Order Number 9029915

Dissolution of discourse in patients with unilateral brain damage

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City University of New York, 1990

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DISSOLUTION OF DISCOURSE IN PATIENTS WITH UNILATERAL BRAIN DAMAGE

By

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A dissertation submitted to the Graduate Faculty in Speech and Hearing Sciences in partial fulfillment of the requirements for the degree of Doctor of Philosphy, The City University of New York

1990

This manuscript has been read and accepted by the Graduate Faculty in Speech and Hearing Sciences in satisfaction of the dissertation requirements for the degree of Doctor of Philosphy.

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Abstract

DISSOLUTION OF DISCOURSE IN PATIENTS WITH UNILATERAL BRAIN DAMAGE

by

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Although deficits in phonological, lexical-semantic and syntactic processing are apparent in left brain-damaged (aphasic) patients, recent studies have demonstrated that the structure and organization of discourse remains intact. In right brain-damaged patients preserved phonological processing and subtle deficits in lexical-semantic and syntactic processing have been documented. However, there is a paucity of research which has examined the discourse of this population.

The purpose of the present study was to examine the discourse of right brain-damage subjects in order to distinguish specific linguistic impairments from the contributions of visual-spatial and emotional deficits associated with right hemisphere pathology. Three groups of 12 subjects were tested: patients with

unilateral right brain-damage, patients with unilateral left brain-damage, and normal controls drawn from the same hospitals and rehabilitation agencies.

Results demonstrated that patients with right brain-damage produce discourse that is diminished in higher-level semantic content, contains ambiguous use of reference and often lacks some of the essential organizing components. Further, patients with right brain-damage were inappropriate in using verbal pragmatic devices, especially when the content of their discourse was emotional. Results strongly suggest that there is a difference in pragmatic competence between the two sides of the brain. A preliminary model of language processing is proposed in an effort to account for the hemispheric-dependent mechanisms used in language processing and their complementary responsibilities in discourse production.

DEDICATION

This dissertation is dedicated to the memory of my father, Joseph Bloom, who taught me about the importance of my work.

ACKNOWLEDGEMENTS

This project took the better part of two years to complete. There are several people who made the arduous task bearable.

First, I would like to thank the members of my dissertation committee. It has been a priviledge working with Professor Loraine K. Obler. Dr. Obler's thoughtful contributions to the dissertation helped create a project that was both innovative and realistic. I am indebted to Professor Joan C. Borod for her suggestions on the experimental design and her ongoing support of this project. Working at the computer with Professor Louis Gerstman was truly an unforgettable experience. I know I have learned from the best.

Thank you to Dr. Joyce West who served as the outside examiner. Dr. West's clinical insight enriched the interpretation of the data.

Several colleagues were enormously helpful in

locating appropriate subjects for the experiment: Renee Kaufman, Susan DeSanti, Margaret Meth, David Jagoda, Grace Oliver, Ann Freund, Deborah Nemchek, and Michael Groher. I could not have completed this project without their generosity.

The speech-language pathologists who carefully reviewed and judged the transcripts deserve a special thank you: Veronica Barile, Caroline Marimaldi and Sandra Xaba. Thanks also to Gitty Braunfeld for her assistance in transcribing the audiotapes and reliably tabulating the data.

This project could not have been completed without the understanding of my colleagues at City College. I would like to thank Dr. Betty Popper and Dr. Brian Shulman for their flexibility and encouragement. A special thank you to Dr. Annette Zaner for her candor and advice.

As a student at the Graduate Center I have learned to rely on the guidance of Dr. Irving Hochberg and the courtesy of Ms. Loretta Walker. I thank them both for their support.

I am indebted to my friend Phyllis Mark for her special insight and endless hours of conversation. Thanks also to Nancy Mahecha for her friendship during the many years of study.

I would be remiss if I neglected the members of my family. I am indebted to my brother Harris for his honesty, humor and his perspective on the educational system. I thank my mother for her love and her faith in my accomplishments. She has taught me the values of patience and perseverance.

My wife Deborah made contributions to the project that are too numerous to list. She not only assisted in subject recruitment but also in typing many drafts of the proposal and dissertation. Most importantly, her perspective on the dissertation process showed me that life can florish, even in the face of what seems to be an unbearable amount of work. Finally, I would like to thank our daughter Jessica who was born during a second draft of the results chapter. Her delightful coos and gurgles are a wonderful conclusion to this work.

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INTRODUCTION

Research on the language behavior of aphasic individuals has provided overwhelming evidence that the left hemisphere is dominant for the expression and reception of linguistic structure up to and including the sentential level. However, recent investigations have demonstrated that the discourse of aphasic individuals may remain intact in that its structure adheres to the linguistic rules for the well-formedness of text.

In contrast to the research on aphasia, investigations on language deficits resulting from right hemisphere damage are inconclusive. Anecdotal reports have suggested that following right hemisphere damage expressive language may become copious and tangential. However, the assertion that right brain-damage results in an impairment in the organization and structure of discourse remains to be experimentally tested.

The idea that the right hemisphere possesses some language function runs contrary to the classical notion that language processing (both comprehension and production) is located in the left hemisphere. Dichotic listening and tachistoscopic lateralization studies have implicated the right hemisphere in processing nonlinguistic auditory and visual-spatial material, respectively. Research on split-brain subjects suggested that each hemisphere is specialized for a different cognitive processing style. Recognition that damage to the right hemisphere can impair certain aspects of language (e.g. comprehension of concrete nouns) has led to the view that language is processed by both hemispheres and that the hemispheres have complementary responsibilities in language processing. However, the nature of these hemispheric responsibilities in discourse production is not fully understood. Describing the structure and organization of discourse in patients with unilateral brain-damage should serve to uncover what these respective responsibilities are.

The purpose of this study is to investigate the effects of right hemisphere damage upon the structure of language beyond the phonological, lexical and

syntactic levels. An investigation of this nature has both theoretical and practical significance. This study will clarify current theories about the hemispheric-dependent processes that contribute to the production of language. Further, it will provide a unique opportunity to examine the theoretical relationships among language form, content and the more recently proposed pragmatic component of linguistic systems. Clinically this investigation has implications for the diagnosis and management of communication disorders in brain-damaged adults. Tests employed to assess language disorders in this population typically emphasize the expression and reception of sentence level stimuli. Consequently patients with language disorders at the level of discourse are often not enrolled for treatment by speech-language pathologists.

Chapter 2.

REVIEW OF THE LITERATURE

Studies of adult language disorders beyond the phonological, lexical and syntactic level are a relatively recent addition to the literature. The categories or abstract units used for evaluating language at the level of discourse are derived from the research on pragmatics. Broadly defined, pragmatics includes features of the social context which may interface with the phonological, semantic or syntactic components of a communicative exchange (Foldi, Cicone and Gardner, 1983). Despite the fact that the study of language use in context has been a major theme in the literature for over a decade, there is considerable discrepancy among researchers when selecting the abstract pragmatic units used in discourse analysis (Wilcox, 1983) and little understanding of the way deficits in pragmatics stratify across disordered populations (Prutting and Kirchner, 1987).

To understand the current views of pragmatics and its application to the analysis of discourse, issues related to the study of language in context will be discussed. The literature review will begin with an

overview of pragmatic theory and will then describe the abstract units that govern the structure and organization of discourse. To elucidate what is known about the preservation and dissolution of discourse structure in brain damaged patients, relevant research on patients with unilateral brain-damage will be reviewed.

Finally, the controversial issue of hemispheric responsibility will be discussed in order to examine the specialized cognitive-linguistic mechanisms which underlie the production of language at the level of discourse.

Pragmatic Perspectives on Language

In the discipline of linguistics a distinction is drawn between the formalist and functionalist approaches to language. This conceptual distinction is relevant for those seeking explanations into the nature of language disorders. Advocates of a formal linguistic paradigm define language as a set of sentences generated by a speaker. For example, de Saussure (1916) discussed the difference between language (langue) and its use (parole) and Chomsky

(1965) distinguished between linguistic competence and performance. Although these formalist descriptions separated knowledge of language from its use, the focus was on characterizing the internal aspects of the sentence. Functionalists, in contrast, view communication as the primary function of language and pragmatics as the overall framework from which language is investigated.

The early pragmatic work in linguistics was based to a large extent on the notion of speech act analysis as was first discussed by Austin (1962) and Searle (1969). Motivated by the philosophical school of American pragmatism (i.e. Pierce, 1878), Austin attempted to reinterpret knowledge as function. To Austin sentences were more like acts than factual statements since some sentences could not be verified as true by the listener. Austin argued that sentences which contained certain verbs (e.g. promise, warn, deny) could not be regarded as true or false. He labeled these verbs "performatives" since by producing them one also performs an act.

Searle (1969) clarified Austin's work by devising a taxonomy of speech acts. Searle asserted that the

speech act is the basic unit of communication and proposed that the components within each unit function simultaneously when a sentence is uttered. According to Searles' taxonomy the components of a speech act include:

1. the utterance act - the words used
2. the propositional act - what the words make reference to
3. the illocutionary act - the speaker's intention
4. the perlocutionary act - the impact of the utterance on the listener

Searle (1965) stated, "It is not... the symbol or word or sentence... which is the unit of linguistic communication, but rather it is the production... in the performance of the speech act that consititutes the basic unit of linguistic commmunication" (p. 222). With the primary emphasis on the intentional (or functional) component of an utterance, language is viewed as an instrument of social interaction rather than a system of symbols which represent thought. To the formalist, language disorders exist within the language. From a pragmatic perspective, language

disorders exist outside of the language in the context of a communicative event.

Communicative context includes a multiplicity of features which must be meaningfully integrated into the verbal message. In order to deal with the breadth of the contextual issue it is necessary to look within the discourse (the linguistic and nonlinguistic context) as well as outside of the conversation in the cognitive, social and physical contexts (Prutting, 1982). Certain contextual features are captured by analyzing the rules which govern the structure and organization of discourse.

Pragmatic Features of Discourse

The set of abstract social, cognitive and linguistic rules which define how elements combine within a discourse will be discussed. The absence of a standardized classification system to categorize these features has produced a literature that is disparate and vague. Despite these limitations, the effort here is to identify the social, cognitive and linguistic features entailed in discourse and understand their interrelationships.

Beyond the analysis of a sentence, social context becomes central to the interpretation of an utterance's meaning. The work of Grice (1975) has focused on describing the role of social context in a communicative exchange. Grice discussed the "cooperative principle" to explain how speakers communicate information that is not present in the propositional content of their sentences. Grice hypothesized that participants in a conversation learn a set of rules that specify that a speakers' information should be truthful, unambiguous, relevant and nonredundant. When the participants adhere to these cooperative rules, inferential jumps between sentences are possible. This enables the listener to supply missing information and interpret the indirect meaning of the speaker. When social conversational rules are violated, participants must actively search the linguistic and nonlinguistic context in order to interpret the meaning correctly.

Several investigators have discussed the social aspects of communicative behavior under the assumption that a speaker's overriding motivation for language is affective commmunication. According to Wilcox (1983) socially appropriate communication consists of three

general skills:

1. the ability to initiate and sustain a communicative interaction
2. the ability to use linguistic and nonlinguistic context when encoding and decoding messages
3. the ability to respond to receiver feedback that indicates a lack of understanding

Wilcox stresses that during actual communciation it is difficult to separate definitively linguistic and social skills. However, appropriate social communicative conventions may exist in the face of linguistic inaccuracies. Thus, when describing pragmatic social features Wilcox asserts that the primary emphasis should be on characterizing the social appropriateness of the interaction.

Prutting and Kirchner (1987) attempted to pinpoint the pragmatic features of communication which are linked to judgments of social competence. Accordingly, they developed a descriptive taxonomy of 30 parameters which comprise socially appropriate communicative behavior in a natural context. Included in the

taxonomy are verbal behaviors (e.g. topic selection, turn taking), nonverbal behaviors (e.g. facial expression, eye gaze) and paralinguistic behaviors (e.g. vocal quality, prosody). These pragmatic features are continuous throughout discourse and are derived from perceptions of a speaker's performance in a conversational context.

Cognitive approaches to discourse are chiefly concerned with identifying the psychological mechanisms that operate during the processing of connected language. Mental operations such as attending, memorizing and generalizing are considered in an effort to construct models of what is represented in the mind of a speaker. Chafe (1977) maintains that analyzing how individuals produce discourse provides insight into the nature of thought and the organization of human knowledge.

Generally, models of cognition de-emphasize the importance of social influences and view the motivation for using language as intrinsic. Language is believed to derive from the general intellectual capacity to symbolize. Piaget (1952) defines intelligence as "a particular instance of biological adaptation" (p. 3-4)

and "a system of living and acting operations" (Piaget, 1970, p.7). According to Piagetian theory the human organism is specially equipped with cognitive structures designed to integrate new sensory information into the conceptual basis of information already established. These structures called schemata are "the organizational properties of intelligence... created through function and inferable from the behavioral content whose nature they determine" (Flavell, 1963, p. 17).

According to Rumelhart (1980), schemata are data structures used to store concepts. In addition, each schema contains "the network of interrelations that is believed to normally hold among the constituents of the concept in question" (p. 34). In this theory schemata are constructed interpretations of events, objects or actions, brought by semantic manipulations into comprehensible units that constitute an individual's view of reality. In addition to constructing comprehension, schemata provide a source for predictions about unexperienced events.

The notion of a schema as a linguistic unit used by a speaker to structure his or her discourse has its

origin in cognitive theory. Bruner (1975) likens schemata to scaffolds which provide the essential undergirding for discourse structure. In Bruner's transactional model of language development the rules of discourse are acquired first, through interaction and joint reference with an interpreting adult. The scaffolding provides the base upon which the more analytical linguistic units are later mapped.

According to Duchan (1985) schema theory suggests that a speaker and a listener must have knowledge about what ordinarily happens. Shared knowledge provides speakers with a cognitively based framework around which language meaning is constructed. That is, schemata allow the speaker and listener to construct knowledge when only part of the information surrounding an object, event or situation is received. When a suitable underlying scheme links the meanings of the utterance within a segment of discourse its context is said to be coherent (Van Dijk, 1977). Thus, coherence is a general cognitive concept which relates to the well-formedness of text in terms of plausibility, conventionality, and conclusiveness. (Ulatowska, North and Maculuso-Haynes, 1981).

Linguistic approaches to discourse are concerned with describing the formal and structural properties of rules governing the well-formedness of discourse and identifying the abstract units entailed within discourse. In addition, linguistic approaches to discourse attempt to discover the cohesive devices that relate these abstract units to each other (Halliday and Hasson, 1976).

Studies have revealed that there are four basic types of discourse, each with its own internal structure and organizational pattern. These four types are narrative, procedural, expository and conversational discourse. According to Clark and Clark (1977) each type of discourse needs to be examined separately as each condition confronts the speaker with its own set of linguistic and pragmatic demands and each has its own grammar. Roth and Spekman (1986) note that narrative and procedural discourse require the speaker to demonstrate different abilities then are necessary in conversational discourse. Narratives carry the expectation that the speaker maintain an verbal monologue and that the listener assume a relatively passive role. Conversational discourse

requires that the speaker and listener participate actively in a verbal exchange of information.

Ulatowska, North and Macaluso-Haynes (1981) have provided a characterization of the different types of discourse. Conversational discourse involves the speaker and listener in a turn-taking exchange of information. Expository discourse is centered on a particular topic and does not have to contain a chronological sequence. Procedural discourse consists of steps, presented in an order that is either conceptually or chronologically linked. Procedural discourse is goal oriented because the focus is on conveying how something is done, not on who does it or what is done as in narrative discourse. Narrative discourse is a description of a real or imagined happening expressed as a sequence of events or episodes. A fully formed narrative consists of at least one episode. Episodes have essential and optional components which contribute to the coherence of the discourse.

This discussion will be limited to the two types of discourse most extensively studied: narrative and procedural. Narrative discourse has a discernable

internal organization and procedural discourse is marked by its syntactical simplicity and constrained temporal order (Ulatowska et al, 1981). Both these forms will be discussed in greater detail.

To specify the formal set of rules underlying the construction of narrative discourse various story grammars have been proposed (Thorndyke, 1977; Stein and Glenn, 1979). Story grammars contain indications for parsing a story into major constituents, just as grammars do for sentences. Although variation among the different rule systems exists, they all include similiar components in a similiar order of occurrence.

The story grammar proposed by Stein and Glenn (1979) consists of a network of story components and the relations linking the components together. A prototypical story usually involves an animate or inanimate protagonist in a particular time, location, or context (setting) who faces a physical obstacle, moral or personal dilemma (initiating event). The protagonist's goals, thoughts and plans are devised (internal response). The protagonist then makes attempts at obtaining a goal or solving the problem (attempt), meeting with success or failure (direct

consequence). Depending on the outcome, the protagonist may try an alternative strategy and the story ends with the protagonist's feelings about what has occurred (reaction).

An episode is a subset of the six major story components which comprise the most salient unit of analysis in the story. A complete episode has been described by Stein and Glenn (1979) as a behavioral sequence of events containing:

1. some reference to the motivation or purpose of the character's behavior (an initiating event or an internal response).

2. an overt goal-directed action (an attempt), and:

3. the attainment or nonattainment of the goal (a direct consequence).

Stein and Glenn (1979) note that setting information and reactions provide information that is not crucial to the development of episode structure. If either a motivating state, an attempt or a consequence is missing from an event sequence, then the episode is judged incomplete. Episodes are connected

to each other by four independent types of relations. The "then" relation connects two episodes whose events occur successively in time. The "cause" relation implies a direct causal relationship between the events in two episodes. The "and" relation links two episodes with events occurring simultaneously. "Embedded" relations occur when one episode is nested within another.

Ulatowska et al. (1981) propose a basic temporal super- structure for operationalizing and sequencing components of narrative and procedural discourse. The essential components established for a narrative grammar include:

1. Setting- statements that introduce information related to the identification of the participants, the time of occurence and the place.

2. Complicating Action - refers to information about the events in the narrative.

3. Resolution - indicates the outcome of the actions.

Other components that are frequently found in narratives but are not required to produce an acceptable grammatical text include:

1. Abstract - refers to a synopsis of what happened.
2. Coda - indicates the moral or conclusion.
3. Evaluation - is a judgment of the events.

Procedural discourse may contain an introducer, resolution and coda. It can also include an evaluation, though less frequently than in narrative discourse.

In summary, the pragmatic features of discourse include numerous social, cognitive and linguistic elements that are inherent in a given communicative situation. The social aspects of discourse take into account the role of context in an exchange of information with the focus on identifying the behaviors that constitute socially appropriate communicative behavior. Cognitive approaches to discourse evoke the notion of a cognitively based framework that aids the speaker in generating a story and the listener in comprehending connected language.

Linguistic approaches are concerned with the rule-governed nature of discourse, its constituent elements and the organization of these elements. Generally the researchers and clinicans who focused on discourse took exception to the limitations of sentential grammars in explaining the role of linguistic and extra- linguistic context in the production and comprehension of language. An analysis of discourse permits the study of communication, not only as manifest through abstract language systems (e.g. phonology, syntax, semantics) but also as manifest through actual text and context-dependent linguistic and cognitive abilities (Van Dijk and Kintsch, 1983).

Effects of Brain Damage on Discourse

In normal-language users the cognitive, social and linguistic systems interact in an orderly way. When these operate normally many of the processes underlying language are not evident. Neurological insult to the brain may cause a disruption in the synergistic processes of language. When language is disrupted selective impairment of the components of language may be observed. The selective impairment of language at

the level of discourse will be discussed in patients with unilateral left brain damage and unilateral right brain damage.

Several studies have attempted to characterize the discourse produced by various clinical groups of aphasics. Berko-Gleason et al. (1980) investigated the ability of Broca's patients, Wernicke's patients and normal controls to retell narratives composed of several connected themes. Clear differences in the narrative style were found among the three groups. Generally, aphasic left brain damaged patients demonstrated a reduction in the number of meaningful themes recalled and an absence of anaphora. The narratives of the Broca's subjects contained fewer lexemes, use of direct speech and more nouns than verbs. Wernicke's subjects were distinguished by the use of many words, concatenated sentences, an abundance of deictic terms and a preference for verbs over nouns. Berko-Gleason and colleagues noted that it was common for the aphasic patients to seize on a salient theme, paraphrase it several times and neglect less important parts of the story.

Yorkston and Beukelman (1980) attempted to develop a technique for quantifying connected speech samples of aphasic individuals as they recover from moderate to the mild range of severity. Verbal picture descriptions from mild to moderate aphasic speakers were compared to those elicited from normal adults and geriatric speakers. These samples were compared on the basis of amount of information conveyed (content units) and two measures of efficiency including speaking rate (syllables per minute) and rate at which information was conveyed (content units per minute). Results indicate an inverse relationship between severity of aphasia and amount of information conveyed. However, mild and high moderate aphasics tended to communicate as much information as normal speakers. Both efficiency measures differentiated groups of mild and high-moderate aphasics from normal speakers as well as differentiating low-moderate from mild aphasic speakers.

Ulatowska, North and Macaluso-Haynes (1981) described the abilities of mildly impaired aphasics and normals to produce narrative and procedural discourse. The aphasic subjects' retelling of narratives were similar to, but shorter and simpler than those of the

nonaphasic subjects. The aphasics produced well structured discourse in that elements that were essential to the overall theme of the stories (i.e. settings, complicating actions, resolution) were present and the chronological order of events was preserved. The aphasics demonstrated a selective decrease in information that did not affect the plot structure. Mildly impaired aphasics used cohesive devices properly for the identification of participants in the action and for the connection of events. Ulatowska and colleagues proposed that the discourse errors of aphasics differed only in degree, not qualitatively from those of normals.

Ulatowska, Freedman-Stern, Doyle, Macaluso-Haynes and North (1983) described the abilities of moderately impaired aphasics and normals to produce discourse when retelling stories, summarizing stories and giving morals to stories. The data were analyzed in terms of sentential grammar, discourse grammar and subjective ratings of clarity and content of language. The results showed that aphasics produced well-structured discourse characterized by preserved narrative structure. The aphasic's narratives had all the essential elements, such as settings, complicating

actions and resolutions. However, the language of their narratives was reduced in both quantity and complexity and had errors that were most apparent at the sentence level. A comparison of anterior and posterior aphasics did not show any conspicuous differences in performance except that posterior aphasics produced more language. Clarity of language of the posterior group was evaluated higher than that of the anterior group.

