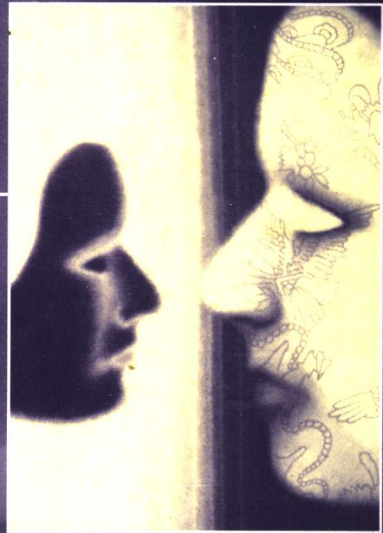


Language and conceptualization

Edited by Jan Nuyts
and Eric Pederson



Language and conceptualization

Edited by

Jan Nuyts

University of Antwerp

and

Eric Pederson

Max Planck Institute for Psycholinguistics



Published by the Press Syndicate of the University of Cambridge
The Pitt Building, Trumpington Street, Cambridge CB2 1RP
40 West 20th Street, New York, NY 10011-4211, USA
10 Stamford Road, Oakleigh, Melbourne 3166, Australia

© Cambridge University Press 1997

First published 1997
First paperback edition 1999

Printed in Great Britain at the University Press, Cambridge

A catalogue record for this book is available from the British Library

Library of Congress cataloguing in publication data

Language and conceptualization / edited by Jan Nuyts and Eric
Pederson.

p. cm. – (Language, culture and cognition; 1)
Includes index.

ISBN 0 521 55303 2 (hardback)

1. Psycholinguistics. 2. Concepts. 3. Cognition. I. Pederson,
Eric. II. Series.

P37.L354 1997

401'.9–dc20 96–8776 CIP

ISBN 0 521 55303 2 hardback

ISBN 0 521 77481 0 paperback

Contents

1	Overview: on the relationship between language and conceptualization	<i>page 1</i>
	ERIC PEDERSON and JAN NUYTS	
2	From outer to inner space: linguistic categories and non-linguistic thinking	13
	STEPHEN C. LEVINSON	
3	Spatial operations in deixis, cognition, and culture: where to orient oneself in Belhare	46
	BALTHASAR BICKEL	
4	Remote worlds: the conceptual representation of linguistic <i>would</i>	84
	PAUL WERTH	
5	Role and individual interpretations of change predicates	116
	EVE SWEETSER	
6	Changing place in English and German: language-specific preferences in the conceptualization of spatial relations	137
	MARY CARROLL	
7	Mapping conceptual representations into linguistic representations: the role of attention in grammar	162
	RUSSELL S. TOMLIN	
8	Growth points cross-linguistically	190
	DAVID MCNEILL	
9	On the modularity of sentence processing: semantical generality and the language of thought	213
	JAY DAVID ATLAS	
10	The contextual basis of cognitive semantics	229
	RONALD W. LANGACKER	

11	The cognitive foundations of pragmatic principles: implications for theories of linguistic and cognitive representation	253
	EDWARD A. ROBINSON	
	<i>Subject index</i>	272
	<i>Index of names</i>	278

1 Overview: on the relationship between language and conceptualization

Eric Pederson and Jan Nuyts

*Max Planck Institute for Psycholinguistics
University of Antwerp*

A state of the art

This volume presents ten chapters which all address – from different angles and in different ways – one and the same core question, viz. What is the relationship between linguistic and conceptual representation? Hereafter we will call this core question simply ‘the relationship question’.

Although this question is scarcely a new one (see below), it remains one of the most intriguing, but also one of the most problematic, in present-day cognitive science. This is already apparent if one makes an attempt to clarify the issue as such. It is quite easy to characterize it in a very general way. Clearly, since people are able to speak and understand a language or languages, they must have an internal ‘representation of linguistic knowledge’ allowing them to perform this behaviour. Equally clearly, people acquire, store, and transmit – through language, but also through other forms of behaviour – information about the world, information they can obviously also use in planning, in reasoning, in problem-solving, and in performing many different types of (intentional) actions in a fairly systematic and relatively well-adjusted way in many different environments. Accordingly, they must have an internal ‘representation of knowledge about the world’, i.e. ‘conceptual knowledge’ (whereby the notion of the ‘world’ includes not only the physical world – ‘external reality’ – but also the social and the psychological world).

