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Interdisciplinary perspectives on discourse: views from sociology, linguistics, computational linguistics and an empirical approach

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1. INTRODUCTION

As the editors of this excellent collection of articles explain in their preface, in spite of the pervasiveness of extended turn-taking communication, our knowledge of how discourse works is amazingly sketchy. We have only rudimentary models of important phenomena such as conversational initiative and turn-taking; we understand little about the process of understanding and interpreting sentences, or about the mental structures that support these processes; we have no adequate means of defining even such basic building blocks of communication as the words "however" or "consequently".

The reasons for this ignorance lie in the multifaceted nature of language: linguistic activity is rooted in almost everything we experience, think and do, as individuals and as social animals. As such, a complete and adequate study of discourse would require the employment of concepts from different fields, such as Anthropology and Sociology (to account for the interlocutor's group interactional behaviour), from Linguistics (to explain grammar and lexis), from Semantics, Logic and Philosophy (to describe the knowledge involved in communications), and from Artificial Intelligence and Cognitive Psychology (to describe the processes by which communication takes place), to mention a few.

This task only seems possible when researchers are willing to diversify their investigations, i.e., when language is studied from the points of view of Linguistics, of Anthropology, of Logic, and so on, independently, but at the same time when cross-informing and fertilization takes place between researchers of different disciplines. This was the aim of the Workshop out of which the present volume grew. Funded by NATO and the Association of Computational Linguistics, the workshop entitled *Burning Issues in Discourse*, celebrated in Maratea, Italy, in April 1993, joined together researchers from around the world working in the areas of Computational Linguistics, Psycholinguistics, Text Linguistics and Sociolinguistics. The intention was to inform one another about developments, insights in the study of discourse, and available methods of addressing them. In spite of the time elapsed between the workshop and the publication of the book, the ongoing impact of the contributions and the fact that research methodologies do not change quickly make the contributions contained in this volume of longstanding interest for discourse researchers.

2. BURNING ISSUES IN DISCOURSE

Given the interdisciplinary character of the workshop, speakers were asked to select a topic from a certain set of issues which were considered as "burning" or highly debated within current discourse research. The "burning" issues were specified as follows:

Multi-Party Discourse: This refers to the several factors involved in the collaborative construction of a coherent discourse, for example, turn-taking, signalling and negotiating initiative. Burning issues involve the way in which current theories account for these phenomena, whether they can be used in computational systems, what needs to be added, and how the open questions can be addressed in testable ways. Two papers in the volume address these issues: one from Sociology on the ways people communicate by not saying anything out loud (Schegloff), another one from Linguistics on the ways people structure their message when they do say something (Ono and Thompson).

Discourse Segmentation: Discourse is structured; in particular, utterances are grouped into chunks or segments. However, discourse structure does not lend itself to the methods and categories of single-sentence grammatical analysis. Burning issues in this area include the type of structuring which characterises coherent discourse, e.g., trees vs. networks, single vs. multiple structures; how to define structural segments. Other important issues deal with the relevant units of segmentation -propositions, sentences, utterances; the signalling of discourse boundaries; the nature of intersegment relations -is it intentional, semantic, structural, or all three? Two papers from Computational

Linguistics and one paper providing an empirical approach address these issues. The papers by Dahlgren on discourse coherence and segmentation, and by Hobbs on the intentional and informational perspectives on discourse interpretation represent the computational view. Passoneau and Litman study people's ability to segment discourses in an empirical way.

Information in Discourse: Information in discourse is not randomly presented but is governed by pragmatic principles of information processing; how does information presentation (by the speaker) influence information access (of the hearer)? What are the differences between related notions such as Theme, Topic, Given and Focus? The paper by Hajicová describes some of the distinctions between Topic and Focus from the perspective of the Prague School. The paper by Martin presents an analysis of several texts arguing that at least three different types of structure are used in discourse to communicate three fundamentally different kinds of meaning in parallel: ideational, interpersonal and textual meaning.

Discourse Structure and Syntactic Form: What kind of relationship is there between discourse and syntactic structures? How do they constrain one another? Can one specify correlations which could be later be used as rules in computational discourse studies? Ono and Thompson describe these relationships in their paper, while Hajicová describes several syntactic means for expressing focus.

