Richard P. Smiraglia — Institute for Knowledge Organization and Structure, Inc.

From Atomic Elements to Fantastical Machines: The "Concept" in *International Classification*

Abstract

The concept—an idea, a notion—is accepted as the core entity in knowledge organization (KO). The founder of the science of KO, Ingetraut Dahlberg, defined a concept repeatedly over time. Concepts have been well-discussed in the literature of both KO and information and have even been described as elementary particles in a theory of knowledge interaction. But an interesting question is what did the concept mean to these original thinkers in the nascent KO a century or more ago? An earlier series of papers about the evolution of the concept in information science based on the discourse of the concept in *American Documentation* led irrevocably to the notion of the concept as an element that could be isolated for analysis alongside frequent references to fantastical machines. This short paper describes an ongoing research project to undertake the same level of discourse analysis in the foremost evolutionary journal of KO, *International Classification*. A simple narrative of the occurrence of the "concept" in *IC* over the course of its run shows evolving definitions but also reveals usage of the notion of the concept as core (or *atomic*) element.

Discourse of the "concept" in knowledge organization

This short paper reports ongoing research into the discourse of the "concept" in the historic early period of the science of knowledge organization. The concept—an idea, a notion—is accepted as the core entity in knowledge organization (KO). The founder of the science of KO, Ingetraut Dahlberg, defined a concept as (Dahlberg 2006, 12):

> the objects and activities of concept theory
> knowledge elements … are characteristics of concepts
> knowledge units, which we equate with concepts
> larger knowledge units, which are concept combinations.

In 1978 she had defined the concept as "a unit of knowledge" where "knowledge may be regarded as the totality of propositions about this world, existing—in documents or in the heads of persons" and "a concept is a knowledge unit, comprising verifiable statements about a selected item of reference, represented in a verbal form (143). It is clear that the establishment of knowledge organization on concept theory relied on a common understanding of the idea of a "concept" promulgated by Dahlberg in her own writing but also in the journal she edited.

Concepts, of course, have elsewhere been well-discussed in the literature of both KO and information science (see for example Hjørland 2009; Szostak 2011). Indeed, concepts have been described as elementary particles in a theory of knowledge interaction (Smiraglia and van den Heuvel 2013; Smiraglia, van den Heuvel and Dousa 2011).

But an interesting question for those of us approaching the first quarter mark of the 21st century is what did the concept mean to these original thinkers in the nascent KO a century or more ago? In Smiraglia (2014; 2018), a series of papers about the evolution of the concept in information science was based on specific analysis of the discourse of the concept in the foremost journal *American Documentation*. The analysis was broad-ranging, but the discourse analysis led irrevocably to the notion of the concept as an element that could be isolated for analysis. Frequent references to fantastical machines littered the writings of early 20th century information scientists, including references to the "fantastical knowledge engine" in Gulliver's Travels (Smiraglia 2018, 128), to Cross's "Universal Index" (Duncan 2022, 211 ff.), and to Otlet's Grinder (Smiraglia and van den Heuvel 2013, 363).

Methodology

The present research project is intended to undertake the same level of discourse analysis based on the use and usage of "concept" and its stem-relations in the foremost evolutionary journal of KO, *International Classification. IC* was published by Dahlberg from 1972 to 1989, when it evolved into the present and more formal journal *Knowledge Organization. IC* contained research articles (usually 3 or 4) accompanied by Dahlberg's editorials, reports from conferences, and a bibliography of classification. The methodology for this research follows that of Smiraglia (2018), applied to the articles.

With this analysis we hope to reveal the contextual usage of the term "concept" in articles in *IC* as well as to discover the discourse underlying that usage.

Research questions are:

What are the origins of the notion of the concept as "atomic element" (knowledge unit, particle, etc.)?

What visioning exercises (including fantastical machines) promote the usage of the "concept"?

The entire run of the journal *IC* in digital form was passed into OCR format for data-mining; all article titles and abstracts are recorded in searchable form and these have been entered into the Provalis ProSuite's WordStat module, in which a KWIC (keyword-in-context) feature allows discovery and analysis of every occurrence of specific terms.

