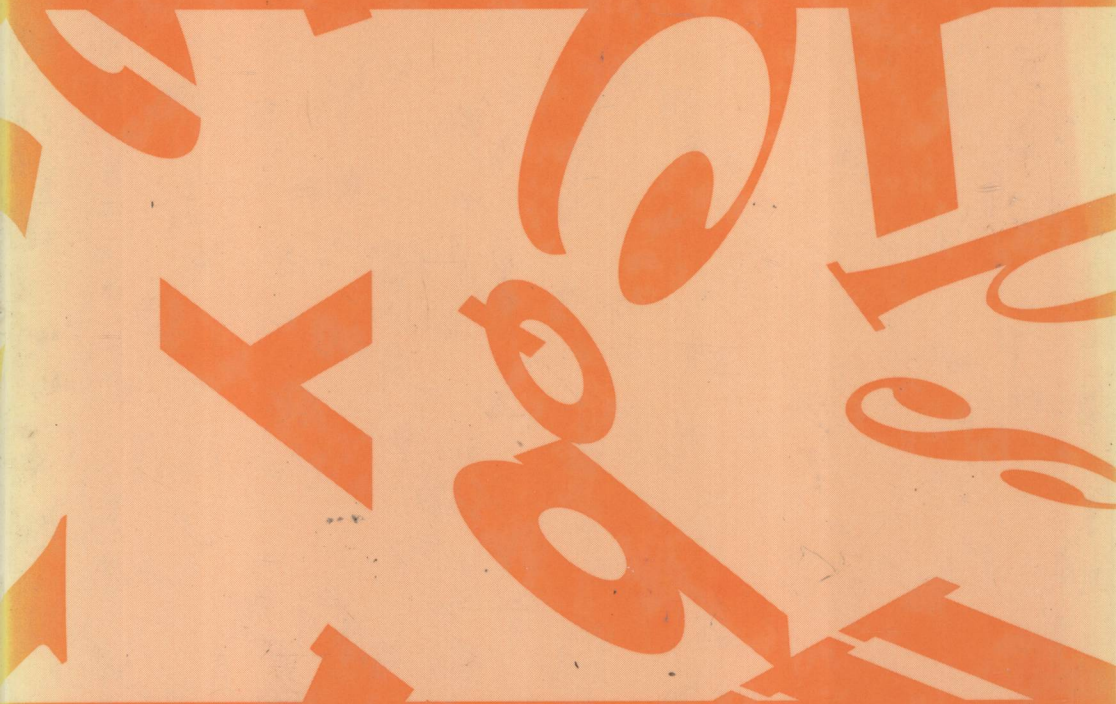
TEXT KNOWLEDGE AND OBJECT KNOWLEDGE



ANNELY ROTHKEGEL

MMUNICATION IN ARTIFICIAL INTELLIGENCE SERIES

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COMMUNICATION IN ARTIFICIAL INTELLIGENCE SERIES

Artificial Intelligence (Al) is a central aspect of Fifth Generation computing, and it is now increasingly recognized that a particularly important element of AI is communication. This series addresses current issues, emphasizing generation as well as comprehension in the AI communication. It covers communication of three types: at the human–computer interface; in computer–computer communication that simulates human interaction; and in the use of computers for machine translation to assist human–human communication. The series also gives a place to research that extends beyond language to consider other systems of communication that humans employ such as pointing, and even in due course, facial expression, body posture, etc.

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1 Introduction

1.1 Assumptions

When we produce a text, we employ a certain knowledge about what a text is. The question is, how can this knowledge be described and reconstructed in a computational model.

The writing of texts belongs to the cultural skills that on the one hand have developed within the social context, and on the other are tied up with cognitive preconditions for linguistic processes. The present study is an attempt to relate the two within the framework of 'social cognition' (Winograd & Flores 1986). In this sense, the question *What does a program do?* or *How does it do it?* is replaced by *What do we do with the computer?* Central to this is an interpretation of language in which the action character is in the foreground. 'Language is a form of human social action directed towards the reaction of what Maturna calls "mutual orientation". This orientation is not grounded in a correspondence between language and the world, but exists as a consensual domain – as interlinked patterns of activity. The shift from language as description to language as action is the basis of speech act theory, which emphasizes the act of language rather than its representational role' (Winograd & Flores, 1986, p. 76). The approach presented here points out consequences that result from such an understanding of language for the development of a computational model of text production. In concrete terms, this concerns the representation of conditions of written text production which play a role in the conveying of information through the medium text. We are concerned in particular with linguistic techniques of the presentation of an object, especially with the presentation of new books as communicative objects. Book announcements, as offered by publishing houses and magazines, are the text type chosen to illustrate this.