Narrative structure was also investigated in aphasic patients by Ernest-Baron, Brookshire and Nicholas (1987). Aphasic and non-brain damaged subjects listened to and retold two narrative stories three times in succession. Both aphasic and nonaphasic subjects were affected by story structure in that they retold a greater proportion of information units that were central to the story structure then information units that were peripheral to the story structure. In both groups there was an increase in the amount of information retold across the three retellings, although only the increase from the first and second retelling were statistically significant. Non brain-damaged subjects always retold more information than aphasic subjects, although the differences were

never significant. In addition, both subject groups maintained a constant order of information units across the three retellings. The most suprising result of the experiment was the similiarity among groups representing different aphasia syndromes and between aphasic and non-aphasic subjects.

In sum, the studies that have evaluated discourse production of mildly and moderately impaired aphasics reveal a striking preservation of narrative structure. Although the aphasic individuals produced shorter and less complex narratives, the reduction of information occurred in the elements within the discourse that carry less information. The discourse produced by the aphasic subjects reflects a hierarchical organization of information and a selective reduction of information without the loss of the essential features of the text.

Although the aphasics were able to produce well-formed discourse, they were less proficient than normals at using certain cohesive devices. Cohesion in discourse is maintained by a number of linguistic devices which include reference, sequencing of verb tenses and use of conjunctions. Ambiguous use of reference was reported in the Berko-Gleason et al.

(1980) study. The authors noted that aphasics frequently produced pronouns without identifying the referent. Ulatowska et al. (1981) noted that aphasics use a higher percentage of definite articles for the first mention of nouns and characters in the narrative than do normal subjects. Use of definite articles signals the listener that he or she should know the exact noun or character being referred to. Inappropriate use of indefinite or definite articles by aphasic subjects signifies a violation of an agreement between speaker and listener. As in the study by Berko-Gleason et al., Ulatowska et al. (1981) also noted that aphasics tend to shift verb tenses frequently and produce a restricted range of connectors. Inappropriate use of these cohesive devices demonstrates a disruption in the aphasic's knowledge of the relationships between linguistic elements in the text. These researchers note that the errors found in aphasic subjects are also found in the discourse of normals, but to a lesser degree. The authors suggest that left brain-damaged patients maintain the ability to utilize certain elements of the context. It is not clear, however, what strategic devices or pragmatic features are available for these patients to achieve their adequacy in communication.

Investigations of the behavioral effects of right brain-damage have indicated that visual-spatial processing deficits (Kimura, 1974; Piercy, 1960; Berlucci et al., 1979) and disorders in the expression of emotion (Borod et al., 1983; Gianotti, 1972; Gardner, 1975) are prominent sequelae of cerebral injury. Despite advances in delineating behavioral deficits, a precise characterization of the linguistic deficits which emerge following right brain damage has remained elusive.

Subtle receptive and expressive language impairments following right brain damage have been documented using traditional aphasia testing procedures. These measures have demonstrated lexical-semantic deficits (Gainotti, Caltagirone, Miceli and Masullo, 1981; Eisenson, 1962; Joanette and Goulet, 1987) and problems in auditory comprehension (Searlman, 1977; McNeill and Prescott, 1978; Van Lanker and Kempler, 1988). However, test stimuli used for the evaluation of aphasia are generally not divergent or sophisticated enough to reveal higher level linguistic deficits. As Myers (1984) asserts "right hemisphere communication disorders clearly fall outside the continuum of aphasic-like behavior (p. 191)."

Investigators have begun to examine the nature of language impairment beyond the sentential level in patients with right brain damage. Clinical observations that right brain-damaged patients tend to be literal minded, to miss nuances and overlook intended and connotative meanings have been supported in several studies.

Gardner and Denes (1973) evaluated aphasic patients' responses to connotative versus denotative material. Included in the experimental population were six right brain-damaged subjects. On the denotative section of the test, subjects were required to match a spoken common word to one of four pictures. On the connotative task subjects had to identify the one drawing out of two which was designed to capture the connotation of the target word. The right brain-damaged subjects performed very differently from the aphasic subjects. Firstly, the right brain damaged subjects frequently protested against the task. Secondly, those who participated produced significantly more errors on the connotative section than the aphasic subjects.

Myers and Linebaugh (1981) further investigated comprehension of connotative language in patients with

right brain-damage, aphasia and normal controls by examining their understanding of common idiomatic expressions. The subjects were presented with short sentences which ended with a common idiom. The outcome of each story could only be determined through an accurate interpretation of the idiom. Subjects were provided with five possible endings which varied according to the literal vs. accurate depiction of the idiom and according to the correct or incorrect context of the story. A final foil which depicted the opposite outcome of the story was also presented. The right brain-damaged group produced significantly more errors than either the controls or aphasic subjects and selected the literal depiction of the idiom more often than the appropriate one.

Winner and Gardner (1977) noted that right brain damaged subjects are particularly poor at interpreting figures of speech. In this study aphasic subjects were compared to right brain-damage subjects when matching a metaphoric sentence to its appropriate interpretation depicted in one of four pictures. The aphasic group selected more correct pictures than did the right brain-damaged subjects. The right brain-damaged group most often selected the literal depiction of the

metaphor. When asked to explain the meaning of the metaphors most of the right brain-damaged subjects provided an appropriate interpretation and appeared not to notice their visually incorrect picture choice.

It seems as though that right brain-damage results in a language deficit that is distinct from aphasia. The research supports the view that the right brain-damaged patients are impaired in many of the pragmatic aspects of language despite their seemingly intact syntax and phonology. Their problems with language exist beyond the sentential level and become more apparent when analyzed at the level of discourse. The research is unclear when identifying and describing the factors which mediate these deficits. That is, it is not certain if the pragmatic deficits of the right brain damaged subjects are motivated by visual-spatial or emotional factors or if the deficit is a specific impairment in the linguistic system. Attempts to characterize the underlying disorders which give rise to the profile of right hemisphere communication problems have been controversial.

Myers (1984) suggests that the right-brain damaged patients' deficit in visual-spatial synthesis on a

lower order perceptual level extends to a deficit in language on a higher level. Myers proposes that the right brain-damaged subjects' failure to use contextual cues in the visual environment results in a deterioration of their ability to process discourse.

Rivers and Love (1980) also asserted that disturbed visual-spatial processing underlies the language performance of patients with right brain damage. To test this hypothesis, visual-spatial tests were administered to right brain-damaged subjects, left brain-damaged subjects, and normal controls. On lower level visual-spatial processing tasks, such as word reading, picture naming and fragmented picture naming, the left brain-damaged group produced significantly more errors than the right brain-damaged groups and the normal controls. An oral story telling test which required subjects to utilize visual information depicted in three sequential pictures revealed a deficit in using the visual information to tell complete stories. Trained raters were also employed to judge the fluency, articulation, syntax and semantics of the subjects during the oral story telling task. The raters who listened to audiotapes consistently judged the right brain-damaged group as having mild

communication difficulties. In many cases, the right brain-damaged subjects displayed disturbances in story telling which equaled or exceeded many of the aphasic subjects. Rivers and Love concluded that right brain damage resulted in language that reflected deficits associated with the special contribution of the right hemisphere in higher level visual information processing.

Moscovitch (1983) suggests that the critical factor underlying the right brain-damaged subjects' problems with discourse is the right hemisphere's superiority in mediating emotion. According to Moscovitch the right brain-damaged subjects' difficulty in apprehending the emotional nuances of a situation is reflected in their processing of the pragmatic features of language at the level of discourse. In this view, disturbances in the use of prosody and facial expression contribute to the deterioration of discourse function in this population.

Wechsler (1973) used a narrative recall task to investigate the degree to which performance of brain-damaged patients is dependent on emotional content. When compared to the left brain-damaged

patients, the right brain damaged patients demonstrated greater impairment on recall of emotionally charged material. When the material was neutral, no difference between the left brain-damaged group and the right brain-damaged group was found. Wechsler's research provides support for the view that the right hemisphere plays a special role in the retention of emotionally charged linguistic stimuli.

Gardner, Brownell, Wapner and Michelow (1983) attempted to characterize the deficits of right brain-damaged patients on tests of complex linguistic processing. These tests were designed to assess subjects' abilities to comprehend, integrate and recall connected discourse in the form of narratives that contained spatial, emotional and noncanonical (bizarre) elements. Each subject listened to three versions of the same story. The stories were constructed so they could be elaborated through the insertion of either spatial, emotional or noncanonical elements. After hearing each version of the story, the subject was asked to retell it in as much detail as possible. The results showed that the recall of the right brain-damaged subjects differed qualitatively from that of the normal subjects. The emotional elements of the

narratives were particularly difficult for the right brain-damaged subjects. Recall of emotional elements frequently triggered inappropriate embellishments. The right brain damaged subjects also demonstrated difficulty in reacting appropriately to the noncanonical elements. In this study spatial elements in the stimulus paragraphs did not present difficulty for the right brain-damaged subjects.

Abilities in narrative organization in right brain-damaged subjects have been investigated by Huber and Gleber (1982). In their study, left and right brain-damaged patients were required to arrange a set of picture cards and a set of written sentences into a narrative storyline. The right damaged patients demonstrated more difficulty arranging pictures than sentences, whereas the left brain damaged aphasic patients demonstrated more difficulty arranging the written sentences. Huber and Gleber note that both groups of brain-damaged subjects rely more on the macro- rather than on the microstructure while organizing their narratives. These authors further suggest that right brain-damaged subjects utilize a pragmatic rather than a descriptive strategy in performing this experimental task.

Delis, Wapner, Gardner and Moses (1983) also investigated the narrative abilities of right brain-damaged subjects and found results similiar to Huber and Gleber (1982). Delis, et al demonstrated that right brain-damaged patient had greater difficulty than did normal controls, in performing a task requiring subjects to organize scrambled sentences into a story. These researchers interpreted their findings as indicating that right brain-damaged patients present deficits in integrating complex units of language (such as sentences) into a coherent whole (such as a narrative). They suggest that the right brain-damaged subjects fail to utilize the surrounding context as they process language.

Using an eight-frame rendering of a trivial story to elicit discourse, Joanette, Goulet, Ska and Nespoulous (1986) evaluated the amount of information in the oral narratives of right brain-damaged subjects and normal controls. Overall, the right brain-damaged subjects' narratives contained a smaller amount of information and appeared to be a subset of the information contained in the narratives of the normal controls. The authors report subjectively that the narratives of many of the right brain-damaged subjects

appear to be composed of bits of information extracted from the illustration that remain unintegrated in the connected discourse. Joanette et al. ask whether or not this problem is properly defined as a linguistic deficit and suggest that additional information about the integrity of the test populations' cognitive processes is necessary to fully answer this question. The authors tentatively conclude that the right hemisphere of right-handers is important for the full elaboration of language.

The literature reveals that patients with right brain-damage perform quite differently from normal controls on tasks involving the processing of narratives. Foldi, Cicone and Gardner (1983) note that despite the right hemisphere-damaged patient's competence with literal language they are severely disadvantaged because of difficulties with abstract meanings and problems verbally organizing and comprehending narratives. Summarizing experiments conducted in their laboratory, Gardner, Brownell, Michelow and Wapner (1983) report that when compared with patients with left hemisphere damage, those with right sided lesions exhibit excessive and rambling spontaneous speech, a tendency to focus on

insignificant details, use of tangential remarks, and difficulty in arranging sentences into coherent narratives.

Data documenting the respective roles of the hemispheres in discourse production have come from an additional source. Recently Lovett, Dennis and Newman (1986) have examined pronominal cohesion in the narrative discourse of three hemidecorticate adolescents and found hemisphere-dependent differences in overall narrative skill. Specifically, the two left hemidecorticate subjects did not plan their narratives in extended discourse units. In contrast, the discourse of the right hemidecorticate subject was economical in form but rich in information. The right hemidecorticate was the only subject who maintained simultaneous story lines with multiple pronouns and cohesively embedded referential relationships. Only the right hemidecorticate's narratives conveyed implication as well as explicit state. These authors imply that the differences found between the two hemispheres in narrative production are purely linguistic in nature. However, the stimuli used in the narrative retelling tasks does not vary in emotional or visual-spatial content; factors which may confound

hemispheric-dependent processing. Lovett et al. characterize the residual linguistic processes of each functioning hemisphere rather than the impaired processes of the damaged hemisphere. These findings are of interest because they strongly support the notion of hemispheric-dependent processing and are consistent with the literature on right brain-damage.

A number of studies have pointed to discrete and measurable impairments in the language of right brain-damaged subjects. It is apparent that the range of disturbances attributed to right brain-damage reflect an unawareness or insensitivity to the rules that govern discourse, especially in the use of context. Just why this is so, and how to characterize the role of the right hemisphere in language processing remains obscure. It may be that deficits in visual-spatial perception or emotional processing are reflected in the language of these patients. Alternatively, the communication disorders of right brain damaged patients may result from specific linguistic impairment.

Hemispheric Responsibility and Neuro. inguistic Organization

In the traditional view the two cerebral hemispheres posess qualitatively different processing strategies. Because of its role in language, the left hemisphere has been considered dominant for most intellectual functions. The right hemisphere has not been as thoroughly investigated as the left and has typically been labeled non-dominant and speechless. Recent evidence that right hemisphere damage can impair certain aspects of language processing, has challenged the classical notion of hemispheric specialization. It may be that language functions are divided between the left and right hemisphere. In this view of language organization, each hemisphere possesses complementary advantages which simultaneously contribute to linguistic processing. The nature of these hemispheric advantages in discourse production remains a matter of conjecture.

A more conventional explanation is that the language processing of brain damaged patients reflects an inability to use the specialized cognitive strategies of the impaired hemisphere. The notion of specialized cognitive processing strategies has its

origin in the research on split brain patients. This data suggested a general dichotomy in terms of the functional asymmetry of the cerebral hemispheres. Galin (1974) summarized this evidence by specifying that the left hemisphere employs "an analytical, logical mode of which words are an excellent tool, and the right ... a holistic, gestalt mode..suitable for spatial relations" (p. 573). In this view the language deficits associated with right brain damage reflect the residual cognitive processing style of the unimpaired left hemisphere but are improvished in the cognitive processing style particular to the right hemisphere.

While a general dichotomy in the cognitive processing strategies that characterize the hemispheres has been suggested, little is known about how these processing strategies interact. In summarizing the processes that characterize each hemisphere, West (1983) notes that there are two major cognitive repetoires: one that involves global processing and is associated with the right hemisphere and one that involves serial processing and is associated with the left hemisphere. West asserts that additional information on the cognitive abilities that remain intact following brain damage is required in order to

determine whether or not each hemisphere can assume the cognitive processing capacities of the other.

Chapter 3.

RESEARCH RATIONALE AND PLAN

The idea that any language functions can be localized in the right hemisphere is intriguing since it runs against the classic notion of exclusive left hemisphere language representation. Although a few studies have examined the performance of right brain-damaged subjects on complex linguistic tasks, there is a paucity of research that has formally examined the structure and organization of discourse in this population. Additionally, there are no studies that have systematically compared the discourse of left and right brain damaged patients. A definitive description of the underlying disorders that give rise to the language problems of right brain damaged patients awaits further investigation.

The purpose of the present investigation is to examine the structure and organization of discourse in patients with right brain-damage. In particular, this testing will be designed to distinguish the specific linguistic deficits from the contributions of visual-spatial impairments or emotional disorders to

the picture of right hemisphere symptoms. Further, a comparison of unilateral left and right brain-damage patients will be conducted in order to isolate the cognitive-linguistic mechanisms that underlie discourse processing in each hemisphere. Both formalistic and pragmatic measures were employed to evaluate the discourse samples. This will permit an understanding of the rules utilized to produced discourse in the various groups, as well as providing a measure of how the discourse impacts upon the receiver of the message.

To explore the effect of right hemisphere damage on the production of language at the level of discourse, the following three questions will be addressed in the present investigation:

1. Do the right brain-damaged subjects and/or left brain-damaged subjects demonstrate a dissolution in the structure and organization of discourse ?

2. Does the type of content (i.e., visual spatial, emotional, or procedural/neutral) alter the adequacy of the discourse in patients with brain damage ?

3. What pragmatic features of discourse are disrupted or preserved in patients with unilateral left or right brain-damage ?

Chapter 4.

METHODOLOGY

Subjects

Three groups of 12 subjects were selected from area hospitals and rehabilitation agencies according to the following criteria:

1. monolingual speakers of English,
2. no history of premorbid psychiatric disease, dementia, drug or alcohol abuse, or neurologic illness prior to the CVA,
3. no uncorrected peripheral visual or auditory impairment,
4. right handed prior to the CVA as confirmed by a score of +80 or better on the Modified Edinburgh Handedness Questionnaire (Oldfield, 1971).

There were two experimental groups of patients who have sustained a single episode of thrombotic or embolic cerebrovascular accident (CVA) over six months ago. One group consisted of patients with unilateral left brain damage. The second group consisted of patients with unilateral right brain damage. In all cases, the locus of lesion was confirmed by CT-scan. Subjects were selected to assure that there was a

similiar proportion of anterior and posterior pathology between groups.

Subjects in the experimental groups were selected to assure that they have adequate visual perceptual, temporal processing, cognitive and auditory comprehension skills. The following is the battery of tests designed to control for deficits in visual and temporal perception, cognition and auditory comprehension and was administered to all subjects.

Visual-form Discrimination Test (VFDT). The VFDT (Benton, Hamsher, Varney and Spreen, 1983) was developed to assess the capacity for visual discrimination of forms. The test includes 16 cards composed of a stimulus figure and four multiple choice responses. A subject must select from among the four designs the item which is the same as the stimulus figure. Each multiple choice array includes the correct design, an incorrect design involving displacement of a major figure, an incorrect design involving displacement of a peripheral figure and an incorrect design which involves a distortion of the major figure. A subject receives 2 points for a correct response and 1 point for every peripheral error response. A major distortion or no response receives 0

points. The maximum possible score is 32 and a score of 26 or above indicates normal performance.

In the present study the VFDT was used to assess a subject's ability to deal with fine discriminations of visually presented forms. Left-brain damaged subjects and normal controls who evidenced defective performance (a score below 26) were not included in this investigation. Since it is unlikely that a right-brain damaged subject achieve a score above 26 on this measure, the ability to deal with information presented visually in this group of subjects was assessed further by the picture description subtest of the Minnesota Test for the Differential Diagnosis of Aphasia (Schuell, 1965) as described below. Scores on the VFDT for the right- brain damaged subjects were obtained and used as an independent variable.

Picture Description Subtest of the Minnesota Test for the Differential Diagnosis of Aphasia. This subtest consists of a simple line drawing and was designed to assess a subject's ability to talk about information presented visually. A subject was required to describe a stimulus picture and was scored on the basis of the quantity of his or her verbal output according to the following guidelines:

0 = Normal performance. Uses sentences, integrates people and action.

1 = Same as above but with mild articulatory defect.

2 = Uses some phrases and sentences and names at least 10 objects correctly, but occasional breakdowns in communication occur: difficulty in thinking of a word or use of a wrong word.

3 = Chiefly enumeration of objects. Names 8 to 10 objects intelligibly and correctly.

4 = Names 5 to 7 objects intelligibly and correctly.

5 = Names 3 or 4 objects intelligibly and correctly.

6 = Unable to name 3 objects intelligibly and correctly.

To be included in this investigation, right-brain damaged subjects and left-brain damaged subjects were required to achieve a minimum score of 2 on this measure. This assured sufficient visual perceptual and linguistic abilities for this experiment.

Temporal Processing Screening Measure. To assure that a subject had the ability to process information temporally, a picture sequencing measure was developed. The content of the materials used in this task were designed to be equivalent in length and complexity to the stimulus pictures used to elicit discourse. Three sets of three-picture sequences were

presented to a subject, one set at a time. If the subject was unable to order the first set of sequence cards, the examiner explained the task and demonstrated how to order the pictures. In order to be included in the final sample a subject demonstrated the ability to order temporally the sequence cards using the left to right convention for placement of the cards on 2 out of 3 attempts.

Information Subtest of the WAIS-R. This subtest consists of 29 questions about general information to be answered by the subject; it belongs to the group of verbal subtests of the WAIS-R which also includes Comprehension, Vocabulary, Similiarities, Arithmetic and Digit Span. One point was given for each acceptable response allowing for a maximum raw score of 29. The raw score was translated into a weighted score, as was the case for all of the other subtests.

The Information Subtest of the WAIS-R was used in the present study as a rough estimate of verbal cognitive function. In order to be included in this study, a right- brain damaged subject and normal control obtained a minimum age-corrected, scaled score of 8 (score at the lower end of the average range). In

order not to discriminate against the language impaired left-brain damaged subjects, inclusion in this study was based on a performance measure, rather than a verbal measure of cognitive function.

Block Design Subtest of the WAIS-R. This subtest consists of 9 block designs to be replicated by the subject; it belongs to the group of performance subtests of the WAIS-R which also includes Picture Completion, Picture Arrangement, Object Assembly and Digit Symbol. This subtest was used in this study as a rough estimate of non-verbal cognitive function.

For designs 1 and 2, two points are scored for passing on the first trial and 1 point for passing on the second trial. For designs 3 through 9, four points are scored for each design successfully completed plus a maximum of 3 bonus points for quick, perfect performance. No credit was given for partially correct or incomplete performance. The maximum raw score is 51 points which was translated into a weighted score. Left-brain damaged subjects and normal controls achieved an age-corrected, scaled score of 8 (score at the lower end of average range) to be included in the study. Time limits were suspended for the left brain-damaged subjects.

Auditory Comprehension Subtest of the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1983). This subtest was designed to measure an adult aphasic's ability to understand a wide range of information presented auditorily. Tasks include single word and body part identification, comprehension of commands and understanding complex ideational material. Raw scores are converted into percentiles making it possible to compare a subject with a normative sample of 242 aphasic patients.

This test was used to rule out the presence of a significant auditory comprehension deficit which could affect performance on the tasks presented. Left brain-damaged subjects and right brain-damaged subjects who scored below the 60th percentile were eliminated from the final sample. A score at or below the 60th percentile was sufficient enough to assure comprehension for the experimental task but would not discriminate against all of the patients with posterior left hemisphere pathology. Typically, patients with posterior left hemisphere pathology demonstrate mild to severe deficits in auditory comprehension (Goodglass and Kaplan, 1982).

Neurologically normal adults drawn from the same hospitals and agencies as the brain-damaged patients served as a control group.

