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Present State and Future Development of Information Retrieval Languages in Czechoslovakia

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Report covers at first socalled systematic information retrieval (IR) languages, such as the UDC and its application in the Slovak National Bibliography, in agriculture (ARDIC-EC), in the Slovak Technical Library and in the Central Economical Library; and the application of the Soviet Library Bibliographical Classification (LBC) at the University Library of Bratislava.
A third kind of systematic IR language is the Rubricator System of the International System of Scientific-Technical Information (ISST). It is explained and described in its application to the field of water research and engineering industry. Secondly special subject retrieval languages are dealt with. Three kinds are distinguished and described in the fields of radiohygiene, environmental pollution control, agriculture, medicine, chemistry, law, building, and water research. Concludingly a list of further activities and the planned development within the ISST are outlined.   (I.C.)

0. Introduction

Information-retrieval languages used in Czechoslovakia have the following functions:
— formulation of identity- and content-data referring to documents being entered into information systems
— storage of documents or document entries in the appropiate formation memory
— guidance for the translation of the user's information query when output from the information system is needed
— retrieval of relevant and pertinent documents and information by means of searching in the information memory
— distribution of the information system output.

An information-retrieval language is a type of information language, and is therefore considered, in accord with the approach of Mr. B. Kovar (I), (2), as a means of formulating the processes of ordering, storage, and retrieval of information.

1. Systematic information retrieval languages, the state of the art, and strategies for development

Systematic information-retrieval languages are a tool for systematic information classification. In the course of this classification the documents and the entries referring to them are "placed" within the totality of human knowledge as it is represented by the information-language considered as a system, both in the sense of "placement" in a discipline and at the proper level of entities (genus/species; cf. B. Kovar (2). Verbal representation of the document content, obtained by means of content analysis, is usually replaced by the signs of the artificial language. Among the most widely applied systematic information-retrieval languages in Czechoslovakia those (which have already been introduced, or are in the process of introduction within the computer-based information systems for scientific-technical information) can be mentioned the Universal Decimal Classification (UDC) the Soviet Library-Bibliographic Classification, and the Rubrikator MSVTI (International System of Scientific-Technical Information).

1.1 Universal Decimal Classification

References (2) and (3) deal with the present state and strategies for development of UDC. According to the Guidelines concerning the principles of unified construction and application of information-retrieval languages (4) the UDC is considered as an additional retrieval language. The following examples of UDC application in automatic information retrieval systems may be mentioned: the processing of the Slovak National Bibliography, the application in the system ARDIS-EC and the application in the Slovak Technical Library (Bratislava) as well as for the system EKO-INDEX.

In the course of processing of the Slovak National Bibliography the UDC is used as one of the information retrieval languages (the second being the subject headings, the so-called "premarked" subject sentences). Mrs. Slížová deals - in her paper (5) - with the problems of mutual relationships between those two retrieval languages and argues that the subject sentence cannot be a verbal expression of the numerical notation of the UDC sign. Both information retrieval languages have different functions in the system of the Slovak National Bibliography - the UDC intercalates the document on its accurately determined place within the hierarchy of a respective discipline, the subject sentence expresses the document contents in broader connections; it expresses not only subjects and phenomena, but also their situation in space and time. Mrs. Slížová deals with the computer-based document processing of the Slovak National Bibliography (6) and describes the experience gained with the computer-assisted processing of another series of lists, i.e. the Series B. From the sample copies of the compilation of this series it can be seen how UDC appears in the output structure of its document entries.

A further example of UDC utilization as a retrieval language in a computer-assisted information system is its application in the computer-based retrieval, documentation, and information system ARDIS-EC using the computer EC 1030 in the Central Agricultural Library of the Study and Information Centre at the Agricultural University, Nitra. UDC is considered in this system as a metalanguage for the accurate definition of logical relationships, by means of which the information retrieval request is arranged. The experience gained with data-base reclassification in this system (from UDC into a form of subject headings, by means of the ARDIS-EC software system) was interesting. This work indicated that the mutual relationships of both of the retrieval languages used may be solved using the computer, and

may be included in the bibliographical data-base design project.