Tools, Techniques and Experimental Methodologies: How can theories of discourse be empirically verified? What techniques and methodologies exist? What aspects of discourse do they best address? The study by Passoneau and Litman investigates the regularities in the interaction of segmentation, coherence and certain linguistic devices empirically, i.e., by measuring people's segmentation of discourses. Schegloff also addresses methodological issues in discourse analysis in the postscript to his paper.

The seven papers included in this volume address all these issues from a variety of perspectives: one paper by Schegloff from Sociology; three papers by Martin, Ono and Thompson, and Hajicová from Linguistics; two papers from Computational Linguistics by Dahlgren and Hobbs; and one paper by Passoneau and Litman taking an empirical, experimental approach.

Some of the aspects addressed by the contributions to this volume are the following:

- The different types of meaning simultaneously communicated in a discourse; these range from the types of representations (Martin), to communicative intentions and inference processes and their representations (Hobbs).
- Implicit and explicit statements in multi-party interaction (Schegloff) and how what is said is embodied in syntax (Ono and Thompson).

- The internal structure of discourse (Dahlgren, Passoneau and Litman) and external signals of discourse structure (Hajicová).

The methodologies dealing with these topics also range from hypotheses and analyses to be verified experimentally (Martin, Schegloff), to highly controlled and measured studies of human linguistic behaviour in very specific setting and tasks (Passoneau and Litman). Intermediate options are the computer studies presented by Hobbs and Dahlgren, and the comparison and substitution studies of Ono and Thompson.

In the remainder of this review I will present a summary of the analysis and the results obtained in each of these contributions, providing a cross-disciplinary comparison of the questions asked and the methodologies adopted.

3. ANALYSIS OF DISCOURSE ISSUES FROM DIFFERENT PERSPECTIVES

The volume is divided into four parts, each one including papers addressing the issues mentioned above from a different perspective. Part 1 presents the perspective from Sociology embodied in a paper from E.A. Schegloff on multi-party discourse issues such as action, interaction and co-participant context. Part 2 presents the linguistic perspective including three papers: one by J.R. Martin on types of discourse structure, another paper by T. Ono and S.A. Thompson on the interaction between syntax and structure in conversational discourse, and a final paper by E. Hajicová on the information structure of the sentence and discourse coherence. Part 3 presents the perspective from Computational Linguistics embodied in two papers: one by K. Dahlgren on discourse coherence and segmentation, and another one by J.R Hobbs on the role of intentionality in discourse. Finally, Part 4 embodied in a paper by R. J. Passoneau and D. J. Litman provides an empirical approach to three fundamental dimensions of spoken discourse: segmentation, coherence and linguistic devices.

In the next sections each of these contributions is reviewed grouped according to the perspective they represent following the order of appearance in the volume.

3.1. The sociological perspective

Part 1 provides the perspective from Sociology represented by a paper by E. A. Schegloff with the title "Issues of Relevance for Discourse Analysis: Contingency in Action, Interaction and Co-Participant Context." In this paper,

Schegloff concentrates his attention on three themes, which, in his view, are fundamental for the optimum development of discourse analysis. The analysis of discourse needs to incorporate an orientation 1) to action, 2) to interaction, and 3) to multi-party interaction. But before launching into discussing these three themes, Schegloff explains the theoretical premises which frame his investigation:

1) His basic target of inquiry is naturally occurring ordinary discourse. This is, in his view, the natural and cultural bedrock of linguistic activity.

2) Conversation is the foundational domain for the study of discourse, in contrast with other approaches where conversation is understood taxonomically, as simply one subtype or genre of discourse. For Schegloff, "...the primordial scene of social life is that of direct interaction between members of a social species, typically ones who are physically co-present. For humans, talking in interaction appears to be a distinctive form of this primary constituent of social life, and ordinary conversation is very likely the basic form of organisation for talk-in-interaction."

After presenting these premises, Schegloff focuses his attention on the three themes which, in his view, are endemic to the organisation of talk-in-interaction.