Of immediate note, there is no consensus on how one should understand or further specify basic notions such as ‘representation’ and ‘knowledge’ beyond ‘that which is necessarily in our heads (in whatever form) to produce behaviour’. Thus, while ‘classical’ cognitive theories would consider representations to be virtual ‘objects’ of some type, manipulated by a ‘machinery’ of procedures or rules which are somehow implemented in the human brain, connectionist and parallel distributed processing theories consider representations to be simply the resultant characteristics of particular states

of the 'conceptual system' distributed across the neural networks of the brain (cf. e.g. Lloyd 1989, McClelland et al. 1986, Rumelhart et al. 1986, Smolensky 1988). In the latter view, if the notions of knowledge and representation are to be used at all, any characterizations of them beyond the vague ones given above are no longer acceptable as descriptions of actual cognitive mechanisms creating human behaviour.

Beyond the quarrels regarding the notions of 'representation' and 'knowledge' as such, there is moderate agreement regarding what the notion of 'linguistic representation' or 'linguistic knowledge' should involve, viz. a systematization of the structural patterning (at different levels of organization: phonological, morphological, syntactic, textual) which one can observe in language behaviour, and a characterization of the 'mechanisms' effecting and analysing this patterning. Yet the huge variety of existing grammatical and language-processing models shows little agreement on precisely how the systematicity in this 'structural patterning' should be understood, on what level of abstractness should be reached in its description, on how the systems effecting and analysing it should be conceived of, and so on.

The differences of opinion regarding the nature and format of linguistic representation are not nearly as diverse as views regarding the nature of 'conceptual representation' and the organization of 'conceptual knowledge', however. What are 'concepts', what do they look like, how do they relate to one another, how are they micro- and macro-structurally organized, and so on? For each of these questions there are nearly as many answers as there are researchers addressing it. The variety of views can be characterized in terms of a few very essential parameters. One of those parameters concerns the basic 'shape' or format of conceptual representation: theories range from (quite different types of) propositional or proposition-like systems – no doubt the most frequent view – to image-based systems, over types of mixed systems combining proposition-like and image-like representations, and abstract systems attempting to transcend the specifics of propositional or image-based representation. An extreme example of propositionalism is the 'language of thought' model à la Fodor (1975, 1987), in which conceptual representation – at least on the level of 'higher' cognitive processes – is considered to be a symbolic system (i.e. involving the arbitrary signifier/signified relation) manipulated by a limited set of logical rules. Another such propositionally described theory is Jackendoff (1983, 1992); and Dik's (1987, 1989) strongly language-based view of conceptualization also belongs in this category. Other types of proposition-like theories include various models of semantic networks, which are particularly popular in 'classical' artificial intelligence (Schank et al.'s 1975 theory of Conceptual Dependency is one of the traditional exam-

ples); and different types of logics as proposed in formal semantics (e.g. Discourse Representation Theory – see Kamp & Reyle 1993). The best-known work defending vision- or image-based conceptualization – though mostly as part of a mixed model of conceptual structure – is Paivio's (1972, 1991), Kosslyn's (1980), and Marr's (1982). The role of imagery (as opposed to propositional representation) in conceptualization has been the subject of a lively debate, the so-called 'imagery debate' (see Block 1981). One of the clearest opponents to imagery as a conceptual representation system is Pylyshyn (1984). A type of theory trying to surpass the proposition-image opposition by aiming for a more abstract type of representation (even though it is still image-oriented) is the theory of mental models (Johnson-Laird 1983, Johnson-Laird & Byrne 1991).

Views concerning conceptualization also vary according to the parameter of universality: to what extent and in which way is human conceptualization universal versus variable across cultures or communities (however defined) or even individuals? For prominent examples, clear universalist positions can be found in the work of Fodor and Jackendoff (no doubt inspired by the Chomskyan conception of human cognition), and some form of conceptual universalism is at least implicit in most of cognitive psychology. Variability in conceptualization, on the other hand, is mainly advocated by anthropologists and anthropologically oriented linguists who have been working on the interrelationship between language and thought (see below).