Groups were matched for age, education, and occupational level. The Hollingshead Redlich Scale (1977) was used to determine an occupation score. Further, the two experimental groups were matched for post onset time of the CVA.

Table 1-3 describes the characteristics of the right brain damaged (RBD), left brain damaged (LBD) and normal control (NC) subjects with respect to age, sex, education, occupational level, number of months post onset, and lesion localization. The three subject groups did not differ on demographic variables, with an overall mean age of 62.47 years (SD = .77), 13.02 years of education (SD = .14) and an occupational level of 4.91 (SD = .17). Six subjects were speakers of Black English. Three were in the left brain-damaged group, two were in the right brain-damaged group and one was a normal control. The typical socioeconomic occupational level was that of middle-class white collar worker.

Despite the presence of aphasia, the left brain damaged patients had sufficient auditory comprehension

TABLE 1: Age, sex, occupational level, educational level, months post onset time and lesion location of the right brain damaged subjects.

Subject	Age	Sex	Ed. Level	Occ. Level	MPO	Lesion Location
1	35	M	16	4	15	Right FP
2	61	F	12	4	106	Right P
3	62	F	16	6	11	Right P
4	62	M	11	4	39	Right FP
5	66	M	12	4	32	Right TP
6	59	M	12	6	51	Right FP
7	52	F	15	8	11	Right F
8	58	F	14	6	84	Right T
9	65	M	12	6	12	Right F
10	66	M	13	4	69	Right T
11	76	M	12	4	27	Right TP
12	75	M	12	4	27	Right P
Mean	61.42		13.08	5.00	43.58	
SD	10.23		1.66	1.29	30.42	

MPO = Months Post Onset CVA

Lesion Locations: T = Temporal F = Frontal
P = Parietal

TABLE 2: Age, sex, occupational level, educational level, months post onset time and lesion location of the left brain damaged subjects.

Subject	Age	Sex	Ed. Level	Occ. Level	MPO	Lesion Location
1	50	M	17	7	192	Left TP
2	65	M	12	4	95	Left TP
3	38	F	12	5	12	Left P
4	58	M	18	8	12	Left F
5	65	M	12	4	60	Left F
6	69	M	12	4	5	Left TP
7	74	M	12	6	7	Left T
8	72	F	12	3	5	Left F
9	63	M	12	4	36	Left P
10	63	F	12	3	53	Left P
11	72	M	12	4	45	Left T
12	70	M	11	4	14	Left FP
Mean	63.25		12.83	4.67	44.67	
SD	9.98		2.11	1.49	51.85	

MPO = Months Post Onset CVA

Lesion Locations: T = Temporal F = Frontal
P = Parietal

TABLE 3: Age, sex, occupational level, and educational level of the normal control subjects.

Subject	Age	Sex	Ed. Level	Occ. Level
1	62	F	12	4
2	70	F	12	5
3	50	M	16	4
4	66	F	12	6
5	69	F	12	4
6	63	M	11	3
7	71	M	12	4
8	54	M	16	8
9	57	M	16	8
10	54	M	15	9
11	61	M	12	3
12	76	M	12	3
Mean	62.75		13.17	5.08
SD	7.63		1.86	2.06

(mean auditory comprehension percentile score on the Boston Diagnostic Aphasia Examination = 79.9, SD = 10.3) and non-verbal cognitive functioning (mean age corrected scaled score on WAIS-R information subtest = 10.3, SD = 1.55) to perform the experimental task. On the Visual Form Discrimination Test (VFDT) the left brain-damaged subjects had a mean score of 29.5 (SD = 1.78).

The right brain damaged subjects had a mean BDAE auditory comprehension percentile score of 90.5 (SD = 5.81) and adequate verbal cognitive functioning (mean age corrected scaled score on WAIS-R Block Design subtest = 9.91, SD = 1.78). On the VFDT the right brain damaged subjects had a mean score of 26.6 (SD = 3.67).

The normal controls had a mean age corrected scaled score on the WAIS-R Information subtest = 11.42 (SD = 1.71) and on the WAIS-R Block Design Subtest = 12.25 (SD = 1.83). On the VFDT, the normal controls had a mean score of 29.4 (SD = 1.75).

Individual subject scores for the WAIS-R subtests, the auditory comprehension subtest of the BDAE, the

VFDT and the Modified Edinburgh Handedness Inventory (MEHI) are presented in Appendices A.1 - A.3.

Development of test stimuli.

Three general methods to elicit discourse from brain damaged subjects are reported in the literature. In the first method discourse is elicited through a picture description task. The Cookie Theft Picture from the Boston Diagnostic Aphasia Examination has been used extensively for this purpose. This picture depicts various characters and actions sufficient enough to elicit several seconds of connected speech. The content of the speech produced is fairly predictable and enables comparisons of different test populations. Using this method, for example, Nicholas, Obler, Albert and Helm-Estabrooks (1985) characterized aspects of empty speech in patients with Alzheimer's disease and fluent aphasia. Disadvantages of using a single picture to elicit discourse are that the events shown are static and it does not allow the subject to talk about ongoing action as it would occur in a natural speaking situation.

The second method requires subjects to recall a story presented auditorily. Using this method,

investigators are able to manipulate the content of the story through the exclusion or inclusion of various elements. Gardner et al. (1983) used this method and demonstrated that through the insertion of spatial elements, emotion elements or bizarre elements, the recall of the right brain-damaged subjects differed qualitatively from that of the normal controls. However, this methodology makes it difficult to distinguish clearly deficits in auditory memory from deficits in expressive language. Further, since story recall is essentially an imitative task, it does not permit an investigation of spontaneous discourse.

A third method elicits discourse through the help of sequenced line drawings. These stimuli are designed to create an ongoing scenario in which various features of the context may be manipulated. An advantage to this method is that it provides subjects with an opportunity to talk spontaneously about the dynamic interaction of characters, actions and events in relation to time. Ulatowska et al. (1983) studied language elicited by sequence stimuli and characterized the discourse structure of mildly impaired aphasic subjects.

For the current study, the stimuli used to elicit each sample of discourse was three 5 x 5 inch picture cards mounted horizontally on cardboard. All pictures were composed of black line drawings that presented a story as a sequence of events. The content of two of the drawings had been manipulated to highlight either visual-spatial or emotional elements. A picture sequence designed to elicit procedural discourse was also constructed as a neutral condition.

The picture stimuli had been developed in consultation with a commercial artist. The stimuli have been planned on the basis of numerous discussions with speech-language pathologists with experience in using different types of picture stimuli to elicit language. Extensive consultations with a linguist and a psychologist familiar with test construction have also contributed to the composition of the materials. All consultations have focused on designing stimuli that delimit specific content thematic elements.
The goals were to create stimuli that were loaded with either visual-spatial thematic content or emotional thematic content and to construct a picture sequence with neither visual spatial nor emotional elements that would elicit procedural discourse.

The visual-spatial picture sequence that was created requires a subject to integrate objects, actions and events into the narrative as the story progresses over time. The major content elements that advance this particular story are movement and changes of location and position in space. Accordingly, the following seven content elements comprise the visual-spatial picture sequence:

1. standing on the chair;
2. attempting to reach the box;
3. on the top of the shelf;
4. books taken from the shelf;
5. books placed on the chair;
6. successfully reaches the box;
7. removes books from chair;

Emotional content elements advanced the story in the second picture sequence. A discrete emotion was depicted in each of the three sequence frames. As this narrative advances, the emotional content of the pictures change from happy, to fearful, to sad. The following seven emotional content elements have been delimited:

1. happy girl;

2. dog escapes;
3. fearful girl yelling;
4. girl crying;
5. unhappy/sad girl;
6. spectator(s') concern;
7. injured dog.

Emotion is explicitly denoted in element numbers 1, 3, 4, 5 and 6. Emotion is implied or connoted in element numbers 2 and 7. This distinction is clarified because of the literature which suggests that right brain-damaged subjects have special difficulty processing connotative information (Gardner and Denes, 1973).

In addition to the seven emotional content elements, there were two elements in this sequence with a significant amount of visual-spatial thematic content. These elements are: dog running across the street; and dog hit by a car. Because these emotional elements are confounded with visual spatial content, they were not counted in this particular analysis.

For the next sequence of pictures, the focus was on creating stimuli that would faciliate discourse about a common procedure. Three sequence pictures

illustrating how to fry an egg were constructed for this purpose. The following seven procedural elements comprise this sequence:

1. materials used;
2. break the egg;
3. pan on fire/stove;
4. cook/fry egg;
5. place on plate;
6. set table;
7. eating.

Test Procedures

Each subject was required to produce three different samples of discourse. Each set of pictures was randomly presented to evaluate independently a subject's ability to:

1. integrate VISUAL-SPATIAL information into a narrative
2. integrate information about EMOTION into a narrative
3. talk about a routinized daily living PROCEDURE

The examiner was always seated directly across from the subject. The task was introduced to subjects with the following instructions:

> "I am going to show you some pictures and tell you a story about them. After I am finished I will show you some other pictures. Look them over. Then I will ask you to tell me a story about them."

To orient the subjects to the story-telling procedure, the examiner first displayed the practice set of pictures and verbally modeled a well-formed narrative about the pictures. The practice narrative contained equal numbers of visual-spatial content elements, and emotional content elements. This picture and practice narrative are presented in Appendix B. The subject was then presented with the first set of picture stimuli. The presentation order of the three elicitation conditions was randomized. The visual spatial, emotional and procedural stimuli are presented in Appendix C.1-C.3. Each sample of discourse was recorded on audiotape and transcribed verbatim for analysis. To assure reliability of the transcription, the audiotapes were reviewed by a second trained professional.

Analysis of the Discourse

Two types of analysis were conducted on each discourse segment: a formalistic analysis and a pragmatic analysis. A formalistic analysis of the written transcripts was conducted to assess the structure, organization and rule- governed nature of the discourse samples. This analysis consisted of counts of specific elements within the discourse sample. Methodology for this analysis is based on procedures previously established in the literature (Berko-Gleason et al., 1980; Ulatowska et al., 1983; Nicholas et al., 1985). For this experiment the following elements were tabulated:

1. length of discourse segment produced - number of words used
2. number of T-units (Hunt, 1965) - a single independent clause plus any dependent modifiers of that clause.
3. anaphora - number of pronouns without antecedents
4. deictic terms - number of indefinite deictic words (use of "this", "that", "here", "there") vs. the total number of words. Deictic verbs like "come" and "go" were not studied.
5. indefinite terms - number of highly non-specific nouns (e.g., "thing", "stuff", "something").
6. definite articles- number of definite articles used for the first mention of a noun, or character, in the story vs. the total number of nouns used in the story

7. presence or absence of elements in a story grammar- use of setting, complicating action, resolution in narratives and introducer, procedural steps and results in procedural discourse

8. the number of visual-spatial content elements or the number of emotional content elements or the number of procedural elements.

9. number of repeated words or phrases

10. "and"s: number of times "and" (the semantically least marked conjunction) is used

11. conjunctions: number of times "but", "or", "so", "because" (excluding "and") are used.

12. number of comments on the task instead of the stimulus (e.g., "words are very difficult for me").

A pragmatic analysis was also conducted to evaluate the impact of the discourse on three trained raters. Since speech pathologists are the clinical personnel involved in assessing a patient's communicative competence, the raters were speech pathologists. The ratings obtained provide a measure of a subject's ability to use language at the level of discourse from the perspective of the partner involved in the communication exchange.

Training the raters required approximately one hour and emphasized familiarity with the terminology and categories used for evaluating the discourse samples. Definitions and examples of the features of discourse were presented. These examples were designed to train the raters to isolate the individual abstract

units used in this pragmatic analysis and appreciate their independence from each other. The terminology and abstract units used in this analysis have been described in normal populations by Grice (1975) and adapted for describing populations with communication disorders by Prutting and Kirchner (1987).

Raters knew nothing about the subject's case history. The order of discourse presentation to the three raters was completely randomized across subjects and across the three elicitation conditions. Raters based their judgments of the subject's language using verbatim transcripts of the subject's discourse. Using a dichotomous scale, raters made judgments of appropriate or inappropriate on the following features of discourse:

1. Topic Maintenance - use of utterances that share a topic with the preceding utterances and add information to the prior communicative act.
2. Conciseness - use utterances that are informative but not too informative
3 Specificity - produces discourse that conveys specific, unambiguous information
4 Lexical Selection - use of lexical items that fit the text
5. Revision Strategy - ability to revise or repair a topic when a breakdown occurs

6. Relevancy - selection of topics that relate to the matter

7. Quantity - provides enough information to convey the content of the story

Raters also answered the following 7 questions about the coherence and clarity of the language:

8. Do you know what is happening in the story?

9. Is the story complete in terms of the stimulus material?

10. Is the language used in the story clear?

11. Does the story follow a logical sequence of events?

12. Does the story have a beginning, a middle and a conclusion?

13. Are the ideas expressed in the discourse unified and connected ?

14. Is the story reconstructable based on the information given ?

For items 8-14, the raters used the following three point scale to respond to these questions:

0 = not at all;

1 = slightly;

2 = yes.

Rationale for the Formalistic Measurements

The purpose of the formalistic analysis was to evaluate various aspects of linguistic structure at the level discourse. An analysis of the microstructure of the discourse (i.e., how the use of specific lexemes affect the cohesion and coherence of the discourse) and an analysis of the macrostructure (i.e., the underlying structure or schema which accounts for the organization of the discourse) were conducted.

There were two measures of discourse length: number of real words and the number of t-units. Because of the difficulty in identifying sentence boundaries in connected speech, t-units were used as an additional unit for segmenting the discourse samples. An overall measure of linguistic complexity or density was obtained by dividing the number of words by the number of t-units produced. High linguistic complexity/ density scores demonstrate that the discourse is composed of complex or dense linguistic constructions.

To assess a subject's ability to appreciate linguistic context, counts of pronouns without antecedents, deictic terms, indefinite terms and definite articles were obtained. Inappropriate use of these elements of microstructure shows a subtle disruption in the knowledge and perspective that a speaker shares with a listener and demonstrates a breakdown in the referential linguistic system.

To examine a subject's ability to produce cohesive discourse, the number of conjunctions was counted. Separate counts of the conjunction "and", the semantically least marked conjunction and the other conjunctions (i.e., but, so, or, because), excluding "and" were obtained. The absence of the latter set of conjunctions would be expected to hinder the unity and connectedness of the discourse. To control for sample length, a ratio score was created by dividing the number of specific linguistic elements by the total number of words in the sample.

The elements that contribute to the macrostructure of each discourse were also considered. This analysis evaluated the subject's ability to organize discourse into a conventional framework by counting the

occurrence of the essential elements of this organization.

Rationale for the Measurement of Content

Since this portion of this analysis involved comparing the content of the discourse produced by different speakers, it was essential that the content of the discourse produced be predictable. Pilot work was conducted to predict how normal speakers produced discourse in response to the picture stimuli and to examine how they used the specific visual-spatial elements, emotional elements, or procedural elements that comprise the stories.

Three normal speakers who met the subject selection criteria were tested using the procedures outlined above. A content element was defined as a reference to any one of the seven visual-spatial or seven emotional elements that were designed to be in the stimulus pictures. Subjects were given credit for mentioning an element if the reference was clear to the examiner and the statement was true. To eliminate credit for redundant information each content element was counted only one time.

Evaluation of the discourse samples obtained during the pilot study indicated that the three normal controls used an average of 5.66 (S.D. = .58) of the 7 target elements in the visual-spatial picture. Normal controls also used an average of 6.0 (S.D. = 1.0) of the 7 emotional elements. For the procedural discourse, normal controls used an average of 5.3 (S.D. 1.15) of the procedural elements. In sum, the stimuli adequately portrayed visual-spatial, emotional or procedural elements and facilitated the production of discourse with predictable content.

Rationale for the Pragmatic Measurements

The purpose of this analysis was to describe a set of pragmatic rules that are used by a speaker to produce well-formed discourse. Explanations of linguistic structure alone do not account for the probabilistic nature of human communication in that a speaker does not always know whether his or her message is being interpreted correctly and the language receiver often misinterprets the message (Harris and Monaco, 1978). In seeking an explanation of discourse processes it is necessary to examine discourse in terms of its linguistic function and recognize the importance

of the context in which the message is received. This analysis attempted to describe the interaction that exists between a speaker's discourse and the language receiver's world knowledge.

The construction of this measure is based on the work of Grice (1975). Grice described the communicative events that take place between a speaker and receiver of a message as rule-governed and as manifesting four basic expectations: 1) the quantity of information provided must be adequate to meet the listener's needs, but not excessive; 2) the quality of truthfulness must be sustantiated; 3) topics must be relevant; and 4) messages must be understandable.

Philosophers (Austin, 1962; Grice, 1975; Searle, 1969) and linguists (VanDijk, 1976; Levinson, 1983) involved in pragmatic theory have been concerned with the assignment of appropriateness conditions for a set of contexts in the same way semantic theory has focused on the properties and relations that sentences have regarding truth (Akmajian, Demers and Harnish, 1986). Accordingly, raters judged the appropriateness or inappropriateness of seven pragmatic features of discourse. Ratings of appropriate were assigned to the

individual pragmatic features that contribute to the well-formedness of the discourse. Inappropriate ratings were assigned by the raters to those pragmatic features that detract from the well-formedness of the discourse.

Raters also answered questions about the coherence (or content) and cohesion (or clarity) of the discourse. There were three questions about the coherence of the language (items 8, 9 and 10). Generally a discourse is coherent if it contains ideas that develop and support a central idea (Richards, Platt and Weber, 1985). There were also three questions about the cohesion of language (items 11, 12 and 13). A discourse is cohesive when the language used clearly conveys the relationship between different sentences or between different parts of sentences (Halliday and Hasan, 1976). Since a discourse may be high in content, but low in cohesion these two measures were considered separately. An additional item (number 14) inquired into the integration of coherence and cohesion into the discourse.

Commmunication is accomplished through the complex interaction of several modalities of expression which

include language, gesture, facial expression and prosody. These modalities have been found to be autonomous and have differential hemispheric organization (Borod, Koff and Caron, 1983; Foldi, Cicone and Gardner, 1983; Ross, 1985). Since the purpose of this investigation is to study language alone, cues provided by other modalities of expression were eliminated. Thus, raters based their judgments solely on written transcripts of the discourse.

Pilot of the Pragmatic Rating Procedures

To evaluate the adequacy of the training procedures and measurement scale used to assess the pragmatic aspects of each unit of discourse a pilot study was conducted. Discourse samples were submitted to four speech-language pathologists. The speech pathologists had a minimum of three years of clinical experience. One rater was provided with a written explanation of the procedures, the stimuli used to elicit the discourse and definitions of the pragmatic features. Three of the four raters were provided with an oral explanation of the rating procedures in addition to the written instructions. This included examples of hypothetical discourse samples and an oral

explanation of the ratings on these samples. To assure that the rating scale produced reliable results, one of these 3 raters received a version of the rating scale with the order of the questions randomized.

Scores from the three raters who received the oral explanation of the rating system and the written instructions were entered into the analysis. To a first approximation, scores from these raters indicated adequate appreciation of the independence of the measures. The rater who received the randomized version of the rating scale made judgments within the same range of reliability as the other two.

In sum, the pragmatic rating procedures were used successfully by the speech-language pathologists to describe the different discourse samples. The instructions to the raters, the definitions and examples of the pragmatic features are shown in Appendices D.1 - D.4. The raters' score sheet is shown in Appendix D.5.

To assure that the final ratings obtained on the pragmatic measure were not influenced by the presentation order of the rating scale, the correlation

scores between adjacent items were compared to the correlation scores for each item across the three raters. Seventy four percent of the variance was unexplained and only 26% of the variance could be accounted for by adjacency. Thus, the final pragmatic ratings used in this experiment reflect an appreciation of the independence of each item. In sum, the rating scale produced scores that were not biased by the overall presentation order of its items.

Reliability

Inter-rater Reliability. Subjects' responses were audiotaped and their discourse was transcribed verbatim. To insure reliability of the transcriptions, the audiotapes were reviewed independently by a second trained professional An agreement was defined as an instance of congruence between raters on individual words. Reliability was calculated using the following formula:

$$\frac{\text{agreements} \times 100}{\text{agreements} + \text{disagreements}} = \%\ \text{agreement}$$

Percentages of agreement were calculated for each of the 108 transcripts. This yielded a 96.7% level of inter-rater agreement.

Inter-rater reliability checks were completed for the formalistic and pragmatic analysis. The following elements were calculated for the formalistic analysis: (1) number of words, (2) t-unit segmentation, (3) pronouns without antecedents, (4) deictic terms, (5) indefinite terms, (6) indefinite articles as first mentioned nouns, (7) elements in a story grammar, (8) content elements, (9) repeated words or phrases, (10) number of "and"s, (11) number of other conjunctions, excluding "and", (12) comments on the task.

All transcripts were reviewed by a second trained professional who independently counted these elements. An agreement was defined as an instance of congruence between raters prior to discussion. This procedure yielded at least a 91% level of inter-rater reliability in each of the twelve reliability areas and a range between 91%-99.7% . No area was unusually disparate from the other.

Scoring

Formalistic analysis. Raw count scores were obtained for each of the 12 measures. Converted ratio scores were created by dividing the raw count score by the total number of words produced by a subject for the following measures: pronouns without antecedents, deictic terms, repetitions, "and"s, conjunctions, and comments on the task. Ratio scores were utilized to eliminate the effects of sample length. For the measure of definite articles a ratio score was created by dividing the raw count score by the total number of first mentioned nouns. Actual counts were obtained for the total number of words and total number of t-units. A measure of linguistic complexity/density was created by dividing the total number of words by the number of t-units produced.

To measure the presence or absence of the elements in a story grammar, raw count scores of the macrostructure elements actually produced were obtained. That is, the number of essential elements in the super- structure of narratives (i.e. setting, complicating action, and resolution) and procedural discourse (i.e. introducer, procedural steps and

results) were counted and the percent each element was used was calculated.

Content Analysis. The use of different types of content was also assessed. Content includes specific use of the visual spatial, emotional and procedural elements that have been depicted in the stimulus pictures. A subject received a score of 0 to 7 by referring or not referring to these elements. Counts of the various elements measured the way a subject organized specific types of content into the discourse.

