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Ingetraut Dahlberg
Frankfurt, BRD

The Terminology of Subject-fields*

Dahlberg, I.: **The terminology of subject-fields.** In: Intern. Classificat. 2 (1975) No. 1, p. 31–37

So far terminological work has been mainly directed towards defining very special concepts. The more general ones, e. g. those denoting subject-fields have been neglected with the result that communication on this level has been seriously hampered. There exists a great number of such terms and also a growing trend for the formation of new ones. In the FRG an R & D project was started in 1972 with the collection of names of subject-fields, it is intended to assemble their definitions in a dictionary and to build a general concept-system by computer-comparison of their characteristics as provided by their definitions. The nature of subject-fields is explained, details on the German collection are given as well as some results from a formel analysis of their concepts. It is proposed to initiate similar projects in other linguistic regions as well; this could be done under the auspices of Infoterm. Some application-possibilities for a general concept-system (e. g. a broad system of ordering) are given. The annex displays a scheme of 9 subject areas and about 90 subareas for the sorting of names of subject fields.

(Author)

1. Introductory remarks

One of the interesting features of human development in history is the fact that a continuing movement towards more abstract and more compound wording and thinking can be observed. This is an ontogenetic as well as a phylogenetic characteristic of mankind. Such a development can also be noticed in the abstract terms denoting fields of knowledge: the septem artes liberales et mechanicae of the early medieval ages developed into the scientific disciplines and the socalled arts of the ages of enlightenment, which are still with us and can be recognized in the structure of our universities. However, in the last few decades a remarkable integrative process has taken place. The former disciplines of more or less monolithic structure and comparable to the pillars of the temple of Salomo – as done by the Vienna librarian J. M. Denis (1729–1800)[1] (in referring to the seven pillars of wisdom) – have not only been split up into many subdisciplines but

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have also been used as aspect sciences in the investigation of special objects. At one time, e. g. there was just the phenomen of 'soil' and the knowledge about soil called 'pedology'. Now we find the following aspect-fields connected with soil as e. g.

soil-physics, soil-mechanics, soil-chemistry, soil-mineralogy, soil-biology, soil-biochemistry, soil-engineering, soil-classification.

Formerly, there was just mathematics, biology, statistics. Now there is biomathematics, biometrics, biostatistics, etc. Kedrov[2] notices that this phenomenon of a "synthesis of the sciences" may be explained as a "synthesis by cementation, – by fundamentalization and – by pivotization".

The creation, in this manner, of new concepts and their terms as required by the necessity of assigning names to the proliferating new fields of research and/or human developing activities is an everyday experience.

Based on the observation (in scanning e. g. the indexes of directories of documentation centers, special libraries, organizations and research institutes) that this development has led to the creation of a great many synonyms and to a lack of clarity concerning the contents and scope of meaning of such terms, it was felt necessary to round up, on a suitable occasion, all field-names existing in the German language and to study the construction laws of such terms and definitions. We had the intention of thereby also uncovering the relationships between their underlying concepts and of providing the means for establishing on this basis, a macro-thesaurus or a broad system of ordering. A research project thus was started in 1972, and some reports on the first phase of this project have since then been published[3].

From the collection of about 7000 thus rounded up field-names we were able to deduct that a respective thesaurus of the conventional (i. e. alphabetical kind) could not be created, since most of the terms denoted composite concepts and consisted of more than one verbal constituent. There were only about 1000 one-word field-names against some 6000 composite terms (e. g. biology vs soil-biology) and a closer look at the components revealed that most of them were recurrent rather than unique, which meant that a faceted scheme of concepts would probably be the best solution for the combining of existing and also future subject-field names.

The experiences from our investigations are hereby reported to this Symposium on International Co-operation in Terminology for two reasons:

1) to attract attention to the existent and growing trend in forming terms denoting subject-fields and
2) to encourage similar collections and investigations as done for the German language also in other languages in order that bases for comparisons of such terms resp. their concepts in different languages can be created.

It is of course not sufficient to only collect such terms; the definitions of their concepts are needed as well. No comparison concerning contents must ever be carried out on the basis of words only or of what one assumes a term to be about. The only objective basis are definitions as found in dictionaries and encyclopedias (usually drafted by experts of a field) or as given by institutions or societies having themselves created such new terms for their field of interest.