Context and Content of *IC*

Historical context

International Classification ran from May 1974 until October 1992, a period of 18 years embracing most of the last quarter of the 20th century. In the world at large, 1974 saw the resignation of Richard Nixon as president of the U.S., the fall of the Pierre Trudeau government in Canada, India's joining the nuclear club, and the discovery of the hominid skeleton "Lucy" in Ethiopia. Food fads were cheese balls and Jello salads. At the end of the run 18 years later, Sinead O'Connor ripped up a picture of the pope, there were earthquakes in Egypt and Colombia, chicken Caesar salad was all the rage, bread machines for the home were introduced and Johnny Carson retired from the *Tonight Show* (*On this Day* 2023; *The People History* 2022; *HobbyLark* 2023). In information, in 1974 *Journal of the American Society for Information Science* (*JASIS*) published articles on copyright, current awareness services and information retrieval systems. Eighteen years later *JASIS* carried articles on psychological relevance, skewness of science and a model for word clustering. *Cataloging & Classification Quarterly* first appeared in 1981 with articles about *AACR2* and *MARC*; its last issue of 1992 was a special double-issue on retrospective conversion of library catalogs from card to online.[1]

IC 1974 and 1992 and the founding of ISKO

The masthead of the first issue of *IC* carried its subtitle "Journal on Theory and Practice of Universal and Special Classification Systems and Thesauri" and identified Ingetraut Dahlberg, Alwin Diemer, Jean Perreault and Arashanipal Neelameghan as editors; consulting editors were Pauline Atherton, Hermann Fangmeyer, Eric de Grolier, Friedrich Lang, Dagobert Soergel and Bryan Vickery. The editorial "Why this Journal?" (1 (1974), no. 1: 1-2) was signed by "the editors" (although it is clear the predominant voice is Dahlberg's) and identified the journal as a "programme" essentially to bring together from all disciplines people involved in

---

[1] Famously, I completed my PhD dissertation in October 1992, defended it in November, and graduated from the University of Chicago in December.

classification and the "ordering of knowledge" for "interdisciplinary common understanding" about the methods of classification. Specifically, the programme was (2):

> on an international scale … 1) to draw attention to the existence of a new, autonomous field of knowledge whose purpose it is to bring about order, whose objects are concepts and concept systems, and whose methods may be regarded as consisting in the construction of concept systems and the relating of concepts from such systems to elements of reality and vice versa" as well as "2) to provide … a common platform" and "3) to unite the specialists from the various fields …to bring about a common basis for their efforts."

Thus, from the beginning, the critical role of the concept as core entity was acknowledged.

The founding of ISKO (International Society for Knowledge Organization), probably the pinnacle of Dahlberg's attempts to formulate a science of the ordering of knowledge around the concept as core entity, took place in July 1989. This was announced in an unsigned editorial in v. 16, no. 2 (71):

> Yes, on this very day of July22nd, 1989, a group of German and non-German members of the German Society for Classification founded the International Society for Knowledge Organisation (ISKO) at the Intercity Restaurant of Frankfurt's central Railway Station.

Beginning in that issue *IC* carried the following notice of its link to the new ISKO on its masthead:

> As of August 1989, *International Classification* has become the official organ of the International Society For Knowledge Organisation (ISKO) (founded on July 22, 1989) and is included for every ISKO member.

The first issue of *IC* carried seven articles, shown in Table 1.

Table 1. Articles in v. 1, no. 1 of *IC*, May 1974.

Bonifati M. Kedrov	Concerning the Synthesis of the Sciences
Ingetraut Dahlberg	Zur Theorie des Begriffs (Towards a Theory of the Concept)
Vladimir Rybatchenkov	Development of a Broad System of Ordering for UNISIST Purposes
Ejnar Wahlin	A Common Classification for Swedish Research Projects
Alan J. Mayne	Progress Report on a New Scheme for the Classification of Knowledge
Max E. Neuenschwander	Systeme der Waren-und Aktivitätsklassifikation (Systems for the Classification of Commodities and Activities)
Dagobert Soergel	Automatic and Semi-Automatic Methods as an Aid in the Construction of Indexing Languages and Thesauri

Notably, Dahlberg's first article in the first issue is "Towards a Theory of the Concept." Soergel, another editor, has an article on construction of indexing languages and thesauri. The lead article by Kedrov is on synthesis of the sciences; the others are reports on specific classifications.

Eighteen years later, the final issue of *IC* before the journal evolved into *Knowledge Organization*, also carried seven articles (during the complete run, most issues carried three or four articles), shown in Table 2.