Pragmatic Analysis. For items 1-7 a subject received a score of 0 for ratings of inappropriate and a score of 1 for ratings of appropriate. To determine the appropriateness (or inappropriateness) of each pragmatic feature of discourse, the three rating scores assigned to a subject were compared and a 2/3 consensus score was derived. For example, if a subject was rated as inappropriate (score of 0) by two out of three raters, the consensus score was 0.

For items 8-14, a subject received a score of 0, 1, or 2 with the higher scores corresponding to judgments of coherent and cohesive discourse.

Consensus scores were derived separately for the coherence items (number 8,9,10) and cohesion items (numbers 11,12,13). Consensus scores for coherence and cohesion (numbers 8-14) were also calculated. In cases when a consensus score could not be derived, the score was determined by the examiner based on an additional review of the transcripts.

Chapter 5.

RESULTS

In order to evaluate differences in the form, content and use of discourse produced by patients with right- and left-brain damage and by normal control subjects, the data were analyzed statistically using Statistical Package for the Social Sciences (SSPS) programs (Nie, Hull, Jenkins, Steinbrenner and Bent, 1975). The primary statistical analyses involved the nonparametric Kruskal-Wallis One-Way Analysis of Variance. Mann-Whitney U tests corrected for tied ranks and expressed as normal deviates were conducted as secondary analyses to compare each pair of adjacent groups. Within group differences were tested using Wilcoxon's matched pairs test. The .05 level of significance was selected a priori as the error rate for each hypothesis because each category was discrete and independent (Kirk, 1968). Additionally, Fisher Tests of Exact Probability (Siegel, 1988) were employed to analyze dichotomous variables using the (one-tailed) .05 level of significance to test each hypothesis.

The results of these analyses are presented in three sections. The results of the formalistic

analysis will be presented in the first section and will address separately the microstructure and macrostructure data. The second section will present the results of the content analysis. Results of the pragmatic analysis will be presented in the third section. Because the pragmatic features of discourse are derived from raters' judgments, this section will also discuss the inter-rater reliability obtained for each of these measures.

FORMALISTIC ANALYSIS

Microstructure

To evaluate how the use of specific lexemes affect the cohesion of discourse, several independent measures of discourse structure were obtained and are summarized below.

Length of Discourse. Two measures of discourse length were obtained: number of words and number of T-units (i.e., the number of independent clauses and any dependent modifier of that clause). When the data were collapsed across conditions the NCs produced the most words with a mean of 82.7 words (SD = 29.7). The RBDs produced a mean of 76.0 words (SD = 30.4) which

was slightly more than the LBDs who produced a mean of 67.9 words (SD = 25.1). With respect to T-units, the LBDs produced a mean of 7.5 (SD = 2.9) which was slightly more than was produced by the RBDs (x = 6.3, SD = 2.1) or the NCs (x = 6.8, SD = 2.8).

To examine for group differences, nonparametric Kruskal Wallis One-Way Tests were conducted. As can be seen in Table 4 none of these analyses proved to be statistically significant.

Referential System. This analysis evaluated the lexical devices used by a speaker to establish whom or what he or she is talking about within a specific text. Figure 1 displays group profiles for these measures. The figure shows that the RBDs tended to be more ambiguous in the use of reference than the NCs. Specifically, the RBDs produced more pronouns without antecedents (x = .9, SD = .98 for the RBDs vs. x = .7, SD = .76 for the NCs), and used slightly more indefinite terms (x = .8, SD = .75 for the RBDs vs. x = .7, SD = .79 for the NCs). The RBDs produced slightly more deictic terms (x = 2.3, SD = .79 for the RBDs vs. x = 1.3, SD = .78 for the NCs) and tended to be slightly more restricted in their use of definite

Table 4: Means (x), standard deviations (SD), χ^2 and probability (p) values from Kruskal-Wallis One Way Analysis of Variance for two measures of discourse length.

Measure/ Discourse Condition	Group			χ^2	p
	RBDs	LBDs	NC		
Number of Words					
Visual Spatial					
x	81.9	83.3	94.8	.98	.61
(SD)	(30.9)	(36.1)	(34.1)		
Emotional					
x	85.3	63.5	86.2	1.29	.52
(SD)	(57.7)	(26.6)	(43.3)		
Procedural					
x	61.0	56.7	66.9	1.63	.44
(SD)	(17.5)	(23.8)	(22.6)		
Number of T- units					
Visual Spatial					
x	6.0	7.9	6.5	1.44	.49
(SD)	(2.4)	(3.8)	(2.4)		
Emotional					
x	7.7	8.0	8.4	.13	.94
(SD)	(3.6)	(4.1)	(4.0)		
Procedural					
x	5.3	6.5	5.3	2.34	.31
(SD)	(1.8)	(2.7)	(2.3)		

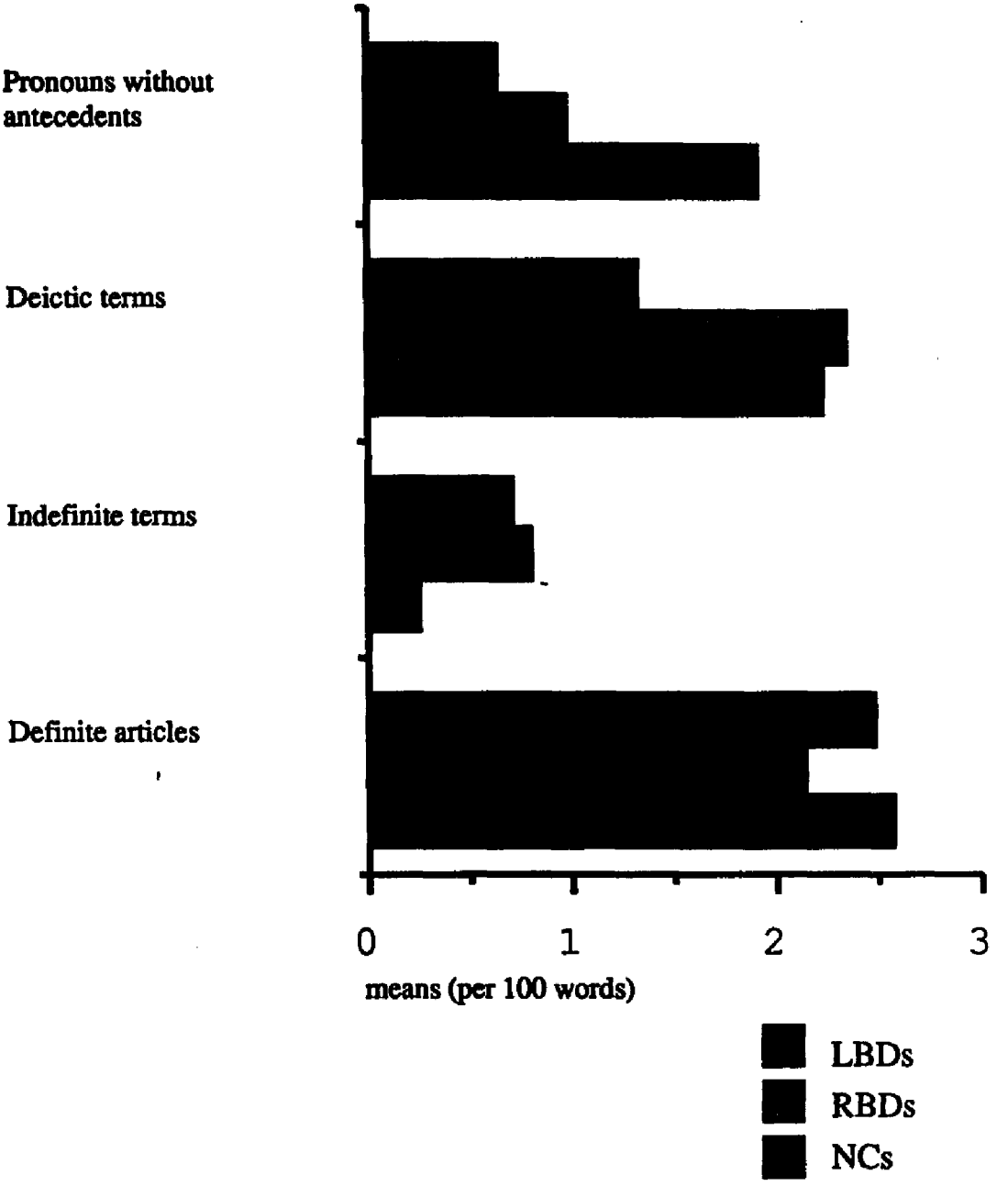


Figure 1. Means (per 100 words) for measures of a speaker's referential system by subject group.

articles for first mention of nouns or characters in a story (x = 2.2, SD = .86 for the RBDs vs. x = 2.4, SD = .98 for the NCs).

When the LBDs were compared to the NCs, the LBDs also used more pronouns without antecedents (x = 1.9, SD = 2.02) and more deictic terms (x = 2.3, SD = 2.04). In contrast to the RBDs, the LBDs used fewer indefinite terms (x = .2, SD = .37) and more definite articles to introduce nouns or characters into the story (x = 2.4, SD = .98).

The referential systems of the subject groups were compared using the Kruskal-Wallis One-Way Analysis of Variance Tests (see Table 5). Significant differences in the use of pronouns without antecedents were found in both narratives (χ^2 = 9.29, p = .01 in the visual-spatial narrative and χ^2= 5.83, p = .05 in the emotional narrative). Mann-Whitney U Tests were computed to compare each pair of groups where significant Kruskal-Wallis H values were obtained. No significant differences in the use of pronouns without antecedents were revealed between the NCs and the LBDs in the visual-spatial narrative (U = 58.5, p = .23). In the emotional narrative, there were statistical

Table 5: Means (x), standard deviations (SD), χ^2 and probability (p) values from Kruskal-Wallis One Way Analysis of Variance for measures of the speaker's referential system.

Measure/ Discourse Condition	Group			χ^2	p
	RBDs	LBDs	NC		
Pronouns w/o Antecedents					
Visual Spatial					
x	1.3	.8	.1	9.29	.01**
(SD)	(1.3)	(.17)	(.2)		
Emotional					
x	.2	.9	.00	5.83	.05*
(SD)	(.70)	(1.7)	(.00)		
Procedural					
x	1.5	3.9	1.9	3.52	.17
(SD)	(3.2)	(4.6)	(2.3)		
Deictic Term Production					
Visual Spatial					
x	1.8	2.1	1.12	1.79	.41
(SD)	(1.3)	(2.1)	(1.2)		
Emotional					
x	2.3	1.4	1.2	3.30	.19
(SD)	(1.6)	(1.5)	(1.3)		
Procedural					
x	2.9	3.2	1.6	3.47	.18
(SD)	(1.8)	(.42)	(.13)		
Indefinite Term Production					
Visual Spatial					
x	1.2	.4	1.0	5.41	.07
(SD)	(1.1)	(.7)	(1.6)		
Emotional					
x	.2	.1	.5	2.25	.33
(SD)	(.4)	(.4)	(.08)		
Procedural					
x	.9	.3	.5	2.18	.34
(SD)	(1.7)	(.7)	(1.1)		
Definite Article Production					
Visual Spatial					
x	2.2	2.3	2.9	1.77	.41
(SD)	(1.3)	(2.0)	(1.7)		
Emotional					
x	1.8	3.5	2.4	4.06	.13
(SD)	(1.1)	(2.2)	(1.8)		
Procedural					
x	2.3	1.9	2.1	.55	.76
(SD)	(1.2)	(1.0)	(1.4)		

* p </= .05 ** p </= .01

differences between the NCs and the LBDs (U = 48.0, p = .033). Statistically signficant differences in the use of pronouns without antecedents were also revealed between the NCs and the RBDs in the visual-spatial narrative (U = 26, p = .002) but not in the narrative with emotional content (U = 66, p = .317).

Lexical Connectedness. This analysis evaluated how subjects used connectors to achieve cohesion in discourse. "And", the semantically least marked conjunction, was used most often by the LBDs. The RBDs used "and" (x = 5.8, SD - 1.6) less often than the LBDs (x = 7.2, SD = 2.1) or the NCs (x = 6.1, SD = 1.3). "Other conjunctions", such as "but," "or," "so" and "because," occurred most often by the RBDs (x = 1.6, SD = 1.2) and least often by the LBDs (x = 1.3, SD = 1.1). The NCs used "other conjunctions" with a mean of 1.4 (SD = 3.52) per 100 words. Kruskal-Wallis One Way Analysis of Variance Tests were conducted for measures of lexical connectedness and revealed no statistically significant differences in the way the groups use conjunctions. These data are displayed in Table 6.

Linguistic Density. A measure of linguistic density was derived by dividing the total number of

Table 6: Means (x), standard deviations (SD), χ^2 and probability (p) values from Kruskal-Wallis One Way Analysis of Variance for lexical connectedness.

Measure/ Discourse Condition	Group			χ^2	p
	RBDs	LBDs	NC		
"ands"					
Visual Spatial					
x	3.8	5.9	4.4	4.96	.08
(SD)	(2.5)	(2.6)	(1.4)		
Emotional					
x	5.9	6.9	6.5	.83	.66
(SD)	(2.1)	(2.0)	(2.0)		
Procedural					
x	7.4	8.8	7.3	.14	.50
(SD)	(3.3)	(3.5)	(2.5)		
Other conjunctions					
Visual Spatial					
x	2.5	2.2	2.3	.14	.93
(SD)	(2.2)	(1.9)	(1.9)		
Emotional					
x	1.7	2.2	2.3	.86	.65
(SD)	(1.2)	(1.7)	(1.4)		
Procedural					
x	.5	.3	.5	.74	.74
(SD)	(.9)	(.9)	(.7)		

words by the number of T-units used in each discourse sample. When these data were collapsed across conditions the NCs achieved the highest score with a mean of 13.94 (SD = 3.5). The RBDs' score (x = 12.4, SD = 2.5) was lower than the NCs' score but higher than the LBDs' score (x = 9.4, SD = 1.5).

Group comparisons using Kruskal-Wallis One Way Analysis Tests (see Table 7) revealed statistically significant differences in all discourse conditions, (χ^2= 8.3, p = .02 in the visual-spatial narrative, = 5.84, p = .05 in the emotional narrative; and 12.76, p = .002 in the procedural narrative). Mann-Whitney U tests were used as secondary analysis to compare each pair of adjacent groups. No significant differences were found between the NCs and RBDs (U = 5.15, p = .24 in the visual-spatial narrative; U = 71.5, p = .98 in the emotional narrative; and U = 54.5, p = .31 in procedural discourse). In contrast, when the NCs and LBDs were compared all of the Mann-Whitney U tests were significant (U = 28.5, p = .01 in the visual-spatial narrative; U = 37.0, p = .04 in the emotional narrative; and U = 18.0, p = .002 in the procedural discourse).

Table 7: Means (x), standard deviations (SD), χ^2 and probability (p) values from Kruskal-Wallis One Way Analysis of Variance for measures of linguistic density and extraneous remarks.

Measure/ Discourse Condition	Group			χ^2	p
	RBDs	LBDs	NC		
Linguistic Density					
Visual Spatial					
x	13.7	11.4	16.2	8.3	.02*
(SD)	(2.09)	(2.60)	(4.53)		
Emotional					
x	10.9	8.3	10.4	5.84	.05*
(SD)	(3.38)	(2.71)	(2.28)		
Procedural					
x	12.6	8.7	15.2	12.76	.002*
(SD)	(5.17)	(1.33)	(10.38)		
Comments on Task					
Visual Spatial					
x	.6	.9	.5	5.62	.06
(SD)	(1.2)	(.70)	(1.40)		
Emotional					
x	.1	2.2	.0	15.76	.001*
(SD)	(.3)	(2.5)	(.00)		
Procedural					
x	.1	1.2	.5	2.74	.25
(SD)	(.4)	(2.2)	(1.0)		
Word and Phrase Repetitions					
Visual Spatial					
x	1.6	4.7	2.0	.944	.62
(SD)	(.9)	(6.0)	(2.1)		
Emotional					
x	.9	5.2	.8	8.73	.01**
(SD)	(1.2)	(6.5)	(1.2)		
Procedural					
x	1.8	6.9	1.7	2.93	.23
(SD)	(1.8)	(7.6)	(.22)		

* p </= .05 ** p </= .01

Extraneous Remarks. Two types of extraneous remarks were assessed: the number of comments on the task rather than on the stimulus; and the number of word and phrase repetitions.

The number of comments on the task was evaluated because it might reflect a strategy employed by a speaker to maintain cohesion or show intention to convey a message. The measures reported here are the means of the number of comments produced per 100 words. Overall, the LBDs produced the most comments on the task ($x = 1.5$, $SD = 1.1$.). The NCs produced a mean of .4 ($SD = .5$) comments per 100 words and the RBDs produced the fewest number of comments ($x = .3$, $SD = .4$).

Kruskal-Wallis One-Way Analysis of Variance Tests (see Table 7) revealed a signficant difference among the groups in the emotional narrative ($\chi^2 = 15.76$, $p = .0001$) and a trend in the visual-spatial narrative ($\chi^2 = 5.62$, $p = .06$). Post hoc Mann-Whitney U tests were conducted to compare further the groups on the number of comments made on the task. The RBDs and the NCs did not differ significantly on these measures ($U = 65.0$, p .68 in the visual-spatial narrative; $U = 68$, $p = .82$ in

the emotional narrative). However, the LBDs and NCs were significantly different (U = 39.0, p = .04 in the visual-spatial narrative; U = 24.0, p = .001 in the emotional narrative). The LBDs also made significantly more comments on the task than did the RBDs in the emotional narrative (U = 28.0, p = .005).

The number of word and phrase repetitions was also evaluated. In normal speech, repetition supplies redundant information or imparts emphasis to convey a special point. The LBDs produced the most repetitions (x = 5.6, SD = 1.5) and the RBDs produced the fewest number of word and phrase repetitions (x = 1.4, SD = .98). The NCs used a mean of 1.5 repetions (SD = 1.3).

Kruskal-Wallis One-Way Analysis of Variance Tests (see Table 7) revealed significant differences between groups in the emotional discourse condition (χ^2= 8.73, p = .01). Mann-Whitney U tests revealed that the LBDs produced signficantly more repetitions than the RBDs (U = 32.5, p .02) or the NCs (U = 29.5, p = .01).

Macrostructure

The macrostructure analysis evaluated the presence of the essential elements that comprise narrative and procedural discourse grammar. Narrative discourse is composed of three elements which may be observed independently of each other: "setting", "complicating action", and "story resolution". Although structurally different from narrative discourse, procedural discourse is also composed of three essential and independent elements: "introducer", " procedural steps" and "result".

Figure 2 displays the data from the narrative macrostructure analysis and Figure 3 displays the data from the procedural discourse analysis. In both narrative conditions, the NCs typically used all of the essential elements of discourse macrostructure. Specifically, the NCs used "complicating action" and "story resolution" 100% of the time in both narratives. In the narrative condition which was loaded with visual-spatial information, the NCs used the "setting" element 83.3 % of the time. In the narrative loaded with emotional information, the "setting" element was used 100% of the time. When formulating procedural

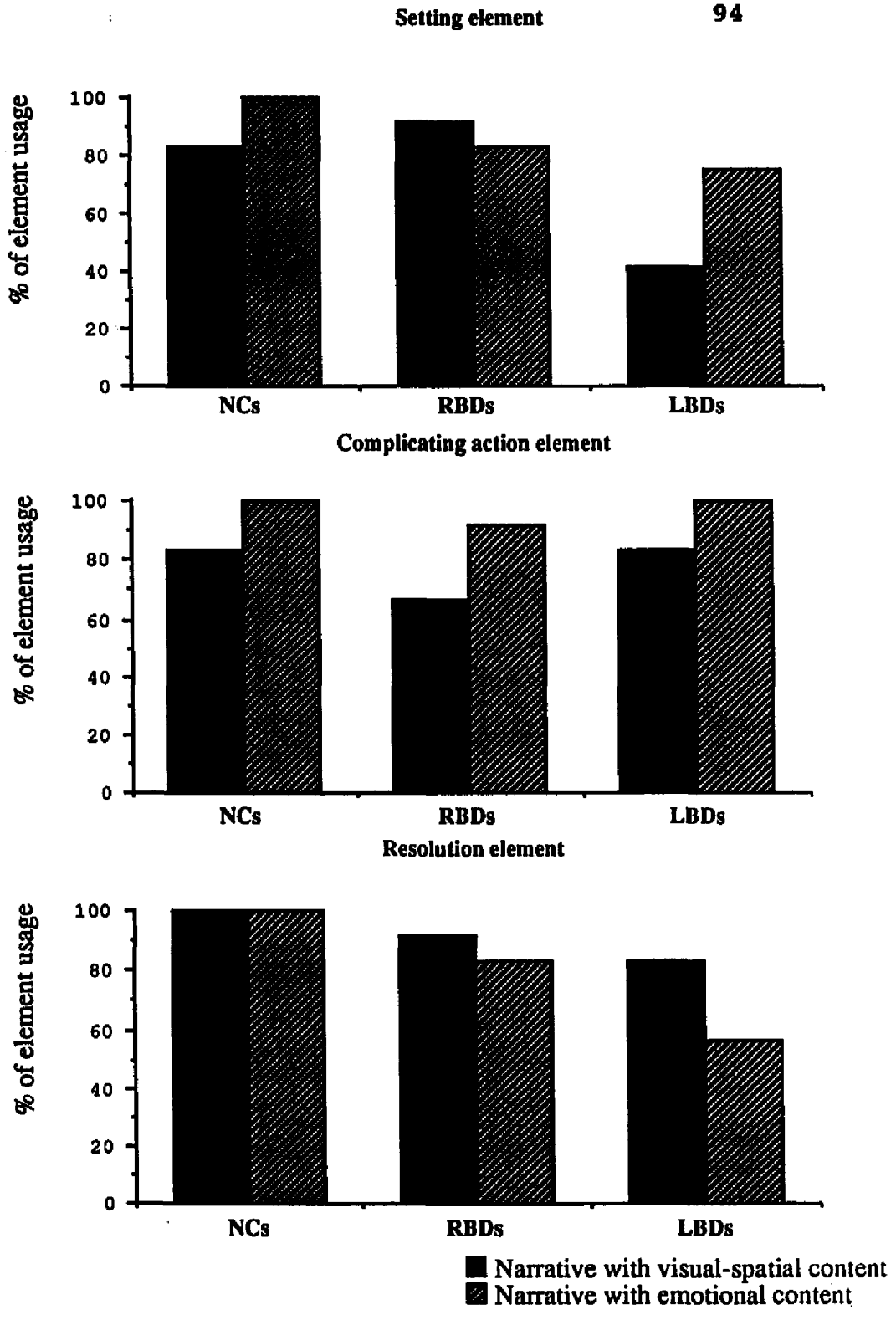


Figure 2. Percent of subjects by group who used each of the 3 essential elements of narrative macrostructure.