Text as a medium implies on the one hand communicative standards, on the other hand standards of linearisation. Correspondingly, the develop-

ment of a text syntax which takes account of the pragmatic conditions of the medium is in the foreground. We believe that a pragmatic perspective most readily corresponds to the real situation of conveying information through texts. Text writers do something when they impart information. They do it in a communicative context, i.e. related to readers, standards of knowledge about objects and evaluation norms, as well as standards of textual presentation forms that are applicable for certain communicative situations and certain social groups. They do it equally within the conditions of a cognitive apparatus. In our model, we consider the relations mentioned above with respect to this apparatus. For this, we shall assume the following:

- Conveying information about an object is to be understood as a symbolic construction of this object. This construction first and foremost serves the orientation of the communication partners. This means, for example, that a book announcement is not merely concerned with a presentation of what is authentically to be found in the respective book. What is important is an organisation of information in the sense of an object construction. This determines what the new book is regarded as and can be integrated in various presentation modes. That means that apart from principles of the object construction, principles of the presentation must also be taken into account. We consider the former within the framework of a text-thematic structuring, the latter as an interactional structure in which the object is considered as the object of a specified interaction. Both are combined in the concept of text action. In this context, we restrict ourselves to text actions of describing, evaluating and asserting.
- Text production is understood as a communicative event and can be described as a 'constructive action' with the object construction as goal. This concerns constructions on the part of the writers, which provide the point of departure for object constructions by the readers. Although in this analysis only the first group is discussed, text readers are implicitly integrated in the model. This is apparent from the fact that text production is seen interactively as an answer (reaction) to questions (text questions). In addition, there are expectations with respect to structural norms according to which the conveying of information takes place and which are reflected in a linguistically describable text structure. We proceed from the assumption that the connectivity structure in the text reflects such expectation structures.
- The computational modelling is a suitable instrument for the presentation of text production processes in the above sense. It permits the formal representation of defined relations with regard to selection and composition processes in the construction of texts.

1.2 Procedure and goal

The goal of this study is the development of a theory of text writing in which strategies of structure formation in the text are in the foreground. The assumption is that text structure formation can be explained by means of two simple formal principles. Text is understood as an independent linguistic form, which is explained as the result of two opposing strategies. Under consideration are 'higher-level' processes at the text topic and text function level. They are combined with formal sequencing strategies. In this way they can be described as global 'left–right' and local 'right–left' directed strategies, which control the development of the text topic and text function in the linearisation and which are reflected in the linguistically manifested connectivity structure of the text.

In order to represent these strategies, the concept of the text action as a text-producing action is introduced. As representation forms text action schemata are developed, which provide the link between the overall text structure and the sentence level. The assumptions on text production in the sense of the establishment of a text structure are re-examined by attempting to reconstruct corresponding text actions on the basis of analyses of available authentic texts. With respect to a machine-aided system for text production, their modelling is to be seen as a specific methodical access, which on the one hand opens up a superordinated frame, on the other hand, by virtue of this frame and the limits inherent in the method, is restricted. What is required of the modelling is that it should deal with 'higher-level' phenomena of the communicative context in the text and at the same time permit links to semantic-syntactic sentence representations. In the present text production model an attempt is made at an integrating approach, which is grounded in text linguistic findings and computational models of text generation. The questions considered are to be seen within the framework of

- a linguistic-conceptual modelling of text production on a linguistic-action-theoretical basis as a description and
- a computational linguistic modelling with formal methods of representation.

It is the goal of this study to develop a framework for the integrated examination of text production phenomena. It should be sufficiently general to take into consideration as many areas of application for text production as possible. It should also be sufficiently open to allow further processes, such as revision processes in text writing, to be integrated. On the other hand, it should be sufficiently specific to take account of the linguis-

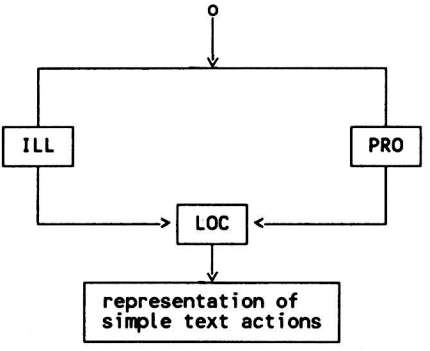

Figure 1.1 Correlation of selection components

tic aspects that are relevant for the textual conveying of information. It should also be possible to consider texts in their entirety as structures.

1.3 Sections

Text knowledge is understood in a dynamic sense. At the focus of attention are processes of selection and composition. It is intended to formulate them as a grammar and thus make them accessible for processing in a program system for text production. Selection refers to the choice of the text-building units, composition concerns their sequencing according to text-oriented patterns.

As text-building units we consider the three components of the linguistic action:

- illocution (ILL)
- propositional content (PRO) and
- the linguistic means, which we subsume under locution (LOC).

