Ingetraut Dahlberg
INDEKS Verlag, Frankfurt/Germany

Knowledge Organization: Its Scope and Possibilities

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Sketch of historical development of knowledge organization and presentation of its scope as shown by the contents of the literature service, now called *Knowledge Organization Literature* (formerly Classification Literature) in the renamed journal KNOWLEDGE ORGANIZATION. The scheme is explained and shown on its three levels as well as its correlation to a universal classification system of knowledge fields, the *Information Coding Classification*. The possibilities of Knowledge Organization as a help for everybody, especially also students and above all students of education, and a help for political, industrial and social leaders are discussed. 10 measures for consideration and activation are listed. (Author)

1. Knowledge Organization, a new subject field

The necessity of ordering knowledge has always been recognized, but in ancient times it seems to have remained the exclusive domain of librarians and philosophers. Later on, authors of encyclopedias (Avicenna, Hugo of St.Victor, Vincent of Beauvais, Bartholomaeus Anglicus) as well as educationists (Comenius, J.H.Alsted, W.Ratke, etc.) came to join them. The history of this development has been most excellently documented by our Russian colleague, E.I.Shamurin (1).

Beginning with Otlet and LaFontaine at the turn of our century, documentalists and information science people joined this group, and ever since E.Wüster's work (2), terminologists became involved into this matter too.

In our present period, the representatives of Artificial Intelligence and the producers of Expert Systems, the Hypermedia experts and again colleagues from the education field are getting interested in applying the methodologies of knowledge organization, and it happens more than once that they "reinvent the wheel" for their own interests.

While classification systems and their verbal offspring, thesauri, are still being used effectively by librarians and information science people, we must say that the representatives of these newest technologies look rather disdainful at these tools, probably assuming that knowledge is far too complex to be captured by any consistent theory or by an ordering system with generally applicable principles.

Now this is exactly where the International Society for Knowledge Organization (ISKO) would like to lend a helping hand and to show that the theoretical foundations developed in classification and thesaurus research during the past decades can well be used in all types of knowledge organization and for all kinds of general and special systems of knowledge organization and representation.

I would like to add here that the most essential item in the theoretical background of *knowledge organization* is the fact that any organization of knowledge must be based on knowledge units - which are nothing else but *concepts*. Concepts consist of *concept elements*, also called *concept characteristics* and exactly these are the factors by which *concept systems* - and classification systems are such concept systems - can be constructed. Knowledge by itself cannot be grasped or represented unless it is presented by knowledge units and their many possible combinations in words/terms or statements. The implications of this insight have been shown in a number of articles (see e.g. (3) and (4)). It can also be related to Ranganathan's theory of faceted classification (5). With the knowledge about this theoretical background it will be possible to easily construct reproducible classification systems or faceted thesauri and to facilitate the very necessary collaboration with our colleagues from the field of terminology.

Therefore, we are dealing here with a volume of knowledge collected, deepened and matured over many centuries which, however, only today has been recognized as being an autonomous field of knowledge which needs to find its proper place in society and which demands to be recognized as such in the system of the sciences.

What Evelyn Bliss put together 64 years ago in his book entitled "The Organization of Knowledge and the System of the Sciences" (6) now seems to become a program for all those with an insight into the integrating force of this knowledge and its potential for the future of mankind.

2. Knowledge Organization: Its Scope

Ever since 1974, the journal INTERNATIONAL CLASSIFICATION had been carrying a current bibliography of its pertinent literature. By the subtitle of this journal, viz.: *"Devoted to Concept Theory, Systematic Terminology and Organization of Knowledge"* it was already indicated that its scope was going much beyond what one would expect to be expressed by the term "classification". Indeed we had always been including all those references, often with their abstracts, which we considered to belong to the field of *knowledge organization*. The basis on which the references were selected are some 300 journals and relevant

monographs and proceedings volumes in the fields of the information sciences (archive and library science, general documentation, data and museum documentation), computer science/informatics (including programming, online technology, artificial intelligence, expert systems), linguistics and terminology, systems research, etc.

When the journal changed its name in 1993 into KNOWLEDGE ORGANIZATION it was therefore not necessary to change or widen the scope of its bibliographical service. Thus, by looking at the outlines (Tables 1 and 2) of this service, the contents of the new subject field, *Knowledge Organization*, can very well be recognized. Let us first look at the rough outline of its 10 major groupings:

0 Form Divisions
1 Theoretical Foundations and General Problems of KO
2 Classification Systems and Thesauri. Structure & Construction
3 Classing and Indexing Methodology
4 On Universal Classification Systems
5 On Special Objects Classification Systems (Taxonomies)
6 On Special Subjects Classification Systems
7 Knowledge Representation by Language and Terminology
8 Applied Classing and Indexing
9 Knowledge Organization Environment

Table 1: First Level Outline of the Classification System for the Literature on Knowledge Organization

This outline needs some explanation as it does not give enough detail. Of the ten major divisions we will leave out the first one, as it is only devoted to forms of documents, like bibliographies, reviews, dictionaries, classification systems and thesauri, proceedings, textbooks, other monographs and standards.

Groups 1-3 represent the constituent divisions of this field, characterized by 1) Theoretical Foundations, 2) Structure and Construction of Classification Systems and Thesauri, and 3) Classing and Indexing.

Groups 4-6 represent the application of the constituent divisions in 4) Universal Systems, 5) Object-oriented Classification systems and Thesauri, 6) Special Subject-oriented CS and T.

