Studies in the Perception of Language

Edited by

W. J. M. Levelt

Max-Planck-Gesellschaft
Projektgruppe für Psycholinguistik, Nijmegen,
and Nijmegen University

and

G. B. Flores d'Arcais

Leiden University
and Max-Planck-Gesellschaft
Projektgruppe für Psycholinguistik, Nijmegen

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Editorial Note

The references and citations in this book follow the APA-norms, with the exception of Levelt's survey of the literature. Here references in the text are made by numbers, in the style of the Annual Review of Psychology. Complete citations of names and dates would have increased the length of the review considerably. The name index to the volume refers to pages in Levelt's chapters as if complete citations had been used.

List of Contributors

T. G. BEVER   *Columbia University, New York*

J. P. L. BROKX   *Institute for Perception Research, Eindhoven*

J. M. CARROLL   *IBM T. J. Watson Research Center, Yorktown Height*

H. H. CLARK   *Stanford University*

G. B. FLORES D'ARCAIS   *University of Leiden, and Max-Planck-Gesellschaft, Projektgruppe für Psycholinguistik, Nijmegen*

W. J. M. LEVELT   *Max-Planck-Gesellschaft, Projektgruppe für Psycholinguistik, Nijmegen, and University of Nijmegen*

W. D. MARSLEN-WILSON   *Max-Planck-Gesellschaft, Projektgruppe für Psycholinguistik, Nijmegen, and University of Chicago*

S. G. NOOTEBOOM   *Institute for Perception Research, Eindhoven*

J. PYNTE   *University of Aix-en-Provence*

C. K. RIESBECK   *Yale University, New Haven*

J. J. DE ROOIJ   *Institute for Perception Research, Eindhoven*

R. C. SCHANK   *Yale University, New Haven*

M. SEIDENBERG   *Columbia University, New York*

M. K. TANENHAUS   *Columbia University, New York*

L. K. TYLER   *Max-Planck-Gesellschaft, Projektgruppe für Psycholinguistik, Nijmegen*

List of Contributors

P. WILCOX   *MRC Applied Psychology Unit, Cambridge*

P. WRIGHT   *MRC Applied Psychology Unit, Cambridge*

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Introduction

This book evolved from the Symposium on Language Perception which was held at the XXIst International Congress of Psychology in Paris, but there is only a partial overlap between what was presented at the symposium and the contents of the present volume. A chronicle of events and considerations can account for what has changed and what has remained, i.e. for what this book is about.

Though successfully held in Paris under the chairmanship of Professor Hörmann, Symposium 13 did have its unlucky moments. Its organizer (W.L.) had originally hoped to make it a truly international venture, in which researchers from both East and West should be involved. During the year of preparation it became frustratingly clear, however, that Eastern scientists would not react to letters, telegrams or telephone calls. The symposium therefore began tilting towards the West. The Western reaction was slightly different. The initial responses were positive, even enthusiastic, but a number of contributors had to withdraw at the last minute (all for good reasons of course), which was no less frustrating. In spite of this, so much intellectual power remained that a stimulating exchange of theoretical views and empirical findings could take place in Paris.

Two of the main features of this symposium are reflected in this book. Firstly, the symposium was one among several dealing with language. Among the other topics were semantic memory, language in apes, development of cognitive structures in children, language and cognition, perception in infancy, neuro- and psycholinguistics of aphasia, artificial intelligence. Because of this context, Symposium 13 dealt strictly with matters of language perception in normal adults, without stressing the AI-approach to language comprehension. The editors did not maintain the latter restriction in this book, but otherwise they kept to the original interpretation of the symposium theme. Secondly, the symposium contained a review paper followed by contributions which, as the invitation put it, 'should be something more than reports of partial works': they should relate facts and findings to more general theoretical issues. This pattern has been maintained in the present book: it starts out with a lengthy review paper, which is followed by articles mostly having a strong theoretical flavour.

At the same time, however, much has changed as compared to the symposium. The editors were very pleased that Riesbeck and Schank agreed to write a paper especially for the book, relating concrete work on artificial parsing of natural language to general theoretical issues of adult language comprehension. We were also able to add a paper by Marslen-Wilson, Tyler, and Seidenberg, which reflects a perspective on the study of language perception that otherwise would not have been directly represented in the book. These authors' work has focused in particular on what they call the 'on-line' aspects of sentence processing, and the paper contains an overview of their research into the word-by-word left-to-right structure of processing.

On the other hand, some new problems gave rise to various changes as well. Shortly after the symposium, the first editor accepted the challenging invitation to set up a Max Planck Projectgroup for psycholinguistics. This interfered badly with the completion of his own review paper, let alone the further editing of the book. At this point, the second editor came into the picture and kept things going where the first could not. One positive result of the consequent delay was that the review paper was able to include material published up to the end of 1976.

