CHAPTER 1: INTRODUCTION

1.1. The Nature of the Problem

Severe closed head injury (CHI) which frequently results from high velocity impact accidents, has become one of the more prevalent types of severe cerebral trauma of the current age (Kraus et.al. 1984). Victims of serious CHI tend not to recover fully. A recent follow up study of 100 consecutive admissions to a rehabilitation unit demonstrated that all subjects had some residual impairment at 6 years post trauma (Tate, Broe & Lulham, 1989). The impairments most frequently described after head injury are those affecting memory function, cognitive abilities and psychosocial factors. However there is a growing awareness in the literature that communication disorders following CHI are also a major long-term rehabilitation issue (e.g. Prigatano, Rouche & Fordyce, 1986; Sohlberg & Mateer, 1989, Hagan, 1982, 1984).

A minority of CHI cases demonstrate classical aphasic syndromes. Cases of fluent, non-fluent, anomic and global aphasia have been widely reported (Sarno, 1980, 1984, 1988: Sarno, Buonarguro & Levita, 1986; Heilman, Safran & Geshwind, 1971; Najenson, Sazbon, Fiselzon, Becker & Schecter, 1978). Anomic aphasia, characterised primarily by word finding problems and verbal paraphasias, is the most prevalent disorder (Thomsen, 1975; Heilman et al. 1971; Levin, Grossman & Kelly, 1976). For a proportion of these patients such aphasic deficits resolve over the ensuing months (Thomsen, 1975, 1984; Groher, 1977; Grosswasser, Mendelson, Stern, Schecter &

Najenson, 1977) although few completely regain premorbid language abilities (Thomsen, 1984).

Residual language disturbances are not restricted to the aphasic minority however. Most CHI patients will perform, overall, within normal limits on conventional aphasia batteries. They cannot therefore be considered aphasic on the basis of the batteries' classification criteria. However their abilities on specific subtests are frequently below normal expectations. A significant proportion of severely head-injured non-aphasic patients have been found to have residual deficiencies in confrontation naming, word finding or verbal associative tasks (Levin et al., 1976; Levin, Grossman, Rose & Teasdale, 1979; Sarno, 1980, 1984, 1988; Sarno et al. 1986). Subgroups of CHI patients have also been identified as performing poorly on the Token Test which is a structured test of comprehension (Levin et al., 1976, 1979; Sarno, 1980; 1984; 1988; Sarno et al. 1986).

Sarno et al.(1986) have argued that these poor test performances reflect a "sub clinical aphasia" which represents the mild end of a continuum of verbal impairments, the other extreme being a full blown aphasic condition. According to Sarno (1980, 1984, 1986, 1988) "subclinical aphasia" is not apparent in casual conversation but is only elicited on these specific formal tasks.

If Sarno is correct, then for these patients, the language disturbance would be too subtle to be of any practical concern. There is however the reverse

situation that there are subgroups of CHI patients who have long term, obvious, pervasive and disabling deficits in communication skills which are not being detected on formal testing. Alternatively, if subtle deficits are apparent on selected subtests such as have been described above, these are not illustrative of the actual problems that the patients face in everyday life.

The insensitivity of aphasia batteries to communication disorders after CHI stems from the fact that they were designed to investigate aphasic behaviour as it disrupts the fundamental processes of language. Aphasia batteries generally test comprehension, expression, naming and repetition in a highly structured and non interactive manner e.g. Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1972) Western Aphasia Battery (Kertesz, 1981), Porch Index of Communicative ability (Porch, 1981). They have been designed specifically to focus on basic encoding and decoding of relatively formal linguistic units. Analysis is therefore restricted to phonemic, semantic and syntactic relationships at no greater complexity than the sentence level.

None of the commonly used batteries directly address the interaction of social context with language behaviour. They therefore fail to assess the more dynamic aspects of language use. As a consequence of this, it has been observed that patients who suffer aphasia from a cerebrovascular accident (CVA), are frequently far better able to communicate in their everyday environment than formal testing would predict. Ability to utilise non linguistic and paralinguistic contextual cues has been suggested to compensate for linguistic processing deficits (Weylman, Brownell & Gardner,

1988; Holland, 1977; Hirst, LeDoux & Stein, 1984). In contradistinction to the aphasic CVA patient many CHI patients, who perform adequately on aphasia batteries, are poor communicators in the unstructured, spontaneous communication setting. Isolated deficits in abilities such as word finding and verbal fluency may account for some of the difficulties they face, however this is far from the complete picture. While linguistic skills are often basically intact, the manner in which the CHI patient uses them to communicate appears to be deficient.