Groups 7-9 represent the influence, application and environment fields, 7) influence from outside, viz. the problems of knowledge representation by language and terminology, 8) the application of classing and indexing to different kinds of data, statements (titles), documents, and 9) the carrying of the special field knowledge to "the outside", the organization of the field on a national and international level, its education and training, its legal and economic aspects, user studies and standardization.

The sequence of these 3 x 3 divisions has been called the "Systematifier". It is a sequence of facets which can be used in almost every subject area and field and helps to mnemotechnically memorize what must be considered as belonging to every subject field (for more of this see (7)).

The next level of specification will show what is covered in each of the 9 divisions (see Table 2).

Again, Table 2 provides only a rough idea on the contents of each grouping. We provided therefore an Appendix 1 including the third level with the topics for the relevant references as "Classification System for Knowledge Organization Literature".

It will be seen from Table 2 and Appendix 1 that at many positions of the system a connection has been established to a universal classification system of knowledge fields called INFORMATION CODING CLASSIFICATION (ICC). In order to understand the implications of the areas 1-9 (occurring e.g. under 5, 6, 78, 82, 88, and at many other positions of the subdivisions ending by 8) the outline of ICC has been added as Appendix 2 in linear and in diagrammatic form. A description of this system has been published in (8) and its 3-level outline was included in the Annexes to (9).

The *Classification System for Knowledge Organization Literature* (formerly *Classification Literature Classification* (CLC)) has served also to structure the *International Classification and Indexing Bibliography* which was published in the years 1982-1985 with references to the literature of the years 1950-1982. (So far, however, only 3 volumes covering the literature of Groups 0-3 could appear (9-11); two further volumes for groups 4-6 and 7-9 are still awaiting publication by the INDEKS Verlag.)

In order to watch how the scope of our new subject field is developing it should be helpful to look into the Calls for Papers of past and future conferences of ISKO; their topics should be taken into consideration, as well as the conference papers of the ISKO Conferences of the past years (12-14). Such topics provide a clear indication of the scope of Knowledge Organization as understood by representatives working in this old and new subject field.

3. Knowledge Organization: Its Possibilities

Knowledge Organization, so far the specific domain of librarians and information science people could become the necessary methodology for the following three main user groups, namely:

(A) Everybody willing to adopt a more conscious way of life and his studies. Wherever possible the teaching of the knowledge of Knowledge Organization to students at the beginning of their university studies ought to be started soon, with a repeating course in the middle of their studies. With this knowledge, I am sure students will be much better equipped to organize their own studies and their further careers than hitherto (a paper by N.Meder, based on an unpublished Memorandum concerning such a university teaching outlines this idea (15)).

(B) In a very special way, Knowledge Organization should be taught to students of education, as it is rather essential for their professional activity: viz. in order to use their educational material in such a way as to optimally transfer it to their future students. Work in this direction has recently been started at a German university institute for didactics; for more on this see the article by E.Kiel (16);

Classification System for Knowledge Organization Literature

Outline

0 Form Divisions
01 Bibliographies
02 Literature Reviews
03 Dictionaries, Terminologies
04 Classif. Systems & Thesauri
05 Periodicals and Serials
06 Conf. Reports, Proceedings
07 Textbooks (whole field)**
08 Other monographs**
09 Standards, guidelines

1 Theoretical Foundations & General Problems
11 Order & Knowl. Organiz.(KO)
12 Conceptology in KO
13 Mathematics in KO
14 Systems Theory and KO
15 Psychology and KO
16 Science & Knowledge Org.
17 Problems in KO
18 Classification Research (CR)
19 History of KO

2 Classif. Systems & Thesauri (CS&T). Structure & Constr.
21 General Questions of CS&T
22 Structure & Elements of CS&T
23 Construction of CS&T
24 Relationships
25 Numerical Taxonomy
26 Notation. Codes
27 Maintenance, Updating & Storage of CS&T
28 Compatibility & Concordance between Indexing Languages
29 Evaluation of CS&T

3 Classing & Indexing (C&I) (Meth.)
31 Theory of Classing & Indexing
32 Subject Analysis
33 C & I Techniques
34 Automatic C & I
35 Manual & Automatic Ordering
36 Coding
37 Reclassification
38 Index Generation and Programs
39 Evaluation of C & I

4 On Universal Classification Systems and Thesauri
41 On Universal Systems in general
42 On the Universal Decimal Classif.
43 On the Dewey Decimal Classif.
44 On the Library of Congress Classif. & the LC Subject Headings
45 On the Bliss Bibliographic Classification
46 On the Colon Classification
47 On the Library Bibliographical Classif.
48 On Other Universal CS and T
49 free

5 On Special Objects CS (Taxonomies)
51 In the Form & Structure Area 1
52 In the Energy & Matter Area 2
53 In the Cosmo & Geo-Area 3
54 In the Bio Area 4
55 In the Human Area 5
56 In the Socio Area 6
57 In the Econom.& Technol.Area 7
58 In the Science & Inform.Area 8
59 In the Culture Area 9

6 On Special Subjects CS & T
61 In the Form & Structure Area 1
62 In the Energy & Matter Area 2
63 In the Cosmos & Geo Area 3
64 In the Bio Area 4
65 In the Human Area 5
66 In the Socio Area 6
67 In the Econom.& Technol.Area 7
68 In the Science & Inform.Area 8
69 In the Culture Area 9