A further problem arose when Wanner, who had eloquently presented the Augmented Transition Network approach to sentence understanding at the symposium, also had to withdraw because of a change of professional position. We made great efforts to find a replacement, but in the end without success. We feel it to be a real omission that a fundamental paper on ATN-models is lacking from this book, the more so since developments in this direction are very much further along than the published literature would suggest. (It is for this reason that, as an exception, the review chapter of the book makes reference to several unpublished ATN studies.)

But this problem apart, the tortuous path of Symposium 13 led, in the end, to a satisfactory result: a collection of papers which, taken together, present a fair view of the major contemporary theoretical and empirical issues in the field of language perception.

Let us now consider the subject matters covered by this book and the ways in which the various papers relate to the main topic of language perception.

In the study of language, the term 'perception' has been used to cover a broad range of phenomena and processes. Students of speech perception have tried to discover the critical features of the acoustic signal which give rise to the identification of a speech unit, such as a phoneme or a syllable. On another level, psycholinguists have devoted much effort to the study of larger units such as clauses and sentences, and the processes by which these become interpreted as meaningful linguistic entities. In the broadest sense the study of language perception deals with the processes by which the intended meanings are attributed to spoken or written utterances; it covers the whole range from recognizing a phoneme to comprehending connected discourse.

This broad range of processes covered by the term 'language perception' implies several levels of perceptual decision-making, corresponding to several different levels of perceptual organization. The fact that these different levels can be considered separately does not, however, necessarily mean that perceptual processing at one level depends on the completion of the processing at some lower level. In fact, much of the available evidence points to a different conclusion: that language perception is a highly interactive process in which structure can be derived simultaneously at many different levels.

An important question in the study of the perception of language, related to the notion of different levels of perceptual organization which we have just outlined, is still: What happens during the initial stages of the comprehension process? Is the initial stage of a basically passive, receptive, nature, or is the listener right from the beginning actively using his knowledge of the language, the communicative situation, and of the task? It might, therefore, seem useful to make a distinction between those processes which take place during the input of the verbal material, and those which follow afterwards, since this distinction might help us to demarcate perception (the first phase) from comprehension, recall, inference, etc. However, this is not fully satisfactory. Since a linguistic stimulus is temporal by nature, the first analysis of one part of the speech event will very probably overlap with later stages in the analysis of earlier parts of the stimulus. It is sometimes possible, for instance, to give a verification response before the whole sentence has been uttered. Thus, probably, initial and later stages in the understanding of verbal material go on very much in a parallel fashion.

A distinction between 'perception' and later 'comprehension' stages of language processing is therefore a rather problematical one. Whether or not one would be able to define perception in this way is obviously very much dependent on one's theory of the structure of language processing. It is at this point that we find the essential differences between theories of language perception. There are, first of all, those global theories which do not single out an initial stage at all; they only tell us about variables which affect how language is understood. Secondly, there are those theories which make specific claims about the initial stages of comprehension. Here, the two major alternatives are theories where the initial stage is something like a general-purpose, task-independent parsing process, and those theories where no such independency is claimed. Many modern theories, and very diverse ones, are cases of the first alternative. These general issues underlie much of the empirical work on language perception of the last decade, and are extensively discussed in Levelt's survey of the literature which opens the book.

In the introduction to a book on language perception, which is intended to represent the trends in theory and research of the 1970s, it might be interesting to compare these trends with the approaches characteristic of the preceding phase of development of cognitive psycholinguistics. A major difference in theoretical

approach between recent work in language perception, and the bulk of research in the late sixties, is the increasing interest for information 'flowing down' as opposed to information 'flowing up'. Models are much more 'top down' than they used to be. The active listener becomes endowed with semantic and pragmatic hypotheses which guide his search for structure. The expectations of the listener, his knowledge of the world, his awareness of mutual communicative agreements with the speaker, all have become central ingredients of models of language perception. This point of view has become very central in the theoretical approach of many recent psycholinguistic studies, sometimes even leading to a lack of sufficient concern for the way in which the stimulus information affects language perception.

We cannot, however, overlook the information flowing up. According to the circumstances, the listener is more or less dependent on stimulus information and on low-level perceptual processing. There may be no fixed pattern or direction of information processing in language perception. The listener adapts to the task and the circumstances, and his mode of processing may accordingly be tilted more to 'top-down' or to 'bottom-up' processing patterns.