Table 2. Articles in v. 19, no. 4 of *IC*, October 1992.

Roy Rada, Angelo Rossi-Mori, Ray Paton, Alan Rector, Fabio Magliani, Pieter de Vries Rob be, and the rest of the GALEN team	The GALEN Dream
Roy Rada, Claude Ghaoui, Ray Paton, Malcolm Taylor	Medical Knowledge and Hypermedia
Robert Baud, Laurence Alphay, Anne-Marie Rassinoux, Judith Wagner.	Natural Language Processing and GALEN
J.C.Binwal	Ranganathan and the Universe of Knowledge
Ingetraut Dahlberg	DIN 32 705: The German Standard on Classification Systems: A Critical Appraisal
Vesa Kautto	Classing and Indexing: A Comparative Time Study
Michael Afolabi	Spiritual Matters: Provision for Independent African Churches in General Classification Schemes

Three articles are co-authored, hypermedia is treated, and natural language processing is featured.

Authors in *IC*

226 articles appeared in the complete run of *IC*. Thirty-eight first or sole authors appear twice or more over the entire run, these are shown in Table 3.

Table 3. Most frequently appearing authors in *IC*.

|			
Ingetraut Dahlberg	13	Anne M. Carpenter	2
Robert Fugmann	8	Clare Beghtol	2
Anthony J .N. Judge	5	D. Goldenberg	2
Roy Rada	5	Dagobert Soergel	2
Fred W. Riggs	4	Douglas J. Foskett	2
Mohinder Partap Satija	4	Edward R. Sukiasyan	2
Thomas Johansen	4	Elaine Svenonius	2
Wolfgang Dahlberg	4	H. Peter Ohly	2
Florence E. DeHart	3	Harald Haendler	2
Hans H. Wellisch	3	Jacques Maniez	2
Hemalata Iyer	3	Jiri Panyr	2
J.C. Sager	3	Joachim Krauth	2
Jean M. Perreanlt	3	Lei Zeng	2
Thomas T. Ballmer	3	Lucyna Anna Bielicka	2
		N. A. Stokolova	2
		Prithvi N. Kaula	2
		Rudolf Ungvary	2

		Shabahat Husain	2

Fourteen appear three times or more; not surprisingly Dahlberg has the largest article count with 13, followed by Robert Fugmann with 8. Dahlberg's son Wolfgang contributed 4 articles.

Keywords and Phrases in *IC*

Using the WordStat module we can use multi-dimensional scaling of keywords and phrases in proximity to visualize the contents of the domain. Figures 1-3 show the most frequently occurring keywords in article titles, most frequently occurring keywords in abstracts, and most frequently occurring phrases in abstracts. The three-dimensional plots demonstrate prominence by the size of the avitar, colors illustrate clusters of co-occurrence, and the proximity of clusters also illustrates the co-occurrence.

Figure 1. MDS plot of most frequently occurring keywords in article titles (stress = .19613 R^2 = .9574)
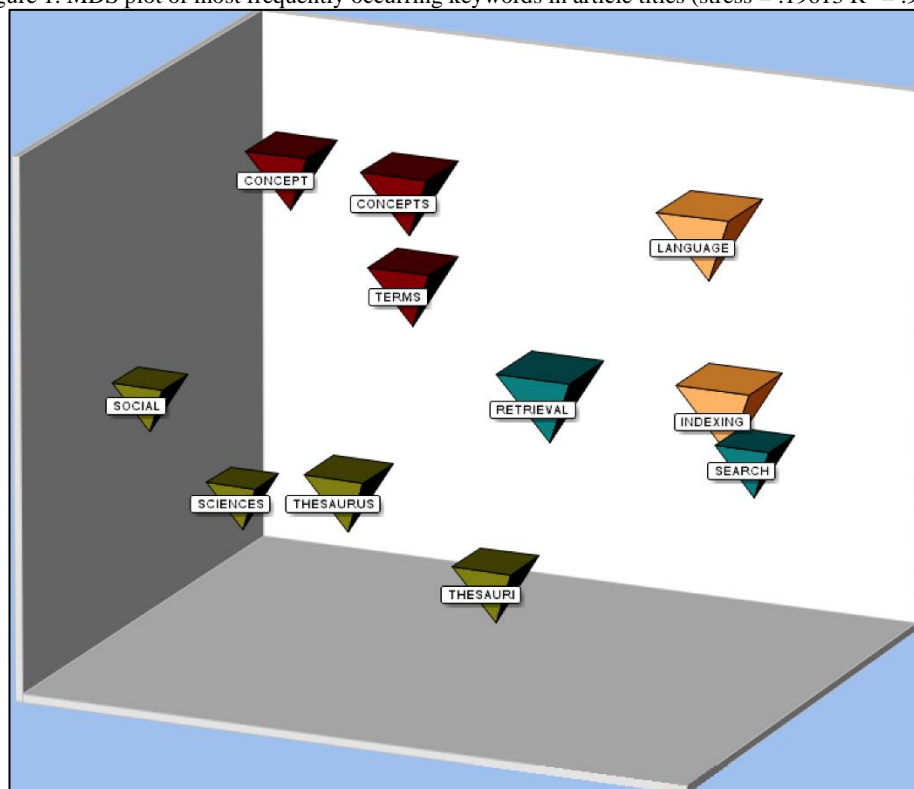