Another example of UDC application as an information-retrieval language in a computer-assisted information system is its use in the Slovak Technical Library, by making accessible selected information from the foreign books accessions holding. UDC is used as an information-retrieval language in the system, subclasses being provided with alphanumeric symbols. In this system the subclass notations with alphanumeric symbols are considered as main UDC classes, based on decimal notation. Within the whole system of foreign book accessions a set with more than 500 UDC symbols has been utilized. The retrieval system makes possible the use of combinations of UDC symbols with descriptors. In the same way as in the foregoing two systems the UDC is supplemented by a further retrieval language of the verbal-subject type.

The last of the selected examples of UDC application as a retrieval language in a computer-assisted information system is its utilization in the EKO-INDEX System in the Central Economical Library, Bratislava (7). The UDC symbols were included in the computerized processing of the bookstock in the sense that library files are arranged according to the systematic classification. But in this case the UDC is supplemented by another type of systematic retrieval language called in the EKO-INDEX System simply "systematics". The third retrieval language of the EKO-INDEX System is the information-retrieval language based on natural language, which during the development of this system experienced its own development - from the precoordinated subject retrieval language on the basis of freely constructed entries, to a postcoordinated descriptor-type retrieval language on the basis of controlled vocabulary of headings.

After a period of hesitation concerning UDC, especially after the widespread growth of use of descriptor-type retrieval languages, the UDC showed its advantages and suitability for computer-assisted information systems. It fulfills its function in macroclassifying large document sets or of information on them. In order to retrieve specific information requests, the information systems using UDC begin by using another retrieval language, one based on natural language.

1.2 The Soviet Library-Bibliographic Classification

The Soviet Library-Bibliographic Classification (LBC) is a systematic retrieval language of the concept of systematic information classification. An example of LBC application in Czechoslovakia is the University Library, Bratislava.

Application of LBC in Czechoslovakia is appropriate in university libraries with their various types of bookstock, various types of catalogues, and needs for both general and special searching. The feasibility of computer-assisted stock processing using the SLBC as the retrieval language (or perhaps as one among several retrieval languages) looks to the future promise of the LBC in scientific libraries of the university type.

1.3 Rubricator System of the International System of Scientific-Technical Information (ISSTI)

The ISSTI rubricator is a new type of systematic retriev-

al language, developed on the basis of experiences gained with rubricators of information publications in the Soviet Union. It is a classification system of hierarchical type, including all branches of science, technology, and national economy. The rubricator notation has signs, fixing the place of the column (heading, rubric) within the classification system; the lower-rank concept of rubrics, their hierarchical level, and the sequence within one hierarchical level are displayed. The symbols of respective hierarchical levels are separated by full stops.

The ISSTI rubricator (8) is defined as a pragmatic classification of scientific and technical domains, branches of the national economy, and complex and practical problems of an interdisciplinany character. It is a classification scheme of a universal topical scope, having three levels.

The ISSTI rubricator is aimed at fulfilling the following functions:

— determination of the thematic profile of subsystems
— elaboration of information sets in ISSTI subsystems with the aim to deliver them to other functionally connected ISSTI subsystems and systems outside the ISSTI
— systemization of information sets within the subsystem's stocks, and publication of information
— searching for information in the stocks according to the rubricator divisions
— normative function for the branch type ISSTI rubricators.

The ISSTI rubricator is the authoritative basis for constructing branch ISSTI subsystems (IBSTIS). The situation in respect to the International Branch Scientific-Technical Information Systems was rather complicated, since several IBSTIS had already developed their own rubricators before the ISSTI rubricator was worked out. After the ISSTI rubricator was completed those IBSTIS had to begin to solve the problem of compatibility of their branch rubricators with that of ISSTI. This was also the case with the VODOINFORM System, where over the years 1979-1980 the problems connected with the compatibility of the branch rubricator with the ISSTI had been studied (9), (10). After several negotiations the rubricator VODOINFORM has been modified on the basis of the ISSTI rubricator.

In the paper "Updating of VODOINFORM rubricator (11) the difference between the VODOINFORM rubricator (1980—83) and its updated version produced in 1984 is dealt with. The updated rubricator is composed of three parts: introduction, systematic part, and alphabetical subject register. The VODOINFORM rubricator fully conforms to the ISSTI rubricator and represents a further working out of the division 70 "Water Management. Amelioration" of the ISSTI rubricator, namely of its third level. In the updated VODOINFORM rubricator the same references are used as in the ISSTI rubricator, especially "see" and "see also" for expressing connections with interdisciplinary branches of water management and amelioration. A computer was used for the processing of the alphabetic-subject register and its vocabulary has been built up from the systematic part of the VODOINFORM rubricator. The alphabetic-subject register was worked out in both the Russian and the Slovak languages.