The first theme concerns the centrality of *action*. Without invoking speech act theory, whose ability to deal with ordinary discourse is debatable, Schegloff claims that the analysis of discourse must incorporate attention not only to the propositional content and information distribution of discourse units, but also to the *actions* they are doing. Exemplifying his point with an extract from a naturally occurring conversation, Schegloff demonstrates how the actions to which analysis needs to attend are not necessarily classes of action defined by professional discourse analysts (as, for example, speech act theory), but those units of action which are indigenous to the interactional participants' worlds, for example, actions such as "pre-offer" or "pre-announcement," which are not mentioned in speech act theory but which characterise actions in conversation.

The second fundamental theme for discourse analysis is *interaction*. By the interactive production of discourse Schegloff means "produced by more than one", and his point is that units such as the clause, sentence, turn, utterance, discourse are all in principle *interactional* units. Illustrating his point with an extended conversational extract, he shows how discourse involves not just action, but action in interaction, and the consequential eventfulness of its absence. The main conclusion one can draw from this analysis is that interaction, understood as the co-construction of discourse by the relevant participation of a second party, may be most critical to our analysis of discourse when one of the participants is not producing talk -or doing anything else visible or hearable. This is because the production of discourse may be one contingent

response by a prior speaker to the absence of a response by a co-participant to an apparently completed, action-implementing turn constructional unit.

The third theme concerns *multi-party interaction.* This concerns those instances of discourse in settings composed of more than two participants. Schegloff sketches several organisational concerns such as the turn-taking issue (who will talk next), the action implications for non-addressed parties of utterances designed for their addressees, and the issue of schism, i.e., the problem of extended discourse in multi-party interactions of maintaining a single discursive arena in the face of the potential for the breaking up of the interaction into two or more separate conversations.

Characterising the organisation of talk-in-interaction is the challenge of *contingency*: this refers to the range of responses which are contingent on the action(s) implemented by a given utterance. None of these is thoroughly pre-scripted: the participation of interlocutors in the production of talk is always contingent on its occasioned expression. As Schegloff points out: "Contingency —interactional contingency— is not a blemish on the smooth surface of discourse, or of talk-in-interaction more generally. It is endemic to it. It is its glory." For him, the three themes of action, interaction and multi-party interaction are three strategic organisational loci of this contingency.

This fact poses an important challenge for computational systems: how to capture the full range of contingency which characterises flexible and smooth discourse. In fact, in the postscript to the article, where Schegloff provides a principled rejoinder to the criticisms made to his work by one of the book referees; interaction, contingency and timing are presented again by Schegloff not simply as mere variables to be added to other, supposedly more basic, factors, such as propositional content, information structure, phonological realisation, lexical or syntactic organisation. On the contrary, all of these factors function within a situation fundamentally shaped by *interactional* considerations, structures and constraints.

From a computational perspective, the challenge posed by these issues is formidable, though not impossible to tackle if the level at which the discourse analysis is performed is sufficiently explicit and replicable to be eventually incorporated into a formal system. From this perspective, it is not enough to say, as Schegloff suggests, that "in the end, it will be the computationalists who will have to figure out how to do this." Interdisciplinary work is the responsibility both of discourse analysts and computational researchers reaching out from their own fields to obtain fruitful results.

3.2. The linguistic perspective

Part 2 includes three papers from Linguistics: one paper by J.R Martin on types of discourse structure, one paper by T. Ono and S.A. Thompson on the

interaction between syntax and the structure of conversational discourse, and one paper by E. Hajicová on the information structure of the sentence and the coherence of discourse. I will start by reviewing the paper by J. R. Martin.

The paper by J. R. Martin entitled "Types of Structure: Deconstructing Notions of Constituency in Clause and Text" presents a view of text structure developed in Australia by the author in collaboration with Halliday's (1994) and Matthiessen's (1995) work on English clause grammar. In his view, constituency is deconstructed as a "semantically biased and reductive form of representation for text structure", i.e., as just one way of looking at text organisation. Martin's point is that discourse models need to be developed which acknowledge the distinct structuring principles which are associated with the ideational, the interpersonal and the textual meanings. According to Halliday (1979), ideational meaning uses *particulate* structuring principles, interpersonal meaning uses *prosodic* principles, and textual meaning *periodic* ones. Particulate structures are segmental, dividing wholes into parts experientially, and relating parts to parts in potentially unbounded series. Prosodic structures are suprasegmental, mapping over a range of segments (e.g. intonation). Periodic structures are wave-like, establishing rhythmic peaks of prominence.