Thus, in Figure 1 we see that in article titles the most prominent cluster is "indexing language" which is proximate to "search and retrieval," concept and concepts anchor a distinct cluster, and in the distance is a cluster for social sciences and thesauri.

Figure 2. MDS plot of most frequently occurring keywords in article abstracts (stress = .20759 R^2 = .9491)
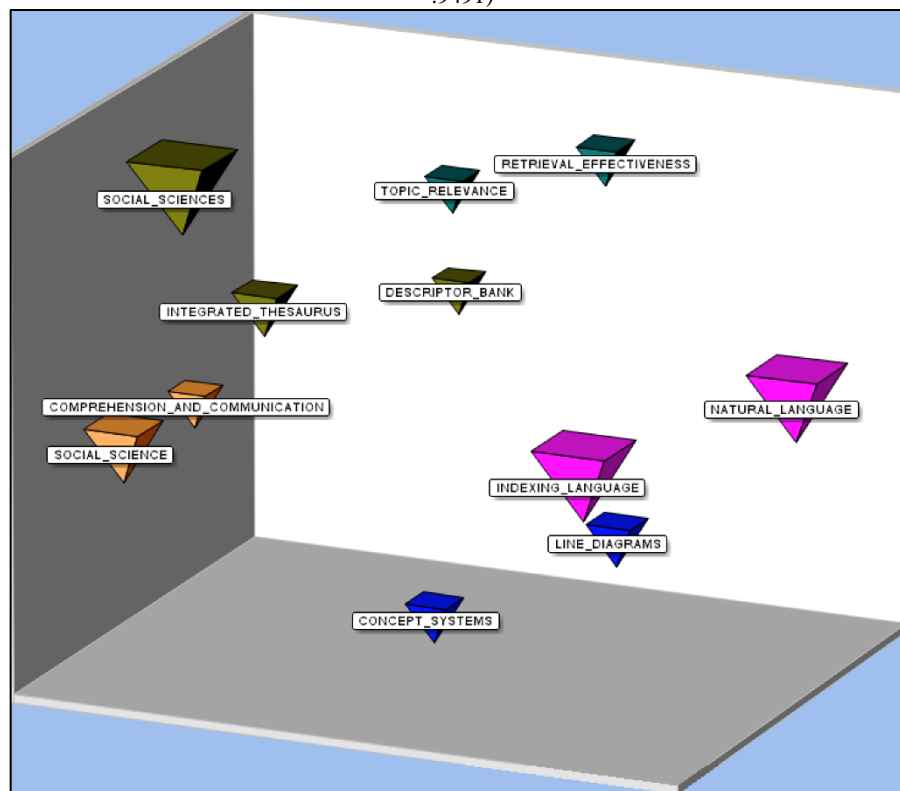
Similarly, the abstracts are dominated by a cluster representing indexing languages. The other largest prominent cluster is social sciences integrated thesaurus, which is somewhat distant indicating the two are distinct topics. Note that "social science" also occurs in conjunction with "comprehension and communication" at some distance, also distant ar clusters for relevance and concept systems.