2. The nature of a subject-field

Before tackling the terminology of subject-field names, it seems appropriate to say a few words on the nature of subject-fields, especially since the conceptual contents of a subject-field is usually reflected in the name of that field. A *science* has one been defined by A. Diemer[4] as being

"a system of statements/propositions on a certain area which are interconnected in relations of foundation and which are complying with the postulate of truth, and which by virtue of such a foundation become 'scientifically meaningful' propositions"

Since a science may therefore be regarded as a system of propositions on a certain area, one may conclude that the definition of a given science should reveal the range of objects or the one single object of interest to that science as well as the kind of activities applied to the object(s) concerned. The definition or perhaps also the defining name of a science may then be regarded as the hierarchically highest-level proposition from among the entire system of propositions forming that one science.

In some cases, besides the attainment of knowledge about objects and activities corresponding, also an attainment of knowledge about specific goals is regarded as tasks and functions of a science. We should like to refer to all those sciences concerned with the conscious change of man's environment and world, as in the policy-sciences and technologies[5].

Besides the well-established sciences conforming to the above definition there are knowledge fields which may be regarded as sciences in an early stage[6], characterized by names which reflect the aforementioned components (objects and activities), e.g.

cancer research, space technology, plant nutrition, anthropometry, adult education, road construction

Such knowledge fields may be called subject-fields if their subjects have become an identifiable concern of a certain group of people. Thus an FID Working Group for the purposes of establishing a Subject-field Reference Code (SRC) defined a *subject-field* as

"a recognized range of activities around one or more subjects where recognition is based on criteria such as
– a number of people active in this field
– documents being produced
– a special terminology existing or being established"[7]

In selecting possible and relevant terms for a collection of names of such subject-fields, the criterion that at least these two components (object and activity) should be recognizable – either in the names themselves or through the definitions of their concepts – has proven to be a valid and practical guide[8]. A syntactical analysis of the relationship between the two components of such terms showed that they – so to speak – condition each other just like subject and predicate within a sentence. Actually, each of the composite terms could be transformed into a passive voice sentence. Since these terms therefore

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include a microform of a sentence they have elsewhere been called 'microsentences'[9]. Others, like e. g. Negulaev (14) call them 'elementary statements'.

The combination of specific subjects with terms denoting disciplines, like 'marine geology', 'cyto-chemistry', 'occupational sociology' to form new subject-fields can be seen as being of this same kind of combination, since the discipline terms (geology, chemistry, sociology) bring into the combination in each case the method used for the investigation of a respective object/subject, thus taking over the role of the predicate of the microsentence involved. Concludingly one may perhaps say that a subject-field is a (cultural) phenomenon emerging out of human practical, intellectual and/or mental activities regarding the investigation and/or change of nature and natural phenomena as well as the emanations and products resulting out of the activities of man and society themselves. It demands recognition by society through either of the criteria mentioned above.

3. Some details on the collection of subject-field terms

In order to attain an overall view of the kind and multitude of suject-field terms in the German language some 13 sources were exploited in 1972, most of them reference books (like directories of documentation centers, research institutes, libraries, scientific journals, scientific and technical societies and associations, economic organizations etc.)[10]; from these altogether 5600 terms have been identified as denoting subject-fields and listed in a card-file as well as on magnetic tape. In 1973 the "Fächerkatalog"[11] was scanned too and another 1200 names went into our files. We are just now searching the new edition of the "Vademecum deutscher Lehr- und Forschungsstätten" which in 1972 already had proved to be the most voluminous single source, yielding more than 2000 subject-field terms (in addition to the 2000 which we already had assembled from other sources), it appears that we might get another 1200 to 1500 from the new edition. For each relevant term two preprinted thesaurus cards were filled out to assist in the necessary organized input for computer processing. Of the very first 5600 terms two printouts were generated, one for the alphabetical and permuted listing of the terms and their components and one showing a very rough grouping according to approx 40 areas of knowledge.

In addition to the printouts not containing indications of source and available definitions two cardfiles were established, an alphabetic one and a systematic one; for the latter the structure was used which has been suggested since 1971[12] for a new organization of knowledge and which also went into the proposal for a structure for the Subject-field Reference Code (or Broad System of Ordering) of the FID. (The main divisions for subject-areas – based on existing object areas and corresponding to them – as well as their subareas are given in the Annex 1.)

