tion over Problem-Solving Experience) desribeEXOR which carries out concept formation over explanations and incorporates explanation-based und case-based research. EXOR abstracts redundant explanation substructures and organizes them hierarchical for reuse.

The explanation-based and case-based paradigms provide some guidance on how inference, categorization, and learning interact, though considerable research remains to be done before the field realizes a robust coupling of these processes within a single model. However, our ability to learn from instances and use knowledge requires a hybrid concept learning which involves both the application of such prior knowledge and the learning from similarities among instances (i.e., inductivelearning). OCCAM illustrates several ways in which knowledge-driven and inductive mechanisms can interact. A hybrid model is also suggested from the experience with such pretentious applications like discovery and exploration, problem solving and planning, engineering applications, natural language processing, and efficient and intelligent information retrieval. Some examples for application are presented by Y. REICH & S. S. FENVES (*The Formation and Use of Abstract Concepts in Design*), W. IBA & J. H. GENNARI (*Learning to Recognize Movements*), P.D. SCOTT & S. MARKOVITCH (*Representation Generation in an Exploratory Learning System*) and T.SIMON, A.NEWELL & D. KLAHR (A *Computational Account of Children's Learning About Number Conservation*).

The volume gives a detailed overview on the activities in concept formation. The latter is a complex domain, and the authors make efforts for a clear representation of their ideas. However, there are obviously some methodical deficiencies. Concept formation systems as well as their psychological models are language-bound in the sense that they start with "representational units", i.e. with the description of objects anticipating in such a way the knowledge base structure for the most part. But how to get such a description is left open, and it seems that for all systems this task has to be performed by the user. The representation of real objects in a technical language may be hard work normally done in pattern recognition, and what is called there a 'pattern' is in fact a concept. It seems that when a real object is described then the most difficult task is already past. Concept formation systems restrict themselves to group hierarchically language objects according to heuristical principles, i.e. the known observations are partitioned into subsets. Doing so, they apparently produce at best meta-concepts. Many experimental results indicate that the human memory also forms such hierarchical structures for a more efficient use of the capacity and a faster access (known as priming effect). That may be an application of concept formation, too. However, the meaning of 'concept' is left unclear. Sometimes the nodes in the hierarchical constructs are regarded as concepts. But a node gets its whole significance from its integration with other nodes, and, as a consequence, we would have to revise our idea of a concept as an autonomous entity; what is called 'concept' seems to be only a short name of an ability: The system behaves for an external observer in such a way as it would have concepts to its disposal. Concepts in a conventional sense are then apparently the description of that ability.

An explicit consideration of suitable validation and performance tasks can have significant implications on the design of both psychological and computational models of unsupervised learning, but (as D. FISHER & M. PAZZANI p. 34f critically note) the importance of this observation is sometimes overlooked and the methods are often left implicit or not considered at all. In the supervised approach, the presence of a teacher with its possibility for a direct intervention mitigates the validation problem. At best, the system will be as subtle as its teacher. Unsupervised systems, however, get their ability from general, hypothetical principles. Thus, the prediction of unknown attributes or missing information about new observations, or augmentation of existing information is considered as an important efficiency proof in concept formation. But it seems to be questionable whether such formal measures can ensure that a system accomplishes in fact that task, for which it was developed.

Validation and performance are therefore important research desiderata. Other research areas concern more complete representation languages for objects and concepts, and the development of more global reorganization strategies for hierarchical methods. Complications caused by noise in the environment and overlapping categories are traditional research topics. Most important is the development of robust control and flexible representations that can mitigate ordering effects (D. FISHER & M. PAZZANI, p. 35). Some promising research is under way, but considerable work remains. The volume contains a variety of stimulations about an interesting domain.

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WILLE, Rudolf; ZICKWOLFF, Monika (Eds.): **Begriffliche Wissensverarbeitung** (Conceptual knowledge processing): Grundfragen und Aufgaben (Basic questions and tasks). Mannheim-Leipzig-Vienna-Zürich: BI Wissenschaftsverlag 1994. 324 p. ISBN 3-411-17241-X

The volume on hand contains the papers read at the conference held at the Technische Hochschule Darmstadt (Darmstadt Technical University) from Febr.23-26, 1994, on the state of the art of Conceptual Knowledge Processing. Scholars from a variety of disciplines spoke out in favor of "a fitting way, from a human point of view, of handling media and tools for the processing and transmission of data and knowledge". Accordingly they advocated "such methods of and instruments for conceptual knowledge processing as assist man in his rational thinking, judging and acting, and as promote critical discourse".

In the paper by R. Wille, Darmstadt, attention is paid to the philosophical foundations of knowledge processing, which generally have been somewhat neglected so far.