7 Knowledge Representation by Language and Terminology
71 General Problems of Natural Language in Relation to KO
72 Semantics
73 Automatic Language Processing
74 Grammar Problems
75 Online Retrieval Systems and Technologies
76 Lexicon/Dictionary problems
77 Problems of Terminology
78 Subject-oriented Terminology Work (TW)
79 Problems of Multilingual Systems and Translation

8 Applied Classing & Indexing (C&I)
81 General Problems, Catalogues, Guidelines, Rules, Indexes
82 Data Classing and Indexing
83 Title Classing and Indexing
84 Primary Literature C & I (except 85)
85 (Back of the) Book C & I
86 Secondary Literature C & I
87 C & I of Non-book Materials
88 C & I in Subjects Fields (manual and computerized)
89 C & I in Certain Languages

9 Knowledge Organization Environment
91 Professional & Organizational Problems in gen. & in Institutions
92 Persons & Institutions in KO
93 Organizat. of C & I on a National and International level
94 free
95 Education and Training in KO
96 Legal Questions
97 Economic Aspects in KO
98 User Studies
99 Standardization in KO work

Table 2

(C) Furthermore, the knowledge of Knowledge Organization must be mastered by all those who lend a helping hand to our political, industrial and social leaders.

All of this presupposes, however, some measures which are herewith proposed for consideration and activation:

1) Function of ISKO Membership

In each country the membership of ISKO should be extendeded and the organization strengthened in order to provide for a strong background of professionals to work towards the common goals.

2) *Elaboration of textbooks*

Next to providing textbooks on the theoretical background and general methodology of KO, a series of textbooks needs to be written and translated into the major languages of this world on KO in special subject fields.

3) *Training of Teachers*

Academies and/or Chairs at universities should be established for the training of the future teachers in knowledge organization on a national, European and an international level.

4) *Meetings*

Conferences ought to be held regularly on current topics and their proceedings should be of interest and available to every ISKO member soon after the event.

5) *Current Research*

Research centers should be established to collaborate with terminologists (using e.g. the help of Infoterm, Vienna) in pinpointing new concepts, their terms and relationships to existing ones and keeping thesauri and classification systems constantly up-to-date with the possibility to publish the results of their findings in a proper way. The INTERCOCTA glossaries could be taken as an example for such a necessary work (17).

6) *Switching Centers*

Also, centers for the coordination of conceptual systems, switching centers between special and general classification systems and thesauri should be established in order to facilitate the exchange of knowledge on existing and new concepts. Such centers might well establish also compatibility between the six existing universal classification systems.

7) *Survey on Colleagues working in KO*

A Who's Who with the roster of people, not only ISKO members but also all those working in and contributing to the field of knowledge organization, should be published at regular intervals.

8) *Current Information*

Journals, newsletters and serial publications in KO should concentrate on making known the results of the research and development work done in the field.

9) *A Concept System for KO*

A classification system for the pertinent literature with a thesaurus-like index should facilitate the current survey on the field itself, especially for the necessary access to the

10) *Current Literature Survey*

by publication of a current bibliography of all kinds of pertinent literature on Knowledge Organization.

4. Conclusion

It has been said, that information is "Knowledge in Action". But it is also true that "knowledge is ordered and digested information" (18). We are living in a world flooded by information which needs very urgently to be ordered and digested to become available knowledge and not only personal but interpersonal, objective, public knowledge too. Very much needs to be done until some results will become visible. And much more support is needed, especially as personal support from the ISKO membership. So far we are only a very small group of some 400 members in 43 countries of this world. But what was achieved by only 12 apostles in the right spirit some 2000 years ago? If each of our members activates a strong will towards our common goals and is willing to contribute his/her share by the special personal graces which he or she has been given, I am sure, that the day will come when changes in our world will become visible.

We are not so much confronted here with the intellectual tasks - although these are definitely not to be neglected - rather it is collaboration and the good will to help without looking at possible personal advantages that is demanded. Of course, we will also need a lot of manpower for all the necessary work to be done and must find somehow the sources for their proper remuneration.

Thus, keeping the goals in mind we shall try to proceed step by step and let us be guided by the Higher Will Who took care - now almost four years ago - that ISKO could be started. This Will will take care - I am sure - that ISKO will succeed if ISKO's members are willing to follow the guidance which has been offered so kindly.

References

(1) Shamurin, E.I.: Geschichte der bibliothekarisch-bibliographischen Klassifikation. Bde.1 u.2. München: Verlag Dokumentation 1967. 404+781 p. (transl.from Russian, 1955-59)

(2) Wüster, E.: Internationale Sprachnormung in der Technik, besonders in der Elektrotechnik. Die nationale Sprachnormung und ihre Verallgemeinerung. 2.erg.Aufl. Bonn: Bouvier Verl.1966. 470 p.

(3) Dahlberg, I.: A referent-oriented analytical concept theory for INTERCONCEPT. Int.Classif.5(1978)No.3, p.142-151

(4) Dahlberg, I.: Conceptual definitions for INTERCONCEPT. Int.Classif. 8(1981)No.1, p.16-22

(5) Ranganathan, S.R., Gopinath, M.A.: Prolegomena to library classification. 3rd ed. Bombay 1967. Reprinted by Sarada Ranganathan Endowment. Distributed by UBSPD, New Delhi, 1990. 640 p.