The illocution indicates the presentation mode for contents. The propositional content represents the object construction and is in this sense determined by the domain and the text topic. The domain is understood as a reference frame, the text topic as text-thematic question. The locution, finally, indicates possibilities for linguistic realisation.

The idea is that the combination of ILL and PRO determines lexical preferences, which can be listed in inventories. In this way, the process of lexicalisation can be reconstructed on the basis of text-related constraints of ILL and PRO. We restrict ourselves to the definition of inventories of text-related verbal expressions, in particular collocations (verb-noun-

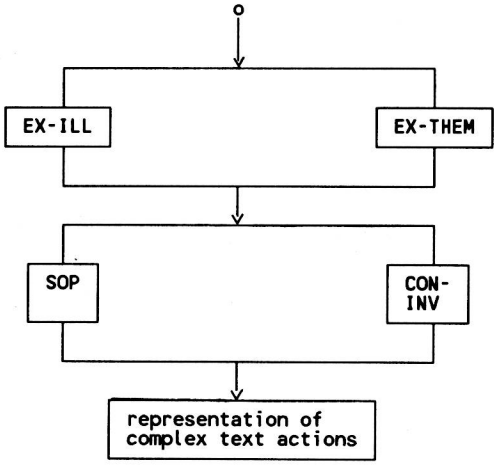

Figure 1.2 Correlation of composition components

preferences). Selection is in this context modelled in the form of relating the components of simple text actions to one another (see Figure 1.1).

Text composition is concerned with the sequencing of simple text actions according to specific sequencing strategies. The combination of four components results in the structure of complex text actions:

- expansions of the illocutions (EX-ILL)
- expansions of the thematic-propositional component (EX-THEM)
- sequencing operations (SOP)
- connectivity inventories (CON-INV)

The expansion of illocutions corresponds to the development of the presentation mode, e.g. in descriptive, narrative or even in an argumentative manner. The thematic development is to be seen as a linking of propositions which give answers to the thematic question. The sequencing operations organise the illocutionary and thematic development according to formal principles of text organisation. As the three fundamental operation types we consider FRAMING, CHAINING and PAIRING. The application of different sequencing strategies is reflected in the connectivity structure in the text. Connectivity inventories in turn contain lexical preferences with respect to the type of the respective attachment. The three components of the linguistic action schema ILL, PRO and LOC find their correspondence in the complex structure as follows: EX-ILL is the complex form of ILL, EX-THEM corresponds to PRO and the combination of SOP and CON-INV is analogous to LOC. Figure 1.2 shows the

sections that cover the aspect of composition in text production.

1.4 The organisation of the book

Chapter 2 introduces the questions relevant for the present model and places them in the context of contemporary research. The point of departure for the determination of linguistically relevant questions is a genuinely occurring, relatively standardised communicative situation, in which information about an object – in this case new books – is conveyed. Topic and communication goal are predetermined. In the foreground is the question as to how the conditions of the conveying process are linked to the linguistic conditions, or in other words, what must a text writer know about text-organising principles in order to be able to verbalise a specific content in text form in a situation-adequate manner. The thematic subject of text producing is developed on the basis of task-orientation; the theoretical access and principles of computational modelling are founded on this.

With reference to the questions developed in Chapter 2, Chapter 3 outlines important contemporary models of automatic text generation. This problem-oriented overview is intended to highlight similarities and differences to the present approach.

Chapter 4 is concerned with the concept of text actions (TA). It forms the basic unit for the text representation. The chapter discusses fundamental aspects of the concept of actions. The internal structure of text actions, as well as their epistemic-cognitive interpretation, form the basis for the definition and operationalisation of the illocution component. In accordance with the communicative task, we distinguish three text action types (DESCRIBING, EVALUATING, ASSERTING) that form complex text actions and are thus a suitable instrument for representing the text structure.

Chapter 5 deals with the conditions that are linked to the individual propositions. Here object and interactional knowledge of writer and reader within the framework of a communication-specific domain modelling play a role. The first section concentrates on the conception of an appropriate reference frame for the object class, its substantiation and its structural organisation as a basis for the organisation of a thematic structure in the text. A domain-specific object model (for the object book) is developed, which is related to a topic-structuring text question. The second section is concerned with the interactional component, in which the contribution that the illocutions make to lexicalisation is considered.

In Chapter 6 the theoretical basis for the representation of composition processes is developed. The emphasis is on principles of sequencing,

which are defined with respect to content and form. Apart from the establishing of coherence, both globality and locality, as well as directionality and connectivity play a role. All of these aspects are integrated in the schema of the complex text action.