Figure 3. MDS plot of most frequently occurring phrases in article abstracts (stress = .22352 R^2 = .9113)
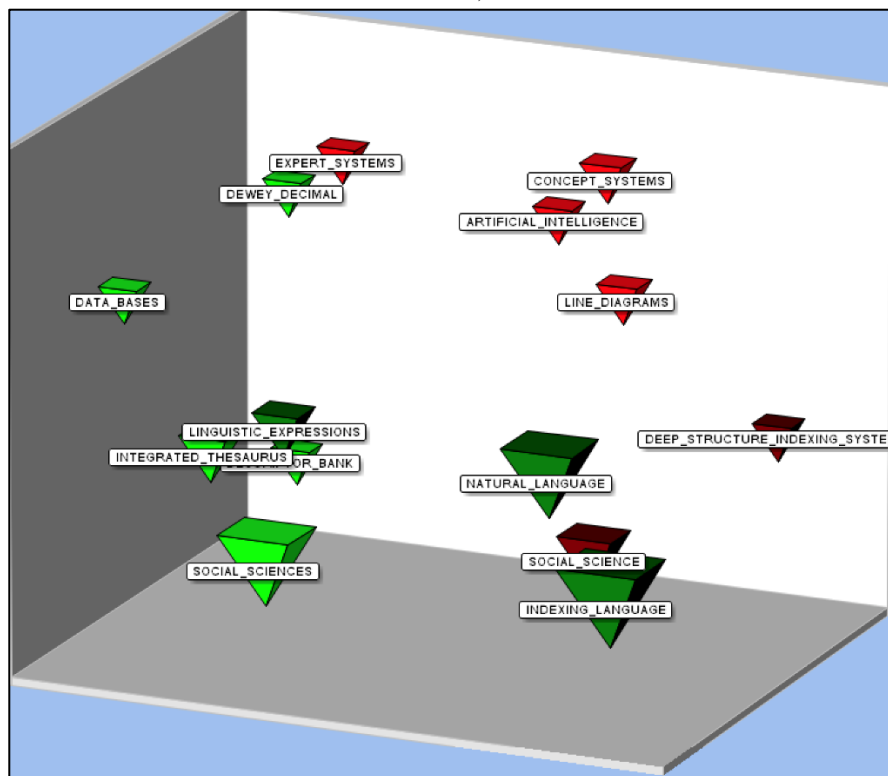
There were no repeating phrases identified as such in article titles; Figure 3 shows the most prominent phrases in article abstracts over the run of *IC*. Confirming what we saw above, indexing languages predominates and competes with social sciences and integrated thesaurus ("descriptor bank" is hidden in the figure in that same cluster). Concept systems, artificial intelligence and data-bases constitute distinct clusters. "Social science" now is clustered with "deep-structure-indexing sytems."

We see, then, that the concept is a core entity in the programme of the newly founded ISKO and in Dahlberg's journal. But, the most prominent research reported in the journal is that concerning indexing languages and thesauri.

Narrative analysis

Using the WordStat KWIC feature we are able to weave a simple narrative of the occurrence of the "concept," "concepts," and "conceptual" in *IC* over the course of its run. For this presentation we have ignored all casual usage and focused instead on articles in which the theory of the concept is either developed explicitly or moved forward in some manner. To save space (and meet the word requirements for a short paper a table of article citations and quotations from the relevant abstracts was constructed as a figure (Table 4).

Table 4. The "concept" narrative.

