-concept. The determination of necessary characteristics, i.e. knowledge elements, which aggregate to a knowledge unit constitutes a concept-forming event with the possible result that concepts of similar or analogous characteristics can form an inter-relationship between concepts.

However, this kind of relationship leads to concepts relying on purely formal aspects (similar/dissimilar; inclusive/exclusive etc.) which are helpful for some reasons, but for the construction of a conceptual classification scheme four different content-determinant types of relationships of concepts are needed:

- the abstraction relationship of genus-species
- the partitive relationship of whole/part-of
- the complementary or opposition relationship
- the function-related relationship, generating a sort of syntax;

Only the third relationship does not provide hierarchies and the fourth only sometimes, as opposed to the first two.

The function-related, grammatical or syntax relationship shows up e.g. in the ventilation of a subject field when proceeding by an element location plan, as indicated under the next section; in this case, each subject-field includes a logical subject and a logical predicate with possible complements. The hierarchy proceeds from the partitive relationship since the substructures of a subject-field are its components. The complementary or opposition relationship applies to the opposition of objects and/or their qualities.

It may be noted that the four relationships produce definitions whenever these appeal to genus-species relationships or whole-part, or else opposition relationships or yet function relationships. Dictionaries are mainly con-

cerned with genus-species definitions, sometimes with whole-part definitions, rather seldom with function-related definitions which concern referents with their eventual incidents. Hence the handling of concepts, particularly with regard to their characteristics is essential to any systematic work in knowledge ordering for they link the concepts within a subject-field and also with the concepts of other subject-fields by systemic elements[2].

The various hierarchy-forming relationships which appear in such systems show that classification systems based on these principles are self-explanatory like a definition system. If the work has been properly done; such systems are very useful for science as well as for every searcher keen on exploring the relations and whereabouts of items searched.

The recognition of this first prerequisite for analytical concept understanding will considerably ease the task of organizing knowledge.

3.0 Second prerequisite: structural elements of knowledge organization

Every builder knows that a large building calls for solid foundations and beams. The development of classification (cf. Shamurin 1967) started in ancient Egypt at the very point we are now in cyberspace, viz. the simple word designating an object. This was replaced later in the Middle-Ages by domain designations leading to the so-called *Septem Artes* and finally the main classes of a universal system became disciplines as still is the case with the six main universal classification schemes. However the Indian mathematician and librarian, S. R. Ranganathan, introduced in his Colon Classification scheme of 1933 a structural element which he called facet, taken up after World War II by a variety of exemplary systems in England, where it became quite common to the point of structuring a thesaurus (Aitchison et al. 1969). In Germany, Martin Scheele used it for his extended biological documentation. Nevertheless, nobody has ever ventured to build a universal ordering scheme by dispensing with disciplines as main classes for sustainment, not to mention improbable thesauri gone alphabetical.

The scheme I developed, the *Information Coding Classification* (*ICC*) (Dahlberg 1982a), which refers so far exclusively to knowledge fields, relies on general object areas of being, underscored by integrating layers of the real world. These allow, beside genuine disciplines, for eventual subdivisions that do not yet qualify for recognition as scientific disciplines. In addition, the ICC relies on the Aristotelian categories which distinguish object areas in their subdivisions similar to facets, viz. a structural element position plan (Elementstellenplan) called "Systematifier" (Dahlberg 1996)[3]. Such a scheme reserves for each subject field subsequent subdivisions, for which the scientific criterion has been retained, whereby knowledge fields are characterized by having their own object as well as their proper methods and if they are well established as fairly developed scientific fields/disciplines also with, in most cases, their theoretical foundations, applications and widespread usage. The ICC subject fields were ordered after criteria common to many consultative works and syllabuses by the following facets:

The digital scale – Systematifier of knowledge fields

General and theoretical prerequisites
Objects and their components
Methods and techniques
to 6 special characterisations

7. Influence of other domains on this field
8. Application of this field's methods to other fields
9. Ambit of respective knowledge field and info on it

The positions 1-3, which represent by their object and methods a sort of syntax, constitute a knowledge field, under 4-6 figure its peculiarities and 7-9 refer to the field's environment.