Chapter 7 applies the parameters developed in Chapter 6 to the decomposition of text examples. In an empirical analysis, the operability of this set of text-grammatical instruments is demonstrated. The sequencing types FRAMING, CHAINING and PAIRING are considered. This is followed by a suggestion for operationalisation, for which sub-sections of the text representation are isolated in the form of connectivity forms. This kind of division allows meaningful text relations within an assumed text space to be processed.

Chapter 8 summarises the possibilities offered by the developed text action grammar with respect to a computer system for text production. Of prime importance for this is the question of the consistency of the model. This is ensured because the concept of text action presents a homogeneous instrument for description that takes account of all the data processed in the system. Furthermore, the operational character of this instrument provides the possibility to develop (or further develop) a design in which the writing activities of system and writer can be synchronised. In conclusion, reference is made to the theoretical innovations that make it possible to bridge the gap between the concept of text-pragmatic action and computational modelling. This concerns above all the representation of higher-level processes of text production, with which socially determined linguistic actions are incorporated in a cognitively determined paradigm of symbolic processing. Furthermore, it also concerns the methodical contribution made towards the investigation of the still largely unresearched phenomenon of the sequence structure of texts.

2 What is meant by text knowledge?

2.1 Definition

Before moving on to discuss the main issues, we will outline the overall framework in which our modelling of text production is to be seen. This first of all concerns defining the text phenomena studied as well as the process-oriented approach taken. The overall view is subsumed under the concept of text knowledge (Keseling 1979, Sandig 1987, Koch 1991). Text knowledge is required for the description of text-producing processes. The concept of text knowledge points to two aspects:

- knowledge as an organised structure
- text structure as an autonomous linguistic structure.

As an organisation structure for text knowledge, we will develop a text action grammar in which simple and complex text actions are represented. The content of these representations is developed systematically. In this context a text structure will be regarded as an independent formal structure which goes beyond relating individual sentences to each other. Of interest to us is the global text structure and its implications for the sentence level. This perspective differs from approaches in which grammatical phenomena are related to contextual features. We will compare this kind of 'bottom-up' approach with our 'top-down' approach. This by no means implies 'communication-oriented' vs. 'transphrastic' (cf. difference in Kallmeyer et al., 1986, p. 221), since systemic grammar, for instance, postulates a communication-oriented, if bottom-up-oriented approach (cf. Halliday 1985, Halliday & Hasan 1976, Benson & Greaves 1985, Steiner & Veltman (eds) 1988). The 'top-down' approach aims at a consideration of the overall structure of the text. Similar global interpretations have been pursued in approaches such as Schmidt 1973, Petöfi (ed.) 1979, van Dijk 1980a, 1981, van Dijk & Kintsch 1983, de Beaugrande &

Dressler 1981, Kallmeyer et al. 1986.

The overall structure of the text also plays a role when the text is interpreted as the result of spoken actions. As a consequence, the description of the text structure is equated with the description of an action structure (cf. Hartung 1981, Sandig 1986, 1987, Gülich 1988, Motsch & Viehweger 1981, Motsch (ed.) 1986, Brandt et al. 1983, Brandt & Rosengren 1991a, 1991b). In the following, we are interested in those linguistic actions that realise a text structure. In this context, linguistic actions will be considered as text-constituting or text-producing actions. The text structure forms a kind of framework that supports selected information about an object (states of affairs, events, etc.). Insofar as the text structure represents a communicative structure, 'textualising' means 'making information available on a communicative level' by embedding it in an interaction between W (text writer) and R (text reader) and conditional upon this, realising it by linguistic means. In this sense, text knowledge represents an interface between object knowledge (knowledge of the world) and linguistic knowledge (Rothkegel 1989a). It connects object structurings with regard to communicative goals to linguistic structures of lexis and syntax. This connection is made in the text. In this respect, the text structure is assigned an independent status, the medium written text is regarded as a specific organisation form for the conveying of information. In the present study, we would like to examine what specific structuring possibilities the text offers and how these affect the choice of linguistic means. The theoretical basis for this will be provided by a text-related linguistic action theory. Of primary concern here is the structure formation in the text.

For our approach we will orient ourselves towards the three fundamental semiotic dimensions: reference to the world (text semantics), interactional reference (person reference, text pragmatics) and the innate structure of the text (text syntax). The reference to the world here is text-oriented. That means, it refers to the way in which an object is constructed in the text, not to the relation between words or sentences and reality. We describe the reference to the world as a relation between a knowledge base and text-thematic units. This concerns a structure of recurring text roles, which determine the predicate-argument structure of the individual propositions (see under section 2.3 Text topic). The interactional reference has to do with the embedding of information in communicative goals which link W (text writer) and R (text reader). It governs to a large extent the choice of lexical means (see below section 2.4 Text function). As the innate structure of the text we refer mainly to principles of successiveness, which express themselves in a linguistically marked connectivity structure (see below section 2.5 Text connection).