Application of the ISSTI rubricator in the field of engineering industry is described in the paper "Function of the rubricator with respect to the present trends of IBSSTI development for engineering industry — INFORMAŠ" (12) where three fields of activity and development of the INFORMAŠ System are:
— technology of the engineering industry including appropriate equipment (subsystem INFORTECHNOLOGY)
— agricultural and tractor engineering (subsystem INFORMTRAKTOR-SEĽSKOCHOZMAŠ)
— chemical and petroleum engineering (subsystem INFORMCHIMAŠ).

The main elements of the INFORMAŠ System — the respective national authorities, basic authorities, and data bases — are further dealt with in defining the sphere of activity of the system. The way the numbers are divided provides for correlation with the ISSTI rubricator.

55.01 General problems of engineering industry
55.03 Engineering industry and parts (units, sections) of the machines
55.09 Engineering materials
up to the 4th hierarchical level.

The INFORMAŠ rubricator is a basic tool for the definition of the activity fields and subject scope of the system proper and of its constituents - subsystems, and respective complex bases represented by respective basic authorities.

A common feature of the strategies for development of the systematic retrieval languages is the question of their applicability, especially at the level of big universal systematic retrieval languages. Systematic retrieval languages, as compared with descriptor retrieval languages, showed their functionality and competence in such information systems.

The construction of the ISSTI rubricator and its gradual application in the Czechoslovak system of scientific-technical information (in accordance with the principles of unified introduction and application of retrieval languages in this system) (13) is one of the most significant steps in the present development of systematic retrieval languages and in the strategies for their development in future.

2. Subject retrieval languages, present state and strategies for development

Verbal subject retrieval languages are based on natural language. Two basic types of subject retrieval languages can be distinguished
— precoordinated subject retrieval languages
— postcoordinated subject retrieval languages

Precoordinated subject retrieval languages express the theme of the document (or of the information inquiry) in a string of words in the natural language connected according to strict rules, making sense only as a whole, from which it is not allowed to remove single words. A typical example of subject precoordinated retrieval languages are subject headings or retrieval languages based on the words occuring in the title and subtitle of the document.

Postcoordinated subject retrieval languages express the theme of the document of information inquiry in a

set of words in the natural language, though this set is composed of mutually isolated and separate words chosen from the controlled vocabulary. These retrieval languages allow arbitrary combinations of words related in that they all refer to the same document. Typical examples of postcoordinated retrieval languages are the retrieval languages of the descriptor type.

The most serious problems involved in subject retrieval languages are those of convertible terms, homonymy, polysemy, and vagueness, all implied by the natural language from which they are drawn.

2.1 Subject languages based on the words occuring in the title and subtitle of the document

This type of retrieval language is based on the principle of key words selection from the title and subtitle of the document, which take over the function of subject headings. Within the Czechoslovak system of scientific-technical information this type of subject retrieval language started to be used in the course of computerization of the system. The index-types KWIC and KWOC are processed using the computer; key words chosen for the entry in the index are alphabetically arranged by means of the computer and are listed within the index together with the words of the title immediately preceding and following the particular key word. The key word being filed on is provided with the reference to the particular bibliographical entry or document entry which the given key word contains.

A pioneer work in this field was done in Czechoslovakia by J. Helbich (14). In Slovakia this technology is used for the processing of the indexing periodicals COMPUTER INDEX and ENPO INDEX, both supplemented with a selection of key words from the abstract. The description of ENPO INDEX, as one of the outputs of the Czechoslovak STI sugbystem for the environment, can be found in (15). In Czechoslovakia the index periodical AGROINDEX is processed in this way.

2.2 Subject Headings

A convenient example of application of the retrieval language based on subject headings is the information retrieval language of the "Unified Agricultural and Forestry headings" (UAFH), constructed on the principle of subject information classification and realized in the "Czechoslovak Computerized Documentation System AGROINDEX".

This retrieval language consists of three components, described by V. Prášek in (16), namely:
— UAFH, having the character of the controlled vocabulary of simple lexical headings
— "International Biotaxonomic System", creating the second parallel component of this retrieval language, though not rigidly fixed in the form of a list of taxons having significance of agriculture and forestry
— specificators, the so called "free" components of the retrieval language, consisting of terms added to headings according to principles defined in the indexing rules of the AGROINDEX system.

