protection, communication, signs and symbols, as well as information and technology. They can be read already *to* children of the pre-school age and – printed as they are in large characters – *by* children from the age of eight upward, while at of the age of nine or ten the children can be familiarized with the language exercises. Clues to all questions asked and an index comprising all words of the spelling exercises are found at the end of the book. Throughout the stories and exercises the youthful readers are accompanied by Adalgard and Umundum, both transposed from the Middle Ages into the present. As they read the stories and solve the exercises the children acquire elementary skills in information and documentation, and with them in scholarly activity and learning. One would wish for further books along these lines, books acquainting one in a playful way with the arts of looking for knowledge, of filing and retrieving it, of searching for it. Such structural capabilities in dealing with knowledge will become more important all the time.

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PRASHER, R.G.: **Index and Indexing System.** New Delhi; Medallion Press (A46 Mohan Garden) 1989. IX,196p.

In India, the practice and study of indexes and indexing has always remained delegated in a subordinated position to notational classification. Mostly, this has happened under the heavy weight of hierarchical classification in the Indian library school curricula. Thus verbal classification has not received its due importance. This has worsely affected the construction and use of indexes and subject catalogues in India. Accordingly, there is a dearth of Indian standard books on this traditional tool of information retrieval. Because of this, a book on various aspects of indexes and indexing is welcome.

Dr.Ram Gopal Prasher, at present a professor at the University of Sagar, is an experienced librarian and a dedicated teacher. His services to Indian scholarship and the library profession in the form of "Indian Books: An Annual Annotated Bibliography (from 1971-1975)" and "Indian Library Literature, 1950-1970" are enviable and enduring. He is thus well equipped to write on indexes and indexing.

The whole book, covering a large spectrum of the art and science of indexing, has been regimented into ten chapters. The first chapter makes a close survey of the various prevailing definitions of an index and the technique of indexing: it enumerates the functions of an index differentiating it from a bibliography and a catalogue and lists also some important indexing services. This chapter is valuable for its survey of the major indexes and their types. The second chapter traces the history of the subject from Cutter to Craven. The history has been narrated not under concepts but under individual personalities and their work in chronological sequence. The next six chapters are devoted to individual indexing systems such as chain indexing, PRECIS, POPSI up to post-coordinate systems. Among them there could have been added a chapter on automatic indexing as well as one on the role of computers in indexes. Also, a chapter on Sears and LC lists of subject headings would have been helpful since they are invariably taught in theory and practice in all the library schools.

The ninth chapter describes some existing indexing services. These include book indexes, collection indexes and newspaper indexes. The rest of the indexing services are listed by subject. Only 53 major services are described, though no explicit criterion has been stated for the selection. For instance "Library Literature" (H.W.Wilson) has been included while LISA (London: Library Assoc.) has been omitted. The chapter, however, is nevertheless useful to the students of reference services. The last, the tenth chapter describes a procedure to evaluate an index in the wider context of an information system. Evaluation is a diagnostic process aiming at its efficiency and efficacy with the overall economy. It enlists factors effecting the handling of an indexing system in the context of practical reality and in the traditional terms of precision and recall ratio. Some surveys and experiments having been carried out, such as the Cranfield Project and the Medlars Evaluation Program have also been described in brief. In the appendix (p.182-192) facsimile reproductions from some eleven indexes are given, so as to provide students with a visual idea of the shape and structure of these indexes.

Basically, it is a textbook. Each chapter - divided into Ranganathanlike paragraphs with feature headings - ends with a summary followed by references and lists further readings. The text is well illustrated with diagrams and examples. The language is simple and in a matter-of-fact style. Here the author shows off as a meticulous editor. The production standards are high. This book bringing many things under one roof, comes handy to the students of indexing and subject cataloguing.

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H., GALINSKI,Ch. (Eds.): **Terminology and Knowledge Engineering. Proceedings.** International Congress on Terminology and Knowledge Engineering, 29 Sept. - 1 Oct. 1987. University of Trier, FRG. 2 vols. Frankfurt/M: INDEKS Verlag 1987/88. 448 + 256p.
ISBN 3-88672-202-3 and -203-1.

The two volumes contain 74 papers (53 in English, 19 in German, 2 in French) of the First Congress on Terminology and Knowledge Engineering organized by the International Information Centre for Terminology and the Association for Terminology and Knowledge Transfer under the patronage of UNESCO. The papers reflect all present activities in terminology science. They may be grouped roughly into (1) fundamentals of terminology science, (2) linguistic problems, (3) knowledge organization, and (4) application.

