The Semantics of Relationships: An Interdisciplinary Perspective

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This book is an edited selection of papers presented at the ACM SIGIR Workshop entitled "Beyond Word Relations," held in Philadelphia in July 1997. Two books arose from this workshop. The first volume, *Relationships in the Organization of Knowledge* (Bean and Green 2001), placed emphasis on thesaural relationships and their role in knowledge organization theory and practice. The second volume, reviewed here, offers an interdisciplinary perspective on relationships and discusses theoretical as well as practical issues concerning their inventory, organization, semantics, and use in real-world applications.

The book consists of 12 chapters organized in three parts, with each part discussing relationships from a different angle. The first part (chapters 1–4) concentrates on relationships and their types. Chapter 1 (Cruse) discusses hyponymy (the inclusion of one semantic class in another), perhaps the most fundamental relation in the organization and representation of meaning. Here we not only learn that the relationship is nearly ubiquitous in human conceptual structures of all kinds, but also that despite its predominance, the relationship has resisted complete characterization. Cruse reviews several definitions of hyponymy and asks important questions: What is the nature of the units related by hyponymy? Are they lexical or conceptual? What are the varieties of hyponymy? Chapter 2 (Fellbaum) examines troponymy, a relationship that characterizes verbs; it is a particular kind of entailment in that every troponym *X* of a verb *Y* also entails *Y*. Unlike nouns, verbs do not seem obviously related in terms of the is-a relation but rather in terms of a variety of manner relations (e.g., *walk* differs from *run* along the dimension of speed). Subrelations of troponymy are discussed, together with the troponymic organization of verbs in WordNet (Fellbaum 1998). Chapter 3 (Pribbenow) investigates meronymy (i.e., the "part-of" relation), discusses the role of parts in human cognition, and introduces classical extensional mereology as an established theory of formalizing parts. Chapter 4 (Khoo, Chan, and Niu) presents a broad overview of the cause-effect relation together with an extensive survey of how the relation can be lexicalized in text.

The second part (chapters 5–8), perhaps the least coherent of the three, discusses relations as exemplified in cognitive semantics, their comparison across ontologies, the notions of identity and subsumption, and a logical system for semantic relationships. Chapter 5 (Green) gives an overview of the conceptual units of cognitive semantics: image schemata, basic-level concepts, and frames. Once the conceptual machinery is in place, linguistic phenomena such as metonymy and metaphor are analyzed. Chapter 6

(Hovy) addresses important methodological questions: What are the characteristics that matter when one describes an ontology? How can one compare ontologies or sets of relations to one another? To address the first of these two questions, Hovy proposes a system of features for the description of ontologies that separate form, content, and usage. For the second, he proposes a methodology by which ontologies can be compared. Chapter 7 (Guarino and Welty) revisits the subsumption relationship from an ontological perspective. Rather than focusing on the relation proper, Guarino and Welty discuss the nature of its arguments and establish the conditions under which subsumption is a well-founded relation. The notions of unity, identity, and essence are discussed at length. Chapter 8 (Jouis) presents a logical system for semantic relationships. The semantic system is based on a set of semantic primitives (types, relations, and properties), and relations are characterized in terms of their functional type, algebraic properties, and relations with other entities.

The third part focuses on applications that make use of semantic relations, methods that automatically discover relations from corpora or knowledge bases, and tools for visualizing relations. Chapter 9 (Evens) explores the use of thesaural information for information retrieval. The types of thesauri used in information retrieval applications are comprehensively reviewed (e.g., Roget's thesaurus, Casagrande and Hale's (1967) relational models, WordNet), together with methods for automatically expanding queries and constructing thesauri. Chapter 10 (Khoo and Myaeng) discusses in-depth methods for identifying semantic relations automatically through pattern matching, again for the purposes of information retrieval. Different types of patterns are investigated (linear, graphical, thematic role), and a methodology for constructing these patterns is presented. Chapter 11 (McCray and Bodenreider) describes the Unified Medical Language System (UMLS) knowledge resources. This is a very clear exposition of a complex system that consists of varied, interrelated and heterogeneous knowledge sources. Descriptions of the Metathesaurus, Semantic Network, and SPECIALIST lexicon are given, together with an example of how UMLS can be used to create specialized semantic networks for a single concept (e.g., heart). Finally, Chapter 12 (Hetzler) explores how visualization can aid the exploration and discovery of relations as well as their expansion and understanding. An informative overview of software for visualizing the presence and absence of relationships is presented.

This book does exactly what its title suggests: it investigates the semantics of relations from an interdisciplinary perspective. It addresses a variety of topics ranging from the theoretical and ontological underpinnings of semantic relations to their visualization, it cuts across research communities, and it does a good job of combining introductory and historical material with technical substance. Although the three parts are loosely related under the general theme of relations, they are autonomous and can be read independently. I would have welcomed more technical detail and more emphasis on evaluation in the third part. The first part notably omits a discussion of antonymy. The various chapters in this book are well-structured and succeed in most cases to present succinctly the topic under discussion, its history and its present. I would have liked to see some more discussion on cross-linguistic aspects and the future of semantic relations. What are the exciting new directions and novel applications? What are the current limitations?

The book should be of interest to theoretical linguists, logicians, and philosophers of language and also to computational linguists and computer scientists. The book is accessible and generally well written. Graduate students with an interest in semantics and their applications will find it useful. I can also imagine some of the chapters being included as reading material for courses on information retrieval and extraction or computational semantics. The lack of an index of authors is compensated for by a

relatively thorough index of terms and rich bibliographic references at the end of each chapter.

References

Bean, Carol A. and Rebecca Green, editors. 2001. *Relationships in the Organization of Knowledge*. Dordrecht, Kluwer Academic Publishers.

Casagrande, Joseph B. and Kenneth L. Hale. 1967. Semantic relations in Papago folk-definitions. In Dell H. Hymes and William E. Bittle, editors, *Studies in Southwestern Ethnolinguistics: Meaning and History in the Languages of the American Southwest*. Mouton, The Hague, The Netherlands, pages 165–193.

Fellbaum, Christiane, editor. 1998. *WordNet: An Electronic Lexical Database.* MIT Press, Cambridge, MA.

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