Still other parameters subdivide views on the nature and structure of conceptualization (see below), and the result is a plethora of positions on the issue. Two elements further trouble the state of the art in conceptualization. On the one hand, most views on the nature and structure of conceptualization remain poorly articulated and vague, or at least very fragmentary, and it has proven very difficult to develop more substantial models. On the other hand, it turns out to be extremely difficult to find knock-down arguments or evidence for or against any specific type of view on the matter.

This situation is no doubt the result of inherent difficulties in investigating human conceptualization. Conceptualization sits at the core of the black-box problem of the human mind (Nuyts 1992): it never reveals itself directly at the observable surface of human behaviour; it only 'appears' indirectly, in disguise, coded in or filtered through the 'structural principles' of the many different types of human behavioural systems, linguistic and otherwise. Hence, the only way to study conceptualization is to study different types of behaviour and try to distinguish between those features of the behaviour which are inherent in the cognitive systems directly affecting it – in the case of linguistic behaviour, the systems responsible for producing

and interpreting linguistic utterances – and those features of the behaviour which must be due to the ‘deeper’ conceptual systems ‘steering’ it.

In view of these problems, the issue of the relationship between language and conceptualization acquires a special status. It does so, first of all, for a very principled reason. Linguistic – and other semiotic – behaviour is relatively privileged as a ‘source of information’ on conceptualization, because it is a type of behaviour which explicitly encodes and transmits conceptual information. Making a cupboard, playing a game, or walking along a certain route to get to a certain place, for example, are, of course, also driven by conceptual information, but they do not ‘encode’ the conceptual knowledge which underlies them, at least not in the same way or to the same extent as information-processing systems. Of course, even in the case of an information-processing type of behaviour such as language, ‘access’ to conceptual structures is indirect. There remains the fundamental challenge of distinguishing between features due to the cognitive systems directly responsible for the behaviour itself and features due to the underlying general conceptual systems.

The relationship question also has a special status for a more practical reason: of all types of human information-processing behaviour, linguistic behaviour has no doubt received the most research attention; hence it currently provides the richest possibilities for investigating conceptualization. (The notion of ‘behaviour’ is meant to cover the productive as well as the interpretive ‘activities’ involved in it. Thus, ‘linguistic behaviour’ means both speaking and perceiving language.) As a matter of fact, most current theories of conceptualization have been inspired by research on language. Hence it is hardly surprising that language-like ‘propositionalist’ views of conceptualization are so prevalent – which makes one wonder whether this view is not overly biased by a single behavioural domain – see below. However, as mentioned, language researchers are far from a consensus on the question of how to understand the cognitive systems involved in producing and understanding linguistic behaviour. Hence it is not surprising that they are even further from a common view on how these systems, and the types of representations processed by them, would relate to conceptual representations and processes. Indeed, the question how one can assess the matter of the relationship has hardly been addressed at all.

Nevertheless, the question of how language relates to thinking has repeatedly attracted students of language, resulting in a wide variety of views. These views range from the extreme position that language is actually **the** tool of thought (i.e. that thinking happens in language) to the other extreme position that language and thought are fully separate, linked only by arbitrary mapping systems which allow the translation of information from one format into the other. Between these extremes are various posi-

tions which can be roughly divided into two camps, viz. those which view conceptualization as being derivative from and/or (heavily) influenced by language, and those which view conceptualization as primary and language as derived from or based upon it.

The extreme positions are rare: an early example is Johann Herder (1766–8, republished 1877–1913), who held the view that ‘speech is thinking aloud’; more recently, Chomsky’s view of ‘cognitive modules’ (such as the one providing ‘linguistic competence’) as structured on the basis of fully autonomous and system-specific principles (e.g. Chomsky 1980) commits him to the independence position.