About 9 papers are devoted to the *fundamentals* of terminology science. Attempts are made to answer questions

such as 'what is a concept? what is terminology?', and 'in which sense are terminology and knowledge engineering related to each other?' The need to standardize scientific terminology (as far as possible across disciplines and with translinguistic methods) is emphasized. The discussions are centred around Wüster's General Theory of Terminolgy and his triad 'object-concept-symbol'. The information given is sometimes quite elementary; it would be better placed in an introductory lesson rather than presented at a conference. Dealing with the solution of terminological problems, terminology science must apply (unlike other sciences) its own principles and methods to itself – with less success as yet, as the uncertain handling of its basic concepts shows: Even the term 'terminology' is used in at least three different meanings: 'theory of knowledge management', 'systems of concepts to which terms have been assigned', and 'terminology science'.

To get a world without communication barriers the UNESCO is interested in promoting adequate terminological tools for knowledge transfer between all countries – *linguistic problems* are serious obstacles to this endeavour: A native speaker, e.g., should accept a neologism as a meaningful word creation if the meaning of the concept in question is explained to him; in two papers this *acceptance problem* of neologisms is discussed explicitely. Problems may arise because *a special language is always embedded in a normal language*. PICHT calls attention to one consequence of this fact: In coining new concepts a scientist uses in general his native language so that numerous normal language phrases with a special meaning appear in a scientific context. This leads to naming problems in other languages: In translating even specialists have problems to find the correct verbs, prepositions etc. Other difficulties arise from the fact that the normal language with its *restricted number of word elements* is less suitable for the formation of the mass of new terms required every year. It has been suggested, therefore, that research should pay more attention to the development of nomenclatures and systems of signs where a sign reveals the position of the concept in its system; banks containing definite word stems and affixes with a terminological key for building new namings will play an important role in the future.

The close ties of the sciences with Western culture and language lead to *special problems in non-European languages* mostly unknown over here. For Japanese some of these problems are cited by FUJIKAWA & ISHIKAWA and HANADA & SASAKI: Along with Roman characters in Japanese three different character types (kanji, hirakana, katakana) are used so that at first great efforts have to be made to standardize word notation and orthography. Additional difficulties are due to problems in forming adjectives, problems with the grammar and sentence structure and word order. The lack of terms to express experimental operations and thinking processes impairs understanding. The original Japanese words are deficient in vocabulary to express abstract ideas, and have less ability to form new words. Simple transliterations are impossible because of the absence of characters denoting consonants without following vowels. In Chinese the main problem in using an online term bank is the lack of an alphabetic order for the Chinese characters. Language-dependent restriction in building new terms are also mentioned for Hebrew, Greek, Persian and Malaysian. To tackle all these problems, hopes are placed on natural language processing, artificial intelligence, machine translation etc. NISSAN describes an expert system for word-formation in Hebrew regarding morpho-semantic aspects. Feeding the system with the definition of a concept for which a term is searched for, new Hebrew words are coined as possibly candidates. EICHHOLZ suggests Esperanto for a common neutral scientific language. Esperanto has – as an artificial language – a simple agglutinative structure; based on the rule that foreign words – except for the Esperantized spelling – have to be adopted without change, and with its pre-defined prefixes and suffixes, it is an ideal tool for expressing scientific concepts, but, as it seems, only for people speaking European languages. The knowledge transfer problems in Japanese mentioned above remain unsolved by switching to Esperanto.

Most papers deal with *knowledge organization* in the broadest sense. The feasibility of standard classification for health data is discussed and an expert system presented which determines for a new concept automatically the number in the universal decimal classification. Examples for *establishing terminology* are given from chemistry, social sciences (especially in Soviet ethnics), medicine, physics, and for taste perception throughout Eastern Asia. We find an attempt to establish a typology of information processing systems and some remarks on teaching terminological principles as an academic discipline. Terminological principles are applied to object-oriented programming and to modelling the information structures in a company. Knowledge representation methods are discussed for understanding the computational problems in agriculture.

Tools and methods for the development of terminological databases (term banks, thesauri, knowledge bases) are dealt with in detail. Thus, an extended entity-relationship-model is suggested for a terminological database which allows for the consideration of user requirements. In another approach definitions of scientific words are represented as formulae of the predicate logic of the first order. It was pointed out that more attention should be paid to the relations between concepts. Relations govern the structure of a thesaurus; there is a trend to introduce additional relations to it and to use a semantic network for its computer representation. A useful tool for users and developers is the universal graphical editor for semantic networks described by BÖHMER. Some examples for *(multi-lingual) term banks and dictionaries* for special subject fields (economics, nutrition science) are given and the problems in establishing them are discussed. TANAKA & YOSHIDA decribe the construction of a microthesaurus by automatically extracting technical terms in Japanese and English from patent data. Only one paper deals explicitly with the validation problem; it treats the assessment of confidence codes in a multi-bilingual terminological database.