It seems to us that the same methods could be used if such collections should be created for other languages as well, exploiting similar reference works of other languages, with the exception, however, of grouping the terms selected according to the more balanced and detailed subdivisions as shown in Annex 1.

4. Some results from a formal analysis of subject-field concepts

In an earlier, German publication on knowledge fields and their names[13] we gave some statistics on the kind of terms and term-combinations denoting subject-fields, indicating that the largest group in the German language was of the kind 'object (or phenomen) + discipline name' as e. g. 'soil-physics', 'soil-chemistry'. Another larger group was formed by terms of the kind 'adjective + discipline' as e. g. 'biological chemistry', 'chemical technology', where the adjective denotes either a discipline itself or may also be of a general character like 'applied', 'analytical', 'special' etc. The one-word terms such as 'anatomy', 'acoustics', 'ethics' and the like, ranged in the secondlast position while the smallest group was of the 'discipline – specification' kind, as e. g. 'physics of glasses', 'hydrology of flood control', 'sociology of education'; such terms are even rarer in the English language. But this latter group is actually only another form of the kind as mentioned as the largest group. It may depend very much on lingual use: thus the German 'Physik der festen Erde' corresponds to the English 'solid earth geophysics' and the German 'Freizeit-Soziologie' to the English 'sociology of leisure'.

We also looked for the kinds of concepts occurring in combinations of field names. For this reason we analysed the concepts and their relations of either objects, processes, phenomena or properties or combinations out of these. We spoke ob object-related concepts or *object-concepts* whenever an object was meant, like a chemical element, a plant, an organization, a piece of art. Whenever an activity was meant, as e. g. evaluation, control, measurement, we spoke of *process-concepts* and equally, whenver a phenomenon was meant, like rain-fall, traffic, radiation, of *phenomen-concepts* and whenever a property was meant, like elasticity, solubility, weight, etc. we spoke of a *property-concept*. Combinations with these different kinds of concepts may simply be called *combination concepts*, however one distinction may be made: whenever an object- or a phenomenon-concept is combined with a process-concept then the case may be called to be a *conjunct concept*, like e. g. temperature measurement or flood control. Here we again find the microsentences from above since such terms can be transformed into passive-voice sentences like 'temperature is measured', 'flood is controlled'. The two components condition each other and thus may be looked at as forming a conjunction, a concept-conjunction.
Though we have not as yet statistically evaluated the entire collection of subject-field terms regarding amounts of kinds of concepts in the combinations occurring, we did look into the combinations occuring with the German morphemes

- kunde
- wesen
- lehre
- wissenschaft
- technik

Since 'Technik' in German is used in at least two senses (Technik I as the application aspect for something, Technik II as the processing aspect) we distinguished these aspects in our counting, too.

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	-kunde	-wesen	-lehre	-wiss.	-technik I	technik II	sum
1 object-concepts	123	68	29	20	82	9	331
2 process-concepts	28	52	40	20	32	92	264
3 phenom.+ prop.conc.	32	12	24	10	29	9	166
sum	183	132	93	50	143	110	

Table 1

Table 1 shows the combination frequencies, with phenomenon-concepts and property-concepts being counted together.

The figures relate to a total number of 6800 names of subject fields. Interesting here are the high usage frequencies of -kunde, -wesen and -lehre as against -wissenschaft, since there is no equivalent for the first three in either the English nor the French language. It is also apparent that the morpheme -kunde is used mostly with object-concepts/terms, whereas -technik II occurs usually with process-related concepts; technik I again is preferably combined with object-concepts.

Such ending morphemes would also be used in connection with combination-concepts[14]. Although such statistics of term combinations may look a little odd, they are, however, quite useful for the establishment of principles for an overall facted system of such concepts. They may also be used to gain some insight into the formation rules for subject-field names.