This book reflects both kinds of approach. It contains, on the one hand, papers with a clear concern for the 'bottom-up' point of view—for example, in the question of how prosodic information affects sentence organization. Some other papers, on the other hand, are inspired by the 'top-down' approach, stressing for example semantically driven parsing, or the listener's awareness of the speaker's communicative intentions.

Both trends are traced in *Levelt*'s review of sentence perception which opens the book. Though the work on sentence perception is, clearly, only a subset of the extensive literature on the perception of language, it is a characteristic subset in that almost all general theoretical and empirical issues in the field of language perception arise in some form or another if one studies the perception of sentences. The paper is an extensive review of the psycholinguistic work in this area which has appeared within the last seven years. The length of the reference list and the variety of studies analysed can give an idea of the vitality of the field. The layout of the review and the approach taken in the analysis of the literature can be easily seen from the table of contents which precedes the chapter. The main theoretical approaches which run throughout the literature examined could be summarized as follows. The first is a linguistic approach: it aims at explaining how a linguistic representation or 'description' is derived from the speech input. The second is the conceptual approach: it is the derivation of a (task-specific) conceptual representation which is studied. The third approach, finally, can be labelled 'communicative'; here, the informational dependency between speaker and hearer is the topic of research: how is it that the hearer deciphers the intentions of the speaker in particular communicative settings? These approaches need not be mutually exclusive, but a substantial difference in tone between the three of them is clearly detectable.

After Levelt's review, the papers have been organized, rather traditionally, on the basis of an informal and intuitive notion of an increasing level of 'complexity' of the linguistic variable being investigated.

The paper by *Nooteboom, Brokx,* and *de Rooij* reviews several experiments and offers an integrated presentation of the ways in which suprasegmental features have been shown to affect perceptual segmentation. In spoken language, prosody is intimately related to the syntactic and semantic structure of the utterance. Prosodic information is used, together with the syntactic and semantic information, in the process of sentence segmentation. And it is probable that prosody is used as an important cue to guide the search for an appropriate structural organization of the incoming signal. But the contribution of this linguistic variable to the perception of language has until recently been largely ignored. In most psycholinguistic experiments prosody has at best been considered as a 'nuisance' variable to be controlled for. In many experimental papers we find statements such as 'the sentences were read with even intonation . . .'. Whether such an 'even intonation' represents a way of controlling this variable is rather questionable, for in some cases the choice of this 'even intonation' might indeed interfere with normal sentence processing.

But during the last few years the neglect of prosody has been compensated for by an increasing number of studies, as the reference list of Nooteboom *et al.*'s paper shows. And it is not difficult to predict still more interest in these areas in the future. The paper by Nooteboom, Brokx, and de Rooij represents some interim conclusions, and a point of departure for further research.

Pynte's paper offers a new contribution to the study of the processing of ambiguous sentences, an area in which the number of psycholinguistic studies is very large, much more than the apparent importance of ambiguity in linguistic communication would suggest. After all, in normal communicative situations with spoken language, no ambiguity arises, unless perhaps in very exceptional cases. But there are several valid reasons why psycholinguists have been so attracted to ambiguous sentences. Just as ambiguous figures in vision represent important paradigms for the study of visual perception, so ambiguous sentences might reveal something about the process of perceptual organization in language. For example, an indication of the moment at which, during input processing, the listener makes a perceptual decision of choosing one linguistic structure from among the two or more potentially available ones, is extremely important for the attempt to construct a plausible theory of sentence perception.

The questions asked by Pynte are not themselves new in the literature on ambiguous sentences. They are the questions of whether one or both possible interpretations are 'constructed' during processing, and whether disambiguation takes place during or at the end of the presentation of the sentence. Data on ambiguous sentence processing obtained with different methods, for example with the phoneme-monitor task, had shown that the point in the sentence at which ambiguity is resolved requires extra effort. Pynte's work

represents an interesting elaboration on the same theme. An important feature of his work is the fact that the French sentences used are a very elegant material for a study on ambiguity, since disambiguation, and the choice of an interpretation, can take place at every single word of the sentence from the second one on. One of the contributions of this paper to a theory of sentence perception is the confirmation that some specific lexical knowledge has to be applied at various points in the sentence in order to make perceptual decisions about syntactic organization.

In their research work *Wright* and *Wilcox* adopt an experimental paradigm where the first phase of the task involves sentence perception. For the topic treated in this book, the first subtask reveals what strategies subjects may adopt in perceptually segmenting the instruction, and how the form of the instructions and the location of the presupposition in the sentence might affect perception. The approach taken in the paper represents a step towards a model of sentence comprehension quite different from those models which emerged from the numerous studies on sentence understanding based on sentence-picture verification tasks, whose generalizability is questioned by the authors of this study.