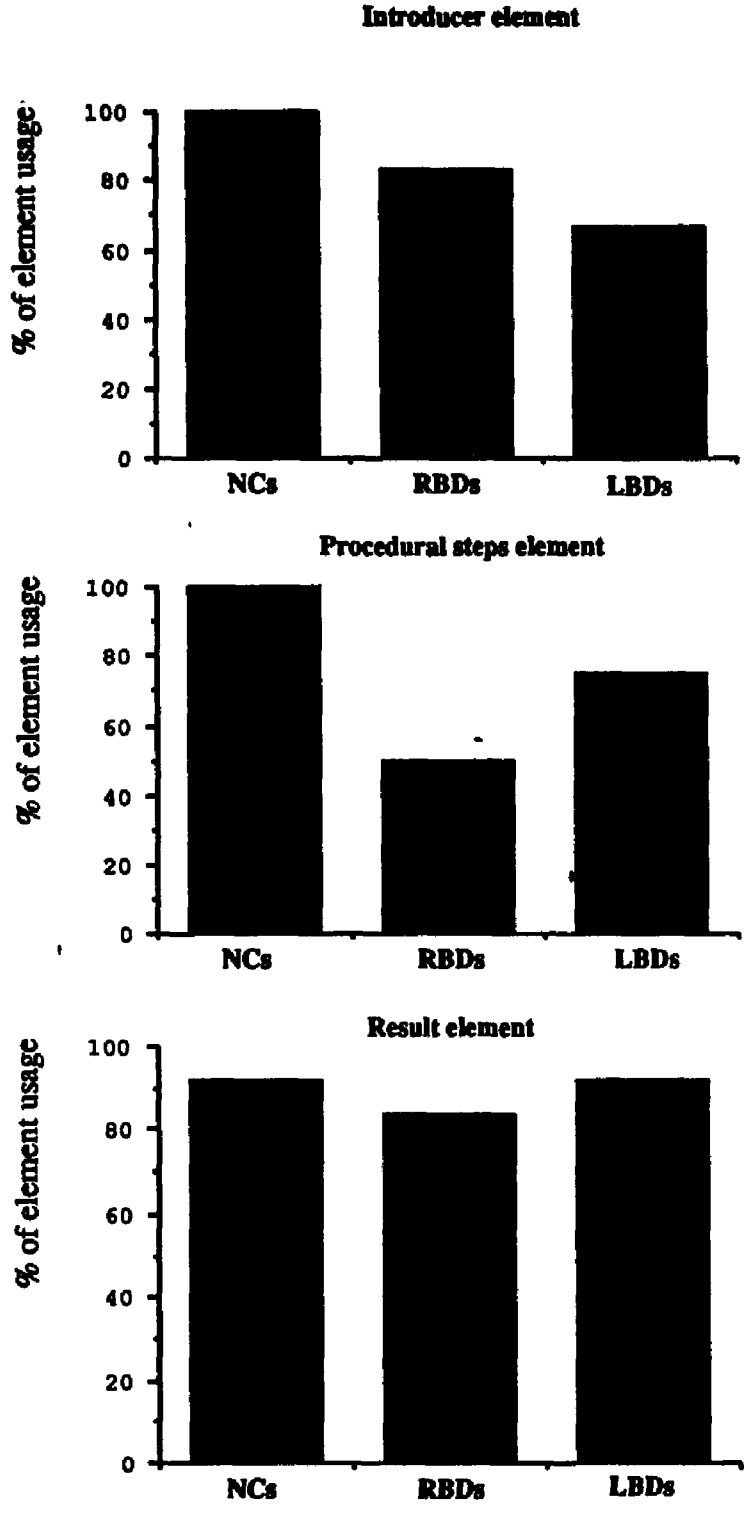


Figure 3. Percent of subjects by group who used each of the 3 essential elements of procedural discourse macrostructure.

discourse, the NCs always used the "introducer" and "procedural steps". A "result" element was present in 91.6% of the NCs' procedural discourse.

The LBDs used the "setting" element 41.6% of the time in the narrative loaded with visual-spatial information and 75% of the time in the narrative containing emotional information. The element of "complicating action" was used by the LBDs 83.3% of the time in the visual-spatial narrative and 91.6% of the time in the emotional narrative. The discourse of the LBDs contained the "setting" element 41.6% of the time in the visual- spatial narrative and 75% of the time in the narrative containing emotional information. In procedural discourse, 66.6% of the LBDs included the "introducer", 75% used "procedural steps" and 58.3% offered the "result" element.

To compare the macrostructure of the LBD's narratives with narratives of the NCs, the presence or absence of each element was examined using Fisher Tests of Exact Probability. Of the 6 analyses conducted (3 macrostructure elements in the visual-spatial narrative and 3 macrostructure elements in the emotional narrative) only one was significant. The LBDs produced

significantly fewer resolution elements (Fisher Exact test: $p < .05$) in the narrative composed of emotional information.

The RBDs performed similiarly to the NCs in using the elements of narrative macrostructure, but not in the use of the elements of procedural macrostructure. Specifically, the RBDs used the "setting" element 66.6% of the time in the visual spatial narrative and 91.6% of the time in the emotional narrative. The "complicating action" element was present 83.3% of the RBD's visual-spatial narratives and 100% of their emotional narratives. The "resolution" element was present in 91.6% of the RBD's visual-spatial narratives and in 83.3% of their emotional narratives. In procedural discourse, the RBDs omitted the "procedural steps" (50% of the time) although they typically included the "introducer" (83.3% of the time) and "result" element (83.3% of the time). A Fisher Test of Exact Probability was conducted to compare the RBDs to the NCs in the use of "procedural steps". This observation proved to be statistically significant (Fisher Exact Test: $p < .025$) supporting the notion that RBDs organize the macrostructure of procedural discourse differently than the NCs.

In summary, subtle differences exist between the RBDs and NCs in the formalistic aspects of discourse despite the suprising similiarity in the number of words produced. Although the RBDs did not differ significantly in the use of the specific lexical devices that maintain cohesion in discourse (except in the use of anaphora), as a group they tended to be less proficient in the overall use of these devices. In this way they performed very much like the LBDs. Unlike the LBDs, the RBDs used more complex sentence structures and did not produce many extraneous comments on the tasks. It is noteworthy that the content of the narratives did not alter the formalistic aspects of the RBDs' discourse. Finally, with respect to the analysis of story grammar, the RBDs demonstrated difficulty in accessing an essential structural component of procedural discourse.

CONTENT ANALYSIS

Content elements are conceived of as structural components that contribute to the comprehensibility and coherence of discourse. This analysis evaluated a subject's ability to use visual-spatial or emotional content in narrative discourse. A subject's ability to

use procedural discourse was also considered since procedural discourse is structurally different from narrative discourse and is not laden with visual-spatial or emotional content.

The mean number of visual-spatial, emotional and procedural/neutral content elements produced by the three groups is displayed in Figure 4. The discourse of the NCs included the most visual-spatial elements (x = 5.8, SD = .45), the most emotional content (x = 5.5, SD = 1.0) and contained the most procedural content (x = 6.0, SD = 1.2). The LBDs produced a mean of 3.0 (SD = 1.35) visual-spatial elements, a mean of 3.3 (SD = .75) emotional elements and a mean of 3.6 (SD = 1.2) procedural elements. The RBDs used a mean of 4.0 (SD = 1.76) visual-spatial elements and a mean of 4.3 (SD = 3.6) procedural elements. The emotional content of the discourse of the RBDs (x = 3.2, SD = 1.1) fell to the level of the LBDs.

A Kruskal-Wallis One-Way Analysis of Variance by Ranks was conducted to examine for group differences in the use of specific types of content (see Table 8). Highly significant differences were found in the use of visual-spatial content (χ^2 = 20.86, $p < .001$), emotional

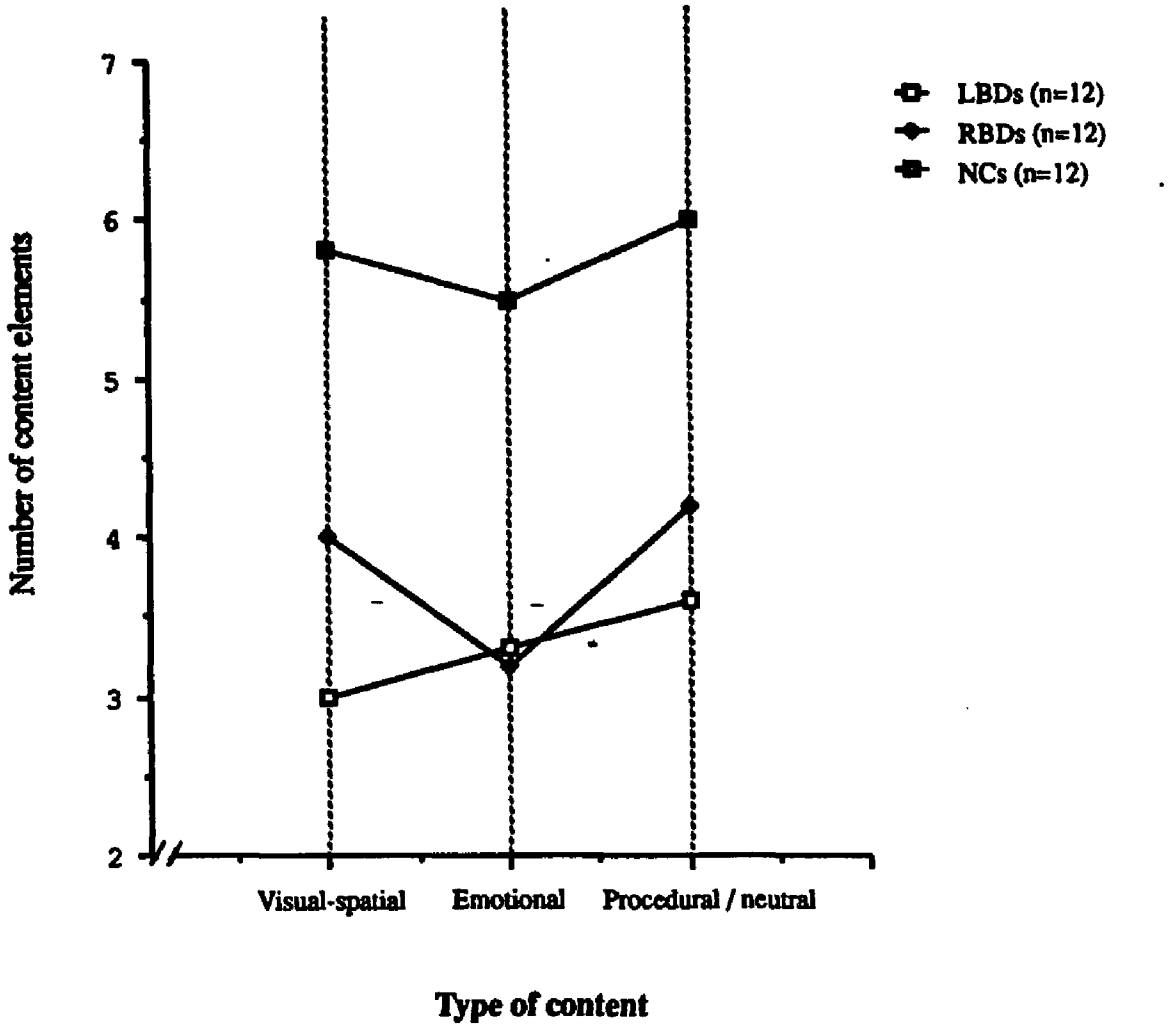


Figure 4. Mean number of content elements used by the RBDs, LBDs and NCs.

Table 8: Means (x), standard deviations (SD), χ^2 and probability (p) values from Kruskal-Wallis One Way Analysis of Variance for the measure of content.

Measure/ Discourse Condition	Group			χ^2	p
	RBDs	LBDs	NC		
Content Element					
Visual-Spatial Elements					
x	4.0	3.0	5.8	20.86	<.001
(SD)	(1.76)	(1.35)	(.45)		
Emotional Elements					
x	3.2	3.3	5.5	21.59	<.001
(SD)	(1.1)	(.75)	(1.0)		
Procedural Elements					
x	4.3	3.6	6.0	21.53	<.001
(SD)	(3.6)	(1.2)	(.6)		

content (χ^2= 21.59, p < .001) and in procedural/neutral content (χ^2 = 21.53, p < .001). To make clearer the differences between groups, they were considered in pairs using the results of the Mann-Whitney U tests.

The RBDs differed significantly from the NCs in the use of visual-spatial content (U = 15.0, p = .001), emotional content (U = 6.5, p = .001) and procedural/ neutral content (U = 11.0, p = .002). The LBDs also differed from the NCs in the use of visual-spatial content (U = 3.0, p = .0001), emotional content (U = 2.0, p = .0001) and procedural/neutral content (U = 2.0, p = .0001). The RBDs were comparable to the LBDs in their use of visual-spatial content (U = 42.5, p = .08), emotional content (U = 70.0, p = .90) and procedural/neutral content (U = 48.5, p = .16).

The above analysis provides evidence that the RBDs included less content in their discourse than did the NCs. However, the frequently evoked hypothesis that the subtle language deficits of the RBDs arise from visual misperceptions could not be ruled out completely. To test the hypothesis that the differences in the RBD's discourse result from visual perceptual deficits, a second analysis was conducted.

Here the (three) RBDs who scored below normal limits on the Benton Visual Form Discrimination Test were excluded from the content analysis (Specific information on subject test scores can be found in Appendix D). In this analysis the RBDs without visual perceptual deficits (n= 9) produced a mean of 4.8 (SD = .67) visual- spatial elements, used a comparable number of procedural elements (x = 4.7, SD = 1.4) and produced a mean of 3.3 (SD = 1.2) emotional elements. The comparison of this subset of RBDs to the NCs is shown in Figure 5. The proclivity of the RBDs to delete visual-spatial content was minimized in the RBDs without visual perceptual deficits but they remained different from the NCs across the measures of visual-spatial content (U = 15.0, p = .002), emotional content (U = 6.5, p = .001) and procedural content (U = 11.0, p = .001).

To test for within group differences in the use of content, Wilcoxon matched pairs tests were conducted (see Table 9). Only the RBDs demonstrated statistically significant differences when the amount of visual-spatial content was compared with the amount of emotional content (Wilcoxon Z = -2.52, p = .01). The RBDs also tended to differ when the amount of

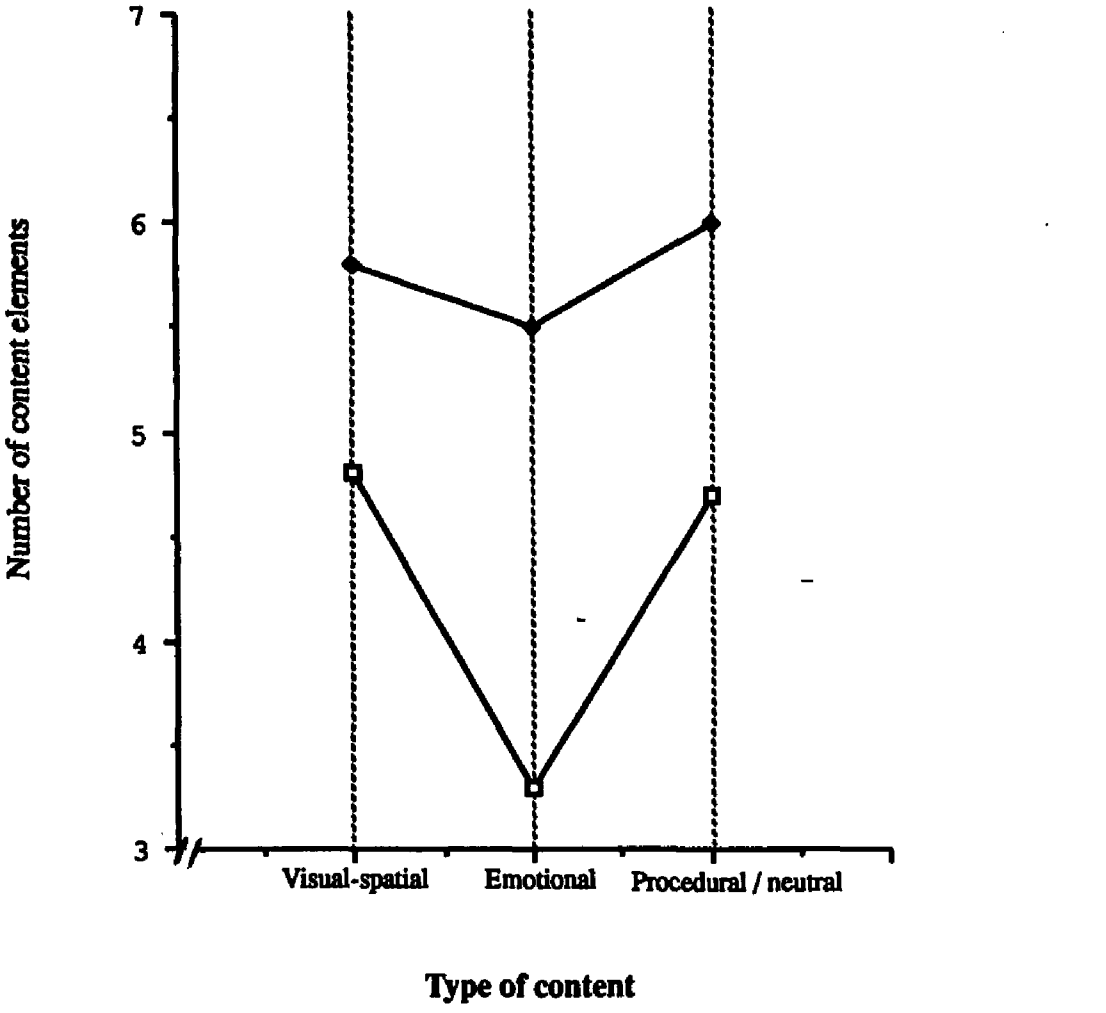


Figure 5. Mean number of content elements used by the NCs and RBDs with normal visual discrimination scores.

Table 9: Wilcoxon Matched-Pairs Signed-Ranked Tests for Within Group Differences in the Use of Content Elements

GROUP	Z SCORE	PROB.
RIGHT BRAIN-DAMAGED		
Visual-S. vs. Emotional	- 2.52	.01
Visual-S. vs. Procedural	- 0.41	.69
Emotional vs. Procedural	- 1.78	.07
LEFT BRAIN-DAMAGED		
Visual-S. vs. Emotional	- 0.53	.59
Visual-S. vs. Procedural	- 1.01	.31
Emotional vs. Procedural	- 0.65	.51
NORMAL CONTROLS		
Visual-S. vs. Emotional	- 0.84	.40
Visual-S. vs. Procedural	- 1.21	.23
Emotional vs. Procedural	- 1.12	.26

emotional content was compared to the amount of procedural/neutral content (Wilcoxon Z = -1.78, p = .07). No significant differences were revealed when the amount of visual-spatial content was compared with procedural/neutral content (Wilcoxon Z = -0.41, p = .69). The LBDs were not significantly different when comparing the number of visual-spatial content elements with the number of emotional content elements (Wilcoxon Z = - 0.53, p = .59), the number of visual-spatial content element with the number of procedural/neutral content elements (Wilcoxon Z = -1.01, p = .31), or the number of emotional content elements with the number of procedural/neutral content elements (Wilcoxon Z = -0.65, p = .52). For the NCs, no significant differences were revealed when the use of the different types of content elements was assessed.

In sum, the NCs produced the most content elements and did so across the 3 different conditions of discourse. Although the LBDs and NCs differed quantitatively in the number of content elements used, the two groups were qualitatively similiar in that the reduction in content occurred in all three discourse conditions. Further, the RBDs' tendency to use less content was intensified when those patients with visual

perceptual deficits were excluded from the sample. In contrast to the LBDs, the RBDs were both quantitatively and qualitatively different from the NCs since the discourse of the RBDs was especially devoid of emotional content.

PRAGMATIC ANALYSIS

Use of Verbal Pragmatic Features of Discourse

Inter-rater Reliability. In the first part of the pragmatic analysis the measure of appropriateness or inappropriateness of the features of discourse was derived from raters' judgments. The percent agreement between the three raters ranged from 52.7% to 97.2% for the RBDs with an overall mean of 77%. For the LBDs, agreement ranged from 52.7% to 83.3% with an overall mean of 65.2%. For the NCs, agreement ranged from 69.4% to 100% with an overall mean of 85.1%. There was total agreement between the three raters on 75.7% of the ratings. A 2/3 consensus was achieved for 100% of the ratings. The consensus ratings were used for further analysis. Tables 10.1 - 10.3 present the number of inappropriate scores out of 36 ratings, the percent that each feature of discourse

Table 10.1: Use of pragmatic features based on 12 samples of discourse for each of three discourse conditions for the normal control (NC) subjects.

Pragmatic Feature	Total # of Inappropriate ratings (max = 36)	Percent Appropriateness based on a 2/3 consensus	Reliability: Percent Agreement Between 3 Raters
Visual-Spatial Condition			
Topic Maintenance	1	100	97.2
Conciseness	8	91.6	77.7
Specificity	3	91.6	91.6
Lexical Selection	4	100	88.8
Revision Strategy	3	100	91.6
Relevancy	5	91.6	86.1
Quantity	3	100	91.6
Emotional Condition			
Topic Maintenance	0	100	100.0
Conciseness	7	91.6	80.5
Specificity	3	100	91.6
Lexical Selection	6	91.6	83.3
Revision Strategy	2	100	94.4
Relevancy	2	100	94.4
Quantity	1	100	97.2
Procedural Condition			
Topic Maintenance	7	83.3	80.5
Conciseness	8	75	77.7
Specificity	9	75	75.0
Lexical Selection	11	75	69.4
Revision Strategy	9	83.3	75.0
Relevancy	9	75	75.0

Table 10.2: Use of pragmatic features based on 12 samples of discourse for each of three discourse conditions for the right brain damaged (RBD) subjects.