Each index-sentence appears in the AGROINDEX as many times as there are terms within it, with each term occurring as the leading element once.

An information retrieval language based on subject headings is not an example of a retrieval language of this type strictly considered, since it is a combination of a retrieval language based on headings with a descriptor-type retrieval language. This retrieval language takes over from the precoordinated heading systems the elements of syntactical character (chiefly for index purposes) and from the postcoordinated descriptors the system elements of simple logic and concept coordination (for information retrieval purposes). Combination of both elements into one retrieval language provides the introduction of index-sentences, by means of which it is possible to express the relationships among heading, taxons, or even their fuller determination by means of specificators.

2.3 Descriptor retrieval languages

In the course of the construction of descriptor retrieval languages in our country there emerged serious dis-coordinations. Strategies for development are now overcoming the lack of coordination in the construction and use of incompatible thesauri by introducing standardization into the structure and compilation of thesauri.

"Thesaurus" and its exact units are fully defined in the Czechoslovak Standard 01 0193 — Mono-lingual thesaurus (17) and in the standard-technical guideline ICSTI NTP 4-75 (29). The process of thesaurus construction is defined by the standard-technical guideline ICSTI NTP 9-75 (18).

Application of mono-lingual thesauri in Czechoslovakia takes place in the following ways:
— on the basis of the English language as the retrieval language of imported magnetic tape data bases
— on the basis of the Czech or Slovak language.
The thesaurus MALIMET of the system EXCERPTA MEDICA is in operation, based on thesauri using the English language. This thesaurus consists of terms occuring in the field of sanitary engineering and medical science.

Another thesaurus of this type is the thesaurus of the data base ENVIROTAPES, divided into 21 thematic categories, each category containing an alphabetical list of descriptors. From the chemical bases the thesaurus of chemical substances "Chemical Abstracts Condensates" and "Chemical Abstracts Search" are interesting, where each substance is provided with its molecular formula as well as with its structure formula with the title and index number.

The thesaurus INIS, having a known logic structure and precise processing belongs into this group.

The thesaurus of the computerized system of information concerning the legal aspects (ASPI) is considered a rather significant achievement. Within the branch of transport, experiments are being performed with the thesaurus system TRIS. An interesting approach to thesaurus-construction can be found in the contribution by J. Mareš (19). This thesaurus is used for the processing of business-economics information in the Department of Foreign Trade. The structure of this thesaurus makes possible a multi-aspect approach to information; it contains equivalent Czech and Slovak descriptors: descriptors expressing goods occuring or

produced in Slovakia are quoted in Slovak, and descriptors of Czech goods are quoted in Czech, with Slovak equivalents listed as non-descriptors.

The construction of multilingual thesauri may be considered as one of the most prominent trends in the sphere of information-retrieval languages of the descriptor type. This trend has recently begun to rely on standardization, especially at the level of standard-technical guidelines of ICSTI (20), (21).

Examples of three international branch systems of the member countries of ICSTI are listed below:
— the thesaurus IBSSTI for the building industry
— the thesaurus VODOINFORM
— the thesaurus INFORMOOS.

The thesaurus IBSSTI for the building industry was described recently by S. Kadečka in (22). This thesaurus is defined as a complex of compatible national thesuri, interlinked by means of a common code, its authoritative source being the so-called basic thesauri in Russian and German. It is divided into 12 subject fields, representing the main groups of the building industry branch, reflecting also to a certain extent the main aspects of content analysis of the processed information sources. Each subject field contains a certain number of group descriptors and each group has a certain number of order descriptors (30—150) in a moderate hierarchical structure (2—5 hierarchical levels). This thesaurus is experimentally operated, and since 1981 it has been introduced as a pilot-plant operation.

The methodology of the construction of the VODO-INFORM thesaurus has been described in (9) and (23). It is a computer-assisted thesaurus containing 13,000 headings, consisting of two parts, namely alphabetic and systematic. The alphabetic part is a modification of the alphabetical arrangement of descriptor sections. Descriptors are arranged alphabetically together with non-descriptors, the descriptors being provided with references to the higher-rank descriptor (denotation B for the higher-rank descriptor) and non-descriptors being provided with references to their pertinent descriptors.

The VODOINFORM thesaurus has been worked out into 20 thematic groups identical with the thematic conclusions of the VODOINFORM rubricator. The descriptor sections are worked out to the 8th hierarchical level.