It may seem at first sight that this kind of representation narrows the concepts and classes of a knowledge field, however experience with the building of the 6.500 knowledge fields of *ICC* down to the 6th digital level shows that no problem of the sort has yet arisen with the classification of themes (for book titles or articles in periodicals). The positions under 1, 8 and 9 permit extensive combinations with other knowledge fields which shows its perfect inter-connectivity.

4.0 The scope of knowledge organization

I considered it essential to expound on the above prerequisites for knowledge systems prior to answering the title question, for it shows the way by which my apparent programme has developed. In fact, most of the required data and tasks had been presented in my 1973 dissertation (Dahlberg 1974b). A first off-spring[4] in 1974 was the English language periodical *International Classification*, re-named in 1993 *Knowledge Organization,* regularly including an extensive section on bibliographical data from the most recent literature on classification. It was and is still presented according to the Systematifier or digital scale of 1974 with minor extensions by my succeeding editors.[5] This class-structure of the classification literature scheme has been used for ordering not only the bibliographical data of the periodical but also its systematic annual indexes up to 1996 and the three volumes published so far as the Inter-

national Classification & Indexing Bibliography (ICIB) (Dahlberg 1982b). This has been maintained even after renaming the periodical. Therefore, the scope of our knowledge organization may be visualized through the following systematic structuring:[6]

Layout of the Classification Scheme for KO Literature

0 Form Divisions
Bibliographies in Classification and Indexing/Knowledge Organisation, Literature Reviews,
Glossaries, Universal Classification Systems, Periodicals and Serials, Proceedings, Textbooks,
Other monographs, Standards.
1 Theoretical Foundations & General Problems
Order & Knowledge Organization (KO), Conceptology & KO, Mathematics in KO, Systems
Theory in KO, Psychology, Sociology & KO, Problems & Research in KO, History of KO
2 Classification Systems & Thesauri, Structure & Construction
General Questions, Structure & Elements of KO Systems, Construction of Classification Systems & Thesauri, Relationships, Numerical Taxonomy, Notation, Codes, Maintenance, Updating &
Storage of KO Systems, & Thesauri, Compatibility/Interoperability and Concordances between
Indexing Languages, Evaluation of KO Systems & Thesauri
3 Methodology of Classing & Indexing
Theory of Classing & Indexing, Subject Analysis, Classing & Indexing Techniques, Computer assisted (automatic) Classing & Indexing, Manual & Automatic Order Techniques, Coding,
Reclassification, Index Generation & Programs, Evaluation of Classing & Indexing
4 On Universal Classification Systems & Thesauri
General Questions, On the Universal Decimal Classification, On the Dewey Decimal Classif.,
On the Library of Congress Classif., On the Bliss Classif., On the Colon Classif., On the
Library Bibliographical Classif., On other Universal Classif. Systems & Thesauri
5 On Special Objects Classifications
(the order follows the nine-layer structure of the ICC and its subdivisions)
6 On Special Subjects Classifications & Thesauri
(the order follows the nine-layer structure of the ICC and its subdivisions)
7 Knowledge Representation by Langua & Terminology
General Problems of Natural Language in Relation to KO, Semantics, Automatic Language Processing, Grammar Problems, Online Retrieval Systems & Technologies, Lexicon, Dictionary
Problems, Problems of Terminology,Subject-oriented Terminology Work, Problems of Multilingual & Cross-Language Systems and Translation of Schemes.
8 Applied Classing & Indexing
General Problems, Guidelines, Rules, Consistency, Classing and Indexing of Data, Titles,
Primary and Secondary Literature. Non-Book Materials, Back-of-the-Book, Subject-field
Indexing, and Indexing in certain languages
9 Knowledge Organisation Environment[7]
Professional & Organisational Problems, Persons & Organisations in KO, Organisation of
Classification & Indexing on a National & International Level, Education & Training in KO,
Policy & Legal Questions, Economics in KO, User Studies, Standardization in KO Work.