Pragmatic Feature	Total # of Inappropriate ratings (max = 36)	Percent Appropriateness based on a 2/3 consensus	Reliability: Percent Agreement between 3 Raters
Visual-Spatial Condition			
Topic Maintenance	1	100	97.2
Conciseness	9	75	94.4
Specificity	24	58.3	66.6
Lexical Selection	4	91.6	88.8
Revision Strategy	4	91.6	88.8
Relevancy	7	75	80.5
Quantity	13	66.6	63.8
Emotional Condition			
Topic Maintenance	1	100	97.2
Conciseness	21	66.6	52.7
Specificity	10	66.6	72.2
Lexical Selection	12	58.3	66.6
Revision Strategy	11	58.3	69.4
Relevancy	14	58.3	61.1
Quantity	3	91.6	91.6
Procedural Condition			
Topic Maintenance	1	100	97.2
Conciseness	8	83.3	77.7
Specificity	15	58.3	58.3
Lexical Selection	14	58.3	61.1
Revision Strategy	13	75	63.8
Relevancy	4	83.3	88.8
Quantity	7	83.3	80.5

Table 10.3: Use of pragmatic features based on 12 samples of discourse for each of three discourse conditions for the left brain damaged (LBD) subjects.

Pragmatic Feature	Total # of inappropriate ratings (max =3)	Percent Appropriateness based on a 2/3 consensus	Reliability: Percent Agreement Between 3 Raters
Visual-Spatial Condition			
Topic Maintenance	6	97.6	83.3
Conciseness	11	75	69.4
Specificity	23	25	63.8
Lexical Selection	19	50	52.7
Revision Strategy	20	41.6	55.5
Relevancy	8	83.3	77.7
Quantity	21	41.6	58.3
Emotional Condition			
Topic Maintenance	9	83.3	75.0
Conciseness	9	75	75.0
Specificity	15	75	58.3
Lexical Selection	16	58.3	55.5
Revision Strategy	11	75	69.4
Relevancy	10	75	72.2
Quantity	10	75	72.2
Procedural Condition			
Topic Maintenance	8	83.8	77.7
Conciseness	11	25	69.4
Specificity	20	33.3	55.5
Lexical Selection	17	58.3	52.7
Revision Strategy	19	41.6	52.7

was judged appropriate by a consensus of 2/3 of the raters, and the percent agreement for all three raters (i.e., reliability) in the visual- spatial, emotional and procedural discourse respectively.

In the narrative composed of visual-spatial content the NCs used appropriately each of the 7 features of discourse 91.6% to 100% of the time. The RBDs were appropriate in the use of the features of topic maintenance, lexical selection and revision strategy 91.6% to 100% of the time, but were somewhat less appropriate in the use of conciseness (75%), specificity (58.3%) and quantity (66.6%). In the visual-spatial narrative the LBDs were the least appropriate. Although the LBDs were able to maintain the topic (91.6% of the time) they were appropriate in the use of specificity only 25% of the time and lexical selection 50% of the time. The pragmatic features of revision strategy and relevancy were used appropriately 41.6% of the time and 83.3% of the time, respectively.

If either the RBDs or the LBDs were appropriate on a particular pragmatic feature of discourse less than 60% of the time, Fisher Exact Probability tests were employed to evaluate group differences between that

group and the NCs. Thus, in the visual-spatial narrative, four Fisher Exact Probability tests were conducted to determine if the LBDs differed significantly from the NCs in the appropriate or inappropriate use of the pragmatic discourse features. All four of the tests proved to be statistically significant below the .05 level of probability. Specifically, the LBDs differed significantly from the NCs in the appropriate use of specificity (Fisher Exact Test: $p < .025$), lexical selection (Fisher Exact Test: $p </= .025$), revision strategy (Fisher Exact Test: $p < .01$) and quantity (Fisher Exact Test: $p < .01$).

In the narrative composed of emotional content, the NCs were consistent in the appropriate use of the pragmatic features of discourse. The NCs used appropriate topic maintenance (100%), conciseness (100%), specificity (100%), lexical selection (91.6%), revision strategy (100%), relevancy (100%) and quantity (100%). The LBDs used appropriately the pragmatic features of conciseness, specificity, revision strategy, relevancy and quantity 75% of the time. The LBDs used appropriately topic maintenance 83.3% of the time and lexical selection 58.3% of the time. The narrative composed of emotional content was the most

difficult for the RBDs. Although the RBDs used appropriately topic maintenance (100%) and quantity (100%), they were less appropriate than the NCs in conciseness (66.6%), specificity (66.6%), lexical selection (58.3%), revision strategy (58.3%) and relevancy (58.3%).

Statistical differences between groups in the appropriate or inappropriate use of the pragmatic features were tested using Fisher Exact Tests of Probability. In the one instance (lexical selection) where the RBDs were less than 60% appropriate, no statistical difference between the RBDs and NCs (Fisher Exact Test: $p > .05$) were revealed. In the three instances where the RBDs were less than 60% appropriate, two analyses between the RBDs and NCs proved to be statistically significant. When compared to the NCs, the RBDs were inappropriate in the use of the verbal pragmatic features of relevancy (Fisher Exact Test: $p < .05$) and revision strategy (Fisher Exact Test: $p < .05$) in the emotional narrative.

In procedural discourse the NCs used appropriately the features of topic maintenance and revision strategy 83.3% of the time. Quantity and relevancy were used

appropriately 66.6% of the time and conciseness, specificity, and lexical selection were used appropriately 75% of the time. The RBDs were appropriate in the use of topic maintenance 100% of the time. Conciseness, relevancy and quantity were used appropriately 83.3% of the time and lexical selection and specificity were used appropriately 58.3% of the time. The LBDs used appropriately lexical selection, relevancy and quantity 58.3% of the time. The pragmatic feature of topic maintenance was used appropriately 83.3% of the time and conciseness was used appropriately 25% of the time. Specificity was used appropriately 33.3% of the time and revision strategy was used appropriately 41.6% of the time. Of the 8 Fisher Exact Tests of Probability conducted (2 comparing the RBDs and NCs and 6 comparing the LBDs and NCs) none proved to be statistically signficant at the .05 level of probability.

Effects of right hemisphere lesion location on the use of verbal pragmatic features of discourse

Because of the limited number of patients with anterior lesion locations (n = 2) in this sample, direct comparison of right anterior patients to right posterior patients was not feasible. To evaluate the

effects of lesion location on the use of the verbal pragmatic features of discourse, the data were reexamined using only the RBDs with posterior lesion locations (n = 7). Subjects were classified as "posterior" if their lesions were confined to parietal, occipital and/or temporal lobe structures and "anterior" if their lesions involved pre-Rolandic structures. If frontal and parietal temporal or occipital structures were involved, subjects were classified as "anterior/posterior."

In the visual-spatial narrative, the posterior RBDs used topic maintenance appropriately 100% of the time. Conciseness, revision strategy and lexical selection were used appropriately 71% of the time. Specificity and quantity were used appropriately 43% of the time. Fisher Exact Tests of Probability were conducted to determine differences between the posterior RBDs and the NCs in the appropriate use of the pragmatic features of specificity and quantity. As a group the posterior RBDs were significantly more inappropriate in the use of specificity (Fisher Exact Test: $p < .05$) and quantity (Fisher Exact Test: $p < .025$) when compared to the NCs. These results are consistent with the way the RBDs (n=12) in general used

the pragmatic features of discourse in the visual-spatial narrative.

In the emotional narrative, topic maintenance and quantity were used appropriately 100% of the time by the posterior RBDs. The features of specificity and relevancy were used appropriately 43% of the time. Lexical selection was used appropriately 57% of the time. The features of conciseness and revision strategy were used appropriately by the posterior RBDs 29% of the time. Five of their pragmatic features of discourse were compared to those of the NCs using Fisher Exact Tests of Probability and all five of these comparisons were statistically significant. In the emotional narrative condition, the posterior RBDs were significantly more inappropriate in the use of conciseness ($p < .025$), revision strategy ($p < .025$), specificity ($p < .025$), lexical selection ($p < .01$), and relevancy ($p < .025$). Thus, in comparison to the total group of RBDs (n=12), the RBDs with posterior lesions (n=7) had more difficulty in using the pragmatic features of discourse (2 inappropriate features for the RBDs vs. 5 inappropriate features for the posterior RBDs) in the narrative composed of emotional content.

In procedural discourse, the posterior RBDs differed very little from the RBDs (n = 12) in general. Specifically, the posterior RBDs used appropriately topic maintenance (100%), relevancy (100%), conciseness (71%), revision strategy (71%) and quantity. The features of lexical selection and specificity were used appropriately 57% of the time. Neither of the 2 Fisher Exact Probability Tests (for lexical selection and specificity) were statistically significiant at the .05 level of probability. Thus, in procedural discourse, posterior RBDs use the verbal pragmatic features similiarly to the RBDs in general.

Effects of Left Hemispheric Lesion Location on the Use of the Verbal Pragmatic Features of Discourse.

To evaluate the effects of lesion location within the hemisphere on the verbal pragmatic features of discourse, the data were reexamined using only those LBDs with posterior lesion locations (n = 8). As with the RBDs, there were too few anterior LBD subjects (n = 3) to permit a direct comparison between patients with anterior and posterior lesion location. Thus, the data were rexamined by comparing those LBDs with posterior pathology to the NCs.

In the visual-spatial narrative, the posterior LBDs used topic maintenance appropriately 87.5% of the time. Relevancy was used appropriately 75% of the time and conciseness was used appropriately 62.5% of the time. Specificity was used appropriately 25% of the time. The verbal pragmatic features of lexical selection, revision strategy and quantity were used appropriately 5% of the time. Fisher Exact Tests of Probability revealed differences between the posterior LBDs and the NCs in the appropriate use of specificity (Fisher Exact Test: $p < .01$), lexical selection (Fisher Exact Test: $p < .025$) and quantity (Fisher Exact Test $< .025$).

In the narrative composed of emotional content the posterior LBDs used topic maintenance, conciseness, specificity and revision strategy appropriately 75% of the time. Lexical selection was used appropriately 50% of the time, relevancy was appropriate 62.5% of the time and quantity was appropriate 87.5% of the time. In procedural discourse topic maintenance was used appropriately 75% of the time, conciseness was used appropriately 62.5% of the time. Both lexical selection and relevancy were used appropriately 50% of the time. The verbal pragmatic features of revision

strategy and quantity were used appropriately 37.5% of the time. Only one Fisher Exact Test proved to be significant in both the narrative and procedural discourse condition. When the posterior LBDs were compared on the verbal pragmatic feature of specificity, the LBDs were significantly more inappropriate (Fisher Exact Test: $p<.05$).

The comparison of the posterior LBDs to the NCS demonstrated that the posterior LBDs performed very much like the LBDs in general. That is, their verbal pragmatic competence was most compromised in the visual-spatial narrative. However, when the content of the narrative was emotional or procedural/neutral, the posterior LBDs used the verbal pragmatic features of discourse similarly to the NCs.

Pragmatic Measures of Cohesion and Coherence

Inter-rater Reliability. On this part of the pragmatic analysis raters were questioned about the cohesion and coherence of each discourse. Raters responded to seven questions for each discourse segment on a 3-point scale (where 0 = not at all, 1 = slightly,

and 2 = yes). For these measures, the three raters agreed totally (i.e., 3 out of 3) on 61.1% of the ratings. The three raters agreed on 2 out of 3 scores on 36.6% of the ratings. Therefore, a 2/3 consensus or better was achieved on 97.8% of the ratings. In the event a 2/3 consensus score was not achieved (as was the case 2.2% of the time) the examiner determined the score for that particular measure based on an additional review of the transcript. As was the case in the first part of the pragmatic analysis, the 2/3 consensus ratings were used for additional analysis.

Kruskal-Wallis One Way Analysis of Variance tests were conducted to determine group differences in the rater's judgments of cohesion and coherence. As shown in Table 11, five out of seven questions about the visual-spatial narrative were statistically significant. Mann-Whitney U tests were used as post hoc analysis to compare group scores. In the visual-spatial narrative, only the LBDs distinguished themselves from the NCs. Specifically, the LBDs were judged to be less coherent on Question 1: "Do you know what is happening in the story?" (Mann-Whitney U = 41.5, p = .03), and less cohesive on

Table 11: Kruskal-Wallis One Way ANOVA for pragmatic measures of cohesion and coherence.

Questions presented to the raters:	χ^2	p
1. Do you know what is happening in the story?		
Visual-Spatial	6.31	.04*
Emotional	4.67	.04*
Procedural	1.32	.52
2. Is the story complete in terms of the stimulus material?		
Visual-Spatial	4.82	.09
Emotional	4.67	.10
Procedural	5.62	.06
3. Is the language used in the story clear?		
Visual-Spatial	5.99	.05*
Emotional	9.53	.001 **
Procedural	2.24	.33
4. Does the story follow a logical sequence of events?		
Visual-Spatial	1.29	.52
Emotional	3.83	.15
Procedural	2.89	.24
5. Does the story have a beginning, middle and end?		
Visual-Spatial	5.93	.05 *
Emotional	3.83	.15
Procedural	4.95	.08
6. Are the ideas expressed in the story unified and connected?		
Visual-Spatial	10.77	.001 **
Emotional	3.83	.15
Procedural	.23	.89
7. Is the story reconstructable on the basis of the information given?		
Visual-Spatial	8.85	.03 *
Emotional	3.83	.15
Procedural	3.61	.16

Question 5: "Does the story have a beginning, middle and end?" (U = 42, p = .01), Question 6: "Are the ideas expressed in the story unified and connected?" (U = 41.5, p = .03) and Question 7: "Is the story reconstructable on the basis of the information given?" (U = 35.5, p = .01). The LBDs were judged less coherent than the RBDs on Question 3: "Is the language in the story clear?" (U = 40.5, p = .02) and less cohesive on Question 6: "Are the ideas expressed in the story unified and connected?" (U = 36.0, p = .01). In the emotional condition, the LBDs were also judged as less coherent than the NCs (U = 34, p = .01) and the RBDs (U = 34, p = .01) on Question 3.

In summary, both the RBDs and LBDs demonstrated deficits in using the verbal pragmatic features of discourse. The LBDs demonstrated the most difficulty in the visual-spatial narrative and the RBDs demonstrated the most difficulty in the narrative composed of emotional content. Posterior lesion location within the right hemisphere appeared to exacerbate verbal pragmatic difficulties in the narrative composed of emotional content. The LBDs were judged to be less cohesive and coherent than both the

NCs and RBDs especially in the visual-spatial narrative.

Chapter 6

DISCUSSION

Introduction

A discourse-oriented approach has been utilized to gain insight into the linguistic systems of patients with right brain-damage. Interest in the discourse of RBDs arises from three recent findings reported in the clinical literature. First are reports that suggest RBDs exhibit excessive speech and demonstrate disturbances on complex linguistic tasks such as rearranging pictorial stimuli into narratives (Huber and Gleber, 1982) and appreciating humor (Brownell, Michel, Powelston and Gardner, 1983). Second are neuropsychological reports of patients with RBD documenting deficits in visual-spatial processing (Kimura, 1974) and in the nonverbal expression of emotion (Borod, Koff, Lorch and Nicholas, 1986); factors that may enter into their discourse processing. Third, the finding that discourse structure remains intact in LBDs despite deficits in phonology, morphology, syntax and semantics (Ultatowska et al., 1981) raises the possibility that discourse organization is a right hemisphere function. Given these observations, this study was undertaken to

examine the effects of right hemisphere damage on discourse and, in doing so, to clarify current theories about the hemispheric-dependent processes that contribute to language production.

Three specific questions were addressed in this study in order to uncover what the respective hemispheric responsibilities are in discourse processing. The first question inquired into the relative dissolution and preservation of the formalistic aspects of discourse structure in the three subject populations. The second question asked about the contribution of various types of information content to the coherence of discourse in order to discover if emotional or visual-spatial content rendered the discourse of RBDs particularly impaired. For the third question, the verbal pragmatic features of discourse were addressed in an effort to describe how the pragmatic component of linguistic systems interacts with the form and content of language.

The following discussion will address each of these questions individually. Contrasts of group performance on the measures of form, content and language use will be used to examine the specialized

cognitive-linguistic mechanisms that underlie the production of language at the level of discourse. Finally a preliminary model of language processing will be proposed in an effort to account for the actual set of mechanisms used by normal speakers to achieve well-formed discourse.

Do the Right Brain-Damage Subjects and/or the Left Brain-Damage Subjects Demonstrate a Dissolution in the Structure and Organization of Discourse?

Any discussion of the formalistic properties of discourse structure in brain-damaged patients must first clarify that basic language functions (i.e., phonology, syntax and low-level semantics) are mediated primarily by the left hemisphere. In fact, the observation of relatively unimpaired discourse structure in the face of LBDs' deficits in the basic language functions has provided impetus for studying further the discourse structure of RBDs. It was hypothesized that despite the RBDs' competence with these basic language functions, they would demonstrate a dissolution in the formalistic aspects of discourse structure. Four areas turned out to be of particular interest in the data in light of previous work in this

area: discourse length, reference, extraneous remarks and macrostructure.

Discourse Length

Anecdotal reports of RBD language led to the expectation that their discourse would be copious and relatively uninformative. Suprisingly, neither the number of words nor the number of T-units (i.e., the number of independent clauses with any dependent modifier of that clause) distinguished the RBDs from the NCs or LBDs. Joanette et al. (1986) hypothesized that attitude towards the experimental task may underlie the uninformative nature of the RBDs' discourse. That the RBDs' discourse was similiar in length to that of the other groups suggests that the uninformative nature of their discourse is not related to their approach to the test situation. However, subtle differences between the RBDs, LBDs and NCs were revealed within the structure of discourse apart from the amount of language produced.

Referential System

Errors in the RBDs' referential system are one factor contributing to the lack of clarity in their discourse. Several lexical devices important for establishing reference were evaluated. As a group, the RBDs tended to be less proficient at establishing whom or what is being referred to within a text. In the visual-spatial narrative, there were statistically significant differences between the RBDs and NCs in the use of pronouns without antecedents. The RBDs demonstrated significant difficulty in using the rules that maintain the identity of nouns or characters in a narrative. In comparison to the NCs, the RBDs also tended to produce slightly more deictic terms and indefinite terms. The overuse of deictic and indefinite terms complicated by unspecified pronoun reference probably rendered the language of the RBDs vague and ambiguous. Taken together these factors suggest that the RBDs were weak in using words to establish a joint focus of attention and diminished in their ability to appreciate what a partner in a communicative exchange needs to know.

Deficits in integrating contextual information (Brownell, Michel, Powelson and Gardner, 1983) and in drawing proper inferences (Wapner, Hamby and Gardner, 1981) as a consequence of right brain-damage have been reported previously. The results of the present study are consistent with these reports of comprehension deficits but suggest further that right brain damage tends to impair a person's verbal ability to establish whom or what he or she is talking about within a text.

Linguistic devices for establishing reference have been studied previously in aphasic LBDs. Evidence of ambiguous reference in the narratives of individuals with aphasia was reported by Berko-Gleason et al. (1980) and Ulatowska et al. (1981). Results of the present study are consistent with previous reports. In comparison to the NCs, the LBDs in this study produced signficantly more pronouns without antecedents in one narrative. Overall, the LBDs tended to overuse deictic terms and mark a referent inappropriately with an article more often than did the NCs. As was the case for the RBDs, the LBDs' referential system was somewhat compromised. Both groups tended to be less proficient than NCs in appreciating linguistic context and sharing perspective with the listener. These findings are

important in that a similiarity in error pattern between the RBDs and LBDs is demonstrated. This observation is consistent with the view that the referential linguistic system is related to general cognitive processes and that both the left and right hemisphere are required for optimal processing of reference.

Remarkable similiarities between the RBDs and NCs in the formalistic aspects of discourse are apparent in the face of the subtle differences discussed above. In fact, analyses of the surface features used in discourse demonstrated that the LBDs were the group who distinguished themselves most often from the RBDs and NCs. For example, when the groups were compared for density of linguistic constructions, the RBDs were similiar to the NCs. In contrast, the LBDs used signficantly less dense linguistic formulations which were characterized by a reduced range of connectors and a tendency to concatenate clauses. The RBDs resembled the NCs with respect to syntactic complexity.

Extraneous Remarks

The LBDs also distinguished themselves from the RBDs and NCs in using two types of extraneous remarks: the number of comments on the task rather than on the stimulus; and the number of word and phrase repetitions. For example, with regards to comments on the task, one LBD remarked "words are awful..." and another "to hell, I can't say it." Extraneous comments on the task show a speaker's intention to convey a message and awareness of their difficulty in accessing words or information. Neither the NCs nor the RBDs used this strategy but given the differences in the amount of information being conveyed by these two groups, omission of the strategy is apparently for different reasons. The RBDs typically do not comment on the task and may be unaware of their deficit in accessing the content of the story.

Production of word and phrase repetitions may in some instances function similarly to comments made on the task. While many of the word repetitions made by the LBDs are clearly perseverative (e.g., "she got..sh-she got") at other times their use of repetition functions to convey special emphasis. This

occurred most often when the context was emotional (e.g., "sad, so,so sad"). Repetition appears to be a consistent strategy used by LBDs to emphasize emotional content (Bloom, Borod, Obler and Koff, submitted). The use of word and phrase repetition distinguished the LBDs from the NCs and RBDs. The LBDs often used repetitions to emphasize a special point and perhaps compensate for their difficulties with sentence formulation whereas the RBDs and NCs continued their discourse without many repetitions.

Macrostructure

Presumably the formalistic components of discourse macrostructure represent a speaker's internal knowledge of story structure. In discourse processing, macrostructure components serve as an organizing framework for the elements of a story that are loaded with the most critical information. In general, macrostructure components are related to main ideas in the story and are central to the internal representation of discourse (Stein and Glenn, 1979).

With respect to left brain damage, Ulatowska, Freedman-Stern, Doyel, Maculuso-Haynes and North (1985)

described the narrative abilities of moderately impaired aphasics in self-generated stories elicited through pictures and in stories immediately recalled. These results suggested that the macrostructure components of discourse were preserved and that the compromise in story structure was selective in that it usually occurred on unimportant story elements. The authors interpret this observation as support for the principle that aphasic language at the level of discourse is rule governed. However, the evidence provided is inconclusive since they do not provide data or statistical analysis to support their assertion.