Recognising the value of Halliday's contribution, Martin points out that in spite of the theory outlined above, the forms of representation which have evolved to implement the theory in language analysis have used the same particulate form of representation for experiential, interpersonal and textual meaning, not doing justice to the other types of structure. Therefore, he suggests dissociating Halliday's interpretation of particulate structures from any mode of meaning per se, reworking it in terms of nuclearity (orbital vs. serial). Thus, experiential, part-whole construals are reworked by Martin in terms of nucleus/satellite organisations. For example, the typical ergative analysis of the English clause into Agent-Process-Medium-Circumstance which focuses attention on the part/whole nature of the particulate structure, is deconstructed by Martin into an orbital structure where the Process/Medium configuration is constructed as the nucleus of the clause, with the Agent as an inner satellite and the Circumstance in outer orbit.

With respect to logical, part/part relations, like, for example, hypotactic projection, where one segment gives rise to another in an open-ended interdependency series, Martin proposes to use the same orbital perspective, reworking particulate structures as serial. Therefore, as far as ideational meaning is concerned, serial interdependency (logical meaning) is opposed to orbital dependency (experiential meaning).

Martin's revision can be considered as a deconstruction of constituency representation; his fundamental point is that a text is not a tree, and, therefore, no form of constituency representation can capture the complementary

particulate, prosodic and periodic structuring principles by which ideational, interpersonal and textual meanings are construed.

This paper is, therefore, an interesting attempt at capturing phenomena beyond the rather limited range usually studied by researchers trained in the mathematical/logical tradition. From the interdisciplinary perspective which, for example, computational linguistic work would need for successful specifications, Martin's metaphors of the particulate, periodic, and prosodic nature of aspects of discourse pose an interesting challenge to current computational systems: it remains to be determined, however, which method will be suitable to express those metaphors in a symbol system which a computer programme will be able to understand and process.

The paper by T. Ono and S. A. Thompson entitled "Interaction and Syntax in the Structure of Conversational Discourse: Collaboration, Overlap, and Syntactic Dissociation" proposes a new way of thinking about syntax by integrating the production of syntactic units with interactional structure. The author's aim is to show that one can learn a great deal about syntax by looking at it in real life: the production of syntactic units by speakers engaged in actual, ordinary, everyday interaction. Using a database of conversational American English, and bringing together two prominent strands of research into interaction and grammar —one arising from conversation analysis, the other one from discourse/functional linguistics—, the authors provide examples of syntactic "co-constructions," and suggest that each of these types provides important clues about the interface between syntax and interaction.

The discussion is centred around two main types of collaboration: the so-called collaborative production of "clean" syntax, i.e., those products of collaboration which result in what grammarians would consider to be canonical instantiations of constructional schemas, and those which result in instantiations which do not match any schema, i.e., what the authors call "messed up" syntax.

With respect to the first type of collaboration, the authors examine instantiations of two main subtypes of collaboratively achieved realisation of syntax which reveal a range of syntactic skills which speakers bring to interaction: the first subtype is when Speaker A does not complete a syntactic unit, and the second is when Speaker A's unit becomes part of a new unit. The analysis reveals that the production of syntactic units is often a joint activity, suggesting that speakers share not only a knowledge of possible syntactic unit schemas but also a knowledge of how to expand shorter schemas into longer ones.

With respect to the second type, i.e., the examination of instances of what the authors call "messed up" syntax —such as, for instance, when speakers overlap, or when there is a dissociation from a schema instantiation— reveals that the speakers did not find any trouble with the interaction. As the authors

remark: "the combination of semantic, cognitive, and pragmatic factors wins out over the mere production of syntactically impeccable schema instantiations."