Owing to its great applicability, the KO's scope is extremely large if one considers that e.g. the cited six universal classification schemes cover so to speak the whole conceptual knowledge of mankind; however, what matters here is the professional acumen with which concepts are collected, processed and ordered. This also applies to the taxonomies in all subject fields as well as to all expert thesauri built in all disciplines in the most important countries. Considering the Linné taxonomies which over more than two centuries have widely sustained biological research, one cannot help adjusting taxa to modern findings; however, this does not mean that one should renounce the fundamental ordering scheme.

5.0 What would be the answer to the question in the title?

It could be subsumed in the following way. Knowledge organization presupposes on the one hand cognizance of concepts/knowledge units under review as well as relative system-theoretical issues connected with structuring concepts and classes of concepts, so that as a result professionally acceptable ordering schemes may be obtained for the scientific world. On the other hand, applications of KO work rely on the elements of KO for all possible tasks in various branches of the art, dealing with all sorts of objects and subjects, including contents of all kinds of documents, films, videos, etc., also items from museums collected by name, title or code for further investigation. In this respect it must be clear that Knowledge Management (KM) lies outside the scope of KO, although KM may well use the results of a subject-conform KO.

As regards the development of KO as such, it may be observed that the roots evoked under the first section above, viz. traditional classification, still hovers over the literature on KO, however owing to informatics and data-processing, where the content moment of data is more and more acknowledged and many a wheel invented anew, thus a new terminology developed as a by-product proposing unfortunate designations, such as "ontology" for KO systems and "metadata" for concepts and concept classes.

6.0 KO as a discipline by its own right

The editors of *Knowledge Organization,* with the joint aid of UDC (Universal Decimal Classification) and *DDC* (*Dewey Decimal Classification*) magazine editors, Ia C. McIlwaine & Joan S. Mitchell as guest editors have produced under no. 2/3 of 2008 an issue which also deals with the question: "What is Knowledge Organization?" Apart from the articles by Birger Hjörland on the question "What is Knowledge Organization," Joseph T. Tennis on "Epistemology, Theory, and Methodology in Knowledge Organization. Toward a Classification, Metatheory, and Research Framework," Maria L. Lópes-Huertas on "Some Current Research Questions in the Field of Knowledge Organization," Claudio Gnoli on "Ten Long-Term Research Questions in Knowlede Organization," Rebecca Green on "Relationships in Knowledge Organization" and Marcia Lei Zeng on "Knowledge Organization Systems (KOS)," the issue contained also my interview on a series of questions which I dealt with in December 2007 (Dahlberg 2008). Question number 8 concerned the issue "What needs to happen in the field for it to gain widespread acceptance as a scientific discipline?" to which I confessed (probably to the great dismay of the two librarian colleagues), that I thought it necessary to take KO out of librarianship and documentation to accommodate it within science of science,[8] for since long other domains such as zoology, botany, microbiology are confronted with taxonomic issues (classification of objects), as well as more recent classifications of commodities, produced in the course of the last century, patents, official statistics,[9] beside the results of the many terminological diploma studies carried out in some countries with their systematic representation of termini of given knowledge fields (cf. Budin 1996) etc.

This would permit KO to interconnect such concept and methodological relevant disciplines, while itself approaching scientific standards, thus justifying its claim to be regarded as a scientific discipline in its own right. Concomitantly, its findings and methods could generally be accommodated in other fields (cf. Dahlberg 1994 and 2006). Already in 1974 the *ICC* reserved the first position for science of science under the ontical rubric 8 – Knowledge & information – to put KO on posit 814.