(Dahlberg, Ingetraut. 1974. "Zur Theorie des Begriffs [Towards a Theory of the Concept]." 1, no. 1:12-19)	"A concept is regarded as the common element of both classification system and thesauri. Reality and knowledge are not represented by words or terms but by the meanings "behind" these tokens. A concept of, say, an object, a property of an object, a process, etc. is derived from verbal statements on these as subjects and may therefore be defined as the whole of true and possible predicates that can be collected on a given subject. It is from these predicates that the characteristics of the corresponding concepts can be derived. Common characteristics in different concepts lead to relations between concepts, which relations in turn are factors for the formation of concept systems.
(Soergel, Dagobert. 1974. "Automatic and Semi-Automatic Methods as an Aid in the Construction of Indexing Languages and Thesauri." 1, no. 1: 34-39)	Development of a framework for the description and classification of statistical and graph-theoretical methods for the determination of terms and concepts and of relationships between and among them. Discussion of the problem of terms versus concepts in this context … methods … to construct global classificatory structures.
(Kashyap, M.M. 1975. "Concept Comprehenshion Building in Students and the Teaching of Theory of Library Classification." 2, no. 1: 22-25.)	Stipulative definitions of the concept 'formal concept', 'technical term', 'concept-comprehension', and 'ambiguous concept-comprehension'
(Haendler, Harald. 1975. "Selektionsgerechte Indikation von Sachgebieten und Sachverhalten [Selection-oriented Indication of Subject-fields and Propositions]." 1975 2, no. 1: 25-31.)	Discussion of the concepts "documentary informing" and "informeme" … the "informeme-theory" of Diemer is supplemented by the concepts "significance" and "efficiency of information" … Referring to the creative aspect in the use of language (Humboldt and Chomsky), it is shown how a description based on the principles of concept-synthesis may be successfully applied for the representation of informemes. Discussion of the concepts "documentary informing" and "informeme" … the "informeme-theory" of Diemer is supplemented by the concepts "significance" and "efficiency of information" … Referring to the creative aspect in the use of language (Humboldt and Chomsky), it is shown how a description based on the principles of concept-synthesis may be successfully applied for the representation of informemes.
(Dahlberg, Ingetraut. 1975. "The Terminology of Subject-fields." 2, no. 1:31-37)	So far terminological work has been mainly directed towards defining very special concepts … it is intended to assemble their definitions in a dictionary and to build a general concept-system … Some application-possibilities for a general concept-system (e.g. a broad system of ordering) are given.
(Dahlberg, Ingetraut. 1976. "Classification Theory, Yesterday and Today" 3 no. 2: 85-90)	After clarification of the elements of classification systems as well as of the basis of concept relationships it is possible to apply a number of principles in the evaluation of existing systems as well as in the construction of new ones and by this achieving relatively predictable and repeatable results.
(Dahlberg, Ingetraut. 1978. "A Referent-Oriented, Analytical Concept Theory for INTERCEPT. 5, no. 2: 91-92.)	"The concept theory presented, meant to serve as a basis for conceptual analyses of all terminological efforts, implies that every concept has a referent (be this a set of objects, a single object, an activity, a fact, a topic, etc.) about which verifiable statements determining the properties and relationships of the referent in question can be made. The totality of all the verifiable and necessary statements on a referent may be summarized and/or synthesized by a term which will then represent a concept in any communication process. A concept is thus regarded as a knowledge unit, and the statements about its referent are found to be the knowledge elements, also known as the characteristics, of the given concept. The possibility of thus determining the characteristics of concepts permits the analysis, construction, reconstruction, correlation, categorization and definition of concepts as well as the formation and control of adequate terms and the construction and comparison of concept systems."
(Dahlberg, Wolfgang. 1979. "Towards a Geometry of Basic Concepts." 6, no. 2: 83-84.)	"The essential pillars of man's thinking and knowing are the basic concepts which structure all his knowledge so far attained and his future knowledge. It is, however, only with great difficulty that these basic concepts can be made accessible for everyone through conceptual clarification, definition and classification."