However, the two types of intermediary positions are common – in fact, they have been present from the very early days of modern language research. The conceptualization-first position can be found in the work of Wilhelm Wundt (1900), while Wilhelm von Humboldt (1836) believed that language is the basis of thought and that the structure of language gives rise to the organization of thought. In developmental psychology, Piaget’s theory of cognitive development assumes that the acquisition of language is dependent upon, and mirrors, conceptual development (Piaget 1959, Piaget & Inhelder 1969, MacNamara 1972). On the other hand, Vygotsky (1962) maintains that high-level conceptualization is the result of an internalization of the concepts of speech. No doubt the best-known and most influential (and controversial) formulation of the view that language to a considerable extent shapes thought is the ‘Sapir/Whorf hypothesis’ (Sapir 1921, Whorf 1956). This hypothesis has triggered considerable amounts of empirical research (cf. Lucy 1992a, b), mainly in psychology and anthropology, but it has also left deep traces in linguistics (for example, the ‘cognitive linguistic’ literature recurrently assumes linguistic relativity – cf. e.g. Lakoff 1987).

Despite the often polemic and lively debates regarding the relationship issue, however, there has been relatively little advance in settling the issue. In fact, for the reasons mentioned above, most positions on the relationship question remain quite general, and to a large extent ‘ideological’, rather than empirical. In any case, as with views on the nature of conceptualization as such, we are still a far cry from the development of concrete and specific models of the cognitive systems and mechanisms relating language and conceptual structures. Until such concrete models are available, it seems unlikely that the debates among alternative views will be settled. Not surprisingly, theories which consider conceptualization to be closest to language are generally much further ahead in terms of formal modelling of conceptual structure and its relationship with linguistic structure (as in the case of Dik or Jackendoff, for example) than are views which maintain that conceptualization is more abstract or at least less directly language-based.

But that is a deceptive situation (and as such it can certainly not count as an argument against the more abstract or less language-related views). It is obviously much easier to formulate the former type of model from the perspective of the relationship between language and conceptualization, but it will be much more difficult for this type of view to account for the relationship between conceptualization and other types of behaviour (cf. Nuyts 1990, 1992). In fact, probably the worst problem with the issue of the nature of conceptualization – and, thus, of its relationship with language – is that characterizing conceptual structure will never be possible on the basis of an investigation of any single type of behaviour in isolation. To the extent that the same conceptual system lies at the core of all types of (intentional) behaviour, understanding the nature and format of conceptualization requires an understanding of what requirements each behavioural system imposes upon it. Hence research into conceptualization ideally incorporates the requirements of each behavioural system. This volume's focus on the relationship between language and conceptualization must then play only one part – although a crucial one – in a research program on conceptualization.

A major problem for our current understanding of the relationship question is also that – for all the breadth of the disciplines relevant to it – there has been little explicit discussion of methodology. There has been an increased sharing of methodological techniques across the traditional disciplinary boundaries – the present collection well exemplifies this trend. However, such techniques are all too often borrowed without a clear sense of their strengths, weaknesses, and underlying theoretical assumptions. Hence, for the future we need an enriched forum for methodological discussion – especially with respect to the problem of the investigation of conceptual structure and its relationship with linguistic structure. Which methods (or combinations of methods) would provide the best possibilities to further our understanding of the relationship question is a worthy topic in itself.

To sum up, then, the relationship question is crucial for the further development of our understanding of human cognition; hence it will require special attention – more than it has actually received so far. Despite its long history and the lively debates it has triggered, it is still not a topic which figures prominently on most research agendas about cognition, nor does it play a central role in most empirical research on language. It should, though: not only because it is an important means of developing our understanding of human conceptualization, but also because it is a means of improving our modelling of human linguistic capacity as such. If a linguistic theory cannot plausibly connect with an empirically verifiable model of language and conceptualization, it should be rejected. Hence, a greater

resolution of the relationship question may help us decide among the many alternative theories of language existing today.

It is also obvious that further exploration of the relationship question will necessarily have to be an interdisciplinary undertaking – in several ways. First of all, no single research methodology or type of approach to linguistic behaviour has a privileged status for grappling with the relationship question. Quite the contrary: it seems likely that only by combining as many different types of language data and by taking into account as many different perspectives on language use as possible will we be able to progress. But, secondly, in order not to be trapped by the problem of the unavoidable bias which research on any specific type of behaviour involves, it is also crucial to take into account as much as possible evidence regarding other cognitive systems apart from language proper (vision, gesture, mathematical capacities, etc.). For both reasons, successful exploration of the relationship question requires the intimate cooperation of students working in disciplines as different as philosophy, psychology, anthropology, linguistics, and artificial intelligence.