It seems to me that ISKO should have engaged since long in a series of scientifically relevant tasks, such as looking after its own terminology by assessing & collecting relevant terms in the many contributions in its publications in order to gain an overview to permit to see where boundaries should be drawn, what is off-limits and to focus on the very issues of KO, as I suggested (in Dahlberg 2009 and 2010a) a while ago. In fact, there lies ahead an exemplary exploitation of sources for an institute of KO open to all knowledge fields. It may be that ISKO would be overtaxed by such a huge challenge. This is why I believe that the time has come to establish an academy for KO or at least an institute in every major country so that scientists of the various disciplines, terminologists and experts in KO could work together and achieve by the above mentioned prerequisites systematic concept exploration. Such a work in such an Institute would be fruitful not only for KO but also for science as a whole in view of the many open issues confronting whomever is engaged in the field of KO.

7.0 Overcoming the present situation in the field of universal classification

At present, the editors of the various universal classification schemes are entangled in updating their structurally completely outdated systems, inherited partly from the 19th century – or as is the case with Library of Congress *Classification*, locked up in pre-combined concepts and obliged to continually adding book after book to its initial 30-volume edition, instead of drawing a line and building a modern scheme according to the hitherto valid theories and principles, developed and presented in Dahlberg (2010b and 2012). "Interoperability" (cf. Boteram et al. 2011) of all extant systems should not be a problem at the time of automatic processing[9] and would be a task worthwhile for the envisaged institutes for KO at universities or other scientific bodies. Any user, trying to find by verbal access a solution to a concept or matter will be better off if he can rely on a properly built classification system which allows him to understand the whereabouts of his query, instead of being confused and angry over multiple "hits" with no bearing.

ISKO as an international society engaged by its statutes in the tasks here discussed, has reached a point at which it has to decide in matters of function, whether to move towards formally setting up its activity under an official "discipline" or not. Furthermore, whether, this would mean or not to envisage practical cooperation with all facilities working in classification, taxonomy and KO,[10] as well as collaborating with the more formally working mathematicians and statisticians and/or the protagonists of the "conceptual knowledge processing" of Professor Rudolf

Wille's school at Darmstadt, etc. all of which I laboured on in my published "desiderata." Indeed, all the above developed considerations condense in the 10 desiderata which I presented during the German ISKO-Conference 2009 in Bonn (Dahlberg 2011 and 2013). They should not fall into oblivion if only its members had some real zeal for the cause of KO and for an adequate streaming for order in knowledge. Already 51 years ago R. Fugmann called for order as the first and foremost requisite in documentation (Fugmann 1962). Order is also a point of love, at least love for clarification's sake, the actual pursuit of KO, not to forget love of beauty in any order and last but not least love for truth, the gist of all science. I heartily wish that this will eventually germinate.

