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NARRATIVE DISCOURSE AND THE BRAIN

The purpose of the paper is to review the origins of studies on narrative discourse in neurolinguistics, especially in reference to Luria's work. It is also aimed to show the development of research on discourse in brain-damaged patients. Investigations on script knowledge reflected in discourse of aphasic and right-brain-damaged subjects are presented. The relationships between discourse representation and the human brain are considered.

Introduction

The year 1997 is associated with several special anniversaries important for studies on discourse. Thirty years ago, Labov and Waletzky (1967) published their paper on narrative analysis which caused considerable changes in the way speech and language were investigated. This was also a year of significant anniversaries for research on discourse in neurolinguistics. Fifty years ago Alexander Romanovich Luria published his book "Traumatic aphasia" (1947) where he described the symptoms of dynamic speech disorders resulting mainly in deficits in narrative discourse production. The year 1997 was also the 95th anniversary of Luria's birth and the 20th anniversary of his death.

What are the origins of studies on narrative discourse in neurolinguistics? What is the place of Luria's work in this field? How has this branch of science developed since Luria's time? What are the relationships between the representation of narrative discourse and the human brain? The present paper is addressed to these questions.

The origins of studies on discourse in neurolinguistics

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

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cording to Bokus, "definitions (...) differ in detail, but all agree on its certain property: a narrative is a verbal representation of events that follow one another in time" (Bokus, 1997, p. 53).

Over the last two decades the field of neurolinguistics has been significantly broadened by the application of discourse analysis. Traditionally, neurolinguistic studies concentrated on the phonological, syntactic and semantic systems of language. Significant development of research on discourse in neurolinguistics has been inspired by studies in other disciplines. The most important works on discourse were published by structural linguists (i.e., Firth or Bartlett), sociologists (i.e., Sacks and Schegloff) in the sixties (see Labov, 1970; Sinclair & Coulthard, 1975), and by psycholinguists (i.e., Clark & Clark, 1977; Labov & Waletzky, 1967; van Dijk & Kintch, 1978).

However, pioneering work on discourse can also be found in studies on brain-damaged patients. Unfortunately, these references have rarely been mentioned in contemporary neurolinguistics. For example, Kurt Goldstein described the influences of extra-linguistic and contextual variables on aphasic performance in the book "Language and Language Disturbances" (Goldstein, 1948).

Many of the conceptions of A. R. Luria on speech can be regarded as fundamental for studies on discourse. Luria formulated his most important ideas on speech in the forties, mainly in the book *Traumatic aphasia* (1947). However, his concepts were popularized outside the Eastern countries much later, when *Traumatic aphasia* was published in English (Luria, 1970).

Luria differentiated the nominative, semantic, and syntactic aspects of language in its pragmatic or directive role. He regarded speech as a special means of communication which uses language for the transmission of information. He analyzed speech as an activity involving speaker and listener. The same theoretical assumptions have been adopted in discourse theory, particularly in the domains of pragmatics and conversational analysis (see Patry & Nespoulous, 1990).

Luria also understood speech as a mechanism of intellectual activity, as a tool for operations of abstraction, generalization and categorical thinking. Research on the cognitive aspect of discourse reflects this premise. In this domain speech is defined as a manifestation of conceptual representation and thought processes. Any formal structure generated to represent discourse is regarded as a hypothesis about human cognitive representations and processes.

Luria's theoretical model of speech included two forms and two mechanisms of speech activity, called by the author expressive speech (now definable as the production of narration) and impressive speech (comprehension of narration). Apart from the levels of phonemes, words and sentences, the model included the general mechanisms of production and comprehension of narrative speech.

According to Luria (1973, p. 306), expressive speech "begins with the motive or general idea of the expression which is coded into a speech scheme and put into operation with the aid of internal speech, finally these schemes are converted into narrative speech (...)".

Impressive speech takes the opposite course from production, and this is done by "the analysis of the perceived spoken expression, the identification of its significant elements and their reduction to a certain speech schema. This is converted by means of (...) internal speech into the general idea of the scheme running through the expression, and finally the motive lying behind it is decoded."

Furthermore, Luria maintained that the processes of narrative performance rely on an individual's life experiences, the cognitive and language organization of these individual experiences as well as the sensitivity to the elements of situation (see Achutina, 1975).

