Knowledge Organization Pro and Retrospective

Abstract
This paper discusses former and expected general developments in the area of knowledge organization. A distinction should be made between long-term and mid-term developments. In addition to these results, significant past developments and their aspects were discussed at a Vienna discussion panel 2006 and at Bangalore and Juelich panels in 2007. These yield a list of expected or suggested future developments.

1. What is Knowledge Organization
Ingetraut Dahlberg writes: Knowledge Organization is the science of structuring and systematically arranging of knowledge units (concepts) according to their inherent knowledge elements (characteristics) and the application of concepts and classes of concepts ordered by this way for the assignment of the worthwhile contents of referents (objects/subjects) of all kinds (Dahlberg 2006).

More precisely, Dahlberg (1998) defines knowledge organization as: A subject area encompassing the organizing of:

a. units of knowledge concepts and
b. all types of objects (minerals, plants, animals, documents, pictures, museum objects, etc.), related to particular terms or categories, so as to capture what is known about the world in some orderly form allowing it to be further shared with others.

Knowledge organization encompasses the following nine sub-areas:

1. the epistemological, mathematical, system-theoretical, cognitive scientific and scientific theoretical premises of order of concepts as well as their historical background,
2. the knowledge of elements and structures of systems of concepts,
3. the methodology of intellectual construction, conservation and revision of this system and computerization; including questions of paradigmatic and syntactic relating of their elements and units as well as keeping the system compatible and evaluating this system,
4. the methodology of intellectual and machine applications of this system via classification and indexing,
5. the knowledge of existing universals and
6. special taxonomies and classification systems including documentation language (thesauri),
7. questions arising from the influential areas linguistics (~ linguistics mathematics) and terminology; including the retrieval problems, especially in online access,
8. the application of content indexing of all types of documents and in all subject areas,
9. the entire periphery of knowledge organization in the workplace, individual centers, societies, countries and in international areas, as well as the question of education, the economy, the user, etc.

At another point Dahlberg stresses (Wiss-Org 2006): “Henry Evelyn Bliss used the composed term, ‘Organization of Knowledge’ in his two books published 1929 and 1933, respectively, i.e. “The Organization of Knowledge and the System of the Sciences” and “The Organization of Knowledge in Libraries.” However, we also considered the term ‘knowledge order,’ a designation which we had equated with ‘classification’ when founding the German “Gesellschaft für Klassifikation” in 1977. … However, after some discussion we favoured the term ‘Wissensorganisation — Knowledge Organization’ as it allowed a direct translation into English, whereas the term ‘order’ in combination with knowledge may be misleading, because of the verb ‘to order’ (e.g. a service, a product).”

“The concept of ‘organization’ however, as it is accepted in German has a wider range than just ‘order.’ namely ‘planned construction,’ ‘structure,’ ‘forming’ (Wahrig 1975), although this does not apply to some other languages where ‘organization’ is only used for collectivities like associations or unions, so that in such cases, ‘organization’ can only be related to people, not to objects.”

Birger Hjørland remarks: “You make a difference between the phrases ‘organization of knowledge,’ and ‘knowledge organization’ … I have so far not searched systematically for the history of the term knowledge organization, but the term appears in the following work from 1910: Principles of the Science of Organisation as applied by the Knowledge Organisation Bureau, Limited, in its Bureau Encyclopedias ”

To reiterate; there is more to be understood by knowledge organization than just organizing; the processes of saving, finding and communicating thoughts can also belong to the practical processes.

2. Knowledge Organization as a Counterpart of Society

Knowledge organization reflects the efforts of man to bring sense to his experience of the world with which he is confronted on a daily basis. He makes the knowledge used in his work, which serves more or less to ensure survival, conscious and accessible. The organized knowledge becomes an extended genetic code which can be called up as needed. Over centuries and millennia, it can be presumed that urgent progress was needed, such as demonstrated in library science, information science and information technology leading to easy, confident usage of knowledge.

However such developments are neither inevitable nor always the same. There are differing needs in knowledge and knowledge technology according to work environment, conclusions drawn from extant knowledge and derived goals. An agrarian society has different needs than a society affected by the new economy and production; trade or fine art have different requirements regarding type of knowledge and how it is utilized. Knowledge and knowledge technology have, thereby, grown historically alongside. Everything we do or think is built on the shoulders of giants, as Robert K. Merton characterizes the quantitative and qualitative development of the scientific knowledge. Phylogenetically between generations, as well as ontogenetically per person, we make experiences through

3. Contribution in June 2006 to Discussion-List Wiss-Org. This thread is currently not available.
4. An example for this is the view that humans, environment and cosmos are equally structured, as early schematic anatomical and architectural analogies suggest it.
5. E.G. the syllogism of Aristotle or Ars Magna of Ramon Llull.
6. As for instance with the linguistic relativity thesis by Saphir-Whorf has been worked out.
7. Whereby also different conversions of ideas are justified, like those of ‘Autopoiesis’ or ‘Post-Modernity’.
the perspective of our predecessors, repeat understandings and change them\textsuperscript{8}. Knowledge is thereby in constant flux and the respective current chapter conforms to the current requirements. This applies also to the conscious or tacit competence to deal with knowledge. Today can be said that knowledge organization is more broadly demanded for than ever, what in addition, means that it must be able to be mediated and if necessary to be carried actively to specialized technical and software engineers.