(6) Bliss, H.E.: The organization of knowledge and the system of the sciences. New York: Holt 1929. 433 p.

(7) Dahlberg, I.: Ontical structures and universal classification. Bangalore: Sarada Ranganathan Endowment for Library Science 1978. XII,64 p. (here p.42)

(8) Dahlberg, I.: ICC - Information Coding Classification -

principles, structure and application possibilities. Int.Classif.9(1982)No.2, p.87-93
(9) Classification Systems and Thesauri, 1950-1982. Frankfurt: INDEKS Verlag 1982. XIV,144 p. = International Classification and Indexing Bibliography, Vol.1
(10) Reference Tools and Conferences in Classification and Indexing. Frankfurt: INDEKS Verlag 1984. XX,140p. = International Classification and Indexing Bibliography, Vol.2
(11) Classification and Indexing Systems: Theory - Structure - Methodology. Frankfurt: INDEKS Verlag 1985. XII,211 p. = International Classification and Indexing Bibliography, Vol.3
(12) Fugmann, R.(Ed.): Tools for Knowledge Organization and the Human Interface. Proc.1st Int.ISKO-Conf., Darmstadt, 14-17 Aug.1990. Frankfurt: INDEKS Verlag 1990/91. 2 vols. 279+280p.
(13) Gödert, W., Jaenecke, P., Schmitz-Esser, W.(Eds.): Kognitive Ansätze zum Ordnen und Darstellen von Wissen. 2.Tagung d.Dt.ISKO Sektion, Weilburg, 15-18 Oct.1991. Frankfurt: INDEKS Verlag 1992. VIII,335p.
(14) Cognitive Paradigms in Knowledge Organisation. 2nd Int.ISKO Conference, Madras, 26-28 Aug.1992. Bangalore: Sarada Ranganathan Endowment for Library Science 1992. XVI,466p.
(15) Meder, N.: Überlegungen zu einer Ausbildung auf dem Gebiet der Informationstechnologie und Allgemeinen Wissensordnung. In (13), p.244-251
(16) Kiel, E.: Further education in knowledge organization. Basic didactic considerations. Knowl.Org. 20(1993)No.2, p.71-76
(17) Riggs, F.W.: The INTERCOCTA Manual: Towards an International Encyclopedia of Social Science Terms. Paris: UNESCO 1988. 166p. = Reports and Papers in the Social Sciences No.58
(18) Eisele,H.: Speed training via terminology. In: Terminology and Knowledge Engineering. Proc.TKE'93. Frankfurt: INDEKS Verlag 1993. p.7-77

Annex 1:

Classification System for Knowledge Organization Literature

Abbreviations:
CS & TClassification Systems and Thesauri
C & I Classification and Indexing
KO Knowledge Organization

0 FORM DIVISION

01 Bibliographies
011 Gen.Bibliographies
012 Current Bibliographies
013 Bibliogr.of CS & T
014 Bibliogr.of Universal CS
015 Recurring Bibliographies
016 Bibliogr.of Spec. C&I Fields
017 Bibliogr.of Spec.Index.Syst.
018 Bibliogr.of CS & T in Subj.Fields
019 Bibliogr.of the Works of Persons

02 Literature Reviews in KO
021 General Review Articles
025 Recurring Reviews
026 Reviews in Special KO Fields
028 Reviews of C&I in Subject Fields

03 Glossaries, Vocabularies, Terminologies in KO
031 Gen.Glossaries in KO
032 Glossaries containing KO Sections
034 Terminol.of Universal Syst.
036 Terms & Glossaries in KO fields
037 Terminol.of Spec.C&I Syst.
038 Terms & Glossaries in KO Application Fields

04 Universal Classif. Systems
041 Library Classif.Systems
042 Universal Decimal Classif.
043 Dewey Decimal Classif.
044 Library of Congress Classif.
0448 LC Subject Headings
045 Bliss Bibliographic Classif.
046 Ranganathan Colon Classif.
047 Library Bibliographical Classif.
048 Other Universal CS

048- Special CS&T
048-1 CS&T in the Form & Structure Area 1
048-2 CS&T in the Energy & Matter Area 2
048-3 CS&T in the Cosmo & Geo Area 3
048-4 CS&T in the Bio Area 4
048-5 CS&T in the Human Area 5
048-6 CS&T in the Socio Area 6
048-7 CS&T in the Econ.& Product.Area 7
048-8 CS&T in the Science & Inform.Area 8
048-9 CS&T in the Culture Area 9

05 Periodicals and Serials in KO
051 KO Journals
052 KO Newsletters, Bulletins
053 Serials in KO
054 Periodicals and Serials for Universal CS&T
055 Periodicals on Spec.CS&T
056 Periodicals on Spec.KO fields
057 Periodicals with Bearings on KO
058 KO Periodicals in Spec.Subj.Fields

06 Conference Reports & Proceedings
(listed according to year, month and day(s):
06.93-11-18/19

07 Textbooks in KO
(subdivision according to the outline notation, for example:
07.1 Textbooks on Theor.Foundations
07.23 Textbooks on the Construction of CS&T...)

08 Other Monographs in KO
(subdivisions as under 07)

09 Standards and Guidelines in KO
(subdivisions as under 07, for example:
09.01 Bibliographies of Standards and Guidelines
09.12 Standards on Concepts and Concept Systems
09.38 Standards for Indexes, etc.)