Combinations of terms with -kunde, -wesen and -lehre are peculiar for the German language. They may have their origin in the 17th century, when German scholars tried to translate their Latin forms and thus created in addition to them German equivalents[15] which later helped as models for the creation of new terms. The German language therefore has many more synonyms for these terms, and sometimes the former equivalents are given different meanings in order to distinguish between the more scientific and the more practical approach, like in Medizin vs Heilkunde. But whereas the English language only speaks of

veterinary medicine

the German language proliferates with Tier-Medizin, Tier-Heilkunde, Veterinär-Medizin and there is as well Gerichtliche Tiermedizin, Gerichtliche Tierheilkunde und Gerichtliche Veterinärmedizin. In addition there is also Veterinärwesen, Staatsveterinärkunde as well as Angewandte Staats-Veterinärmedizin. In English the following endings occur more frequently:

- – ology as in pharmacology
- – ics as in therapeutics
- – nomy as in astronomy
- – graphy as in reprography
- – metry as in biometry
- – scopy as in spectroscopy

but these correspond to similar German endings and one can observe the framing of new field-terms today along these lines, also perhaps in order to find similar names in German and English for the same concepts. One of the latest creations seems to be "Environtologie".[16]

Although in each of the above endings a specific meaning is involved, this does not mean that the specific meaning remains consistent throughout all of its possible applications. Usually, however, -ology means 'the science', 'the teaching of' and -ics (from the Greek ending $-\iota\kappa\acute{\eta}$) means 'similar to', 'belonging, pertaining to', somewhat like the German -wesen, that is, 'all things having something to do with ...' e. g. a certain object or activity.

5. Furtner work and further plans

From the very beginning of our project "Ordnungssystem der Wissensgebiete" we realized that the definitions of the terms denoting fields of knowledge would play a crucial role insofar as the elements of such definitions would display the characteristics of the respective concepts. Only by identifying these characteristics one may recognize the relationships between concepts, which in tum are necessary for the construction of concept systems.

When the project was granted 1972, however, only terms were to be collected, no mentioning of definitions was felt necessary. Meanwhile another research project has been formulated leading a) to a dictionary of subject-field terms and b) to a computerized matching of the definitions from this dictionary in order that the computer may reveal the conceptual system behind the terms in question. One may perhaps ask where the definitions should come from. Partly they may be found in the dictionaries and encyclopedias but most of them will have to be traced back through the sources of their mentioning, and the scientists concerned must be asked directly. This may not always be possible. For the rest of the cases one would therefore have to ask experts for new definitions and for advice regarding the abandoning of terms or their labelling as probable synonyms or perhaps even as out-of-date terms.

All of this work has to be documented and to be entered into a preliminary dictionary which should be made available in alphabetical and systematic arrangement to many experts for ciritical comments and selection of most appropriate terms and definitions in cases of choice.

The next step with regard to the terminological work would then be to edit an approved dictionary of subject-field terms and definitions. This may be a help for similar projects in other languages.

There would, of course, be other applications of such dictionaries, e. g. the creation of a broad system of ordering, but this cannot be entered in here.

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6. International cooperation concerning subject-field terms

It would be extremely valuable for the further work regarding the problems involved in naming fields of knowledge if an international body like the Unesco or Infoterm could be interested in helping to create the organizational framework for the support of this work, both on the international as well as on the national level(s). Any international work needs national support, but here we also need the stimulation from the international part in order that national work may be started. Besides the international recognition of the necessity of a tool like a multilingual dictionary of subject-field terms it seems therefore necessary that different nations or language groups be encouraged to undertake similar projects to the one started for the German language. So far in some countries macrothesauri are being constructed[17] and some people seem to consider this task as equivalent to the one outlined. However, thesauri usually do not contain definitions and thus they cannot be as explicit as terminological dictionaries, while on the other hand such macrothesauri do not only contain terms denoting subject-fields but also terms for objects, processes, etc.; the terms are not checked against criteria as given in section 2 of this paper.

For reasons of comparability of results it would be advisable, therefore, to take care that input as well as methods are described well enough so that such descriptions may serve as general guidelines for projects in specific languages.

A small international board of terminologists (perhaps an "Infoterm Board on Subject-field Names") should elaborate such guidelines and be given the authority to invite different nations or specific linguistic regions to undertake the respective research and development projects. Perhaps this might be done in the first place for English, French and Russian and later on in other languages too.

Judging from our experience it should take about half a year to get started and about one year for a list of about 5000 terms and their definitions to be presented as a computer printout.