The present volume, then, is intended to help us progress a few steps forward in solving this intricate research question. Specifically, in keeping with the tenets of the state of the art as outlined, this volume first of all aims to contribute to establishing the relationship issue as a critical research topic in the various cognitive sciences. Secondly, and most important, the volume also aims to provoke a richer interdisciplinary debate on the matter than exists now, and to force researchers who are often unaware of each other's work to inform each other about their views and research findings. Hence, this is one of the first collections featuring work from a number of disciplines, involving different types of research methodologies and providing complementary perspectives on and discussions of the relationship question. As such, it provides readers unfamiliar with the issue a broad overview of the – unfortunately hitherto scattered – recent work on this multifaceted research topic. At the same time it challenges the established participants in the debate to consider carefully some important recent advances from disciplines and methodologies other than their own.

Structure of the volume

The collection starts with a chapter by **Stephen Levinson** which serves to further introduce the relationship question. On the one hand, Levinson argues that conceptual representation must be separate from linguistic representation because of the inherent characteristics of both systems. On the other hand, he shows, on the basis of empirical data regarding spatial expressions, how a community of Mayan-speakers has a linguistic

representation for this semantic domain which clearly differs from, say, a typical European linguistic representation of it. Further evidence suggests that the conceptual representations are similarly different, and this implies important interdependence of the two representations. Thus, Levinson's chapter is part of a growing concern – across disciplines – about spatial terminology in languages and what it can tell us about variability and universality in spatial conceptualization. Other chapters in this volume tapping this same tradition are Balthasar Bickel's and Mary Carroll's.

The subsequent set of chapters involves a number of primarily data-driven approaches to the relationship issue using different types of methodologies. **Balthasar Bickel** shares Levinson's basic concerns and methodology. He provides more detailed results based on field methodology working within a single non-European language, Belhare. He shows that while there is a richly organized linguistic representation of spatial notions, non-linguistic correlates to this organization pervade the entire cultural organization of the Belhare. This again clearly suggests interdependence of linguistic and conceptual representations. Thus, like Levinson, Bickel introduces a crucial factor into the relationship debate, viz. that of typological variability. Any claim regarding the relationship issue must ultimately stand the acid test of large-scale cross-linguistic and cross-cultural comparisons, which may allow us to infer what is variable and what is universal. In-depth empirical studies of specific semantic domains – such as the domain of spatial orientation – in a wide variety of typologically different languages are a first and essential step towards that end.

Paul Werth also works within a single language, drawing on corpus data from the more familiar English. One of his more important contributions to the field lies in foregrounding the importance of larger-scale linguistic representations, viz. the text. So far, this level of language structure has been largely ignored by cognitive scientists. Werth shows how studying its properties can help us gain better insights into the relationship question. On the basis of an analysis of the uses of *would* in the context of his model of text worlds and sub-worlds, he joins Levinson and Bickel in arguing for an intimate connection between the linguistic and the non-linguistic.

Eve Sweetser joins Werth in detailing a semantic analysis for English, albeit at the level of single constructions rather than the text. With Ronald Langacker, she represents the cognitive linguistics tradition in this volume. Specifically using the mental-spaces modelling of Fauconnier, she argues that the role interpretations of a particular set of change-of-state predicates in English are iconically motivated and can only be accounted for by positing underlying 'cognitive structures' at a conceptual level.

The third researcher in this volume addressing spatial cognition, **Mary Carroll**, shares with the preceding chapters an in-depth lexical-semantic

analysis in order to address the relationship issue. She offers a complementary perspective, however, by using an experimental methodology to generate her linguistic corpus, and by introducing a comparative linguistic perspective (which is another way of contributing to the typological perspective mentioned above). She shows that, given identical communicative tasks, even speakers of such closely related languages as English and German organize their partitioning of space in strikingly different ways. This points to differences at least at the level of 'thinking for speaking' (Slobin 1991).

In a very original approach, **Russell Tomlin** zooms in on the relationship question from the opposite direction. Unlike the other authors in the volume, he takes a specific cognitive state as his starting point and examines its particular linguistic effects. Specifically, he investigates the role of attention in the selection of word order and voice. By experimentally controlling attention, which presumably generates a fairly specific mental state, he tests for the linguistic output people produce from that state. Again a relationship of some intimacy can be seen. Such work, which takes as its point of departure such universal conceptual elements as attention, balances the many studies which start with linguistic variation and try to trace this back to conceptual representations.