The conclusions of this paper are extremely important not only for discourse researchers but for grammarians: syntax cannot be just something static that speakers "carry around in their heads," but must be understood in a much more dynamic way as a resource that guides the production and interpretation of utterances. Syntax must ultimately be understood as "intersubjective and jointly constructed," as a knowledge which is constantly modified by conversational encounters and other sequential requirements. As the authors show in this paper, it is necessary to revise our notions of what it means to be "fully grammatical" or "not fully grammatical" in the light of the way grammar and interaction work together.

On a cursory reading one may be tempted to conclude that there seems to be an incompatibility between the description of syntax presented in this paper, and that prevailing in linguistic circles, especially in those belonging to the transformational-generative tradition. However, both views are perfectly compatible: Ono and Thompson's use of the notion of constructional schemas as "patterns, distilled from a large number of speech events, to the point where they have a cognitive status independent of any particular context," resembles the mentalistic notion of the syntax of a language as a structured inventory of such patterns, a view which can be supplemented with the results of empirical and sociolinguistic analysis which suggest that syntactic and semantic needs are often subordinated to interactional needs.

The paper entitled "The Information Structure of the Sentence and the Coherence of Discourse," by E. Hajicová, attempts to call attention to the topic-focus articulation (TFA) of the sentence as a phenomenon necessary for an adequate analysis of discourse from the perspective of the coherence of discourse using coreference. After providing a brief characterisation of the formal framework she works with, i.e. the functional-generative tradition, Hajicová explains how in this approach, the TFA, together with the scale of communicative dynamism, is regarded as a *semantically* relevant distinction which belongs to the level of the linguistic meaning of the sentence, i.e., of the underlying syntactic structure. Computational models of discourse dealing with the so-called attentional structure referring to the focus of attention —recently called *centering* theory (Grosz and Sidner 1986, Grosz et al., 1995)— closely corresponds to the TFA analysis, with one proviso: what is called *focus* of attention or *center* in those computational models is the element just introduced by the speaker, who focuses his/her attention on it. Thus in computationally-oriented research, the focus or center of discourse would refer to "the baby" in (2), since "the baby" is one of the items "just introduced" in (1). In linguistic analysis, however, the pronoun "it" referring to the baby in (2) belongs to the topic rather than to the focus of this utterance:

(1) The mother picked up the baby.
(2) It had been crying nearly all day.

In an attempt to extend the formal model of TFA to the domain of discourse, Hajicová provides a series of descriptive observations about the relationship between the TFA of individual sentences and changes in the degrees of salience of referring expressions in the discourse. These observations are then illustrated with the analysis of an extract from the weekly news magazine *Time*. Her belief is that this approach allows for a description of the dynamic aspects of discourse without losing track of the information structure of the individual component parts which are the building blocks of the discourse as a whole.

However, the general validity of this model to describe discourse development remains untested when confronted with complete and/or longer stretches of naturally occurring discourse which have not been carefully chosen to fit the theoretical model. In spite of this fact, the model may be considered as a starting point for more discourse-oriented studies which investigate the relationship between the information structure of the sentence and information flow in discourse.

3.3. The computational perspective

Two papers are included in the volume representing the perspective from Computational Linguistics: one by K. Dahlgren on intersegment relations, and another by the computational linguist Hobbs on communicative intention and its effects on discourse structure.

The paper entitled "Discourse Coherence and Segmentation" by K. Dahlgren explores the basis of discourse structure, cognitive mechanisms of recovering it, and computational algorithms designed to mimic human discourse structure recovery for text. The author's point of departure is the observation that discourse structure is infrequently marked by cue phrases, and that other linguistic signals such as, for instance, paragraph shift, tense shift and focus shifts do not provide sufficient information for the identification of discourse segment boundaries. Dahlgren's proposal is to account for discourse structure in terms of coherence and naive semantics. Her fundamental point is that a coherent discourse is one for which the hearer can build a cognitive representation such that the relations among individuals, events, states and other abstract types in the representation correspond with his/her understanding (naive theory) of the way actual world individuals and events relate. A coherence relation is defined by Dahlgren as "part of a naive theory of the relation between elements introduced into a discourse. It is a binary predicate

whose arguments are discourse individuals, discourse events or states, facts, propositions, event types, or sums of these."