The different views on the concept 'knowledge' and, in line therewith, the various definitions thereof encoutered in the literatrue, which definitions frequently reflect highly incongruous aspects, have, in my opinion, led to a certain chaos in the conceptual realm and to uncertainty in the terminological one. Not in the last place is this the case with such composite concepts, as e.g. 'knowledge acquisition', 'knowledge representation' and 'knowledge processing', which are defined differently depending on whether they are viewed from the aspect of human memory or from that of computer application. This does not strike one as being particularly conducive to facilitating the development of semantic and classificatory means for supporting *human knowledge processing* prior and up to the point where computer application is being resorted to.

No less important is the definitional 'transillumination' of the word 'concept' as used in the sense where concepts are seen as units of our knowledge, but also in the sense where they are seen as units of human perception and thinking (B.Seiler, Darmstadt).

A detailed explanation of the TOSCANA ('Tools of Concept Analysis') system can be found in the paper by W.Kollewe, M.Skorsky, F.Vogt, and R.Wille, where the problems of data analysis and data exploration are likewise gone into more closely.

In the paper by Ingetraut Dahlberg, Frankfurt, the concept 'Knowledge Organization' is looked at under various aspects, and the highly topical importance of this new knowledge field is explained.

The often widely varying subtopics of the main topic 'Conceptual Knowledge Processing' illustrate how a multidisciplinary approach may help to bring highly complex problems closer to a solution. Gerd Bauer

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PS: The papers of this conference have been listed in German and English in the Knowledge Organization Literature section of our journal 1994-4, p.246 (Nos.1214-1229)

INGENERF, Josef: **Benutzeranpassbare semantische Sprachanalyse und Begriffsrepräsentation für die medizinische Dokumentation** (User-adaptable semantic language analysis and concept representation for medical documentation). St.Augustin: Infix 1993. 345p., refs., Diss.Künstl.Intelligenz, 43

The aim pursued by Josef Ingenerf in the book under review is described precisely in its title: what he wishes to accomplish is to develop a system permitting the automatic analysis and representation of medical terms according to their meaning, such to be done in a way that is particularly suited to medical documentation purposes and capable of being adapted to user-specific requirements. Thus an ambitious, but current and urgent desideratum of medical informatics has been formulated and a beginning been made with its implementation. Let it be said right away that Ingenerf makes an impressive attempt to live up to the claim formulated. He is in full posssession of, respectively thoroughly familiar with, the required interdisciplinary knowledge and methods from such fields as medical terminology, philosophical semantics, language processing as practised in informatics, and Artificial Intelligence, and he applies this knowledge in a commendably lucid way to the task of solving his problem, not restricting himself in so doing to theoretical considerations, but pursuing his endeavors to the point where he can outline a prototypical implementation of his system in PROLOG. Specifically, his approach is based on

- a reconstruction of the semantic categories and those relationships existing between them which constitute the disease concepts used in diagnostics (termed the "model of diagnosis");
- a representation formalism patterned after the "terminological representation formalisms" such as they have been developed since the KL-ONE system;
- an associated grammar, realized through a feature-based grammar formalism;
- a chart parsing algorithm which performs the grammatical derivation and, with it, the semantic language analysis on the basis of the other components.

This overall concept is marked by a high degree of originality and is based on diverse considerations and further developments by the author himself of the current state of the art in the fields concerned, so that a variety of starting points for further scientific work results. It is hardly possible, particularly within the scope of a book review, to go into all problems brought up and points of discussion highlighted. I will therefore restrict myself in the following to discussing that aspect of his overall concept which is the most important one from the point of view of the problems of knowledge representation, while otherwise recommending this book for reading by all those concerned with concepts relevant here.

Following Ingenerf's method, the meaning of a medical term is reconstructed by being translated into the terminological (concept) representation formalism adopted. For diagnostic disease concepts this formalism has a metamodel ("model of diagnosis") available which supplies semantic basic categories as well as semantic roles, with the latter specifying the relational linking-up possibilities between the categories. As syntactic constructs for the linking-up of concepts Ingenerf uses the conjunction, the all-quantified value restriction and the cardinality restriction. What semantic categories and roles are to be used as basis is something for the user of the system to decide, respectively for the user of a terminology to indicate; that's what the 'user adaptability' of Ingenerf's system consists of. The flexibility thereby obtained means at the same time, however, an abstraction from the question as to the criteria for a *contents-wise* adequate modeling of medical concepts and terms. On this matter, Ingenerf's book contains, on the one hand, examples of "models of diagnosis" (36, 50, 118, 121) evidently deemed adequate by him, and on the other hand discussions of principles and critical analyses of existing terminological systems and nomenclatures.

In the discussion of principles, Ingenerf singles out the principles of semantic compositionality, of intensionally oriented concept classification and of differentiation between lingualogical levels as being essential for semantic language analysis (4-8, 13-29). From this point of view, Ingenerf exposes such established concept classifications as ICD and SNOMED as manifesting major shortcomings (292-33). His own illustrative modeling is, as it were, a further development ('decomposition') of the SNOMED categories, notably of topography and morphology, with the