Statistical evidence to support the assertion of Ulatowska et al. (1983) was obtained in this study. That is, there were no statistically significant differences between the aphasic LBDs and normal controls in using the components of discourse that were essential to the overall development of narrative structure ("setting," "complicating action," "resolution") or procedural ("introducer," "procedural steps," "result") discourse. In one narrative condition, the LBDs were statistically different from the NCs in the use of the "setting" component.

However, both the LBDs and NCs were similiar with regards to macrostructure in all other observations.

When the narratives of the RBDs were compared to the narratives of the NCs, no significant differences were found in the use of the macrostructure. However, this was not the case for the RBDs in procedural discourse. Specifically this occured in the use of the "procedural steps" component of the procedural discourse condition. The RBDs' difficulty in producing this particular macrostructure component is curious and may be related to the fact that the specific "procedural steps" were not explicit in the stimulus pictures designed to elicit procedural discourse. (See Appendix C.3). Instead, the subjects were required to deduce the steps necessary to accomplish the procedure depicted. In this experimental task all discourse samples were elicited from pictorial stimuli placed directly in front of the subject so that language uncomplicated by deficits in memory could be studied. The RBDs' vulnerability with this particular component of macrostructure is revealing since their discourse was elicited without taxing visual or auditory memory and probably represents their best efforts in discourse production. Perhaps in a narrative recall task or in

social conversation where the communicative exchange is less structured additional macrostructure deficits would be revealed.

Suffice it to say that in this experiment the component of discourse macrostructure remained relatively robust following both left and right brain damage. The RBDs' special difficulty with the "procedural steps" element in procedural discourse raises the possibility that in communicative situations less structured than the experimental task presented here, the RBDs might demonstrate special deficiencies in forming an internal representation of a story. Of course, the hypothesis that right brain-damage impairs speakers' ability to use fully the rules that govern basic discourse organization must be tempered by recognizing that these findings have not been replicated. Nevertheless, damage to the right hemisphere seems to impair the structural components of procedural discourse in a manner that is distinct from the impairment resulting from left brain-damage.

These data seem to suggest that the underlying representation of discourse form is a fundamental cognitive process that relies on the right hemisphere

in two areas: establishing reference and structuring procedural discourse. A surprising finding was that the RBDs produced discourse of equal length to the other groups. This refutes the anecdotal accounts of copious language in the RBDs but suggests that the perceived lack of clarity in their language may stem from subtle disruptions in their referential linguistic system and in consistently forming an internal representation of discourse structure. The discussion now turns to the analysis of content in order to examine if it is visual-spatial or emotional factors which underlie the dissolution of discourse in right brain damaged subjects.

Does Type of Content Alter the Adequacy of the Discourse in Patients with Left and Right Brain-Damage ?

To address the second question, the number of visual-spatial elements and the number of emotional elements produced were counted and compared between groups. The number of procedural elements was also counted since these were not loaded with either visual-spatial or emotional content. In this study, content elements are equivalent to what Bruner (1975)

and Duchan (1985) call schemata since they are information units loaded with specific cognitive structure (i.e. visual-spatial or emotional) and are processed as incoming stimuli. Failure to produce a specific type of informational content is viewed as a deficit in processing a particular aspect of cognitive structure. Linguistically these abstract cognitive structures are expressed as higher-level semantic or ideational units.

Dissolution of Content in Left Brain-Damaged Subjects' Discourse

Consistent with previous reports of LBDs (Berko-Gleason et al., 1980) it was expected that their use of content would be reduced when compared to that of the NCs. The results of the present investigation are in line with the findings of Berko-Gleason et al. insofar as both studies found that LBDs typically limit themselves to one or two basic units of information and paraphrase it several times throughout a narrative. Additionally in this study the LBDs' discourse was significantly reduced in the use of all types of content (i.e., visual-spatial, emotional, and procedural) when compared to the NCs.

Interestingly, the LBDs did not differ in the number of content elements produced among the three conditions. This suggests that the reduction in the use of information content in the LBDs is consistent with a language deficit across all conditions.

Dissolution of Content in Right Brain-Damaged Subjects' Discourse

Originally it was predicted that the RBDs would not differ signficiantly from the NCs in the use of procedural/neutral content but that they would differ in the use of visual-spatial and emotional content. Such a finding would challenge Myer's (1982) assertion that lower level visual perceptual deficits alone determine the poor language production of right brain-damaged subjects on higher level linguistic tasks. It would also challenge the observation made by Gardner et al. (1983) that the language of right brain-damaged subjects reflects their difficulty in apprehending emotional nuances.

Joanette et al. (1986) previously reported that the narratives of RBDs contained a smaller amount of information content than did the narratives of the NCs.

However, these authors do not exclude visual perceptual impairments as underlying the lack of information in the RBDs' narratives nor do they address the effect of different types of content on narrative structure.

In the present study it was possible to distinguish specific linguistic deficits from the contributions of visual-spatial impairments and the nonverbal emotional deficits associated with right hemisphere pathology. In comparison to the NCs, the RBDs included signficantly less visual spatial, emotional and procedural/neutral content in their discourse. To rule out completely the possibility that visual misperceptions underlay the RBDs' diminished use of content, the three RBDs with visual perceptual deficits (as measured by the Benton Visual Form Discrimination Test) were excluded from the next level of analysis. The subset of right brain-damaged patients without visual perceptual deficits remained significantly different from the NCs in the use of content across all three measures. This suggests that visual misperceptions alone do not account for all of the RBDs' difficulties with discourse production.

The RBDs without visual perceptual deficits were then compared for within group differences in the use of different types of content. These data showed that there was a significant reduction in the RBD's use of emotional content when compared to their use of visual-spatial content. Additionally, the RBD's use of emotional content tended to be reduced when compared to their use of procedural/neutral content. No significant differences were found between the RBDs' use of visual-spatial content and procedural/neutral content. Within groups differences in the use of content demonstrated that RBDs are qualitatively different from the LBDs and NCs. In contrast to the RBDs, the LBDs' production of content was equally diminished across all conditions and the NCs characteristically included all the different types of content elements. This finding distinguishes further the discourse deficit of the RBDs from those of the LBDs and NCs.

The content of the narrative discourse of the RBDs was most compromised when the information was loaded with emotion. Although an impairment in visual-spatial perception per se did not account for all of the discourse breakdown of the RBDs, as a group they

demonstrated deficits in talking about visual-spatial information. The observation that the RBDs were reduced in procedural/neutral content relative to the NCs suggests further that the dissolution of their discourse is related directly to deficits in the production of language content.

Although visual-spatial and emotional deficits complicate the use of informational content in the RBDs, these impairments do not operate apart from other linguistic functions. Rather than characterizing the RBDs as deficient in cognitive structure, these data suggest that there is a concomitant impairment in discourse as well. That is, the RBDs demonstrate both cognitive and linguistic impairments in discourse production which manifest themselves as a reduction in the expression of higher level semantic information and are present regardless of the nature of the content.

Contrary to initial expectations, the discourse of the RBDs was not only reduced in emotional and visual-spatial content (factors typically associated with right hemisphere pathology) but also in the discourse composed of procedural/neutral content. This contradicts the hypothesis of Myers (1981) in that

lower-level visual perceptual deficits were shown to account for some but not all of the RBD's deficits in discourse production. Moreover, these data extend the findings of Gardner et al. (1983) and suggest that while emotional material is especially difficult for RBDs, deficits in higher-level semantic processing occur regardless of the nature of the cognitive structure they express.

These results demonstrate that the left hemisphere does not operate in isolation in discourse processing. The right hemisphere plays a special role in processing specific cognitive structures (i.e. visual-spatial and emotional content) and in the use of higher-level semantic information in general. Clearly, the right hemisphere is required for the production of language that is elaborate and discourse that is fully informative.

What Pragmatic Features of Discourse are Disrupted or Preserved in Patients with Left- or Right Brain-Damage ?

Only recently has the role of pragmatics in language processing received attention in the

neurolinguistic literature. This investigation evaluated only the verbal pragmatic features of discourse and excluded from analysis the paralinguistic and nonverbal aspects. The verbal pragmatic features studied here were derived from Grices' (1975) description of conversational logic and emphasize the relationship between a subject's intention, the words selected to express this intention, and their combined effect on the receiver of the message (rater). Adherence to the rules that govern verbal pragmatic competence results in discourse that clearly conveys the speaker's intent.

In an extensive review on the pragmatic aspects of communication in brain-damaged patients, Foldi, Cicone and Gardner (1983) offer some interesting but inconclusive speculations. Foldi et al. argue that following left brain-damage certain aspects of pragmatics (e.g., distinguishing direct from indirect commands) are retained even if their language content is unclear. These authors assert that right brain-damage can impair pragmatic competence even if linguistic competence is spared. Moreover the authors suggest that a disruption in left hemisphere processing

may be compensated for by the pragmatic abilities of the right hemisphere.

Originally it was hypothesized that the RBDs would be inappropriate in the use of the verbal pragmatic features of discourse. It was expected that these results would stand in contrast to the results of the LBDs who will have preserved their pragmatic competence. The results of the present study strongly suggest that there exists a difference in pragmatic competence between the two sides of the brain. Further, this study indicates that the difference in pragmatic competence reflects the operation of cognitive rather than linguistic function.

Based on the findings of this study, it may be concluded that emotional content distinctively impaired the pragmatic competence of the RBDs. In the narrative loaded with emotional information, the RBDs were unable to clearly convey their intention to the receiver of the message. Specifically, the RBDs were more inappropriate than the NCs in producing discourse that was relevant to the task and topic and in using revisions to clarify their intent. Interestingly, when the content of the discourse was visual-spatial or

procedural/neutral, the verbal pragmatic abilities of the RBDs did not differ from the NCs at all.

The verbal pragmatic abilities of RBDs with posterior hemisphere pathology were especially compromised in the emotional narrative. When this subset of RBDs was compared to the NCs, these RBDs typically produced irrelevant and ambiguous language. They often selected words that did not facilitate the message's clarity. Further, the posterior RBDs often gave excessive details and did not repair their messages when a breakdown did occur.

That right brain-damaged subjects have deficits in the nonverbal expression of emotion has been reported previously (Borod, Koff, Lorch and Nicholas, 1986; Ross, 1985). The results of this study extend these previous observations and suggest further that the RBDs' deficits in emotional expression have a verbal pragmatic component that cannot be explained by disorders in nonverbal expression or prosody. These results add to the research that addresses how emotion is organized within the right hemisphere by suggesting a special role for posterior structures in the expression of emotion.

In the LBDs, emotional content seemed to facilitate verbal pragmatic competence. Specifically, the pragmatic competence of the LBDs resembled the pragmatic competence of the NCs when the narrative content was emotional but not visual-spatial. Given the evidence suggesting a special role for the right hemisphere in emotional processing, it is probable that the right hemisphere is mediating this facilitation effect. A similiar facilitation effect was reported by Borod, Lorch, Koff and Nicholas (1987) who demonstrated that emotional context can facilitate the facial motor performance of LBDs with apraxia of speech. Similarly Boller, Cole, Vrtunski, Patterson and Kim (1979) showed that the auditory comprehension of (aphasic) LBDs improved when the content was emotional. That neither visual-spatial content nor procedural/neutral content produced such an effect suggests that the effects of emotional content are not incidental. Rather, emotional content seemed to activate the right hemisphere's potential, enabling it to compensate for the pragmatic deficits of the left hemisphere. Interestingly, neither emotional, visual-spatial nor procedural/neutral content had a discernible effect on the linguistic deficits associated with left brain-damage.

In addition to examining discourse for the appropriate use of verbal pragmatic features, each transcript was also rated with respect to its cohesion and coherence. Originally it was predicted that there would be a clear dissociation between the use of cohesion and coherence. Since cohesion is achieved grammatically it was expected that the LBDs would be particularly deficient at conveying these lexical relationships to the raters. Coherence, a general cognitive concept that is related to the way meanings are linked in a text, was expected to be differentially impaired in the RBDs.

Contrary to these expectations, the LBDs' discourse units were judged to be both less cohesive and less coherent than the RBDs. This was especially true in the narrative composed of predominantly visual-spatial information. One possible explanation for this finding is that surface features of discourse are more salient to raters and may interfere with judgments of pragmatic competence. The rules that govern coherence and cohesion are not as neatly defined as the rules that govern linguistic structures themselves. It may be that deficits in language form mask coherence in the same way that intact language

form gives an impression of coherence. This view is consistent with Ulatowska et al. (1981) who hypothesized that there should be a relationship between objective measures of discourse structure and ratings of coherence.

The results of the pragmatic analysis are striking since the transcripts were rated without cues provided by facial expression or prosody. Since facial expression and prosody are thought to be regulated by the right hemisphere, it is remarkable that the RBDs perform so poorly in the use of verbal pragmatic features of discourse. These results are intriguing since they implicate the right hemisphere in language or, more specifically, in the verbal pragmatic processing of discourse.

The verbal pragmatic features of discourse are not as distinctly coded as the rules that govern sentence formulation. Although pragmatic competence in brain-damaged subjects appears to be related to the cognitive processing style of the unimpaired hemisphere, no singular notion about hemisphere asymmetry and the organization of pragmatics is possible. However, there were certain regularities in

the data which may shed some light on the relative preservation or disruption of the verbal pragmatic features of discourse in the LBDs and RBDs. First is the finding that the left and right hemisphere are required for optimal use of the verbal pragmatic features of discourse. That the RBDs have difficulty in formulating discourse that was judged pragmatically appropriate is perhaps more striking since the RBDs demonstrate intact sentential formulations. Another interesting finding is that posterior right hemisphere pathology seemed to exacerbate the difficulties in using the verbal pragmatic features of discourse. This suggests that parietal, temporal and/or occipital structures within the right hemisphere play a special role in the use of the verbal pragmatic features of discourse. Finally, the pragmatic component of language appears to interact closely with the content of discourse. Specifically, when the content of the discourse was emotional, the LBDs produced discourse that was pragmatically appropriate. This suggests that emotional content triggers compensatory adjustments in the verbal pragmatic aspects of the LBDs' discourse.

COMPARISON OF SUBJECT GROUPS

The three subject groups were matched for age, sex and educational level as well as for cognitive, temporal and perceptual functioning. The left and right brain-damaged groups were similar with respect to the distribution of lesion site and the number of months post onset of the CVA. In fact the left and right brain-damaged groups differed only in terms of hemispheric side of lesion. The normal control subjects were drawn from the same hospitals and rehabilitation agencies as the stroke patients.

Given the similarities in these groups, differences in their discourse production are now considered in pairs.

Normal Control Subjects vs. Patients with Right Brain-Damage

The NCs and RBDs used an equivalent number of words and produced utterances of equal length and syntactic complexity. However, the RBDs tended to be more ambiguous in the use of reference, producing more pronouns without antecedents, and slightly more

indefinite and deictic terms. In comparison to the NCs, the RBDs were deficient at generating the essential components of procedural discourse. The RBDs demonstrated striking differences in comparison to the NCs when the content of their discourse was considered. Not only did the RBDs produce significantly less content, but in the subset of RBDs with no visual perceptual deficits, qualitative differences were revealed as well. The RBDs further distinguished themselves from the NCs in the use of the verbal pragmatic features of discourse. In the narrative composed of emotional content, the RBDs failed to produce appropriate pragmatic devices to aid the message receiver (rater) in deriving meaning from the discourse. Inappropriate use of the verbal pragmatic features of discourse was especially prevalent in the RBDs with posterior lesion locations.

Patients with right brain-damage produce errors in discourse that are seen in normals but the RBDs have particular difficulty in expressing information about emotion. When information is not implicit, the RBDs appear to have difficulty generating an internal representation of story structure and sharing reference. The RBDs fail to revise their messages and

are apparently not aware of their problems with information content. These findings suggest that the right hemisphere is involved in the aspects of language production that will be called simultaneous.

Patients with Left Brain-Damage vs. Normal Controls

Although the LBDs produced an equivalent amount of language to the NCs, the LBDs used syntax that was less complex and utterances that were shorter in length. The LBDs produced significantly more word and phrase repetitions and made significantly more comments on the task rather than on the stimulus. Characteristically the LBDs used fewer content elements than the NCs and did so in all three types of discourse: visual-spatial, emotional and procedural discourse. The visual-spatial problems in the LBDs could be related to the preponderance of posterior brain-damage subjects. In comparison to the NCs, the LBDs used the verbal pragmatic features of discourse inappropriately especially when the narrative content was visual-spatial. In comparison to the NCs, patients with posterior left hemisphere pathology tended to be more impaired in the use of verbal pragmatic devices than the LBDs in general.

Individuals with left brain-damage produce errors within discourse that are similiar to the errors found in the discourse of normal speakers. The LBDs' reduction in content appears to be selective or self-regulated because their internal representation of story structure appears to remain relatively intact and they seem to be aware of their linguistic shortcomings. Overall, these findings suggest that the left hemisphere operates concurrently with the right hemisphere in the processing of discourse structure. However, the left hemisphere appears to operate alone in the successive processing of linguistic form.

Patients with Right Brain-Damage vs. Patients with Left Brain-Damage

The linguistic systems of these two groups of brain-damaged patients were clearly differentiated at the sentence level and subtly differentiated at the level of discourse. As a group, the RBDs tended to use more indefinite terms and more deictic terms, although both groups made numerous errors establishing reference within a text. The two groups were not different on measures of discourse length, but the LBDs used utterances that were reduced in syntactic complexity.

Further, the LBDs used significantly more word and phrase repetitions and made more comments on the task. These strategies often imparted emphasis, showed intention to complete a message and an awareness of communicative difficulties. The RBDs demonstrated no such awareness and rarely revised their messages.

The LBDs and RBDs were similiar with respect to the use of content but the RBDs demonstrated significant within group differences in the use of emotional content. In contrast, the LBDs were equally diminished in the use of all types of content. For the RBDs, verbal pragmatic deficits were most apparent when the content of the discourse was emotional. The LBDs demonstrated verbal pragmatic deficits when the content was visual-spatial. Posterior lesion location within the right hemisphere exaserbated the verbal pragmatic deficits of the RBDs. Posterior lesion location within the left hemisphere also tended to intensify problems in the appropriate use of the verbal pragmatic features of discourse. The differences revealed at the sentence level in the LBDs and the discourse level in the RBDs clearly place the language deficits of the RBDs outside the continuum of aphasia. Because of the covert nature of the RBDs' problems with discourse, they are perhaps

more disadvantaged than the LBDs in using language in real communicative situations.

The language deficits from left brain-damage and right brain-damage are clearly two distinct clinical syndromes. Whereas the linguistic structure of the LBDs generally becomes fragmented at the word and sentence level, the RBDs' discourse breakdown lies in processing larger language units that are either ideational or related to the underlying scheme that organizes the meanings of utterances. The discourse of the LBDs reflects the cognitive style of the right hemisphere. For example, LBDs are able to take advantage of emotional content, repair and emphasize messages, and generate an internal representation of story structure. In the same way, the language of the RBDs reflects the linguistic capacities of the unimpaired left hemisphere but is impoverished in the particular cognitive style of the right hemisphere. Specifically, the RBDs are able to produce the temporal aspects of linguistic form but are deficited in simultaneously producing various aspects of discourse structure. Unaware of their deficits, the RBDs demonstrate a dependency on immediate context and a dissolution of the rules that permit a speaker to

construct knowledge and share perspective with a communication partner.

TOWARDS A MODEL OF DISCOURSE PRODUCTION

Models of language production attempt to move beyond descriptions of clinical syndromes and develop theories of language that account for both normal and pathological linguistic behaviors. In this tradition, models of language processing have been developed to account for single word reading (e.g. Cotheart, Patterson and Marshall, 1980), word finding deficits (e.g. Morton, 1985), agrammatism (e.g. Saffran, 1982) and sentence production (e.g. Garrett, 1980).

Typically, these models are composed of discrete components of the linguistic system that are organized as hierarchical levels. Construction of these models is based on observable dissociations between intact and impaired structures within a speaker's linguistic system and are hypothesized to parallel normal language processing. For example, Garrett's model of sentence production identifies the level of linguistic impairment (phonological, semantic or syntactic), describes the point in processing where the breakdown

occurred (e.g. storage, accessing) and relates these processes to a model of sentence production in normal speakers.

Whereas word and sentence level descriptions are conducive to componential models of linguistic processing, descriptions of discourse production must also account for the capabilities of the larger language system. The present investigation demonstrated that discourse production requires complementary hemispheric responsibilities that can only be explained as a series of synergistic processes. Thus, a model of discourse production should not only focus on identifying the components or modules of discourse but also on how these modules interact with each other.

The preliminary model of discourse production proposed here describes simultaneous and successive processing networks and the interaction of the modules which delimit linguistic form (phonology, low-level semantics, syntax), content (high-level semantics) and pragmatics. The components of discourse are posited on the basis that they are autonomous or exist independently of each other. Components have been

assigned to the simultaneous processing network if a lesion in either hemisphere disrupts the function of that particular component. Components have been assigned to the successive processing network if a disruption in that component arises from a unilateral (left) hemisphere lesion. The proposed model is depicted in Figure 6. This model has been entitled "The Synergistic Model of Discourse Production" since it focuses on the simultaneous action of separate but cooperative modules. In this model discourse production is viewed as a unitary cognitive process, with right hemisphere cognitive processing being supported by (simultaneous and successive) left hemisphere processes, with an evolving end-stage mediated only by the left hemisphere (Brown, 1983).

In this preliminary model, a unit of discourse is generated based on input to any one of the simultaneous processors. The pragmatic module implements the verbal pragmatic rules that describe what a speaker needs to do in order to convey his/her message to a listener. These verbal pragmatic rules (e.g. appropriate use of specificity) are defined over the entire unit of discourse and are processed simultaneously with other general cognitive functions.