Her approach is similar to the cognitive one of van Dijk and Kintsch (1983), but differs in defining coherence as relating discourse events, rather than as relating sentences. In addition, her proposal clarifies the question of truth conditions as opposed to naive inference regarding discourse interpretation, and provides an algorithm. The author also uses a set of coherence relations drawn from different sources (Hobbs 1979, Mann and Thompson 1987), but she defines them as relating discourse events and structures of these in a *cognitive event model* , rather than as relating sentences or discourse chunks.

In more explicit terms, Dahlgren proposes a formal model of discourse structure, following Discourse Representation Theory (Kamp 1981, Asher 1993, Asher and Kamp 1995), where each clause in the discourse introduces an individual, event, state, and propositional reference markers into the discourse representation structure (DRS). In this model, coherence can be viewed as defined over constituents of the DRS which reflect the content introduced by clauses. The model also predicts a series of principles which provide a definition of discourse segments and constraints on different types of anaphora. In this sense, the paper can be considered as an excellent illustration of how to incorporate linguistic descriptions into a formal system which can serve as the basis for interdisciplinary computational-linguistic work.

The paper by J. Hobbs, entitled "On the Relation between the Informational and Intentional Perspectives on Discourse," provides a framework where both the "informational" and the "intentional" perspectives can be reconciled as necessary and compatible accounts of discourse interpretation. The "informational" perspective on discourse interpretation, as elaborated by Hobbs et al. (1993), presents the view that to interpret an utterance is to find the best explanation of why it would be true. By contrast, under the "intentional" perspective, to interpret an utterance is to find the best explanation of why it was said.

Hobb's main point is that while the "intentional" perspective has been the canonical perspective in natural language processing since the middle 1970s (Grosz 1979, Cohen and Perrault 1979, Hobbs and Evans 1980, Grosz and Sidner 1986), it cannot be the whole story. According to him, "the speaker's intention is indirect, it is often uninformative, and it is frequently not very important." It is, therefore, necessary to provide an account of the primary use of language, i.e., that of conveying information about situations, relying on shared background knowledge. This is the "informational" perspective on discourse interpretation which tells us how to understand the situations described in a discourse, while the "intentional" perspective tells us how to discover the uses to which this information is being put.

In his paper, Hobbs provides a unified framework of both types of interpretation where the informational account has to be embedded in an intentional account. He summarises this relation by the following formula:

intentional-account = goal(A, believe(B, **informational-account**))

This can be paraphrased as meaning that the speaker (A) has the goal of changing the beliefs of the hearer (B) to include the content characterised by the informational account. Depending on the situation, there may be strong or weak correspondence between both accounts. For example, in some cases the content is something reasonable to believe; in other cases, such as, for instance, in pragmatically elliptical utterances, the informational account is undetermined and one has to rely on the intentional account for a global interpretation.

The paper, therefore, is an interesting proposal for computational linguistic work on discourse since it encompasses intentional and information interpretations in a unified framework.

3.4. An empirical perspective

The last paper in the volume, entitled "Empirical analysis of three Dimensions of Spoken Discourse: Segmentation, Coherence and Linguistic Devices" by R. Passoneau and Diane J. Litman, adopts an empirical approach to investigate the regularities existing in the interaction of segmentation, coherence and three types of linguistic devices: pauses, cue words and referential noun phrases. In particular, using Chafe's (1980) pear story corpus, the paper addresses the following questions:

- are discourse segments objective units that correspond directly to more abstract semantic or pragmatic units?
- how can theories of discourse segmentation be empirically verified?
- what is the nature of the boundaries between segments; for instance, do they have precise locations?
- what linguistic devices correlate with segment boundaries, and to what degree?

Since the questions are interrelated, they are gradually explored in different sections of the paper. To answer the first two questions, the authors use an empirically derived database of segments. This is achieved by asking "naive" subjects to segment discourse using communicative intention as the segmentation criterion. The use of this non-linguistic criterion allows them to investigate the correlation of linguistic devices with independently derived segments. The results of the experiment, consisting of a quantitative evaluation of the degree of reliability among subjects, demonstrate an extremely significant pattern of agreement on segment boundaries.