1 THEORETICAL FOUNDATIONS AND GENERAL PROBLEMS

11 Order and Knowledge Organization (KO)
111 Classification theory in general
112 Structures in general
113 General activities in KO
114 Universal order
115 General order of objects, object orientation
116 General order of subjects
117 free
118 Problems of order in application fields
119 Role and significance of KO

12 Conceptology in KO
121 Logical & philosophical bases of concepts
122 Theory of concepts
123 Concept construction, definitions
124 Logic of knowledge representation
125 Basic concepts, categories
126 General and special kinds of concepts
127 Individual concepts
128 Concepts of certain subject fields
129 Concept documentation

13 Mathematics in KO
131 Mathematical theory of KO
132 Algebraic methods of KO
133 Formalization and mathematical models
134 Geometrical methods
135 Graph-theoretical methods
136 Distribution theory and frequency studies
137 Numbers in KO
138 Mathematical methods in subject fields
139 Mathematical methods for certain purposes

14 Systems Theory and KO
141 Systems principles
142 Systems, typology of
143 Systems analysis and description
144 Systems approach, knowledge analysis
145 free
146 Level theory, integrative levels
147 Neural networks
148 Systems in specific fields of knowledge
149 free

15 Psychology and KO
151 Psychological basis of KO
152 Thought and memory
153 Intellectual work
154 Concept formation (non-scientific)
155 Psychology of KO processes
156 Knowledge acquisition
157 Computerization of thought processes, Knowledge-based systems
158 Psychology of KO in special subject fields
159 free

16 Science and Knowledge Organization
161 General problems
162 Structure and interrelationship of science
163 Science methodology
164 Development of knowledge and science
165 Control of knowledge, growth, knowledge systems
166 Structure of scientific literature
167 Contribution of KO to science development
168 Development of fields of knowledge
169 Documentation of scientific progress

17 Problems in KO
171 KO/Classification problems in general
172 Problems from classification systems
173 Methodological problems
174 Organizational problems
175 Problems of choice of class.systems
176 Problems from new methods, e.g. pattern recognition
177 Problems from new technology
178 KO problems in subject fields
179 Trends and future tasks in KO

18 Classification Research (CR)
181 General problems
182 State-of-the-art of CR in general
183 Research on classif. methods and techniques
184 Research on classification systems
185 Areas for research, proposals
186 Research on new topics in classification
187 Influence from outside on CR
188 CR in special subject fields
189 CR in certain countries and institutions

19 History of KO
191 History of knowledge and library classif.
192 History of construction of classif.systems
193 History of indexing and subject cataloging
194 History of certain classif.systems
195 free
196 History of subjects related to KO
198 History of KO in special subject fields
199 History of KO in certain countries & inst.

2 CLASSIFICATION SYSTEMS AND THESAURI (CS & T). STRUCTURE AND CONSTRUCTION

21 General Questions of CS & T
211 Theory of CS and T
212 Typology and characteristics of CS
213 Management of CS, incl.computerization
214 Thesauri in general, def.,etc.
215 Characteristics and kinds of thesauri
216 Thesaurus systems, integrated T.
217 Role & function of CS & T
218 Use of CS & T in spec.environments
219 Comparisons between CS & T

22 Structure & Elements of CS & T
221 Conceptual structures of CS
222 Components of CS & T in general
223 Vocabulary selection and extraction
224 Hierarchy & hierarchical levels
225 Facets, faceted classification
226 Descriptors, keywords, subject headings: properties and functions
227 Compound descriptors, descr.combinations
228 Descriptors in certain subject fields
229 Representation form of descriptors Graphical form of CS & T

23 Construction of CS & T
231 Preconditions for construction
232 Design principles for CS
233 Methodology for CS construction
234 Linguistic support of descriptor languages
235 Construction of T in general
236 Construction of T for special purposes
237 Computer supported construction of CS & T (programs see 276)
238 CS & T construction in diff.natural languages (in subject fields see 5-6)
239 Evaluation of thesaurus construction work

24 Relationships
241 Gen.& theor.problems of relationships
242 Paradigmatic relationships (hierarchy see 224)
243 Syntagmatic relationships
244 Descriptor relationships
245 Roles and links
246 Weights
247 Relational data files
248 Relations in special subject fields
249 Representation of relationships

25 Numerical Taxonomy (NT)
251 General and theoretical problems
252 Cluster Analysis
253 Classification procedures
254 Hierarchy in NT
255 Pattern recognition
256 Place-related NT
257 Time-related NT
258 Application of NT in spec.subj.fields
259 Evaluation of NT procedures

26 Notation. Codes
261 General problems of notations
262 Notational systems
263 Code & notation development, construction and manipulation
264 Characteristics of codes
265 Book numbers, call numbers
266 Class numbers, notation of CS and T
267 Number syst. & Codes for special purposes (e.g. MARC format)
268 Notation in certain subj.fields
269 Evaluation of notations & codes

27 Maintenance, Updating and Storage of CS & T
271 Revision principles
272 Maintenance of CS & T
273 Methods of revision and updating
274 Revision of CS & T in general
275 Computer programs for CS
276 Computer programs for thesaurus compilations
277 Updating, maintenance programs
278 Storage problems of CS & T

28 Compatibility & Concordance between Indexing Languages
281 Objectives & nature of systems compatibility
282 Intermediate languages
283 Compatibility in classing and indexing
284 Establishment of concordances
285 Correlative indexes. Mapping
286 Systems reconciliation, e.g.between CS & T, linking terms
287 Organized compilation of compatible CS & T, integration
288 Compatibility in subject areas
289 Evaluation of compatibility

