Discourse functions and hemispheric asymmetry

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Abstract. This paper presents a review of the main results of an application of discourse analysis in aphasics with the left hemisphere damages and in the right hemisphere damaged (RHD) patients. Research findings indicate that aphasics have marked deficits on the level of microstructure, especially cohesion of discourse, whereas the coherence and superstructure of their texts are relatively well preserved. RHD patients show difficulties at the microstructure of discourse but not so marked as that of aphasic subjects. The main impairments of RHD patients’ discourse can be observed at the level of text coherence. The both populations have also preserved cognitive representation concerned with script knowledge. Discourse processing at macrostructural level of discourse is affected in aphasics as well as in RHD patients. These results suggest that both hemispheres are necessary for normal discourse processes.

Key words: discourse processes, aphasics, right hemisphere damaged patients, hemispheric asymmetry
INTRODUCTION

Over the last several decades lateralization of language processes was one of the main problems in the field of functional asymmetry of the human brain. Hundreds of studies indicate that the left brain hemisphere markedly dominates over the right one as far as phonology, syntax and semantics of language are concerned. However, the results on processing of lexicosemantic contents in the right brain hemisphere force us to reject the idea of absolute functional predominance of the left hemisphere in language. That conclusion can be confirmed by neuropsychological studies on discourse.

Dennis and Lovett (1990) defined discourse as language in the contextual, narrative, and conversational settings in which it is daily used and understood. The study of discourse is the study of communicative language in context, in contrast to types of language analysis at the level of closed, formal linguistic system.

According to the model of van Dijk and Kintsch (1983) there are three levels of discourse representation: 1) The surface of verbatim trace - concerned with the memory for particular words and surface structure of discourse which rapidly decays over time; 2) Text base, consisting of the microstructure and macrostructure of discourse; 3) Situational (or mental) model representing the world knowledge.

The level of text base is the most frequent subject in neuropsychological studies on discourse. I will describe it in a more detailed way.

The microstructure of discourse contains two types of information: local and global information. The first one, called cohesion, corresponds to the relationships between the meaning of individual words in a text. It refers to the syntactic, morphological and lexical means of connecting sentences within a text. Cohesion represents the more linguistic level of discourse representations.

The global information refers to the semantic and pragmatic meaning of discourse contained in sentences. The single idea unit expressed in a sentence creates a proposition that is the semantic unit of a text. The relations between propositions are defined as coherence of discourse.

The macrostructure is the global semantic content of a discourse. It represents the main ideas of a text, corresponding to notions such as: theme, gist, topic, summary. Larger portions, elements of discourse have additional, specific meaning which organize discourse at the macrostructural level. These elements create a general scheme or superstructure of discourse. The type of discourse is stipulated by the original superstructure of a text. For example there are narrative, procedural or conversational types of discourse. A related concept to superstructure of discourse is script defined by Schank and Abelson (1977). General story scheme, scripts or other superstructures of discourse influences processes of knowledge acquisition and the integration of old and new information in memory. The metastructural level of discourse is the most cognitive one and strictly refers to a situational, mental model representing the world knowledge.

DISCOURSE AND FUNCTIONS OF BRAIN HEMISPHERES

Model structures of discourse developed in linguistics and psycholinguistics started to be applied in clinical neuropsychology in the 1980-ties. Text analysis in brain damaged patients has allowed to discern preservation or impairment of many linguistic and cognitive processes which were omitted in researches focused on the sentence level of communication.

Although studies on discourse in neuropsychology are still exploratory in nature, the existing data can be the base for making tentative inferences about functional asymmetry or rather cooperation of human brain hemispheres.

The next part of the paper will present the results of some of the studies referring to particular discourse structures in the populations of aphasics with the left hemisphere damages and patients with the right brain damages (RHD).
Cohesion in aphasics

Most of the experimental work gives evidence that there is an impairment of linguistic representation of discourse in aphasic patients. Ulatowska and Bond Chapman (1990), as well as Huber (1990) reported the following disturbances of cohesion in aphasics discourse:

- the overall reduction of cohesion complexity (i.e.: lack of complete syntactic constructions, lack of conjunctions),
- high proportion of deictic pronouns ("this", "that", etc.),
- high proportion of pronouns without the appropriate, referential word or context.