Knowledge organization has a large scope for *application*, above all the Retrieval of information stored in the various bases. The emphasis lies on user-friendly interfaces. A natural language front-end is discussed and we find design principles for a user interface which allows, among other things, for the integration of different types of term banks, a comfortable updating, and the extraction of specific subsets. BRÜCKLER et al. describe a smart assistant for information retrieval which provides the user with intelligent aids for access. GÜNTZER et al. present a self-adaptive information retrieval system for semi-automatically constructing a high-quality thesaurus without great efforts. The system observes the retrieval behavior and draws conclusions from it. This also could be a tool for linking bibliographic and archival information systems. Noticably less papers deal with utilizing terminological tools in knowledge processing and engineering even though this exactly was the topic of the conference. Storage and retrieval of information in natural language messages and *(knowledge-based) extraction of knowledge* from natural language texts may be mentioned here. Furthermore, a case study is presented to incorporate term banks for an integrated electronic office system in a European multilingual environment.

An important field of application for term banks and thesauri is *machine translation and text generation*. Both tasks are closely related to each other because the input of a text generator is normally the output of the foreign language analyzer. HEID & WECK describe such a generator for German sentences based on Steiner's verb classification. In another system the parsing result of a Chinese sentence is represented as a multi-labeled and multi-branched hierarchical tree. It is the starting point for a multilingual machine translation from Chinese to English, French, Japanese, German, and Russian. Two multilingual translation projects from the Commission of the European Communities are presented. One of them, SYSTRAN, is an existing system for nine operational language pairs with additional modules for Russian, Japanese and Arabic; EUROTRA, the other, which has just been launched, is a project to create a prototype machine translation system capable of dealing with all Community languages. Both activities are based on the quite homespun language pair strategy, which means that for nine official languages 72 pairs have to be dealt with. SADLER outlines an interlingual architecture in a multilingual system for (tomorrow's) machine translation systems: it is translated first from a source language into an intermediate language and from this into the wanted target language so that nine languages only require 18 pairs. He adopts the common language idea from EICHHOLZ and suggests a modified form of Esperanto as the intermediate language.

For multilingual systems, TOMITA et al. describe a *universal parser architecture* worth mentioning in more detail. Starting at the fact that the semantic information can remain invariant across languages (in contrast to their linguistic structure), the unversial parser is equipped with three kinds of knowledge sources: one containing syntactic grammars for different languages, one containing semantic knowledge bases for different domains, and one containing sets of rules which map syntactic forms (words and phrases) onto the semantic knowledge structure. Each of the syntactic grammars is totally independent from any specific domain and likewise, each of the semantic knowledge bases is totally independent from any specific language, hence, if new linguistic information is added it will apply across all semantic domains, and if new semantic information is added it will apply to all relevant languages. The mapping rules are both language- and domain-dependent, and a different set of mapping rules is created for each language/domain combination. In an offline step the grammar compiler takes one of the syntactic grammars and one of the domain knowledge bases (along with the appropriate set of mapping rules) producing one machine-efficient grammar for an online parser which contains both syntactic and semantic information. Syntactic grammars, domain knowledge base and mapping rules are written in a highly abstract, human-readable manner. This organization makes it easy to extend or modify the knowledge sources.

The quality of the papers varies in a wide range. Some of them have to be considered out of place for that conference. KÖTTER & LUFT, for instance, emphasize the language-oriented pragmatical aspects of terminology and knowledge acquisition. They attack the correspondence theory in which the progress of knowledge acquisition is conceived as a successive appproximation to reality. According to these authors, this theory is not a good basis for research, because in each individual case the quality of such an approximation cannot be estimated, unless, we had omniscience to our disposal. However, this is incorrect: it is sufficient to decide which of two approximations is the better one. The procedure of the recommended pragmatic approach is very similar to what is called supervised learning in pattern recognition: a pattern is learned by providing the machine with positive and negative examples. In this procedure the machine can only learn what the teacher knows, as a consequence, the teacher's omniscience is now presupposed. The pragmatic approach involves the consensus theory of truth; one of its prerequisites is the assumption that those involved in the process of agreement are well-informed. This may be the case at the end of a research process but there is no teacher who knows what is the right answer during the process; in terms of pattern recognition: it is an unsupervised learning. It would be quite interesting to hear what Japanese researchers -- in face of their genuine problems mentioned above -- think about such pragmatic recommendations. From another epistemological ivory tower, DE BEAUGRANDE presents an approach which regards both, a general purpose language and a terminology as a complex control system. Some implication from thermodynamics, quantum theory, and molecular biology are raised in order to propose a new orientation for linguistic theory. His arguments are a confusing mixture of linguistic, epistemological and physical reminiscences. Following a popular trend, terminological problems are related to some speculative and misunderstood laws, above all Heisen-