29 Evaluation of CS & T
291 Principles for evaluating CS & T
292 Comparison of CS among each other
293 Testing & evaluating the validity of one or more CS and T
294 Natural vs controlled languages
295 Comparative analysis of CS & T
296 Descriptor languages vs CS
297 Evaluation of patent CS
298 Evaluation of CS & T in certain subject fields

3 CLASSING & INDEXING (C&I) (Meth.)

31 Theory of Classing and Indexing
311 Principles of C & I
312 Methodology of C
313 Methodology of I
314 Indexing errors, constraints
315 Indexing characteristics (depth, intensity, objectivity, etc.)
316 Indexing on different levels of abstraction
317 Author and editor indexing
318 Special purpose indexing

32 Subject Analysis
321 General problems of "aboutness"
322 Data analysis and interpretation
323 Subject/information/knowledge analysis
324 Contents analysis - text analysis
325 Facet analysis, indexat.formulae
326 Preparation of inform.for machine handling
327 Subj.analysis of kinds of documents
328 Subj.analysis in certain fields
329 Comp.analysis of data and subjects

33 Classing and Indexing Techniques
331 C & I in general
332 Classing methods & techniques
333 Indexing methods (exc.334/7)
334 Coordinate indexing
335 Phrase indexing (in general)
336 Chain indexing
337 PRECIS indexing
338 Other phrase ind.methods by name

34 Automatic Classing and Indexing
341 Theory of automatic C & I
342 Term values, discrimination, precision, etc.
343 General, linguistic & statistical methods
344 Semi-automatic methods and computer-assisted indexing
345 Permutation indexing
346 Thesaurus-based automatic indexing
347 Online indexing
348 Automatic classification
349 Evaluation of automatic indexing

35 Manual and Automatic Ordering
351 General and theoretical problems
352 Math.basis of file organization
353 Generation of clustered files
354 Manual ordering, shelving
355 File ordering/organization
356 Hypermedia, Hypertext, etc.
357 Document structuring, SGML etc.
358 File organization in subject fields
359 Evaluation of ordering procedures

36 Coding
361 General and theoretical problems
362 Coding systems
363 Coding methods
364 Encoding of index entries
365 Encoding of catalogue data
366 Encoding of text and data
367 Coding of techno-economic data
368 Coding in subject fields

37 Reclassification
371 Gen. & theor. problems
372 Parameters of reclassification
373 Organization of reclassification
374 Administrative viewpoints
375 Reclassification to LCC
376 Conversion to LBC
377 Other reclassification projects
378 Reclassification in subject areas

38 Index Generation and Programs
381 Gen. & theor. problems of index generation
382 Special kinds of indexes
383 Manual & computerized methods for index preparation
384 Programs for index prep., general
385 Index generation programming systems
386 Index generation programs, by name
387 Programs for other activities in C & I
388 Index generation in subject fields
389 Representation form of indexes

39 Evaluation of Classing and Indexing
391 Problems and principles of indexing evaluation
392 Evaluation criteria: consistency, functional efficiency, etc.
393 Methods of evaluation
394 Evaluation of a single CS application
395 Evaluation of a single indexing system
396 Comparative studies of subject indexing systems, incl. thesaurus vs free indexing
397 Comparative studies of CS vs indexing systems
398 Comparative studies of indexing in subject fields
399 Comparison of certain indexes

4 ON UNIVERSAL CLASSIFICATION SYSTEMS

41 On Universal CS in general
411 Library classification in general
412 Surveys on existing univ.syst.
413 free
414 Problems of library classification
415 Specific. for a new univ. system or thesaurus
416 free
417 Problems from comparative studies of univ. CS
418 Special topics treated in universal CS
419 Trends in the development of universal CS

42 On the Universal Decimal Classification (UDC)
43 On the Dewey Decimal Classification
44 On the Library of Congress Classification
45 On the Bliss Bibliographic Classification
46 On the Colon Classification
47 On the Library Bibliographical Classification

48 On other Universal CS & T
481 On proposals for universal CS & T
482 On CS for general purposes
483 On thesauri & other devices for gen. purposes
484 On CS & T for archives
485 On CS & T for libraries
486 On CS & T for doc.& inf.serv.
487 On patent CS & T (subdivide by country codes)
488 On CS & T for research & terminology
489 On CS for other spec.purposes
(Children, School and Youth libraries
Public offices, state documents, etc.)

5 ON SPECIAL OBJECTS CS (Taxonomies)
51 On taxonomies in Area 1 (ICC)
52 On taxonomies in Area 2
53 On taxonomies in Area 3
54 On taxonomies in Area 4
55 On taxonomies in Area 5
56 On taxonomies in Area 6
57 On taxonomies in Area 7
58 On taxonomies in Area 8
59 On taxonomies in Area 9

6 ON SPECIAL SUBJECTS CS & T
61 On CS & T in Area 1 (ICC)
62 On CS & T in Area 2
63 On CS & T in Area 3
64 On CS & T in Area 4
65 On CS & T in Area 5
66 On CS & T in Area 6
67 On CS & T in Area 7
68 On CS & T in Area 8
69 On CS & T in Area 9