Following these data-driven chapters are more theoretical chapters which help to broaden out the relationship question and to clarify what research questions must be undertaken next.

David McNeill draws on (naturalistic) experimental studies concerning the use (and variation of use) of gesture, especially as it unconsciously accompanies speech. Gestural studies are a welcome addition to the debate surrounding the relationship question, since gesture is one of the few observable behaviours directly relevant to the relationship question. To the extent that gestural representation and linguistic representation converge and diverge in the scenes they depict, we have a major new line of evidence to bring to bear on models of the mental representations preceding the production of both language and gesture. McNeill argues for the existence of a mixed linguistic and imagistic mental structure – the 'growth point' – to explain his cross-linguistic data, and he discusses methodology which can further examine the relationship question in the light of serious cross-linguistic variation.

Jay Atlas continues the sequence in this collection towards more purely theoretical studies. By means of conceptual analysis and a survey of some of the claims made by Fodor and others, he tackles the main philosophical debate surrounding the relationship question and the 'language of thought'. Atlas argues that the processing of visual information is similar to the processing of linguistic information. In his view, sentence understanding must

be kept distinct from the understanding of a speaker's intent. That is, a sentence processor cannot inform the language user of a speaker's meaning – it can only constrain the range of possible interpretations (via the sentential meaning). At this level, grammatical processing can be taken as modular. However, the interpretation of a speaker's communication need not be modular. This chapter thus demonstrates the high relevance of a philosophical scrutiny of theoretical issues for the relationship question.

While **Ronald Langacker's** work is based on many empirical linguistic studies, his present chapter clarifies some of the assumptions and assertions of his theoretical framework of 'cognitive grammar', one of the more developed linguistic theories to make clear assertions about the relationship question. For Langacker, an emphasis on the cognitive basis of language does not mean that one should de-emphasize the contextual properties of language and conceptualization: minds are not to be taken as autonomous entities but rather as 'embodied' and highly interactive with their environments. Langacker also reminds us of the need for caution in ascribing mental structures to observed patterns of behaviour which are not necessarily the direct reflex of mental structures.

Edward Robinson takes Langacker's warning to heart and further strengthens and generalizes it by proposing that one should not readily ascribe psychological reality to our descriptions of linguistic behaviour. Indeed, for Robinson, most theories of mind fail on precisely this point. Delicately trying to avoid falling into the same methodological quicksand, Robinson proffers a model of mind which limits discussion of conceptual representation to descriptions of probabilistic associations deriving from the interaction of individual with environment. Thereby this chapter provides a cautionary note and invites reflection on the content of the volume as a whole.

Acknowledgements

The ordering of the editors' names on the title page, and of the authors' names at the head of this introductory chapter, does not mean anything beyond the fact that language forces one to linearize information. Research for this volume was supported by a grant to Jan Nuyts from the Belgian National Science Fund and the Research Council of the University of Antwerp (BOF). A considerable part of the work on it was done while Nuyts was a visiting scholar at the University of Heidelberg and the Max Planck Institute for Psycholinguistics, Nijmegen, sponsored by an Alexander von Humboldt fellowship. This volume would not have been possible had it not been for the timely and thorough criticisms provided by the following colleagues: Melissa Bowerman, Penelope Brown, Bernard

Comrie, Eve Danziger, Susan Duncan, Michele Emanation, William Foley, John Haviland, Debbie Hill, Wolfgang Klein, Ekkerhart König, Willem Levelt, Stephen Levinson, Walter de Mulder, Thomas Müller-Bardey, Herman Parret, Fritz Serzisko, Christiane von Stutterheim, and David Wilkins, as well as anonymous referees provided by Cambridge University Press. We thank them all and can only hope that they too are pleased with this volume. We also thank Judith Ayling for her valuable guidance and assistance in creating the manuscript.

Postscript: As this book was going to press, we received the unexpected and tragic news that Paul Werth has passed away. It is with great sadness that we publish his contribution to this volume knowing that we shall never do so again. We will miss you, Paul . . .