There is anecdotal evidence concerning such communication difficulties in the literature. Levin et al. (1979) studying CHI patients one year post trauma, noted that many suffered inefficient filtering of extraneous material and that their conversation would frequently drift to irrelevant topics. In two other reports (Snow et al.,1986; Milton, Prutting & Binder, 1984) CHI patients were described as failing to maintain the topic of conversation, of making tangential and irrelevant comments, and of being verbose. These authors also described impaired turn taking, inadequate specificity and informational redundancy in conversation. Thomsen (1984) interviewing CHI victims years after their head injury, found that despite the absence of aphasic symptoms many patients were slow in their responses and required frequent repetition of questions. Their expressive speech was characterised by numerous pauses and a reliance on set expressions. They also tended to leave sentences unfinished. Prigatano, Roveche and Fordyce (1986) described talkativeness, tangentiality and the use of peculiar phraseology as characteristic of CHI patients. Milton and Wertz (1984) also described many of the characteristics

mentioned above as well as problems assimilating and using contextual cues.

While these features are not normally detected using conventional aphasia assessment techniques, the impact on listeners cannot be denied. McKinley, Brooks, Bond, Martinage and Marshall (1981) reported that in a significant proportion of cases, relatives complained of reduced fluency (44%) or excessive talking (26%) in the CHI patient. Rollins and Deanes (1987), in a long term follow up study (3 - 10 years post trauma), compared video tapes of 29 non-aphasic CHI adults engaged in spontaneous conversation with those of 14 non-head injured matched controls. They found that 10 trained judges were able to discriminate reliably all controls as normal and a subset of 7 CHI subjects as "abnormal". A further 15 CHI patients were considered abnormal by some but not all judges. Furthermore they found that while non-aphasic CHI patients themselves felt they had only a few limited problems in communicating, their relatives thought they had many more. This suggests that some CHI patients are not only poor communicators, but also have impaired awareness of their communication difficulties.

Rollins and Deane's study demonstrated that impaired communication competence is obvious in some CHI patients. It also showed that for these patients, the problems continued to exist many years post trauma. The implications of persisting poor communication skills after CHI can be exemplified by Thomsen's 10-15 year follow-up study of severely head injured patients. She found that social isolation was the most serious handicap they faced (1984). A more recent study (Tate, Lulham, Broe, Strettles & Pfaff,

1989) found that even amongst severe CHI patients considered to have made a good recovery and to have attained "good" reintegration, there were many that continued to suffer from social isolation and a drop in vocational status. As pointed out by Milton and colleagues (1984),

"inappropriate management of communication exchanges by the head injured individual and the penalisation that follows often present a major barrier to social integration" (p.115).

Long standing communication disorders following CHI thus present a major challenge to rehabilitationists. Early identification and remediation of these disorders will be influential in maximising the head injured individual's capacity to reintegrate into his/her social, vocational and interpersonal worlds.

1.2. Recent Approaches to Assessing Communication Disorders in the CHI Population.

There is a growing awareness of the communication problems faced by some CHI victims and the inadequacy of conventional methods by which to assess or remediate their difficulties. This has lead to an advance of clinical research into the realm of pragmatic theory. Pragmatics may be conceptualised as the study of language as it interacts with the context in which it occurs. Pragmatic theorists are concerned with a broad range of issues such as the impact of context on the lexico-grammatical structure of natural discourse (Halliday & Hasan, 1985; Stubbs, 1983); the interaction of context and language to convey indirect meaning and resolve ambiguity

(Levinson, 1983; Sperber & Wilson, 1986), and the study of communication behaviour between speakers (Searle, 1969, 1975; Grice, 1975, 1978; Brown & Levinson, 1978; Clark & Schunk, 1980; Franick & Clark, 1985)

The study of language in context is a radical departure from classical aphasia assessment. It also mirrors endeavours to assess aphasic conditions in more realistic ways (e.g. Snow, Mealings & Ponsford, 1984; Holland, 1982; Aten, Caligiuri & Holland, 1982; Ulatowska, North & Macluso-Haynes,1981; Chapman & Ulatowska, 1989; Wegner, Brookshire and Nichols, 1984; Bottenberg, Lemme & Hedberg, 1987; Wilcox, Davis & Leonard, 1978).