The concept of dynamic aphasia (Luria, 1947) has been recognized in the literature as his primary contribution to the study of narrative discourse. This type of aphasia is usually based on a left frontal lesion, most often the third frontal convolution. Characteristics include a lack of spontaneity of speech, difficulty in production of long narratives, and a disturbance of the predicative component of speech necessary for the formation of complete thoughts and sentences. The basis for the disorder is found in the mechanism of narrative speech, which requires an intention to speak and the creation of a plan to follow, both dependent on intact frontal lobe functioning. The mechanism of narration Luria identified as internal speech with its predicative role. In his later publications, Luria also noted that frontal damage may result in difficulties with comprehension of narrative speech, particularly when complex narratives are offered (Luria, 1973).

Luria differentiated dynamic aphasia from a more general asponaneity and adynamia, a state in which there is little spontaneous output, and responses are passive and monotonous (Stuss & Benson, 1990). He also suggested that dynamic aphasia is a subtype of the classical transcortical motor aphasia (1973), described for the first time by Wernicke and later by Lichtheim in the eighteenth century (see Kądziaława, 1997). Luria's views on dynamic aphasia have also been creatively developed by his pupils (see Achutina, 1975).

By the differentiation of dynamic aphasia it was shown that the production of narrative speech is an independent linguistic as well as cognitive function and could have a separate cerebral organization. Luria included the assessment of narrative speech in his set of neuropsychological examination techniques. He used to ask patients to describe thematic pictures, arrange a set of pictures into a story, to tell or write a story.

Novel contributions of Luria's theoretical approach included a level of narrative speech in his model, the analysis of cognitive mechanisms of narrative speech, and the importance of contextual variables for speech performance. Moreover, the cognitive processes involved in speech listed by Luria (i.e.: identification of the most important speech elements, reduction and generalization) are still considered as basic for discourse.

There is no doubt that current knowledge on discourse and the views on its cerebral representation are much more advanced today. The psycholinguistic models of discourse (van Dijk & Kintsch, 1983; Frederiksen, Bracewell, Breuleux & Renaud, 1990) are more developed than Luria's model of speech. Some of Luria's ideas (e.g. the notion of internal speech) were intuitions rather than well-developed concepts. Moreover, there is agreement that the processes of discourse production and comprehension are not a simple opposition, as Luria assumed.

Current clinical studies on patients with different brain damages also show that the frontal lobes are not the only brain structures involved in mediating discourse processes. Both brain hemispheres are involved in discourse production and comprehension; lesions in different hemispheres lead to various discourse disorders. The level of involvement of each hemisphere in processing various discourse representations is currently under study in neurolinguistics.

Investigations on discourse in brain-damaged subjects

Theoretical bases for research on discourse in neurolinguistics are models of text representation and performance. According to the model by Frederiksen and colleagues (1990), three major levels of representation and processing of discourse have been identified. These

involve representations of linguistic, propositional and conceptual graph structures. Linguistic structures include word sequences, syntactic trees and relations across syntactic trees, referring to cohesion of discourse. In other terms, this level of discourse is called the microstructure (van Dijk & Kintsch, 1983). Propositions consist of representations of semantic information explicitly encoded in language structures, inferred propositions that connect information in a text (the coherence of discourse), and derived propositions that result from the application of logical or macrostructure rules. Conceptual graph structures (i.e., the superstructure of discourse) involve various semantic networks integrating text-derived information with prior world knowledge and conceptual frame structures (such as cognitive scripts or schemata). The global semantic content of a text can also be called discourse macrostructure.

Experimental work has provided evidence that there is an impairment of the linguistic representation of discourse in patients with left hemisphere damage and aphasia. Disturbances of cohesion in aphasics' texts include an overall reduction of cohesion complexity (i.e., lack of complete syntactic constructions, lack of conjunctions), high proportion of deictic pronouns ("this", "that", etc.), and pronouns without the appropriate referential word or context (Huber, 1990). Cohesion errors occur in all types of aphasia but it is difficult to establish a pattern of disturbances in relation to particular types of aphasia.

Some difficulties at the level of processing language units of discourse have also been noticed in the right hemisphere damaged (RHD) population. Some of these patients show problems in the appropriate use of reference in spoken discourse (Joanette & Brownell, 1990).

Processes connected with discourse coherence seem to be preserved in mild to moderate aphasia caused by left hemisphere damage. Despite their language problems aphasic subjects are able to produce and comprehend the main ideas of discourse; they provide well-organized texts, including the most important content.

Specific impairments of text coherence were found in subjects with damage to the right brain hemisphere. The texts produced by some of these patients are characterized by a wrong order of information, many personal remarks, focus on insignificant components, and reduction of main information. They show difficulty in interpreting and using contextual data and in integrating content of discourse with new information (Herzyk, 1985; Osiejuk, 1994).

Macroprocessing difficulties are present in the discourse of both left and right brain-damaged populations. Marked disorders can be observed when the task requires abstract thinking, for example, in a task of supplying morals, titles, or gists to narrative texts (Ulatowska, Allard & Bond-Chapman, 1990).