Notes

1. Notabene: The Society for Classification prospered also thereafter, while continuing with its group of librarians. Perhaps this rift came from a former animosity between librarians and documentalists?
2. Cf. the valuable contribution from Philosophisches Institut Düsseldorf on systems (Diemer 1968).
3. A panel of the main *ICC* rubrics appears in many a publication of mine e.g. Dahlberg (1994 and 2006).
4. Precedents were findings (since 1959) in documentation of atomic energy (Gmelin-Institut-Prof. E. Pietsch); 7 years "Documentation of Documentation" under the Gesellschaft für Dokumentation, including setting up a first thesaurus on this domain (1963), as well as a system of descriptors (1967); collaborating with the Féderation Internationale de Documentation (FID) I proposed in 1968 for a committee on innovation of UDC an extensive classification of types of documents & their facets. Later on (in 1977 and 1989) were set up the societies mentioned in the first section (naturally together with a number of colleagues, Robert Fugmann as permanent Vice-Chairperson between 1977 and 1997)), followed by the organization of annual conferences from 1977-1989 as well as organizing committees and other conferences, the establishment (for ISKO) since 1989 of local chapters in a number of countries etc. In 1977, at a seminar-week in Bangalore the first public presentation of *ICC* in India. Also in 1977 till 1987, I was entrusted with heading FID's Classification Research Committee, which implied also the organization of various conferences, particularly the important meeting in Augsburg in 1982 (cf. Perreault 1983). In 1982–84 the ICIB-volumes were published under a BMFT-Project and preliminary work on a systematic and alphabetical lexicon on knowledge fields (DFG-Project Logstructure) began 1976-1979, but only in 2011 took place finally the drag and drop of some 3500 definitions of the first three hierarchical levels under this project in form of an Excel folder, in fact a preliminary work for the much needed updating and completion of the whole amount of 6.500 subject fields, which was possible in cooperation with Prof. Walter Koch, Graz.
5. First by G. Riesthuis (1997-2006), thereafter by Ia McIlwaine (2007-2012), after 2013 by Hur-Li Lee, as pdf-files or after 1997 as a cumulative data-bank.
6. A casual overview of this class-system may be taken from the mentioned publications (Dahlberg 1994 and 2007). Recently it has been published under http://www.isko.org/scheme.php.
7. Under 94 we find today "cataloguing." In devising the scheme, I had left this class empty. In my text (above) I omitted this class, as it does not belong into the scheme of KO. Cataloging is an activity in the field of the information sciences. My dear librarian successors filled it by their desire. But "Subject cataloguing" belongs under the main rubric 3, whereas "Cataloguing of documents" is a purely formal rubrication, not contents-related or concept-oriented.
8. In our universities, science of science is, if at all, linked to theory of science, which, however, is still put under philosophy. Therefore, a complete misunderstanding will always prevail in this matter. Another point of dissent is my placing logics on its own right before mathematics. This must be so because without logic, nothing will do.
9. Remarkable in this respect the contribution of D. Soergel "Conceptual Foundations for Semantic Mapping & Retrieval" (Soergel 2011).
10. An enormous list of major classification schemes appears under the Wikipedia "Classification" entry.

References

Aitchison, Jean, Gomersall, Alan and Ireland, Ralph. 1969. *Thesaurofacet: A thesaurus & faceted classification for engineering & related subjects*. Whetstone: Leicester English Electric Company Limited.

Bliss, Henry Evelyn. 1929. *The organization of knowledge and the system of the sciences*. New York: Henry Holt and Company.

Bock, Hans Hermann. 1974. Automatische klassifikation. *Theoretische und praktische methoden zur gruppierung und strukturierung von daten (cluster-analyse)*. Göttingen: Vandenhoeck & Ruprecht.

Budin, Gerhard. 1996. *Wissensorganization und Terminologie. Die Komplexität und Dynamik wissenschaftlicher Informations- und Kommunikationsprozesse*. Tübingen: Gunter Narr Verlag.

Dahlberg, Ingetraut. 1974a. Zur Theorie des Begriffs. *International classification 1*: 12-9.

Dahlberg, Ingetraut. 1974b. *Grundlagen universaler Wissensordnung. Probleme und Möglichkeiten eines universalen Klassifikationssystems des Wissens*. Pullach bei München. Verlag Dokumentation.

Dahlberg, Ingetraut. 1979. On the theory of the concept. In Neelameghan, A, ed., *Ordering systems for global information networks: Proceedings of the Third International Study Conference on Classification Research held at Bombay, India, during 6-11 January 1975*. Bangalore: Sarada Ranganathan Endowment for Library Science, pp. 54-63.

Dahlberg, Ingetraut. 1982a. ICC- Information coding classification – principles, structure & application possibilities. *International classification 9*: 87-93.

Dahlberg, Ingetraut. 1982b. *International classification and indexing bibliography*. Frankfurt: Indeks Verlag.

Dahlberg, Ingetraut. 1987. Die gegenstandsbezogene, analytische Begriffstheorie und ihre Definitionsarten. In Ganter, Bernhard, ed., *Beiträge zur Begriffsanalyse*. Mannheim: BI-Wiss.-Verlag, pp. 9-22.