(Wille, Rudolf. 1984. "Line Diagrams of Hierarchical Concept Systems." 11, no. 2:77-86.)	The possibility of visualizing conceptual relationships by graphic representation of hierarchies … ·is demonstrated here using a set-theoretical model for hierarchical concept systems. For a fixed context it is provable that the concepts in generic relationship (subconcept - superconcept) form - as a mathematical structure - a complete lattice called the "concept lattice" of the context. Methods and results of order and lattice theory can thereby be used for concept analysis. … building blocks of modified line diagrams may be understood as scales in the sense of a conceptual measurement theory.
(Riggs, Fred. 1979. "A New Paradigm for Social Science Terminology" 6, no. 3: 150-58.)	Terminology is concerned with the naming of concepts, and hence both with the meanings of words and with the need to signify concepts unambiguously.
(Dahlberg, Ingetraut. 1982. "ICC - Information Coding Classification -, Principles, Structure and Application Possibilities." 9, no. 2: 87-93.)	Presentation of … a new universal classification system called ICC … the categorial concepts denoting general entities.
(Nedobity, Wolfgang. 1985. "Terminology and Artificial Intelligence." 12, no. 1: 17-19.)	Artificial intelligence research … besides the surface structure of facts there is a deep structure of concepts which provide access to the entire system. This means that terminological principles have to be observed.
(Wilfried Lex, Wilfred. 1987. "A Representation of Concepts for their Computerization." 14, no. 3: 127-32.)	A lattice theoretical description of concept hierarchies is developed using for attributes the terms "given", "negated", "open" and "impossible" as the truth-values of a four-valued logic. Similar to the theory of B. Ganter and R. Wille (6) so does this framework permit a precise representation of the usual interdependences in a field of related concepts - such as superconcept, subconcept, contrary concepts etc. … we have here a tool to deal with concepts and their interrelations on a computer, which may be of importance for some applications in artificial intelligence: automatic classification, information retrieval, data bases, expert systems, automatic theorem proving and machine translation.
(Alexiev, Boyan. 1992. "The Conceptual Structure of Terms as the *Tertium Comparationis* in Contrastive Terminology." 19, no. 2: 91-92.)	the issue of determining the proper tertium comparationis (TC) for contrastive equivalent terminological units from two languages. … Hence the aim of contrastive analysis is reduced to assessing quantitatively and qualitatively the various linguistic means used in the two languages for reflecting the characteristics (genus and differentia) of the same concept.
(Gilreath, Charles T. 1992 "Harmonization of Terminology - An Overview of Principles." 19, no. 3: 135-39.)	Harmonization is the process in which diverse positions are largely reconciled and assimilated into a single unified position. In terminology work there are four basic things needing to be harmonized: 1. concepts, 2. concept systems, 3. definitions, and 4. terms. These are briefly discussed, along with the related notions of extension and archetype (intension).

The narrative is as follows:

In the first issue of IC Dahlberg lays out clearly her theory of the concept and of how concept systems (KOSs as we know them now) might be formed. It is critical to understand the distinction between the concept, which is a meaning, and the "words" or "verbal statements" that represent it. The concept itself is the "whole of true and possible predicates" that represent it. Relationships in the system are formed among "common characteristics of different concepts." In the same issue, Soergel follows the same path presenting suggested empirical methods for "determination of terms and concepts and of relationships between and among them." In 1975 Kashyap shows implementation of this understanding of concepts for education. Haendler puts forward "principles of concept-synthesis" for the development of informemes; he quotes Dahlberg alongside Chomsky, Diemer, Humboldt and Wittgenstein.

Dahlberg presents an implementation for concept-system generation (1975) and shows how incorporation of the "concept" in classification theory allows for replication, a key element of a science (1976).

In 1978 Dahlberg reiterates her concept theory and demonstrates its utility for the generation of theory-based concept systems. Notice we move from the concept itself now to the "knowledge unit" and that "statements about its referent are … the knowledge elements" or "characteristics of the given concept." A year later Wolfgang Dahlberg supports the general concept theory and, citing primarily I. Dahlberg but also Diemer creates a "geometry" of basic concepts. It is a bold attempt to denote another empirical approach to concept identification. In the same year Riggs shows usage of the concept theory and incorporation in relationship to terminology.

In 1982 Dahlberg introduces International Coding Classfication (ICC) using her concept system; she also introduces her "systematifier."

In 1984 Wille advances the theory of the concept using a set-theoretical model to develop a "concept lattice" mathematical structure of the concept with its context. In 1985 Nedobity makes reference to early AI research, and relates the "deep structure of concepts" to the need for harmonization with terminological principles. In 1987 Lex draws together and demonstrates the use of the "lattice" theory introduced by Wille, and relates it to its potential use for computer applications, including AI.

In 1992 Alexiev moves the theory of the concept along theoretically into "contrastive terminology" to allow "contrastive equivalent terminological units from two langues." and Glireath describes harmonization of concepts and concept systems in terminology work.

Discussion: Definition, Dissemination, Replication

We find definition of a "concept," of course, but also revealing usage of the notion of the concept as core (or *atomic*) element. It is clear that the journal *IC* played a critical role in the evolution of Dahlberg's concept theory over time. *IC* was not just a vehicle for dissemination but also for evolution of the theoretical construct, which over the course of the 18 years proved useful for the construction of classifications, but also moved into information retrieval, thesaurus construction, automatic indexing, and most notably terminology and artificial intelligence. It is clear from the beginning that the role of empirical science was on the minds of these authors who exert processes of replication as proof of their theoretical points of view. As noted, this narrative avoids the regular occurrence of the term "concept" in regular usage, which accounts for the apparent gap in the narrative between 1985 and 1992, during which time it is clear the definition has settled into common use in the domain.