Beside the contribution to a general theory of sentence comprehension, the work reported is one of the first psycholinguistic studies on the comprehension of instructions. So far, sentence comprehension has mainly been studied with declarative statements in different forms. The use of a broader range of linguistic forms can not only enlarge our knowledge of psycholinguistic processes, but also represents a way of testing the models more critically. And if one tries also to look at psycholinguistic studies as a means to improve communication in daily life, it is clear that a better knowledge of how people understand instructions can be of enormous practical importance.

The work discussed in *Flores d'Arcais'* paper is much in line with the notion that the clause is an important unit in sentence perception, and that sentence segmentation takes place clause by clause: there is already some evidence for this hypothesis from the experimental work of the last few years. The main idea underlying the experiments discussed in this study is that a complex sentence made up of various clauses is processed at different levels, and that the clause represents an important level of such processing. The experiments reported are based on two assumptions. First, that a sentence is perceptually organized and stored in working memory clause by clause, and that at the end of the clause this memory is 'cleared' of clausal surface information. The second assumption is that the processing load tends to be higher towards the end of the clause, and that any additional tasks should therefore be more difficult to perform at that point.

The work reported confirms the notion that the clause is an important level of perceptual organization. But the paper also provides some evidence in favour of the hypothesis that the different types of clauses within connected discourse

affect perceptual organization differentially and that some clauses might produce more load on the processor during perception than others. Also, an attempt has been made in the paper to specify some of the possible strategies hearers use when constructing clausal structures as they segment a sentence.

The work reported by *Carroll, Tanenhaus,* and *Bever* represents a further development along the same line, which has been pioneered by Bever and some of his associates, and which has been the subject of several important papers by these authors. One of the problems for a syntactic model of sentence segmentation concerns the use of surface information to form surface-structure constituents of various levels. But how can we construct such structural units within the constraints of the processing capacity of the perceiver (for example, within limits of working memory)? Carroll *et al.* propose that perceptual segmentation is based on perceptual cues which give signals to the hearer about the possible internal structure of the sentence. The work reported is an attempt to specify the types of cues which might be used, and to develop the notion of the functional unit as a basis for perceptual segmentation.

The paper by *Marslen-Wilson, Tyler,* and *Seidenberg* is also concerned with the role of clausal variables in sentence processing. They approach the issues from the point of view of an on-line interactive model of processing, and their paper has two main functions. On the one hand, they demonstrate that the serial clausal-processing hypothesis makes incorrect predictions about on-line processing phenomena at and around the mid-sentence clause boundary. On the other hand, they also attempt to account for the clausal structuring of the input in the context of their interactive processing theory. In this respect, their paper is consistent with the two preceding chapters, since it also emphasizes the role of non-syntactic interpretative variables in determining the organization of a sentence into clause-like processing sequences. The work reported shows that at least one 'interpretative informational variable'—the presence of a pronoun referring forward across the clause boundary—does affect the degree of clausal structuring of the material. This paper also provides something of a link between the psychological work and the artificial intelligence research described in the following chapter. Marslen-Wilson and coworkers share with Riesbeck and Schank an emphasis on the left-to-right structure of the word-by-word processing of the linguistic input.

The chapter by *Riesbeck* and *Schank* discusses the problem of human sentence processing in the light of the authors' recent work in artificial understanding of natural language. The purpose of this chapter, which is especially written for a psycholinguistic readership, is to explain the operating principles which should be adopted in order to make an artificial system which has the properties one would want to assign to the equivalent human understanding system. At the same time the paper discusses the thorny question of how AI models of human language understanding can have empirical predictive force. Although the theory distinguishes between a rather general-purpose parser

(ELI), and more task-dependent inferential activities—and this, as we have mentioned, is a characteristic of various modern theories of sentence understanding—it also specifies the interdependencies between those two logical (not temporal) phases in the comprehension process. The authors' approach is very much conceptual in tone: the theory should explain how a conceptual representation is derived.

Clark's chapter, finally, is a clear case of what we described as the communicative approach. How is it that the hearer derives the speaker's intentions in a given communicative context? Clark treats this as a problem-solving task, where several inferences have to be made in order to attain the required result. The way the hearer infers intentions is highly dependent on tacit agreements between speaker and listener. Clark tries to spell out such cooperative principles for the cases of understanding indirect requests, definite noun phrases, and shorthand expressions. A variety of empirical results is presented in support of these conjectures. This finishing chapter brings the student of language perception back to the question raised in the first chapter: what exactly should be explained? The process of understanding the literal meaning of what is said may be interesting to study, but—as Clark remarks—'speakers rarely mean what they say'.

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W. J. M. LEVELT
G. B. FLORES D'ARCAIS

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