The systematic part of the VODOINFORM thesaurus is also processed by means of computer, the hierarchical level being expressed by means of a certain number of points placed before the descriptor. The principle is strictly observed that each descriptor can be introduced into the thesaurus only once, without respect to the argument that it could have been introduced into several thematic groups.

In the environmental protection branch the thesaurus INFORMOOS (24) had been worked out with alphabetic and systematic parts.

Three paradigmatic relationships are considered in this thesaurus, namely
— hierarchy,
— synonymy,
— association.
The systematic part of the thesaurus contains descriptors classified into thematic classes, the titles of which are practically identical with the titles of rubrics

from section 87 of the ISSTI rubricator. This contribution has substantially arisen from an experiment in indexing 860 documents of a chosen set of abstracts from the Referativnyj Žurnal "Ochrana i vosproizvodstvo prirodnych resursov".

Among the strategies for development in the field of subject retrieval languages the transition from free to controlled vocabulary of lexical units can be mentioned. This trend can be seen in case of retrieval languages based on subject headings, as well as in case of descriptor-type retrieval languages. The main trend of development in descriptor-type retrieval languages is the standardization and unification effort at the national and international level and the construction of multi-lingual thesauri. The endeavour to provide compatibility between thesauri in the various national languages is one of the most significant tasks to be dealt with in the near future.

Integration trends were among the most important characteristics and strategies for development of retrieval-language development in the last years. These trends can be noted as sanctioned by ISSTI as well as by the UNISIST Programme. Experience gained with the uncoordinated construction of descriptor retrieval languages in various COMECON member countries caused incompatibility among the languages of respective ISSTI subsystems, giving rise to the trends toward unification of the descriptor-type retrieval languages, and toward unification of the formal structure of the thesaurus and its updating. The urgent need to proceed toward a qualitatively new, higher, organizationally safeguarded control of retrieval-languages development was evident. Only in this way it is possible to cope with the qualitative and quantitative variability of retrieval languages in use and to remove the language barrier between multi-lingual thesauri.

3. Conclusion

The activity concerning retrieval-languages development will be seen to be focused in the Czechoslovak System of Scientific Technical Information, so as to create adequate space for confrontation of this activity and for its coordination with modern strategies in information technologies and services, i.e. automation of information processes, development of international information systems on a multilingual bases, application of on-line factographic data-base systems, and transition to direct storing of texts or data without previous indexing. This concept is different from the traditional approach to retrieval languages as to autonomous elements of information systems and substitutes for that tradition a broader, more complex understanding based on the linguistic approach. It is also assumed that the problems of language modelling, automatic abstracting and indexing, and development of optimization retrieval algorithms would be dealt with by this linguistic approach (13).

In this spirit also the effort towards the computer-assisted thesaurus-development using the semantic analyzer (27), and experiments with information searching by the method of information selection from the full text (28) is aimed at.

Problems concerning the concept compatibility of classification systems (25) and language compatibility in the course of transition from the superficial to depth structure (26) call for ever-increasing attention in the field of retrieval languages. The carrier part of retrieval languages in the Czechoslovak Scientific-Technical Information System will also be created in the future by the system of ISSTI retrieval languages. In this field further activity would be focused on the solution of the following problems (30):

— improvement of the ISSTI rubricator and development of methods of its application in document and information inquiry indexing
— working out of all further components of the ISSTI retrieval languages system, especially the macrothesaurus and the set of grammatical means
— solution of problems concerning the construction of a unified language for searching in different data bases
— processing of linguistic processors for automatic indexing and retrieval of texts of secondary documents
— processing of linguistic processors for automatic correction of texts at the stage of input into the automated system
— exploitation of the work performed up to the present time in the field of information-retrieval languages for construction and application of factographic information systems.

It is expected that in the coming years attention would be focused in information retrieval languages development of the ISSTI system on
— the solution of problems involved in computer-based indexing methods using multilingual retrieval languages (thesauri)
— working out and application of automation method in retrieval-languages development
— providing for compatibility of ISSTI retrieval languages with retrieval languages outside the ISSTI
— application of natural language in automatic searching.

The development and application of the ISSTI retrieval-languages system would create a decisive step towards the construction of computer-based systems, operating in conditions of broad algorithmization and automation of processes of intellectual document- and queries-handling, thus increasing the quality of information services for the systems users.

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