Aphasic subjects also show difficulties in comprehension of texts with high level of cohesion complexity (Ulatowska et al. 1990). However, the results are not concordant with the data obtained by Huber and Gleber (1983). They maintain that aphasics can compensate their comprehension deficits by using the general world knowledge, in other words by relying more on macro- than microprocessing.

Cohesion errors occur in various types of aphasia but it is very difficult to elaborate a pattern of cohesion disturbances in relation to a particular type of aphasia. However, the data indicate strong dependence between the level of aphasia impairment and the grade of cohesion difficulties in discourse processing (Ulatowska et al. 1990).

Cohesion in RHD patients

Some difficulties in discourse cohesion had been also noticed in the population of RHD patients. Joanette et al. (1983, 1990), Hough and Wilcox (1989) in their experimental works as well as Tonkovich (1989) on the basis of clinical observations maintained that RHD patients had problems with appropriate using of reference in spoken discourse. However, Joanette et al. (1983, 1990) stressed that RHD patients population is not homogeneous pertaining to impairment on cohesion. Only half of RHD subjects made reference errors. Cohesion of discourse in the remaining patients was comparable to that of normal controls. The authors could not identify either anatomic, genetic, or environmental factors that could have accounted for the observed differences in the RHD group.

Coherence in aphasics

The series of experiments demonstrates that processes connected with discourse coherence seem to be preserved in aphasics with mild to moderate speech disorders. Despite their language problems aphasic patients are still able to produce and comprehend the main ideas of discourse. Discourse of aphasics is also well organized and the main information is produced chronologically. They can successfully use redundant cues included in the context of discourse. On the other hand, a significant reduction in the amount of detailed information in aphasics utterances can be observed. The above results were described in works by Stachowiak et al. (1977), Ulatowska et al. (1983a,b, 1990), Brookshire and Nicholas (1984), Osiejuk (1989, 1991), Wilcox et al. (1978), and others.

Coherence in RHD patients

Analysis of discourse in RHD patients indicate impairment of coherence in some of the subjects. Coherence difficulties which can be found in that population refer to:

- wrong order of information,
- focusing on insignificant components,
- making personal remarks,
- reduction of some main information from text,
- difficulty in interpreting and using contextual information,
- impairment in integration content of discourse with new information (see: Joanette and Goulet 1990, Kaplan et al. 1990, Osiejuk, 1989, and others).

The authors point out that various patients differed markedly in their pattern of discourse impairment, some manifesting only certain of the deficits. However, the coherence structure produced by many of the RHD patients is as correct as that of normal controls.
Macrostructure of discourse in aphasics and RHD patients

The pattern of disturbances at that level of discourse representation is similar in aphasics and RHD patients.

According to the investigation by Armus et al. (1989), Roman et al. (1987), as well as my last work (Osiejuk 1992) it can be stated that world knowledge referring to cognitive representation of scripts is preserved in both aphasics and RHD patients.

The marked impairment of macroprocessing in that population occurs when the discourse task requires abstract thinking. For example: in a task of giving morals, titles, gist to a story (see: Ulatowska et al. 1983b, Osiejuk 1989). Macroprocessing difficulties also appear when aphasics and RHD patients are asked to find a general similarity between scripts and when they have to describe abstract prerequisites for produced plans (Osiejuk 1992). However, more statistically significant differences on macrostructure processing can be noticed in aphasics than in the RHD group in comparison with healthy people (Osiejuk 1992).

CONCLUSIONS

The described findings present only the first step in research on discourse in clinical neuropsychology. It is clear that the evidence is not complete and further investigations are needed to answer the raised questions, such as:

- Are there any specific cognitive processes typical only to one of the hemispheres involved in the processing of particular discourse representations?
- What is the connection between anatomical structures of hemispheres and discourse processes?
- Why are there different patterns of abilities in discourse functions in RHD patients?

Although many problems still remain unsolved, the existing data do suggest that both hemispheres are involved in discourse processing. The right hemisphere as well as the left one is necessary for correct processes at all levels of discourse representation, even if they are more linguistic (like cohesion) or more cognitive in nature (like macrostructure processing). The results of neuropsychological studies on discourse also support the hypothesis that the more complex is the analysed process or function the more engaged are both hemispheres of the human brain.

REFERENCES


Paper presented at the 1st International Congress of the Polish Neuroscience Society; Session: Hemispheric asymmetry