7 KNOWLEDGE REPRESENTATION BY LANGUAGE AND TERMINOLOGY

71 Gen. Problems of Natural Language in rel. to KO
711 Linguistics and KO
712 Natural Language and metalanguage
713 Mathematical and comput.linguistics, gen.
714 Semiotics
715 Formalization of natural language
Artificial Intelligence
716 Problems of structure
717 Language universals
718 Problems of diff.natural languages

72 Semantics
721 General problems of semantics
722 Word & sentence meaning
723 Semantic analysis
724 On synonyms & other ambiguities
725 Semantic networks & associations
726 Semantics of texts & languages
727 Semantics of data bases, memory systems
728 Semantics in subject fields

73 Automatic Language Processing
731 General and theoretical problems
732 On language items for processing
733 Methods and procedures of natural language processing, parsing, word allocation, etc.
734 Computer programs for ALP
735 Word truncation, root, stem proc.
736 File, text compression
737 Automatic analysis of special natural languages
738 Automatic analysis in subject fields

74 Grammar Problems
741 General & theoretical problems of grammar
742 Grammars
743 Syntactic analysis & their algorithms
744 Gramm.forms, e.g. of keywords, terms, words
745 Special grammatical problems, e.g. frames
746 Generation of phrases, syntax structures
747 Syntax of special natural languages
748 Syntax in special subject fields

75 Online Retrieval Systems and Technologies
751 General and theoretical problems
752 Dialogue systems. Interactive, Online Catalogs
753 Online access, query optimization, navigation
754 Programs for online queries
755 Problems of online syst., e.g. structured searches
756 Classification and thesaurus-based queries
757 Expert systems
758 Online systems in subject fields
759 Evaluation of online retrieval techniques

76 Lexicon/Dictionary Problems
761 General & theoretical problems
762 Dictionary structures
763 Construction and updating of dictionaries
764 Kinds of dictionaries, except
765 Automatic, monolingual ones
766 Automatic, multilingual ones
767 Data bases in dictionary form
768 Dictionaries in subject fields

77 Problems of Terminology
771 General & theoretical problems
772 Form and designation of terms and names
773 Terminological work (TW)
734 Computer programs for TW
774 Term systems and terminological systems

775 Classification and terminology
776 Terminological databanks
777 Country and language-oriented TW
778 Special language research
779 Contrastive terminology

78 Subject-oriented Terminology Work (TW)
78-1 TW in Area 1 (ICC)
78-2 TW in Area 2
78-3 TW in Area 3
78-4 TW in Area 4
78-5 TW in Area 5
78-6 TW in Area 6
78-7 TW in Area 7
78-8 TW in Area 8
78-9 TW in Area 9

79 Problems of Multilingual Syst. & Translation
791 General & theoretical problems
792 Aspects and models of translation
793 Methods of machine translation
794 Translation of CS & T
795 Bilingual CS & T
796 Multilingual CS & T
797 Indexing, multilingual syst.
798 Transl.problems in subject fields
799 Interlinguistics and translation

8 APPLIED CLASSING & INDEXING (C&I)

81 General Problems, Catalogues, Guidelines, Rules, Indexes
811 General problems of indexes and indexers
812 Alphabetical and classed subject catalogues
813 Establishment and maintenance of subject catalogues
814 Manual, rules, codes for subject catalogues
815 Index specifications
816 Rules for good indexes
817 Editing and printing of indexes
818 Subject indexes and catalogues in certain institutions
819 Evaluation of indexes and catalogues

82 Data Classing and Indexing
820 Data C & I in general
82-1 Data C & I in Area 1 (ICC)
82-2 Data C & I in Area 2
82-3 Data C & I in Area 3
82-4 Data C & I in Area 4
82-5 Data C & I in Area 5
82-6 Data C & I in Area 6
82-7 Data C & I in Area 7
82-8 Data C & I in Area 8
82-9 Data C & I in Area 9

83 Title Classing and Indexing
831 General problems
832 Information contents of titles
833 Methodology of title and sentence C & I
834-837 free
838 Title indexes in subject fields
839 Title indexing in special institutions

84 Primary Literature C & I (except 85)
841 C & I of research reports
842 C & I of patents and similar docs.
843 C & I of biographies
844 C & I of news and newspapers incl.Prestel/Viewdata, etc.
845 C & I of journals and serials
846 C & I of theses and dissertations
847 C & I of archival materials
848 C & I of field-oriented primary documents
849 C & I of other kinds of primary documents

85 (Back of the) Book C & I
851 General problems
852 Term or topic for entries
853 Methodology of book indexing
854 Characteristics of book indexing
855 free
856 Index generation of special books, e.g. proceedings
857 Computerized book indexing
858 Book indexing in subject fields
859 Evaluation of book indexing

86 Secondary Literature C & I
861 C & I of encyclopedias, manuals, dictionaries
862 C & I of bibliographies
863 C & I of abstracts and abstracting journals
864 Citation indexing
865 C & I of library catalogues
866 Establishment of indexes to CS in general
867 Establishment of indexes to universal CS
868 Establishment of indexes to special CS
869 C & I of other secondary literature

87 C & I of Non-book Materials
871 General problems
872 Picture C & I, including photographs
873 Microform C & I
874 Slides C & I
875 Video tape & film C & I
876 Cartographic C & I
877 C & I of phonographic records
878 Museum objects C & I
879 C & I of other non-book materials, e.g. CD-ROM

88 C & I in Subject Fields (manual & comput.)
88-1 C & I in Area 1 (ICC)
88-2 C & I in Area 2
88-3 C & I in Area 3
88-4 C & I in Area 4