berg's uncertainty principle. It states (according to de Beaugrande) that position and momentum are "conjugate variables". However, this is incorrect: the uncertainty principle holds only for a pair of canonical conjugate variables; and two variables are canonical conjugate to each other if one generates the other in a canonical transformation. Thus, some superficial analogies with uncertainty are not enough to apply Heisenberg's principle to linguistics; the underlying conditions have to be observed, too, i.e. there has to be something (among others) like a linguistic canonical transformation. KUCK's knowledge engineering by quantum logic leaves a no less confused impression. No connection could be found between quantum logic and knowledge processing. The paper deals mostly with the derivation of four physical "axioms" from a generalized propositional calculus. Quantum logic is called 'theory of knowledge' without proof or any indications. It is represented by a graph replacement system which looks like a well-known graph grammar technique. The author has no doubt that it would proof useful for artificial intelligence applications. From one replacement example he draws the conclusion that in the future (processing his quantum logic) parallel computing is needed. This and other displeasing statements create the impression that the author cannot be well acquainted with the problems of knowledge processing.

There is an excellent name and subject index for both volumes; it contrasts noticably with the superficial editorial work. Only 10 papers (from 74) contain an abstract. Some papers show considerable linguistic shortcomings. We also detect the ineradicably silly custom to give definitions and explanations in terms of the programming languages used. This is unreasonable to all readers with no experience in that language but it is also no pleasure for specialists to fight with dozens of brackets in a text which could be placed better in a table or figure. Despite these shortcomings, the interested reader will gain an admirable insight into the state of the art in terminology science.

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INEICHEN, Hans: **Einstellungssätze: Sprachanalytische Untersuchung zur Erkenntnis, Wahrheit und Bedeutung.** (Sentences Expressing Propositional Attitudes: Language Analysis of Knowledge, Truth and Meaning) Munich, Germany: Wilhelm Fink Verlag 1987. 367 p. ISBN 3-7705-2382-2.

Ineichen's abridged version of his dissertation of 1983/84 is a thorough introduction to various aspects of "belief sentences" and – at the same time – to the way of thinking about language typical of the school of "analytical philosophy" (representatives: G.Ryle, L.J.Austin, P. F.Strawson, D.Davidson, etc.), which strongly influenced his views.

The first part of the book has the title "Knowledge-theoretical and psychological problems of verbs expressing propositional attitudes".

There are several classes of this category of verbs expressing feeling ("I am afraid that x"), belief ("Peter believes that x"), knowledge ("Otto knows that x") and other attitudes to a proposition ("x"). One interesing property of such sentences: their truth value is independent of the truth value of the proposition "x": The sentence "Peter believes that x" may be true (or false) even though "x" is false (or true).

Ineichen shows a great number of such verbs together with the history of their analysis by a number of scholars of different disciplines. In this way he gets the opportunity to contrast his ideas with those of other philosophers, psychologists, logicians, linguists etc.

In addition to this, the sequence of presentation, the careful introduction of the relevant examples and their meticulous analysis show us a kind of "panorama of the history of philosophy, psychology and logic from the point of view of propositional attitudes". A fruit of many years of study and thought, this comprehensive view of the problem is one of the greatest merits of the book.

The topics dealt with include grammar, psychology, mentalism, behaviorism, introspection, self-reference, intentionality, modal expressions, language learning, language understanding, belief, knowledge, epistemology etc. and the ideas of Descartes, Hume, Brentano, Kant, Frege, Husserl, Putnam, Quine, Carnap, Wittgenstein, Hintikka, Piaget, Sebeok, Chomsky, Fodor, and of course of the British analytical philosophers.

In the second part "On semantic interpretation of language expressions" Ineichen makes his decisions concerning his formal theoretical framework: Chomskian understanding of language system, the apparatus of formal logic, a variant of "logical grammar" as a basis of semantic interpretation and other tools he needs to arrive at a formal (but intentionally interpreted) representation of the meaning of expressions of natural language.

The third part "The logical form of statements of propositional attitude as their semantic interpretation" summarizes the assumptions and conditions of formal representation of sentences expressing propositional attitudes. To fulfil this task, the constituents of meaning must be made explicit. For details of Ineichen's approach, we refer to the book itself (Chapters 14 to 15).

To conclude the final third part of the book, Ineichen presents a survey of other approaches to propositional attitudes (Aristoteles, Middle Ages, Leibniz, Frege, Kaplan, Hintikka).

Ineichen's book contributes to the German terminology of the theme. It is certainly interesting. However, some of the linguistic and psychological assumptions remain controversial.

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