One tool that has been developed and piloted on a variety of clinical populations, is the "Pragmatic Protocol" (Prutting & Kirchner, 1983,1987). The Pragmatic Protocol, based on speech act theory, provides a check list in which the clinician observes whether verbal, nonverbal and paralinguistic behaviour is appropriate or inappropriate to the conversational exchange. Milton et al. (1984), used this protocol to observe 5 CHI patients and 5 normal controls during 15 minutes of spontaneous conversation. Whereas the normal controls had none or at most only one inappropriate piece of behaviour, particular patients were noted to have problems with turn-taking, topic selection and maintenance and prosody as well as some items of non-linguistic communication such as giggling.

This protocol heralds a welcome advance into the area of more realistic assessment of communication practices. Critical evaluation of the

methodology however highlights the difficulties yet to be overcome in pragmatic measurement. The authors stressed that the protocol is no more than a screening device. Once target behaviours were identified, more systematic evaluation would be required. One of the difficulties however for both the protocol and follow up evaluation, is that there is very little experimental or descriptive literature to date which explores and delimits the realm of normal pragmatic skills against which the head injured can be evaluated. Without this, identification of appropriate communication behaviour is reliant on intuition.

Snow et al. (1986) described the possibility of using a check list based on the adaption of Grice's conversational "cooperative principles" by Damico (1985). They gave examples of some procedural texts and their scores on the protocol as part of the description, but to date have not published a more detailed methodology or experimental study.

Mentis and Prutting (1987) compared use of different cohesion strategies (as defined by Halliday & Hasan, 1985) in three CHI patients compared to three control subjects. They found that the CHI subjects were more inclined to use pronominalisation and incomplete references than their non-brain-damaged counterparts. These issues will be taken up in Chapter 3.

Other attempts to develop assessment techniques for conversational practice following CHI have been described in the literature (e.g. Bolton & Dashiell, 1984; Ehrlich & Sipes, 1985; Ehrlich & Barry, 1989). However these have

focused on practical treatment and assessment issues and, as such, have not addressed the need to evaluate the nature of the disorders themselves.

1.3. Neuropsychological Considerations

The research into pragmatic skills after CHI has developed directly from pragmatic theories of normal language, adapted to explore clinical language disturbances. As such there has been little attempt to explain observed communication deficits in terms of co-existing cognitive deficits. Yet the typical neuropathology of the insult and its neuropsychological ramifications introduces a likelihood that the language deficit will be associated with, if not caused by other deficits and disruptions. It has been widely intimated that the language problems evidenced after CHI are a consequence of more general cognitive and memory impairments (Thomsen, 1975; Mentis & Prutting, 1987; Holland; 1984, Braun & Bairbeau, 1987; Hagan, 1982, 1984; Ylviske & Szekeres, 1989).

The deceleration rotational force which is associated with severe head injury, often as a result of motor vehicle accidents, causes two distinct types of damage: multi-focal lesions, predominantly of the temporal and frontal lobes, and diffuse microscopic changes. Microscopic degeneration of neural tissue throughout the cerebral hemispheres is caused by shearing of neuronal fibres (Stritch, 1956, 1970) or microscopic haemorrhaging and secondary anoxic changes (Oppenheimer, 1968). Holland (1984) has suggested that because of these diffuse changes, the particular language disturbances seen in this population may better resemble that seen with the dementias than the more

conventional comparison with stroke. Anomia and/or word retrieval difficulties are characteristic of both Alzheimers Disease (Ober, Dronkers, Koss, Delis & Friedland, 1986; Chertkow & Bub, 1990) and CHI (Thomsen, 1975, 1984; Holland, 1984) and may indeed reflect this generalised pathology. However the presence of multi-focal lesions in the CHI population may ultimately have more important ramifications for their language skills.

Focal lesions may occur anywhere in the cerebral tissue as a result of blunt head injury. Such lesions result from bruising and laceration as the cerebral tissue impacts directly on the hard cranium in either coup or contre-coup action (Brain & Walton, 1969). Larger vessel haemorrhaging is also common (Walsh, 1978). Given the variety of possible neuropathological sequelae, it is no surprise that there is great variability in recovery patterns and residual impairments after severe CHI. None-the-less predominant patterns have emerged in survivors with ongoing disabilities. These reflect the high probability of damage to the basal portions of the frontal lobes and much of the temporal lobes as the soft brain tissue ricochets against the bony protuberances of the anterior and middle fossa and the sphenoidal ridges which separate them (Courville, 1942; Holburn, 1943).

As a consequence of temporal lobe pathology, many survivors of CHI have permanent impairment of recent memory, i.e. new learning capacity, although the severity and characteristics of the problems experienced vary enormously (Tate et al. 1989; Groher, 1977, Thomsen, 1984, Levin et al. 1979). The importance of these concomitant impairments in influencing

communication skills is obvious. For example a patient with rapid forgetting might be expected to have difficulty retaining the theme of a narrative or the progress of an extended conversation.