The existing data suggest that, apart from the frontal lobes (as Luria assumed), the remaining structures of both hemispheres are necessary for correct processes at all levels of narrative discourse. One of the important problems for future study relates to the role of each hemisphere in the processing of particular discourse representations.

The background research

In our study on script knowledge reflected in discourse of aphasics and RHD subjects, interesting findings regarding the levels of propositions and conceptual graph structures of discourse in these populations were obtained (Łojek, 1994; Osiejuk-Łojek, 1996). As con-

ceptual structures, scripts influence production as well as understanding, remembering, and recalling the content of discourse. Scripts guide and facilitate identification of discourse participants, objects, and actions (Adams & Collins, 1979; Brasalou & Sewell, 1985; Bellezza & Bower, 1981; Gibbs & Tenney, 1980; van Dijk & Kintsch, 1983; Yekovich & Walker, 1986).

The purpose of this study was to investigate the preservation of different discourse representations referring to propositional and conceptual levels of discourse in left hemisphere damaged (LHD) subjects with aphasia and in RHD patients.

Subjects

Fifteen mild to moderate aphasics (LHD), 15 RHD, 15 neurological patients without central nervous system damage (C1), and 30 normal controls (C2) took part in the investigation. The groups were comparable in regard to mean age, gender, education level, and duration of illness in the case of patients. All subjects were right-handed. None of the subjects showed evidence of a clinically detected dementia.

Etiology of brain damage in both experimental groups was established on the basis of neurological data. Most of the patients (LHD – 14; RHD – 13) suffer from cerebral vascular infarcts. The localization of cortical lesions in both groups was very heterogeneous. There were 7 aphasics and 7 RHD patients with anterior lesions involving frontal lobes and other parts of the cortex (e.g., the parietal and/or temporal lobes). The remaining subjects suffer from posterior damages that did not involve the frontal lobes (e.g., the temporal, parietal, and/or occipital lobes).

The general level of cognitive functioning, measured by the full scale of the Wechsler Adult Intelligence Scales (WAIS), was average in the LHD (Mean IQ=98,9) and RHD patients (Mean IQ=100,3), and high in the control group (Mean IQ=111,1).

Materials and methods

A battery consisting of two sets of experimental tasks was designed to elicit discourse reflecting knowledge of scripts. The sets consisted of the following tasks:

- 1) Recall of a simple story based on a script (first set: Story about a robbery; second set: Story about Mr. Kowalski reading a newspaper). This task tested both the knowledge of scripts and abilities to produce narrative discourse structures.
- 2) Production of titles to the stories. The task required making an inference based on the text of the narration.
- 3) Description of a social situation referring to a script (first set: the situation of borrowing money; second set: asking the way in an unfamiliar town). Script knowledge and abilities to produce discourse structures were examined in this task.
- 4) Generation of similarity between situations described in the first and third tasks. The task activated the process of generalization.
- 5) Listing of examples of other situations having the same purpose as those described in the first and third tasks. In this task, knowledge of scripts was investigated.
- 6) Description of a plan (i.e., outlining the general course of action usually taken when money or information is lacking). This task examined the knowledge of plan structure which is a part of script knowledge. Plans consist of abstract and concrete elements. Abstract elements relate to the prerequisites of an action (e.g., considerations on possible needs, methods, and consequences of an action). Concrete elements represent particular ways of reaching a goal (e.g., "Call somebody to get information").

The tape-recorded data were transcribed verbatim. The responses regarding stories were compared with the content and structure of the original story. The descriptions of social situations and plans produced by the subjects were matched to the model texts consisting of propositions derived from the discourses of 30 normal controls. Discourse measurement with regard to stories, social situations and plans included the overall amount of information, appropriateness versus inadequacy of text content, the sequential order of information, and the preservation of discourse frames.

The level of appropriateness and abstraction of titles, similarities and examples were estimated by three independent raters on a five-point scale (from 5 to 1). Higher scores indicated better estimation. The reliability coefficient estimated by the median interrater correlation ranged from 0.72 to 0.89.

Results

Statistical analysis revealed that both LHD and RHD patients produced less overall information describing stories (first task), social situations (third task), and plans (fifth task) in comparison with healthy controls ($F(3,71) = 7.28, p < 0.0001$).