Next steps: Fantistical machines?

IC also contained advertisements and notices of future meetings as well as summaries of meetings that had taken place. One such note appeared in 1990 (17, no. 2: 76) under the headline "Meeting on Concept Relationships." According to the report, 74 persons attended the meeting hosted by Rudolf Wille in Darmstadt to receive and discuss 18 papers, although "there were only a few concerned expressly with concept relationships in a more or less philosophical-logical, psychological and linguistic way." Nonetheless, it shows the growth of the notion of the concept as a core atomic element of a theory of knowledge organization.

The next step for this research is to construct a discourse analysis around the papers referenced above. Elements of the discourse already emerge as the atomic role of the concept in a theory

of KO, and the critical requirement that such a theory appear to be "scientific," primarily by making concepts and their structures replicable. We are particularly intrigued by the informeme, the concept-latttice, the systematifier, the geometric structure of concepts, and the deep structure of concepts.[2]

References

Dahlberg, Ingetraut. 1978. "A Referent-Oriented, Analytical Concept Theory for INTERCONCEPT." *International Classification* 5: 142–51.

Dahlberg, Ingetraut. 1990. "Meeting on Concept Relationships." *International Classification* 17, no. 3: 76.

Dahlberg, Ingetraut. 2006. "Knowledge Organization: A New Science?" *Knowledge Organization* 33 (1): 11–19.

Dahlberg, Ingetraut. 2011. "Brief Communication: How to Improve ISKO's Standing: Ten Desiderata for Knowledge Organization." *Knowledge Organization* 38 (1): 68–74. https://doi.org/10.5771/0943-7444-2011-1-68

Duncan, Dennis. 2022. *Index, A History of the: A Bookish Adventure from Medieval Manuscripts to the Digital Age*. New York: W.W. Norton.

"The Founding of the International Society for Knowledge Organization, Frankfurt, 22 July 1989." 1989. *International Classification* 16, no. 2: 71.

Hjørland, Birger. 2009. "Concept Theory." *Journal of the American Society for Information Science and Technology* 60 (8): 1519–36. https://doi.org/10.1002/asi.21082

HobbyLark. 2023. website. Arena Media Brands, Inc. https://hobbylark.com/party-games/1974-Fun-Facts-and-Trivia ; https://hobbylark.com/party-games/1992-Fun-Facts-Trivia-and-History

On this Day. 2023. website. On this Day, Pte. Ltd. https://www.onthisday.com/events/date/1974/may ; https://www.onthisday.com/events/date/1992/october

The People History. 2022. website. https://www.thepeoplehistory.com/1974.html

Smiraglia, Richard P. 2014. "The Concept of Concepts: A Case Study from American Documentation." In *Connecting across Borders: Globalization and Information Science Research: Proceedings of the Annual Conference of the Canadian Association for Information Science, St. Catharines, ON, May*. St. Catharines, ON: Canadian Association for Information Science.

Smiraglia, Richard P. 2018. "The Evolution of the Concept: A Case Study from *American Documentation*." *Canadian Journal of Information and Library Science* 42 no. 1-2: 113-34.

Smiraglia, Richard P., and Charles van den Heuvel. 2013. "Classifications and Concepts: Towards an Elementary Theory of Knowledge Interaction." *Journal of Documentation* 69 (3): 360–83.

Smiraglia, Richard P., Charles van den Heuvel, and Thomas Dousa. 2011. "Interactions Between Elementary Structures in Universes of Knowledge." In *Classification & Ontology: Formal Approaches and Access to Knowledge: Proceedings of the International UDC Seminar 19-20 September 2011, The Hague, Netherlands*, ed. Aida Slavic and Edgardo Civallero. Würzburg: Ergon Verlag, 2011, 25-40.

Szostak, Rick. 2011. "Complex Concepts into Basic Concepts." *Journal of the American Society for Information Science and Technology* 62 (11): 2247–65. https://doi.org/10.1002/asi.21635

"Why this Journal." 1974. *International Classification* 1, no. 1: 1-2.

---

[2] Referees inquired about comparisons between *IC* and *American Documentation*; in fact, there is almost no overlap, suggesting perhaps competing notions of the concept were developing in parallel—a potential hypothesis.