Of particular interest, however, is the likely impact of frontal lobe pathology on communication competence. Rigidity, inability to synthesise information, disinhibition, egocentricity, etc., are common impairments after CHI that have been attributed to frontal pathology (Lezak, 1978: Walsh, 1985). These deficits will have major ramifications in the management of normal communication which is complex, dynamic and interactive. It is therefore worth considering the potential role of frontal pathology in communication in more detail.

1.4. Frontal Lobe Functions.

Most work elucidating frontal lobe function has involved patients with lesions caused by other etiologies than CHI for two reasons. First the proliferation of CHI is a relatively recent phenomenon. Apart from war injuries, most CHI cases are the result of accidents involving high speed motor vehicles. Secondly there has been a strong preoccupation with localisation in the traditional literature and CHI cases are not ideal for this purpose. The multi-focal and diffuse nature of CHI, makes evidence of lesion site difficult to determine prior to autopsy. Consequently most of the literature which has specifically addressed the role of the frontal lobes has been written by observing patients with focal lesions caused by other pathologies e.g. tumour, psychosurgery, cerebrovascular lesions and penetrating wounds. From this

literature certain patterns are apparent.

Firstly, it is well known that some areas of the frontal lobes are associated with basic language deficits. Since Broca, posterior frontal lobe lesions in the lower motor cortex, operculum, or underlying white matter in the left hemisphere have been traditionally associated with dysfluent aphasias (Alexander, Benson & Stuss, 1989). Lesions in the equivalent area on the right have been reported to produce affective dysprosodies (Ross & Mesulum, 1979). In contrast lesions more anteriorly and/or inferiorly placed, in the prefrontal lateral and orbito-medial areas of either hemisphere, rarely result in any notable aphasic condition. Nor are other basic processes such as memory, perception and praxis disrupted. Prefrontal lobe lesions have however, been associated with major personality and behavioural change and a disorganisation of action and thought processes.

These deficits, while extremely disabling, can be subtle and the disturbed processes difficult to define. The researcher whose work has been definitive in has been influential in describing frontal lobe function is Luria (1973, 1976 a,b). On the basis of numerous case descriptions Luria proposed that the frontal lobes, in particular the prefrontal regions, were responsible for the activation, programming, regulation and verification of other cognitive activity. With circumscribed lesions in the frontal lobes, routine behaviour previously learnt may be carried out normally and basic skills retained. There may, however, be a disruption of the individual's capacity to focus his attention voluntarily and to deal with novel situations adaptively. Patients

may suffer a disorder of drive, resulting in an uncontrolled apathy or inertia and perseveration of responses. Alternatively there may be a disorder of control characterised by overactivity with poor response inhibition and concomitant distractibility.

Many of these symptoms involve disturbances in the intellectual regulation of behaviour. Patients may be unable to anticipate a situation, or analyse it critically. They may focus on concrete or superficial aspects of their environment, failing to assume a more abstract attitude. They may be disorganised in formulating a plan of action and have difficulty maintaining a stable intention when carrying it out. Frontally impaired patients may also fail to regulate their own behaviour with an internal command. Error utilisation may also be affected, preventing the patient from evaluating his/her progress critically, modifying it in light of feedback or learning from experience.

Luria has not been without his critics, in particular about his failure to use adequate controls (Shallice, 1988). It has been shown experimentally that the severity and pervasiveness of intellectual disturbance ascribed by him to frontal lobe pathology, is often a result of frontal lobe pathology in association with more global cerebral dysfunction (Canavan, Janota & Schurr, 1985). Patients with more circumscribed lesions may escape many of the deficits described (Drewe, 1974).

However other empirical work has indicated that many features outlined by

Luria are indeed associated with frontal lobe dysfunction, although the particular constellation of deficits and the severity varies enormously (for review see Walsh, 1978, Stuss & Benson, 1986). The dorsolateral aspects with their rich connections to sensory and motor functional systems have been associated with the intellectual regulation of behaviour and cognition and the orbito-medial aspects with their rich limbic connections have been associated with control and regulation of internal drives (Alexander et al., 1989). Evidence for lateralisation of function is fairly equivocal at this stage. Again the reader is referred to Walsh (1978) or Stuss and Benson (1986) for a review. The particular manifestation of the frontal lobe syndrome exhibited will depend on the size and locus of the lesion.