Considering the particular tasks, aphasics and RHD patients tended to omit different types of information. A reduced number of abstract elements in plans was the main limitation in aphasics' discourse. The differences were significant as compared to healthy subjects in the first ($F(3,71) = 3.31, p < 0.05$) and the second plan ($F(3,71) = 5.03, p < 0.05$). The number of concrete elements provided by aphasics was comparable to both control groups. Aphasics' plans usually included an incoherent sequence of concrete methods of acting. In contrast to plans, the amount of information in the descriptions of stories and social situations produced by the LHD patients was comparable to that of the control groups. All texts provided by aphasics were also characterized by the appropriate sequence of information. The number of inadequate remarks and commentaries made by aphasics in all discourse tasks were comparable to the normal controls.

A significant deficit in the production of a particular unit of information observed in the RHD subjects concerned recall of the first story. These patients tended to omit important information referring to the setting, action and end of the story. The remaining groups obtained significantly higher results for that story than the RHD subjects. Disordered sequence of information was the second important impairment observed in the RHD patients' discourse. The total amount of errors in order of information was significantly higher in the RHD subjects than in all remaining groups ($F(3,71) = 5.43, p < 0.01$). Moreover, the mean number of inappropriate information in all tasks was significantly higher in the RHD patients than in both control groups ($F(3,71) = 4.38, p < 0.05$).

All subjects produced titles to both stories and there were also no marked differences between the groups on the number of given examples in both sets of tasks. The task of providing similarity was not easy for all the subjects, but appeared to be the most difficult for aphasic patients. The overall number of subjects who finally succeeded in producing similarity in both sets of tasks was similar in the control and the RHD groups, but was significantly lower in aphasic than in healthy subjects ($F(3,71) = 4.79, p < 0.05$).

The scores on appropriateness and abstraction of titles, similarities and examples estimated by the independent raters revealed that the means of ratings ranged from 3 to 4 points in all groups. Standard deviations ranged from 0.35 to 1.28 for appropriateness and from 0.33 to 1.83 for abstractness of discourse. None of the aphasics' or RHD patients'

utterances was estimated as completely inadequate. However, the total result on appropriateness was significantly lower in both experimental groups in comparison with the control subjects ($F(3,56) = 7.88, p < 0.0001$). The total score on abstraction was also markedly lower in the RHD patients than in both control groups ($F(3,56) = 2.81, p < 0.05$).

The differences in discourse performance between brain damaged subjects with anterior (involving the frontal lobes) and posterior cortical lesions (not involving the frontal lobes) in the LHD and RHD groups were also analyzed. There were no significant differences between subjects with anterior versus posterior lesions either in aphasic or RHD groups on any of discourse measures.

Discussion

The findings of the study showed preserved abilities to produce information belonging to a given semantic category of script knowledge in mild to moderate LHD aphasics and RHD patients. These subjects appropriately named social situations presented in stories, described two social situations, and provided many appropriate examples of methods suggesting how to get money and information. These data are in agreement with other studies on script knowledge in brain damaged populations (Armus, Brookshire & Nicholas, 1989; Ostrove, Simpson & Gardner, 1990; Roman, Brownell, Potter, Seibold & Gardner, 1987).

These findings also showed that the conceptual graph structures of discourse referring to the knowledge of scripts were preserved in both brain-damaged groups. Interestingly, similar results were obtained in subjects with anterior and posterior lesions to right and left hemispheres. The fact that none of the aphasic subjects suffered from a typical dynamic aphasia might have influenced the final results of the study. However, the data from this research indicate that knowledge of well-known social situations is not connected with any particular part of the cortex. It seems that this kind of knowledge is represented more globally in the brain.

Specific deficits in the discourse of both experimental groups were also noted. The findings are concordant with the previous research (see Osiejuk, 1994, for review). The most marked disorders in the LHD group were found in description plans, especially in providing abstract elements. Describing a plan, aphasics usually omitted general preconditions and listed concrete methods of achieving a goal. These difficulties pertained to the limited amount of information but not their appropriateness or order. The observed deficits in aphasics' performance should be interpreted in terms of impairment of discourse macroprocessing rather than in terms of disorder of a specific text structure.

Disorders of discourse macroprocessing in aphasic patients poses the question of the language versus the cognitive mechanism of this disturbance. In the present study the utilization of the same words (e.g. "money") was required in tasks of different language and cognitive difficulty. Interestingly, aphasics successfully utilized these notions in the tasks of simple knowledge reproduction involving a lot of language abilities (in making stories, social situations, and providing examples). On the other hand, they were not able to use the same word in intellectually more difficult discourse tasks which required only a one-word or simple sentence (in providing similarities). This finding may suggest that the deficits of aphasics in discourse macroprocessing are due more to cognitive decline than to linguistic limitations caused by aphasia.

The impairment of text structure was significantly apparent in the RHD group. The structure of a story produced by these patients often did not contain information about the

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