key items of the strategy adopted for the project; some of these key items are: (1) Never start terminological work in alphabetical order; (2) Terms to be considered should be for use in scientific and technical writing; (3) For a term under consideration, try first to find all other terms related to it; (4) The root of a word family could be borrowed from any language but it had to be used under the regulations of the Persian grammar; and so on. The project aims at producing a standardized bilingual dictionary of scientific terms.

The eighth sub-theme, "Terminology and knowledge in multimedia applications", is developed in three papers. Winiwarter et al., in "Multimodal natural language interfaces for hypermedia distance education", present a 'Japanese natural language interface' that includes search using context information. New questions by students are collected and grouped for each context on the basis of their semantic representation. After the question is answered by the teacher, it is added to the Frequently Asked Questions knowledge base so that future questions can be answered automatically. Frequency data about answered FAQ is also available and can be used for improvement of the teaching material. Cabre and Rojo, the authors of "Specialized knowledge representation toward a new hypertextual/multimedia proposal", discuss representation of the polyhedral nature of terminological data and indicate how hypertextual links would be more appropriate for such representation. They propose a 'Hyper Media Decision Net Terminology Model' which could be used to produce hypertextual terminology data bases and dictionaries. A "hypermedia project on the design of a telematic hypertextual dictionary" is described by Cabre et al. The procedural steps involved in the compilation of a LSP hypertextual dictionary of 'alternative renewable energies' in four languages (Catalan/Spanish/French/English) are presented. The dictionary is organized on the basis of conceptual maps and it would be made available on the WWW.

The last section, "Demonstration models for terminological knowledge engineering", includes two papers. In "The construction of English terminology on the semantic field of plastics", Pueyo and Solans show that, though much technical taxonomy work is a process of renaming an existing vernacular word, there is also a process of reordering the words into technical hierarchical taxonomies. The data are processed through an expert system which allows the user to choose a semantic field among the options presented and the system shows the possible languages (English, Spanish, German, French and Italian) the term can be translated into, as well as the definition of the chosen term. In the final paper, "Structure of an indexed multilingual on-line system for industrial use", Wingartz discusses the need, design and available standards for a system for use in industries. The author also stresses the need for a reference hierarchy as specified in ISO 13584 part 42 to be used across industries to structure the information.

This volume of proceedings is well organized, with a separate list of all the authors' names, addresses, and e-mail addresses. A three-column index provides easy access to specific topics, concepts and names. The physical get up and quality of the materials used are good. This will be a valuable document for all those interested in terminology and knowledge engineering work (terminologists, information professionals, librarians, classificationists, term bank designers, etc. It will constitute a useful addition to libraries and information centres.

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POLLANDT, Silke. **Fuzzy-Begriffe: Formale Begriffsanalyse unscharfer Daten** (Fuzzy concepts: Formal concept analysis of imprecise data). Berlin: Springer-Verlag, 1997. 146 p. ISBN 3-540-61335-8.

Silke Pollandt has written the first book combining two apparently totally different theories, namely Fuzzy Theory (introduced by L.A. Zadeh (1965)) and Formal Concept Analysis (introduced by R. Wille (1982)). This mathematically very precise treatment of imprecise data with sharp concepts is based on her doctoral thesis (Silke Umbreit: Formale Begriffsanalyse mit unscharfen Begriffen, Halle-Wittenberg 1995). The purpose is to develop a theory of fuzzy concepts based on the theory of L-Fuzzy sets and many-valued predicate logic. It is shown by several examples how to apply this theory in practice.

The first chapter contains basic notions in Formal Concept Analysis and L-Fuzzy sets. Here "L" denotes an arbitrary *L-Fuzzy algebra* in the sense of W. Wechler (The Concept of Fuzziness in Automata and Language Theory (1978)). The set of *L-Fuzzy sets on a set X* is as usual identified with L^X the set of all *(membership)* functions from X into L.