REFERENCES

- Block, Ned (ed.). 1981. *Imagery*. Cambridge: MIT Press.
- Chomsky, Noam. 1980. *Rules and representations*. New York: Columbia University Press.
- Dik, Simon C. 1987. Linguistically motivated knowledge representation. In M. Nagao (ed.), *Language and artificial intelligence*. Amsterdam: North Holland, 145–170.
1989. Towards a unified cognitive language. In F. Heyvaert & F. Steurs (eds.), *Worlds behind words*. Leuven: Leuven University Press, 97–110.
- Fodor, Jerry A. 1975. *The language of thought*. New York: Crowell.
1987. *Psychosemantics*. Cambridge: MIT Press.
- Herder, Johann. 1777–1913. *Sämtliche Werke*, ed. Bernhard Suphan. 33 vols. Berlin: Weidmann.
- Humboldt, Wilhelm von. 1836. *Über die Verschiedenheit des menschlichen Sprachbaus und ihren Einfluß auf die geistige Entwicklung des Menschengeschlechts*. 2nd edn. Bonn: Dümmler.
- Jackendoff, Ray. 1983. *Semantics and cognition*. Cambridge: MIT Press.
1992. *Semantic structures*. Cambridge: MIT Press.
- Johnson-Laird, Philip. 1983. *Mental models*. Cambridge: Cambridge University Press.
- Johnson-Laird, Philip, & Ruth M. J. Byrne. 1991. *Deduction*. Hillsdale, N.J.: Erlbaum.
- Kamp, Hans, & Uwe Reyle. 1993. *From discourse to logic*. Dordrecht: Kluwer.
- Kosslyn, Stephen. 1980. *Image and mind*. Cambridge: Harvard University Press.
- Lakoff, George. 1987. *Women, fire, and dangerous things*. Chicago: University of Chicago Press.
- Lloyd, Dan. 1989. *Simple minds*. Cambridge: Bradford/MIT Press.
- Lucy, John. 1992a. *Language diversity and thought: a reformulation of the linguistic relativity hypothesis*. Cambridge: Cambridge University Press.
- 1992b. *Grammatical categories and cognition: a case study of the linguistic relativity hypothesis*. Cambridge: Cambridge University Press.

- MacNamara, J. 1972. Cognitive basis of language learning in infants. *Psychological Review* 79: 1–13.
- Marr, David. 1982. *Vision*. San Francisco: Freeman.
- McClelland, J., D. Rumelhart & the PDP Research Group (eds.). 1986. *Parallel distributed processing*, vol. 2. Cambridge: MIT Press.
- Nuyts, Jan. 1990. Linguistic representation and conceptual knowledge representation. In J. Nuyts, A. M. Bolkestein & C. Vet (eds.), *Layers and levels of representation in language theory*. Amsterdam: Benjamins, 263–293.
1992. *Aspects of a cognitive-pragmatic theory of language*. Amsterdam: Benjamins.
- Paivio, A. 1972. *Imagery and verbal processes*. New York: Holt.
1991. *Images in mind*. New York: Harvester.
- Piaget, Jean. 1959. *The language and thought of the child*. London: Routledge.
- Piaget, Jean, & Bärbel Inhelder. 1969. *The psychology of the child*. London: Routledge.
- Pylyshyn, Zenon W. 1984. *Computation and cognition*. Cambridge: MIT Press.
- Rumelhart, D., J. McClelland & the PDP Research Group (eds.). 1986. *Parallel distributed processing*, vol. 1. Cambridge: MIT Press.
- Sapir, Edward. 1921. *Language*. New York: Harcourt.
- Schank, Roger C., N. M. Goldman, C. J. Rieger III & C. K. Riesbeck. 1975. *Conceptual information processing*. Amsterdam: North Holland.
- Slobin, Dan. 1991. Learning to think for speaking. *Pragmatics* 1: 7–25.
- Smolensky, Paul. 1988. On the proper treatment of connectionism. *Behavioural and Brain Sciences* 11: 1–74.
- Vygotsky, L. S. 1962. *Thought and language*. Cambridge: MIT Press.
- Whorf, Benjamin Lee. 1956. *Language, thought, and reality*. Cambridge: MIT Press.
- Wundt, Wilhelm. 1900. *Völkerpsychologie, vol. 1: Die Sprache*. Leipzig: Engelmann.