With respect to the third question, the corpus analysis reveals the existence of a large amount of variability in the data, such as imprecision in the location of certain boundaries. The conclusion reached by the authors is that segment boundary location is inherently imprecise or fuzzy. This fact may be due to different causes, for example, the role of certain utterances may be ambiguous, i.e., a subject may have a divergent interpretation of the narrator's intentions, or a single utterance may simultaneously have multiple functions, thus leading to different segmentations.

The fourth question is explored by evaluating quantitatively the performance of three algorithms based on three linguistic devices whose distribution or surface form has frequently been hypothesised to be conditioned by segmental structure: referential noun phrases, cue words, and pauses. The results suggest that levels of approximating human performance could eventually be achieved, but no single strategy for identifying segments would be sufficient: individual discourses vary significantly in how reliably humans or algorithms can segment them (variation across speakers), and in how they may be signalled within the same discourse (variation within speakers). Due to this variability, the authors believe that the most effective algorithm would need to dynamically adjust to different cues, possibly dependent on user modelling.

The final section of the paper is devoted to relating the results of the empirical investigation to coherence. The authors examine the relationship among segments, segment boundaries and suprasegmental coherence, and re-evaluate one of the algorithms.

The concluding section discusses implications for natural language understanding and generation systems: since individual speakers and hearers have different skills at producing coherent discourse, understanding and generation systems will have to account for these differences. In the case of generation systems, the production will have to resemble the performance of the 'best' or most clearly understood speakers, while understanding systems will have to accommodate the widest range of hearers to achieve successful performance.

From an interdisciplinary perspective, the usefulness of this type of empirical approach to computationally-oriented work is unquestionable. Empirical methodologies have now established themselves as the standard ones for, e.g., natural language generation, where different studies have demonstrated the need to provide empirically-tested results for successful computational implementations (Bateman 1998, Lavid 1998). This does not imply that qualitative type of research should be abandoned but that empirical methodologies are demonstrating their strength over other methods for testing the validity of linguistic models based on more intuitive type of research.

4. CONCLUDING REMARKS

The wide range of approaches and perspectives from which the study of discourse is undertaken by different disciplines points to a burgeoning field of inquiry where cross-disciplinary discussion and fertilisation will eventually materialise in complex models or theories capable of providing precise predictions which can be tested, verified or falsified.

As illustrated by the studies included in this volume, there seems to be a negative relationship between complexity and descriptive accuracy: as the "scope" of the phenomenon studied increases, the precision of the notation used to describe it decreases. For example, the precise mathematical formalism of Hobb's predicate calculus used to represent the inference processes required to interpret single utterances is not immediately transparent when applied to more than a few clauses at a time, thus limiting its applicability to larger stretches of discourse. At the other extreme, an ethnomethodological description of the patterns of reasoning underlying certain interactions, such as the one in Schegloff's paper, or Martin's metaphors of the particulate, periodic and prosodic nature of aspects of discourse are carried out using well-written prose, which, nevertheless, cannot provide sufficient information about the generalisations, the processes, etc., that underlie the discourse phenomena described.

If one adheres to the belief, as suggested by the editors of this volume, that a theory about a complex phenomenon, such as discourse, is most complete when it provides a notation and a taxonomization of phenomena where precise predictions can be made, tested, verified or falsified, a view shared by this reviewer, it is obvious that an effort is necessary on the part of discourse researchers to incorporate their findings into formalised systems. Examples of this effort are the discourse structure relations postulated by Mann and Thompson, Hobbs, Dahlgren and others, as well as the idea of discourse segments, as postulated by Grosz and Sidner and others, and described in Dahlgren and tested by Passoneau and Litman.

The current volume, therefore, is an invaluable companion for all those discourse researchers interested in widening their views with the results obtained in other disciplines, and a repository of ideas from different fields waiting to be applied, extended and tested in new environments. The reader, however, misses a contribution on the issue of genres/text type classifications, which, from this reviewer's point of view, would have increased the overall impact of the volume. Nonetheless, it was the editors' decision not to include it as an issue per se, given the fact that it cuts accross all the other burning issues, and its interdisciplinary possibilities have only recently begun to be explored (Bateman and Paris 1990, Lavid 1994). We should expect and welcome further developments in this area in the very near future.

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