The second chapter on *(L-) Fuzzy contexts* generalizes the notion of a *formal context* (G,M,I) as defined in Formal Concept Analysis by replacing the incidence relation I by a Fuzzy relation R defined by its membership function m_R : G'M ® L. The value $m_R(g,m)$ is interpreted as the quasi truth value of the proposition "g has the attribute m". Using many-valued predicate logic these quasi truth values are used to introduce *fuzzy concepts* analogously to Formal

Concept Analysis. This leads to a complete lattice called the *fuzzy concept lattice* of the given fuzzy context (G,M,R). It can be described as the concept lattice of the formal context (G'L, M'L, I_R) where (g,n) I_R (m,l) iff n×l £ m_R(g,m).

The third chapter introduces *(L-) fuzzy valued contexts* as many-valued contexts (G,M,U,I) where the values u Î U (for example "old") of an attribute m Î M (for example "age") are L-Fuzzy sets on a set X_m which is interpreted as the set of all possible values (for example the set of all ages [0, 100]) of a measurement on the set G of objects. The ternary incidence relation I is interpreted as the set of all triples (g,m,u) where attribute m has at object g the value u. Then a complete lattice, called the *concept lattice of the (L-) fuzzy valued context* is defined using a derivation operation which is based on the inclusion of L-Fuzzy sets.

The fourth chapter generalizes the well-developed theory of implications in formal contexts to a theory of implications in Fuzzy contexts. The section on approximate reasoning suffers from the lack of an introduction of *linguistic variables* and *fuzzy rules* into the previously developed theory. Therefore the usage of inference schemes containing fuzzy rules is not clear.

In the fifth chapter on *generalized complementary contexts*, Pollandt introduces analogously to the complement of a formal context the *complement of an (L-) fuzzy context* if L is a complemented lattice. The corresponding concept lattice can be represented using a *complementary derivation operator* which can be generalized for arbitrary (L-) fuzzy contexts where L does not need to be complemented. This construction is generalized in the last section to *complementary fuzzy valued contexts*

In her final remarks Pollandt states that her theory of fuzzy concepts rests mainly on generalizations of definitions and methods of Formal Concept Analysis. One should mention that some of the generalizations are quite straightforward while others lead into difficult calculations which have been mastered with mathematical intelligibility.

Pollandt emphasizes the importance of the choice of a suitable L-Fuzzy algebra – but she gives no hints as to which ones should be used in which situations. Indeed only some small Lukasiewicz algebras are used by her in the application examples, and only they seem to be useful. Therefore the generalization to the class of L-Fuzzy algebras has not yet proven its practical importance - the reason might be the difficulty to relate the algebraic operations in L-Fuzzy algebras with meaningful conceptual structures in the given data while the ordinal structure of L-Fuzzy algebras allows the representation of "graded concepts" in chains or even in direct products of chains.Finally one should mention that Pollandt uses linguistic values in (L-) fuzzy valued contexts in different ways than it is done in Fuzzy Control Theory where the *crisp* values m(g) of a measurement m at an object g are used to calculate the crisp values m_v(m(g)) where v is a linguistic value with membership function m_v : X_m ® L (cf. D. Driankov, H. Hellendoorn, M. Reinfrank: An Introduction to Fuzzy Control, Springer Verlag 1993, p. 91). This is the central observation which led the reviewer (1995) to the understanding that *linguistic variables* play the same role as conceptual scales - both representing a "language" about the crisp values in X_m. The main formal step is the representation of each membership function m_v : X_m ® L - where L is now an arbitrary ordered set - by a formal context, the so-called *cut context* and its concept lattice. This opens the possibility to choose for each many-valued attribute m its own "logic" L_m as a suitable meaningful ordering, for example a concept lattice, which can be chosen with respect to the given purpose of the investigation - in contrast to the restricted possibilities for choosing an L-Fuzzy algebra. A further step is the development of a Fuzzy Scaling Theory by combining the objects and the linguistic variables to *realized linguistic variables.* This leads to conceptual interpretations of fuzzy rules as implications, partial implications and dependencies in *dependency tables* (cf. K.E. Wolff: Conceptual Interpretation of Fuzzy Theory, Proceedings EUFIT'98, Verlag Mainz 1998).

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