3. Knowledge Organization in the Long Run
A compressed look at the historical progress of knowledge organization points to the following noteworthy occurrences. It began with the coding and availability of knowledge. This became manifest with wood and bone cutting and particularly with Stone\textsuperscript{9}. Then these were eventually replaced by transportable pottery tablets and representations in bronze\textsuperscript{10}. Libraries created ways of searching for this growing inventory\textsuperscript{11}. The printing press served to multiply the knowledge carrier. Knowledge was organized according to logical rules, being string systems or hierarchies. Mass storage allowed for broadening of capacity and circulation. Statistical analysis made more organization and selection possible regardless of the large amounts of knowledge carriers\textsuperscript{12}. Knowledge was organized according to logical rules, being string systems or hierarchies\textsuperscript{13}. Mass storage allowed for broadening of capacity and circulation\textsuperscript{14}. Statistical analysis made more organization and selection possible regardless of the large amounts of knowledge carriers\textsuperscript{15}. Flexible availability was increased via communication technology. Graphics served for holistic comprehension of content\textsuperscript{16}. Then finally we return to the starting point whereby cave painting already used pictures to codify, even if a bit less strictly in relation to what was being said.

The following aspects played a role in these developmental steps that would trigger the development of knowledge organization in the course of history:

**Content:** Beginning with humanities (religion, philosophy), on through science and technology, product catalogues and collectibles, processes (software, computer models) were also worth collecting.

**Sustainability and the public availability:** Initially only a close circle was responsible for access to knowledge. Then came the class of learned and nobility who saw knowledge as their privilege. Then finally knowledge became part of the cultural assets belonging to the people. Today it is in principle everywhere and available to all.

**Persistence:** From stone and burned clay (resistant and permanent) to correctable wax, and then to quickly coded, lightweight paper. Later, punch cards could be copied and electronic form enabled transformation.

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\textsuperscript{8} Just like family sozialisation, where values of parents are taken over, there is also the lifelong sozialisation in the working sphere and in science.

\textsuperscript{9} Thus Stonehenge is by now regarded as an observatory for typical sky constellations to predict seasons.

\textsuperscript{10} As found in Mesopotamian palace archives.

\textsuperscript{11} The library of Alexandria seems to have listed the place of origin, the owners and the editors.

\textsuperscript{12} Of Schedel's world history already approx. 1,400 copies in Latin and 700 copies in German were printed. Pirated editions followed.

\textsuperscript{13} E.G. circle representations (7 free arts), trees of the knowledge, decimal classifications.

\textsuperscript{14} This concerns analogue memory, like microfiche, as well as digital memory, like magnetic tapes or optical memory.

\textsuperscript{15} E.G. so called multivariate reduction methods, like cluster analysis.

\textsuperscript{16} E.G. selforganizing maps or cognitive maps.
Coding: It began with pictures, moved on to symbols and eventually led to language and meta-languages. Indexing languages began with ordering, then subdividing (decimal), to pre- and post-coordination. Facet classification, links and roles enriched the power of coding. Networks and clusters of codes introduced a quality of context and transition.

Processing: It began with filing, later giving way to subsumption (ordering, classification, organization). More sophisticated were polyhierarchies and keywords in context. The distinction between object, concept and notation gave more expressiveness. Then language-processing and logic reasoning was introduced. Now statistical calculations help in reduction and patterns.

Organizing: Rules for title and alphabetic cataloguing were followed by generality of universal classification systems. Rules for controlled terms were followed by metadata recommendations and ontologies for documented types. Gateways and interoperability are examples of recent efforts.

4. Future Mid-Term Expectations from Panel Discussions
At the German ISKO Conference 2006 (International Society for Knowledge Organization) in Vienna, a panel on the future of knowledge organization was convened (Ohly 2008).17

Gerhard Rahmstorf indicated that knowledge, among other things, would grow through research activities, that it is complex and that it must be computer processable. He sees recourse to the language as still necessary. Word meanings and sentences must be clarified and representable by computer technology. The composition of a knowledge base then encompasses the analysis of sentence forms and storage of sentences. Appropriate representation can be presented in tables. Questions can thereby be answered.