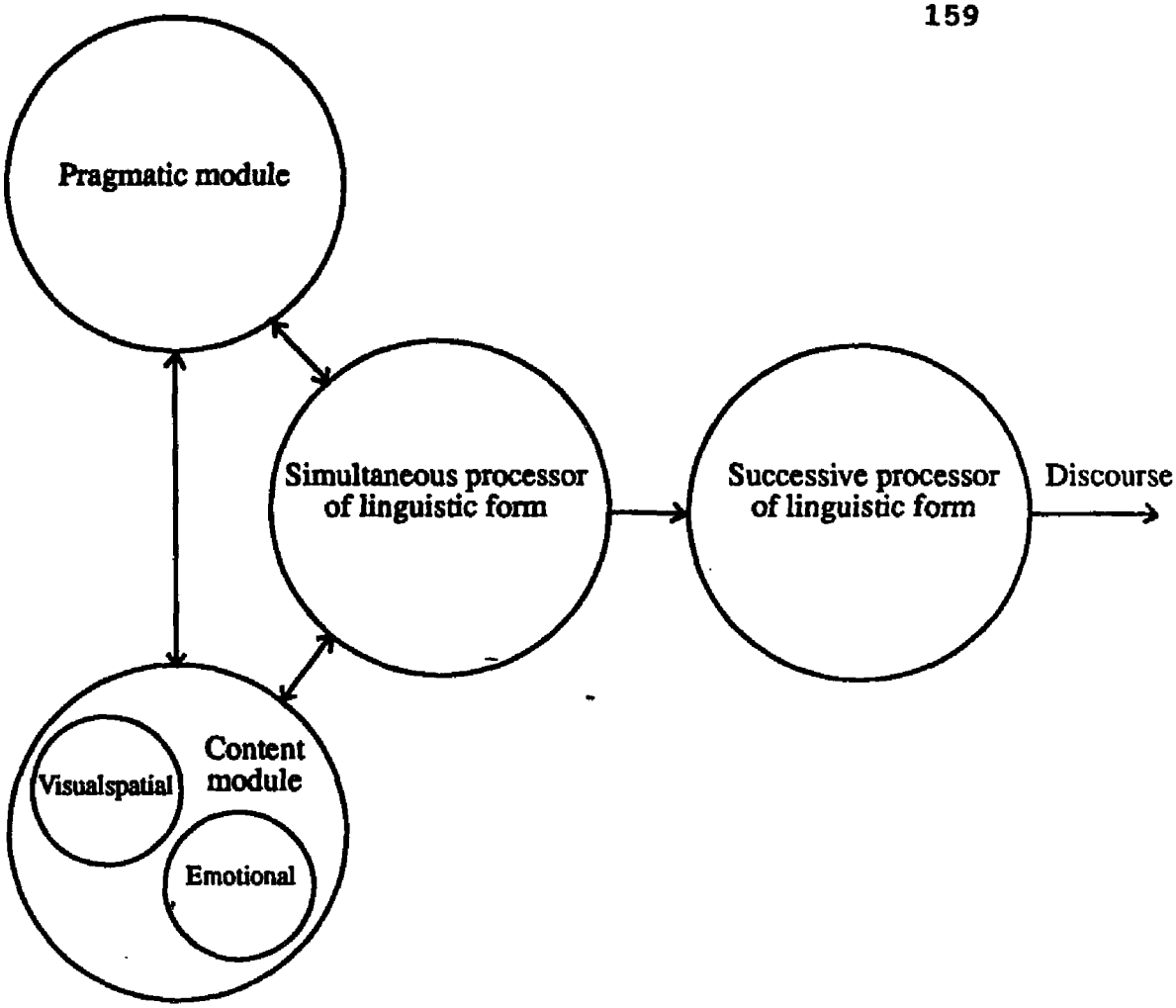


Figure 6. Synergistic model of discourse production.

A minimum of two content modules which process specific cognitive structure are posited. So far only visual-spatial and emotional content modules have been delimited. Both of these regulate higher level semantic processing and closely interact with the pragmatic module. Both content modules also reflect the operation of general cognitive functioning. Apparently, failure to process one aspect of content (e.g. emotional information) may trigger compensatory adjustments within the pragmatic language system.

The formalistic rules of discourse structure are best understood as a pair of coexisting modules that differ in the type of processing they do and the way they interact with other modules. Together these modules define the rules that regulate the possible structure of language. One of these formalistic modules is a simultaneous processor which connects linguistic form to the pragmatic module. This formalistic module generates the rules that account for a speaker's representation of story structure and referential system. The second formalistic module processes linguistic form (i.e., phonology, semantic, syntax) successively and interconnects with the first formalistic module. The phonological, semantic and

syntactic form of the discourse are actualized here. The connection between the two formalistic modules accounts for a speaker's ability to relate form to context, while maintaining the autonomy of the phonological, syntactic and semantic processing systems. However, the simultaneous processor of the formalistic module and the content module are interconnected. To account for the observed dissociation in linguistic form and content, there is no direct interaction between the content module and the module that successively processes linguistic form.

In healthy adults the synergistic processes that characterize discourse processing are so intermixed that they do not reveal themselves. Following unilateral left or right brain damage, the capacities of the two hemispheres become somewhat more differentiated. For all adults incoming stimuli (e.g. a request for a story) are evaluated through any of the simultaneous processors. Based on either a speaker's experience in social contexts, the nature of the request or the speaker's notion of story structure, the verbal rules that convey intention to the listener are constructed and activated continuously over the discourse unit.

Following injury to the left hemisphere there is often a disruption in the second formalistic module. Output is thus characterized by successive processing deficits which manifest themselves as impairments in utilizing particular aspects of linguistic form (e.g. some anterior aphasia syndromes). This disruption may also impede the function of the first formalistic module resulting in impairments in generating a story structure and in using words to establish reference within a text (e.g. some posterior aphasia syndromes). Following left brain damage, emotional cognitive structure, stored in one of the content modules, is spared and through the operation of the central processor pragmatic competence may be activated. Overall, damage to the left hemisphere appears to mask verbal pragmatic competence. Although there is evidence of preserved intention in the discourse of the LBDs, these patients are without the linguistic means necessary to accomplish their communicative goal. The reduction in content in the LBDs appears to be selective or self-regulated. Without the ability to execute successively the form of language, their discourse becomes laden with repetitions and attempts to complete their pragmatic goal are often futile.

Following right brain damage, the cognitive structure of the content modules (i.e. visual-spatial and emotional information) is often disrupted. Evidence obtained in this research supports the view that some of the impairment in cognitive structure arises directly from the central processor but peripheral deficits (e.g. visual misperception) may also account for some of their discourse deficits. Other simultaneous processors such as the formalistic module which relates linguistic form to the pragmatic module are often disrupted as well. This accounts for the RBDs' deficits in making reference and their vulnerability in generating an internal representation of story structure. When there are any disruptions in the simultaneous processors the RBDs are less likely to execute appropriately the rules that define pragmatic competence. Preservation of the successive formalistic processor gives the RBDs control over immediate context and consequently, they are able to construct well-formed sentences. However, problems in accessing cognitive structure and disruptions in the simultaneous formalistic processor limit the RBDs' ability to construct knowledge or impart their intention to their listener.

This preliminary model attempts to describe the system necessary for implementing and producing discourse. It operates from the assumption that discourse processing involves integrative and mutually dependent processes. In discourse production the simultaneous cognitive processing of the right hemisphere as supported by the simultaneous and successive processing of the left hemisphere where speech is actualized. Where a breakdown in a particular aspect of the system occurred, an adjustment within the language system may be triggered. Both the interaction and dissociation of the components or modules that comprise the system have been considered in an effort to account for the construction of the language system beyond the sentence level.

Chapter 7

CONCLUSIONS

The three research questions for this research project can be answered in the following way:

Despite the RBDs' proficiency with phonology, syntax and lower level semantic processing, they demonstrated a breakdown in certain aspects of discourse structure. Specifically, the RBDs tended to use reference ambiguously and were deficient in their ability to access some of the essential components of procedural discourse. When compared to the NCs, the LBDs were also less accurate in establishing reference within a text. Additionally, the LBDs produced many comments on the task that expressed awareness of their discourse difficulties. In contrast, the RBDs produced few comments on the task and were apparently oblivious to their discourse deficits.

In comparison to the NCs' discourse, the LBDs' discourse was quantitatively different in the use of higher level semantic content. Specifically, the discourse structure of the LBDs was equally diminished in the use of visual-spatial, emotional and

procedural/neutral content. When the content of the RBD's discourse was compared to the content of the NC's discourse, both quantitative and qualitative differences were revealed. The RBDs were especially uninformative when the content of the discourse was emotional. In addition to the RBDs' special difficulty with emotional content, a reduction of higher-level semantic information was present regardless of the content of the discourse.

Apparently both hemispheres are responsible for production of the verbal pragmatic features of discourse. In this study the manner in which the verbal pragmatic component of language interacted with the content of language was systematic. Specifically, when the content of the discourse was emotional, the RBDs failed appropriately to use the verbal pragmatic features of discourse. Emotional content also appeared to facilitate appropriate use of the verbal pragmatic features of discourse in the LBDs. This strongly suggests that there is a difference in pragmatic competence between the two sides of the brain. In discourse production, the simultaneous cognitive processes of the right hemisphere are supported by the

simultaneous and successive cognitive processes of the left hemisphere where speech is actualized.

CLINICAL IMPLICATIONS

Results of this study have implications for the diagnosis and treatment of brain-damaged adults. Historically, assessment of language disorders in this population has focused on the production and comprehension of sentence level stimuli. This method has been appropriate in identifying aspects of LBD (aphasic) language syndromes, but has failed to diagnose more subtle forms of communication impairment in populations such as right brain-damaged patients. As a result, patients with language disorders at the level of discourse are often not referred for speech-language services. Because of the subtle nature of discourse formulation deficits in the face of intact sentence production skills, these patients are often at a disadvantage in real communication situations. Based on the findings in this study it is recommended that these patients be referred routinely to speech-language pathologists for assessment of their discourse deficits.

It is apparent that patients with RBD would be at risk for having problems organizing discourse, expressing higher level semantic content, and in using words to establish reference within a text. Given that the subjects employed in this study were mildly impaired, the speech-language pathologist working in a hospital or rehabilitation setting might expect to find patients who are more involved. It is predicted that these patients would exhibit discourse production deficits that severely interfere with daily communication.

This investigation demonstrated that descriptive analysis of the verbal pragmatic features of discourse was an effective means of identifying subjects with discourse deficits. Adaptation of the pragmatic rating scale (see Appendix D.2-D.5) could serve as a clinical description of the conversational rules used by a patient to produce discourse. It would be important to share information obtained about a patient's discourse deficits with other rehabilitation specialists, therapists and family members. The impact of these deficits on daily communication should be emphasized.

It may be that heightening patients' awareness about their limitations in discourse facilitates improvement in production. Future studies should be directed towards evaluating the efficacy of the treatment of discourse deficits in right brain-damaged subjects.

APPENDIX A.1: Scores of the right brain-damaged subjects on the WAIS-R Information subtest, Boston Diagnostic Aphasia Examination (BDAE), Benton Visual Form Discrimination Test (BVFDT), and the Modified Edinburgh Handedness Inventory (MEHI).

Subject	WAIS-R Information Subtest *	BDAE Auditory Comp.%	BVFDT	MEHI
1	9	87	21	+100
2	11	98	27	+100
3	8	80	32	+ 80
4	13	95	32	+ 95
5	8	90	22	+100
6	10	92	26	+100
7	8	95	26	+100
8	9	97	24	+100
9	9	85	26	+100
10	11	83	26	+100
11	10	87	26	+100
12	13	97	32	+100

* Age corrected scaled score

APPENDIX A.2: Scores of the left brain-damaged subjects on the WAIS-R Block Design subtest, Boston Diagnostic Aphasia Examination (BDAE), Benton Visual Form Discrimination Test (BVFDT), and the Modified Edinburgh Handedness Inventory (MEHI).

Subject	WAIS-R Block Design Subtest *	BDAE Auditory Comp.%	BVFDT	MEHI
1	11	65	31	+100
2	10	75	30	+ 90
3	8	85	31	+100
4	13	87	28	+100
5	12	90	32	+100
6	10	70	29	+100
7	9	75	30	+100
8	10	85	30	+100
9	11	87	29	+100
10	8	60	27	+100
11	10	95	31	+ 90
12	12	85	26	+ 90

* Age corrected scaled score

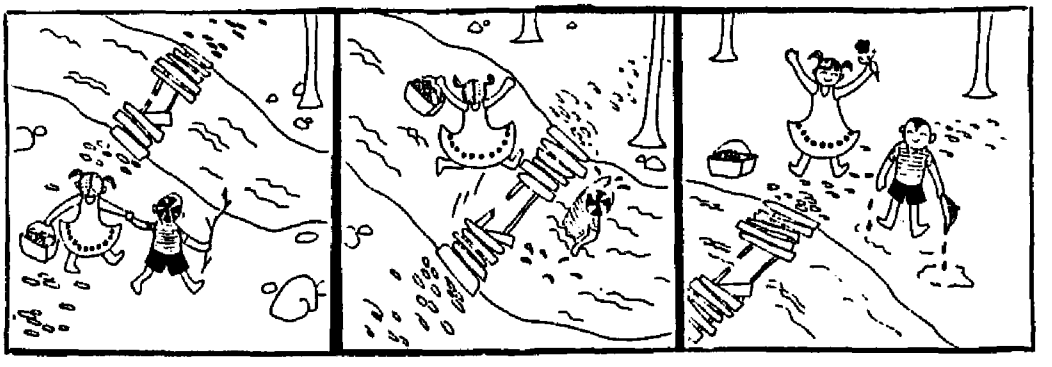
APPENDIX A.3: Scores of the normal control subjects on the WAIS-R Information and Block Design subtest, Benton Visual Form Discrimination Test (BVFDT), and the Modified Edinburgh Handedness Inventory (MEHI).

Subject	WAIS-R Information Subtest *	WAIS-R Block Design Subtest *	BVFDT	MEHI
1	12	13	26	+100
2	11	9	29	+100
3	12	8	32	+100
4	9	11	32	+100
5	12	13	28	+100
6	10	13	31	+100
7	10	13	29	+ 80
8	11	13	30	+ 80
9	16	13	29	+100
10	12	13	31	+ 90
11	12	14	28	+ 85
12	10	14	28	+100

* Age corrected scaled score

APPENDIX B

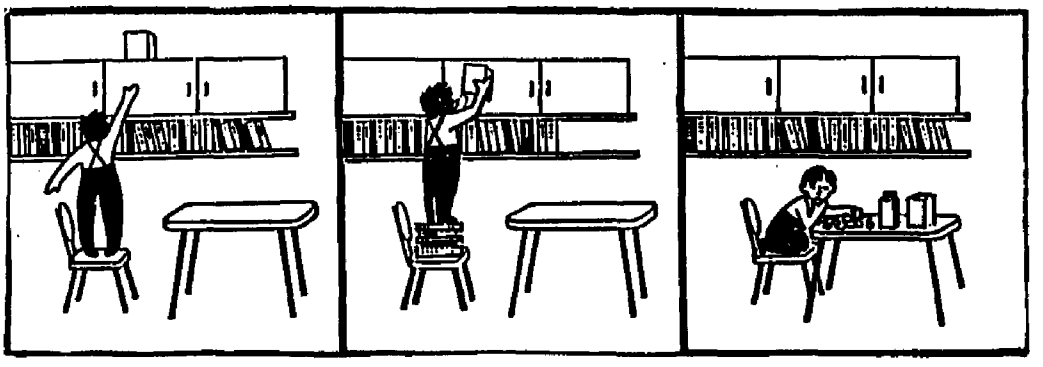
Practice Stimulus and Narrative Read to Subject



This is a story about a girl and her brother. They are going on a picnic. They decide to eat their lunch on the other side of the river. When they get to the old bridge they are sad because the bridge is broken. The girl jumps over the bridge. The boy swims across to the other side. When they get to the other side the boy is soaking wet. They are happy because it is time to eat their lunch.

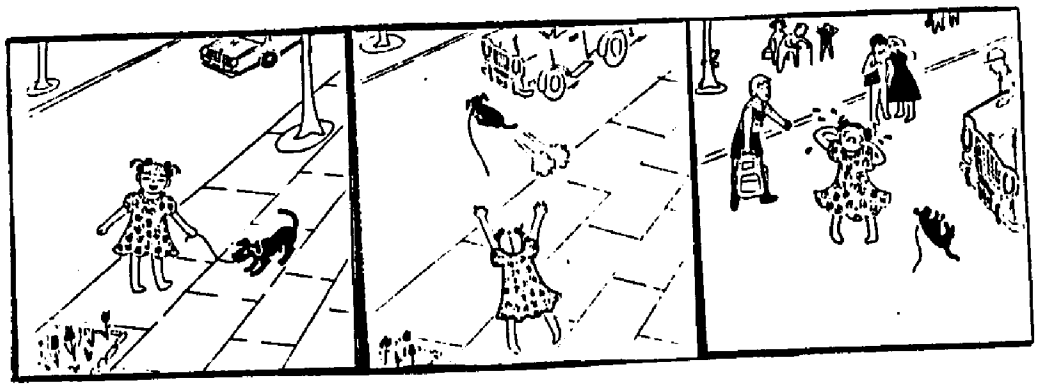
APPENDIX C.1

Visual-Spatial Stimulus



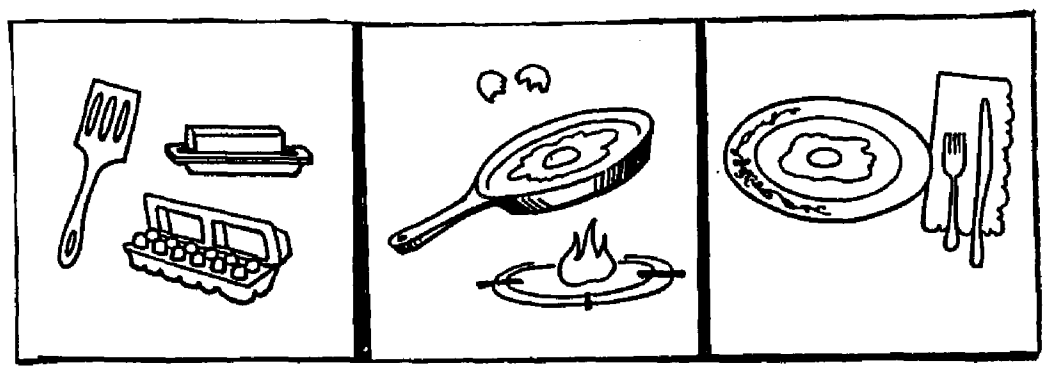
APPENDIX C.2

Emotional Stimulus



APPENDIX C.3

Procedural Stimulus



APPENDIX D.1

INSTRUCTIONS

You will be asked to make judgments about the well-formedness of different samples of discourse. Before you do so it is important that you examine the pictures that were designed to elicit the discourse.

Note that there are 3 different picture sets, labeled either "V", "E," or "P." The transcripts that you will be rating are labeled in the same way and correspond to a particular picture set.

A subject was instructed "... look over the pictures and tell me a story about what you see."

For the analysis you will rate certain features of discourse as appropriate or inappropriate. Kindly review the names of these pragmatic features, their definitions and the examples provided. After these ratings are completed continue to answer the questions that follow.

TAKE AS MUCH TIME AS YOU WOULD LIKE TO COMPLETE THESE RATINGS.

APPENDIX D.2

PROCEDURES FOR RATING TRANSCRIPTS

The purpose of this investigation is to obtain a clinical measure of a subject's ability to use language at the level of discourse. You will be asked to evaluate a range of pragmatic features of language in narrative and procedural discourse. The stimuli used to elicit the discourse will be available to assist in your judgments. You will judge each pragmatic feature as appropriate or inappropriate based on the entire unit of discourse rather than individual words or sentences.

Definitions and examples of the features of discourse will be provided to familiarize you with the terminology and categories used for evaluating each unit of discourse.

Pragmatic Feature	Definition
1. TOPIC MAINTENANCE	Use of utterances that share a topic with the preceding utterance and add information to the prior communicative act.

EXAMPLES: Appropriate Behaviors: utterances contribute to the topic; provides information or feedback to move the topic forward. Inappropriate Behaviors: introduces new unrelated topics.

2. CONCISENESS	Use of utterances that are informative as required but not too informative.

EXAMPLES: Appropriate Behaviors: quality of information is sufficient to convey the point of the story. Inappropriate Behaviors: provides unnecessary information; gives excessive details.

APPENDIX D.3

Pragmatic Feature	Definition
3. SPECIFICITY	Produces discourse that conveys specific, unambiguous information.

EXAMPLES: Appropriate Behaviors: provides specific information to make the story interesting. Inappropriate Behaviors: omits details; information is vague.

4. LEXICAL SELECTION	Use of lexical items that fit the text.

EXAMPLES: Appropriate Behaviors: makes lexical choices that convey information; uses specific referents. Inappropriate Behaviors: makes lexical choices that are non-specific; uses words that do not facilitate understanding.

5. REVISION STRATEGY	Revises or repairs a topic when a breakdown occurs.

EXAMPLES: Appropriate Behaviors; revises the message to facilitate understanding; clarifies message when an ambiguity occurs. Inappropriate Behaviors; Fails to recognize a misunderstanding or ambiguity; does not clarify or provide support to the receiver of the message.

6. RELEVANCY	Selection of topics that relate to the matter under consideration.

EXAMPLES: Appropriate Behaviors; Topics are relevant and relate to the stimuli. Inappropriate Behaviors: Makes unrelated, irrelevant remarks given the nature of the task.

APPENDIX D.4

Pragmatic Feature	Definition
7. QUANTITY	Provides enough information to convey the content of the story.

EXAMPLES: Appropriate Behaviors: Amount of information given is sufficient to convey the content of the story. Inappropriate Behaviors: An insufficient amount of information is given; content of the story is missing.

APPENDIX D.5

RATER'S SCORE SHEET

Transcript # _____ Rater's Name _____

Pragmatic Feature	Rating (Circle One)	
1. Topic Maintenance	Appropriate	Inappropriate
2. Conciseness	Appropriate	Inappropriate
3. Specificity	Appropriate	Inappropriate
4. Lexical Selection	Appropriate	Inappropriate
5. Revision Strategy	Appropriate	Inappropriate
6. Relevancy	Appropriate	Inappropriate
7. Quantity	Appropriate	Inappropriate

Answer the following questions about each unit of discourse (Circle one answer).

1. Do you know what is happening in the story ?
   Not at all Slightly Yes

2. Is the story complete in terms of the stimulus materials ?
   Note at all Slightly Yes

3. Is the language used in the story clear ?
   Not at all Slightly Yes

4. Does the story follow a logical sequence of events ?
   Not at all Slightly Yes

5. Does the story have a beginning, a middle and a conclusion ?
   Not at all Slightly Yes

6. Are the ideas expressed in the discourse unified and connnected ?
   Not at all Slightly Yes

7. Is the story reconstructable based on the information given ?
   Not at all Slightly Yes

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