The members of the Infoterm Board concerned should have direct contact with the project leaders of the different language projects to be able to give advice if questions should come up.

As soon as the first two natural language dictionaries of subject-field terms are available one may start the first multilingual dictionary of this sort by comparing the terms and definitions, and determine the equivalencies. Thus one dictionary after another has to be compared with the other ones and all the differences have to be documented.

This task should be done by a small permanent working group since it involves hard work and probably constant contacts with scientists and experts.

7. Concluding remarks

So far terminological task groups have mainly been busy with terms and definitions of very special concepts. The more general ones have been neglected with the result that communication on this level is seriously hampered and with it international co-operation as well.

There is one reason for such a terminological task, however, which should be even more convincing: there may not be a universal broad system of ordering unless we have an objective basis for its elaboration which would be agreed upon definitions of the concepts which it contains. Most of those who still have reservations against such a system base their arguments on the existing differences in cultural developments of nations. But here we are concerned with scientific knowledge founded on verifiable and justifiable propositions. In this way there exists somehow an objective foundation for an exchange of knowledge. We should at least try to overcome the obstacles still present, since – for a number of reasons – we badly need such a system:

(1) as a tool for the exchange of information on the contents of the fields named
(2) as an intermediate lexicon to correlate different universal and special classification systems and thesauri
(3) as a common terminology for national and international statistics in many application fields, esp. also for statistics of research and development
(4) as a common tool for the ordering of contents of reference books and aids,
(5) as a basis for any internationally uniform assignment of book numbers/call numbers (Signaturen)
(6) as an indexing device for statements involving or about fields of knowledge

It is my firm belief that we shall be able to elaborate this broad system of ordering. However, we ought to approach this goal step by step, above all by first doing the necessary research work, by cleaning and clearing up the terminology involved.

It seems therefore a timely concern for Infoterm to realize the importance of this specific task and to settle the preliminaries for the organizational structure of an international dictionary of subject-field names and its resultant concept-system.

Notes:

1 The 7 disciplines were: theology, medicine, jurisprudence, history, philosophy, mathematics and fine literature (belles lettres). For the comparison see: M. Denis: Einleitung in die Bücherkunde. 1. Teil, Bibliographie. Wien 1777. p. 262–3

2 See his contribution (1) where also the kinds of syntheses are explained.

3 These may be found in (2), (3) and (4).

4 My own translation from (5) p. 14, the German text: "Wissenschaft ist ein Gesamt von Aussagen, die in einem Begründungszusammenhang stehen und am Wahrheitspostulat orientiert sind, und die durch die Begründung zu 'wissenschaftlich sinnvollen' Aussagen werden". Prof. Diemer later added to this definition "... on a certain area" (über einen bestimmten Gegenstandsbereich),

5 An 'epistemological goal' (Erkenntnisziel) was seen by R. Rochhausen (6) to exist in all those sciences concerned with theoretical and applied objectives. See also (7) p. 225–228 and p. 210–211.

6 See K. Lewin (8), cited also in (7), p. 200–202.

7 This was the former definition of May 1973. In July 1973 this was slightly changed as can be seen from the annual report of FID/SRC of 1973.

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Subject Areas and Subareas for a Broad Ordering of Subject-fields

1 FORM AND STRUCTURE AREA

11 Logic
12 Mathematics
13 Statistics
14 Systemology
15 Organisation
16 Control and automation
17 Measurement
18 Standardization
19 Testing, inspection, supervision

2 MATTER AND ENERGY AREA

21 Physics (classical ph.)
22 Particle physics (microph.)
23 Bulk matter physics (macroph.)
24 Physical chemistry
25 Chemistry & chem. technology
26 Electronics
27 Electrical technology
28 Energy physics and technol.