Dahlberg, Ingetraut. 1994. Wissensorganization—eine neue Wissenschaft? In Wille, Rudolf, ed., *Begriffliche wissensverarbeitung in der Wirtschaft*. Mannheim : BI-Wiss.-Verlag, pp. 225-38

Dahlberg, I. 1996. Compatibility and integration of order systems 1960-1995: an annotated bibliography. *Compatibility and Integration of order Systems (Research Seminar Proceedings of the TIP/ISKO Meeting, Warsaw, 13-15 September, 1995*. Warsaw: Wydawnictwo SBP.

Dahlberg, Ingetraut. 2006. Knowledge organization—a new science? *Knowledge organization 33*: 11-9.

Dahlberg, Ingetraut. 2008. Interview with Ingetraut Dahlberg December 2007. *Knowledge organization 35*: 82-5.

Dahlberg, Ingetraut. 2009. Concepts & terms: ISKO's major challenge. *Knowledge organization 36*: 169-77.

Dahlberg, Ingetraut. 2010a. Begriffsarbeit in der Wissensorganisation. In Sieglerschmidt, Jörn and Ohly, H. Peter, eds., *Wissensspeicher in digitalen Räumen: Nachhaltigkeit, verfügbarkeit, semantische Interoperabilitäi; Proceedings der 11. Tagung der Deutschen Sektion der Internationalen Gesellschaft für Wissensorganisation, Konstanz, 20. bis 22 Februar 2008*. Würzburg: Ergon Verlag, pp.112-23.

Dahlberg, Ingetraut. 2010b. Information coding classification. Geschichtliches, Prinzipien, Inhaltliches. *Information: Wissenschaft & Praxis 61*: 449-54.

Dahlberg, Ingetraut. 2011. How to improve ISKO's standing. Ten desiderata for knowledge organization. *Knowledge organization 38*: 68-74.

Dahlberg, Ingetraut. 2012. A systematic new lexicon of all knowledge fields based on the information coding classification. *Knowledge organization 39*: 142-50.

Dahlberg, Ingetraut. 2013. Desiderata für die Wissensorganisation. In Ohly, H. Peter, ed., *Wissen, Wissenschaft, Organisation. Proc.12.Tagung d.Dt.ISKO-Sektion, Bonn, 19-21 Okt.2009*. Würzburg, Ergon Verlag, pp.106-13.

Diemer, Alwin. 1968. *System und Klassifikation in Wissenschaft und Dokumentation; Vorträge und Diskussionen im April 1967 in Düsseldorf*. Meisenheim am Glan: Verlag A.Hain.

Fugmann, R. 1962. Ordnung – oberstes Gebot in der Dokumentation. *Nachrichten für Dokumentation 13* n3: 120-32.

Boteram, Felix, Gödert, Winfried and Hubrich, Jessica. 2011. *Concepts in context. Proceedings of the Cologne Conference on Interoperability and Semantics in Knowledge Organization, July 19-20, 2010*. Würburg: Ergon Verlag.

Perreault J.M. and Berman, S. 1983. A dialogue on the subject catalogue : "a representative of the new left in American subject cataloguing." Occasional papers. No. 161.

Scheele, Martin. 1967. *Wissenschaftliche Dokumentation. Grundzüge, Probleme, Notwendigkeiten*. Schlitz/Hessen: Verlag Dr. Martin Scheele.

Shamurin, E.I. 1967. *Geschichte der bibliothekarisch-bibliographischen Klassifikation. Bd.1 u.2* München-Pullach: Verlag Dokumentation.

Soergel, Dagobert. 2011. Conceptual foundations for semantic mapping and semantic search. Boteram, Felix, Gödert, Winfried and Hubrich, Jessica. 2011. *Concepts in context. Proceedings of the Cologne Conference on Interoperability and Semantics in Knowledge Organization, July 19-20, 2010*. Würburg: Ergon Verlag.