Winfried Schmitz-Esser realized that knowledge as known until now in the sense of ‘shelving order’ is no longer sufficient. Digitalized sources in large qualities, with heterogeneous text and in various languages need more organizational means than was previously necessary. A world model is needed that integrates means of organization and that can also detect and process knowledge in texts. Non-language materials must also be integrated and the results presented for the user as comprehensible. In the future it should be possible to track down and evaluate without the help of librarians.

Gerhard Budin stated that Knowledge Organization nowadays is an interdisciplinary effort to engineer shared knowledge. This comprises cognitive, epistemic, communicative, and automatic knowledge representation, creation and processing. One predominant requirement is concept and terminology work.

The view of Michael Nentwich is that information seekers — as well as scientists — are too modest in their searching demands and that subject-specific portals offer worse quality than the existing specialized databases. This includes community driven blogs, social bookmarking, etc. as well. Such half-solutions should at least work against special solutions. Knowledge organization specialists create something like a Google 2.0 when semantic intelligent solutions are sought.

The ongoing discussion stressed — more than ever — the broad demand in knowledge organizations, meaning that it must be also communicated to experts and software engineers.

The IKONE conference (International Conference on Future of Knowledge Organization in the Networked Environment) 2007 in Bangalore can generally be summarized as: Knowledge organization is needed worldwide especially in connection with technological enhancing of storage and distribution means. Knowledge Organization is no longer a domain of librarians but also of practitioners, knowledge engineers, and knowledge managers. In connection with the Internet and full text the field of knowledge organization must be seen much more broad and flexible than classification or thesauri systems, such as ontologies. I will enlighten this by stressing out the contents of some selected talks.

In the inaugural session Prasad Bhaarat Ram restated information supply as “Give me what I want, not what I ask for”. Means for that might be procedures that deal with misspellings, spam ranking, user models. Maximilian Stempfhuber stressed out that aggregation of data resources in portals requires special treating of heterogeneity with respect to user demands.

Kavi Mahesh introduced into the creation of a ‘situated’ knowledge organization scheme for various demands for knowledge management in enterprises. To achieve balance between compositional semantics and nominals certain proliferation principles must be applied: similarity, specificity, opposition, and unique axis. According to Madan Mohan Rao knowledge management should not only focus upon IT. He stated that successful knowledge management practices can be facilitated by adequate access to knowledge management tools, user-friendly work-oriented content, communities of practice, a culture of knowledge, learning capacity, a spirit of cooperation, commercial and other incentives, and carefully measured capital investments and returns.

A concluding panel moderated by Peter Ohly named as biggest challenges in the next five years: Construction of virtual Knowledge Organization schemes (Mahesh), enhancements in education in knowledge organization (Khoo), understanding “human needs” and open modeling that incorporates even non-standardized material (Malone), building methodologies for knowledge organization (Stempfhuber).

A conference on Scientific Communication of the Future in Jülich 2007 centered more or less around similar topics. Emphasis was given on eScience-Tools, collaborative techniques, information networking and open access. The outcome yielded in diversification of knowledge and types of knowledge communication distinguishing between mainstream knowledge and ingenious knowledge creation.

A special discussion panel focused on quantitative aspects of science output, general frameworks for science and research and science as mass phenomena. Individual statements were:

We have too many data — primary and even secondary data. Thus we should not collect too many but carefully select them. The investigation into information acquisition in scientific work is important but too less reimbursed by the funding agencies. Information questions from Information Science migrate to the specialized sciences, but document management rests as a primary function for librarians — but on a high know-how standard. The science of the future requires collaborative communication techniques, but leading research will still require individual efforts. Mass indicators for science efforts must be changed to qualitative examinations where trust plays an important role.

To give a general summary, knowledge organization must realize the increasing diversity of knowledge and communication styles together with public training in organization tools and communication techniques.

**Conclusion**

If lessons are to be learned from the past, then definitely the following. Whatever was new was almost always supplementary, not substitution. Sometimes detailed, and sometimes general information was in demand. Recall (extension) and precision (intension) alternated. Input (documentation) and output (information) mutually determine one another. Durability and flexibility are constant opponents. Self-serving interests in information conflicts with sustainable information availability.

Nowadays knowledge must be compiled and evaluated by many persons, and that means more, faster, and more flexible knowledge processing. Compatibility is not sufficient, instead heterogeneous information needs to be transferable. New object forms — in addition to texts — need to be considered. Information must be offered as multi-disciplinary and user-oriented. In general a knowledge organization literacy has to be created since new medium technologies require also new handling skills.

**References**


Wiss-Org 2006. “What is Knowledge Organization”. Contributions to the discussion lists wiss-org@bonn.iz-soz.de and isko-l@lists.gseis.ucla.edu in Aug. 2006.