88-5 C & I in Area 5
88-6 C & I in Area 6
88-7 C & I in Area 7
88-8 C & I in Area 8
88-9 C & I in Area 9

89 C & I in Certain Languages
(Subdivide by language code)

9 KNOWLEDGE ORGANIZATION ENVIRONMENT

91 Professional and Organizational Problems in General and in Institutions
911 free
912 Professional questions, new professions
913 Work descriptions, etc.
914 Workstations
915 Ergonomic factors in KO
916 Organization of work in institutions
917-918 free
919 MARC format for classification data; also classif.data in MARC

92 Persons and Institutions in KO
921 free
922 Historical persons
923 Comparison of persons
924 Contemporaries
925 Societies, research groups,
926 International societies and groups
927 International institutions
928 free
929 Awards in C & I

93 Organization of C & I on a National and International Level
931 General principles
932 International cooperation & systems
933 International activities
934 Activities in Europe (subdivide by country code)
935 Activities in Asia
936 Activities in Africa
937 Activities in America
938-9 free

94 Free

95 Education and Training in KO
951 General problems
952 Subject, curricula and training programs
953 Methodology of teaching KO
954 Side effects of teaching KO
955 Teaching aids
956 Educational requirements
957 Education and training in particular countries
958 Teaching of subject-oriented C & I systems
959 Teaching of end-users

96 Legal Questions
(e.g. Copyright of CS, copyright of computer programs in C & I)

97 Economic Aspects in Knowledge Organization
971-2 free
973 Economizing KO work
975 Economic aspects in CS construction
976 Economic aspects in cataloguing
977 Economic aspects in C & I
978 Economic aspects of publishing CS
979 free

98 User Studies
(Application of systems see 218)
981 Studies of users, readers in general
982 Requirements of C & I users (user interfaces, user feedback, search term selection)
983 Use of certain C & I practices
984 Use of CS
985 Use of thesauri
986 Use of subject catalogues
987 Use of indexing systems and methods
988 Use of indexes
989 Use of CS & T in certain institutions

99 Standardization in KO Work
991 General problems
992 Standardization of terms and characteristics
993 Standardization in shelving and organizing materials
994 Standardization of CS
995 Standardization of thesauri
996 Standardization of subject catalogues
997 Standardization in indexing
998-9 free

(Following page:)

Annex 2:

Information Coding Classification (ICC) - Outline

INFORMATION CODING CLASSIFICATION

Outline

0 GENERAL FORM CONCEPTS
01 Theories, Principles
02 Objects, Parts
03 Activities
04 Properties, Attributes
05 Persons
06 Institutions
07 Techn.Production
08 Applications, Determination
09 Synthesis, Distribution

1 FORM AND STRUCTURE AREA
11 Logic
12 Mathematics
13 Statistics
14 Systemology
15 Organization Sci.& Technol.
16 Metrology
17 Cybernetics (Control, Automat.)
18 Standardization
19 Testing and Checking

2 ENERGY AND MATTER AREA
21 Mechanics
22 Physics and Matter
23 Gen.& Technical Physics
24 Electronics
25 Physical Chemistry
26 Pure Chemistry
27 Chemical Technology and Engg.
28 Energy Science and Technol.
29 Electrical Engineering

3 COSMO- AND GEO-AREA
31 Astronomy & Astrophysics
32 Astronautics & Space Research
33 Basic Geosciences
34 Atmospher.Sci., Meteorology
35 Hydrospher.& Oceanol.Sci.
36 Geological Sciences
37 Mining
38 Materials Sci.& Metallurgy
39 Geography

4 BIO-AREA
41 Basic Biological Sciences
42 Microbiology and Cultivation
43 Plant Biology and Cultivation
44 Animal Biology and Breeding
45 Veterinary Science
46 Agriculture and Horticulture
47 Forestry and Wood Sci.& Technol.
48 Food Sciences and Technol.
49 Ecology and Environm.Sci.& Techn.

5 HUMAN AREA
51 Human Biology
52 Health & Theor.Medicine
53 Pathology & Spec.Medicine
54 Clinical Med.& Nature Cure
55 Psychology
56 Education
57 Profession, Labour, Leisure
58 Sports and Games
59 Household and Home Life

6 SOCIO-AREA
61 Sociology
62 State and Politics
63 Public Administration
64 Money and Finances
65 Social Aid, Social Politics
66 Law
67 Area Planning and Urbanism
68 Military Sci.& Technol.
69 History

7 ECON.& TECHN.PROD.AREA
71 Gen.Economics & Natl.Economy
72 Management of Enterprises
73 Technol., Engg. in general
74 Mechanical Engg.
75 Building
76 Commodity Sci.& Technol.
77 Vehicle Sci.& Technol.
78 Transport Technol.& Serv.
79 Service Economics

8 SCIENCE AND INFORMATION AREA
81 Science of Science
82 Information Sciences
83 Computer Sci. & Technol.
84 Information in general
85 Communication Sci. & Technol.
86 Mass Communication
87 Printing and Publishing
88 Communication Engineering
89 Semiotics

9 HUMANITIES & CULTURE AREA
91 Language
92 Literature and Philology
93 Music
94 Fine Arts
95 Performing Arts. Theatre
96 Culture Science (Ethnol.,etc.)
97 Philosophy
98 Non-Christ.Rel.& Secret Teaching
99 Christian Religion & Theology