3 COSMO- AND GEO-AREA

31 Astrosciences
32 Space res. & technol.
33 Basic geosciences
34 Air; sciences & technol.
35 Water; sciences & technol.
36 Geology
37 Geotechnics
38 Geo-materials technology
39 Geography

4 BIO-AREA

41 Basic biosciences
42 Biology (general)
43 Microbiology
44 Plants; science & production
45 Animals; science & production
46 Agriculture
47 Forestry
48 Food; science & technology
49 Ecology and environment

5 HUMAN AREA

51 Human biology
52 Health (-supporting activities)
53 Medicine
54 Clinical, pharmaceutical & therapy-dependent recovery
55 Psychology
56 Education and pedagogics
57 Occupation, labor, leisure
58 Sports and games
59 Home, household, living

6 SOCIO-AREA

61 Sociology
62 Politics
63 Administration
64 Finance
65 Social welfare, security and relief
66 Law
67 Regional & urban planning, settlement, housing
68 Military science & technology
69 History

7 ECONOMICS AREA

71 Macroeconomics
72 Microeconomics
73 General technology
74 Commodities; sciences & technol.
75 Building, construction
76 Precision engg, mechanisms & instruments
77 Vehicle engineering
78 Traffic and transportation
79 Utilities, services, crafts

8 SCIENCE AND INFORMATION AREA

81 Science of science
82 Information sciences
83 Computer science & technology
84 Media science & technology
85 Communication science
86 Recording, reproduction & publication
87 Communication engineering
88 Postal and telecommunication services
89 Semiotics

9 CULTURE AREA

91 Language
92 Literature
93 Music
94 Arts (fine arts)
95 Theatre
96 Culture sciences (narrow sense)
97 Philosophy
98 Religion (general sense)
99 special religions, e. g. 99 (C) Christianity

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8 Especially in the Fächerkatalog (9) we found many socalled disciplines like "oscillators", "digital computers", "elasticity", etc., which are of course either objects or properties but no subject fields.

9 This was done in (7), p. 175.

10 They are listed in (2) and (3).

11 See (9); it contains about 2270 fields ordered in 88 larger groups. It contains only those fields being taught in German universities in the recent years. Right now a second edition is being prepared.

12 Actually since 1970 but then for the purpose of a total revision of the UDC; see (11) and (12) (a slight modification has been introduced in (11)).

13 See (4) – a first linguistic evaluation of the collection.

14 In (4) a larger table shows the frequencies of these combinations.

15 We should like to refer to Wolfgang Ratkes (1571–1635) "Entwerfung einer All-Unterweisung" where he suggested e. g. the following translations: jurisprudentia – Rechtslehr, Medicina – Arzneilehr, Philosophia – Vernumftlehr, etc. See also (7), p. 305.

16 Thus in (10) p. 1138.

17 See e. g. M. Wolff–Terroine's one as projected in (13).

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REPORTS AND COMMUNICATIONS

Third International Study Conference on Classification Research

I. A Brief Note

The Third International Study Conference on Classification Research was held in Bombay, India, from 6–11 January 1975. The Conference organised by FID/CR in collaboration with FID/LD and FID/TM + OM, and cosponsored by the UNESCO, the Indian National Scientific Documentation Centre (New Delhi) and the Sarada Ranganathan Endowment for Library Science (Bangalore), was hosted by the Bhabha Atomic Research Centre, Trombay, Bombay. The theme of the Conference was "Ordering Systems *for* Global Information Networks". Fifty-seven papers were received on the following specific topics of the Conference.

I Linguistic research in classification and information processing (7 papers)

Linguistic problems in natural language interactive inquiry systems (3 papers)

Input-output problems in multilingual information networks (1 paper)

Languages for control and access as related to both data entry and inquiry (1 paper)

Semantic and conceptual foundations of classification (2 papers)

II Recent developments in the theory of classification and the role of classification and other switching mechanisms in global information networks (45 papers)

Research in the theory of classification and representation of subjects in information systems (17 papers)

Research in mechanised classification and indexing (9 papers)

Use of classification in computer-based information systems (4 papers)

Development of broad ordering systems such as the Subject-field Reference Code (SRC) for use in global information networks such as UNISIST (2 papers)

Formulation of systems of subject headings, thesauri, and similar subject structuring tools, with potential application of these systems in global information networks (13 papers)

III Impact of modern technology of information systems (5 papers)

Problems and solutions relating to accessibility to distributed knowledge for fast action-oriented information use (1 paper)

Ordering problems in decision situations at global distance from potential information sources (4 papers)

Pre-prints of the papers were distributed to the participants in advance of the Conference. The volume of papers and proceedings of the Conference is expected to be published in 1976.

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