As a refinement of Luria's model Norman and Shallice (1986) have cast his conceptualisation within a cognitive science framework. This model incorporates Luria's idea that routine operations are decentralised and unconscious. Selection between them for any given action or thought process is also relatively automatic triggered by environmental perceptions or output from other operations. Norman and Shallice termed this process as "contention scheduling". However non routine (novel) operations require the involvement of a general purpose supervisory system which modulates the operation of the rest of the system by inhibiting and activating particular sub-schemata. This supervisory system sacrifices speed for flexibility in its operations. It has access to all processes, can override automatic responses, detects novel situations, plans the approach to be taken and learns from its mistakes.

Shallice (1988) has suggested that the supervisory system corresponds to Luria's description of the programming, regulatory and verification processes of the frontal lobes. Predictions on the basis of this model are similar. Disconnection of the supervisory system may lead to responses based on contention scheduling alone. There may therefore be perseveration as the same response continues to be triggered. Alternatively random responding to irrelevant stimuli may occur if all triggers are equipotential. Problem solving behaviour is also disrupted and reflects failure to detect novelty, fragmentation of approach and failure to benefit from experience.

Stuss and Benson (1986) and Alexander et al. (1989) incorporating both Luria's work and that of Norman and Shallice, have developed a model which also takes into consideration neuroanatomical evidence. According to their model, basic functions including memory, perception, language and attention etc. are fixed, organised and integrated processes each of which has its own neuroanatomical substrate in the posterior portions of the cerebrum. The prefrontal lobes incorporate four conceptually separate functions. The first two, sequencing operations and drive control are also fixed organised and integrated but are superordinate over all more posterior functions. These are associated with the lateral and medial aspects of the prefrontal lobes respectively. The executive control function, equivalent to Norman & Shallice's supervisory system and Luria's regulatory functions, is organised differently, and is superordinate over both drive and sequencing. Finally a functional system which enables self analysis mediates all other operational

processes.

These more recent models indicate a growing formalisation in the description of frontal lobe processes and will hopefully enable more specific empirical work to be achieved. Of particular relevance to this thesis however, is the implications of such theorising for models of natural language functioning in normal communication contexts.

1.5. Frontal Lobe Function and Language.

According to the descriptions of frontal lobe functions above, lesions to the prefrontal zones do not disrupt basic language skills. They may however interfere with the individual's ability to use them adaptively. Here again, Luria's theorising is a useful starting point. Apart from his work on frontal lobes Luria also explored the issue of neurolinguistics. He developed a model of language production (1973, 1976b), based in part on the work of Vygotsky (1962). He argued that verbal expression begins with a motive or intention which is then developed into a general schema for the entire expression. The speaker must then convert the thought into an appropriate linguistic form by the active selection of relevant alternatives and inhibition of others. With extended discourse, continuous monitoring preserves continuity and direction and prevents deviation.

This model predicts particular difficulties for patients with frontal lobe lesions with concomitant loss of active control. According to Luria's model, the difficulty may arise at a number of stages. There may be a failure to

develop a stable intention. There may be problems in the conversion of thought to language in a planned or active way. Alternatively if a plan is established, the output may be disrupted due to an inability to subordinate the verbal expression to the original intention and thought. Comprehension, considered to be an equally active process, may also fail if the input is complex and requires active integration, problem solving skills and a level of abstraction (e.g. proverb interpretation).

Alexander et al. (1989) also applied their model of frontal lobe function to predictions regarding language disturbances and have supported this with a review of clinical studies in the literature. Their main thesis was that lesions of the medial frontal lobes are associated with disorders of activation of speech, while prefrontal lesions result in formulation deficits, disrupting the organisation and manipulation of language and leading to poor self analysis of language output.

Case descriptions abound in the literature which support these views of frontal involvement in language. Patients with prefrontal lesions have been described as having confabulatory, disorganised discourse (Alexander & Freedman, 1984; Stuss, Alexander, Lieberman & Levine, 1978) disturbed by the constant cyclic intrusion of irrelevant associations (Luria, 1976b). Alternatively patients have been described to be listless and apathetic and unable to produce a sustained narrative (Damasio & Van Housen, 1983; Rubens, 1976), or to be reliant on perseverative stereotypic speech patterns (Luria, 1976b). They have also been described as having a communication

disorder of "social dysdecorum". This is clearly related to other features of the frontal lobe syndrome, including personality change, blunted social awareness, tactlessness, poor reasoning and behavioural dyscontrol (Alexander et al., 1989; Weinstein & Kahn, 1955).

Empirical work has also confirmed subtle deficits on conventional cognitive-linguistic tasks. Poor abstract reasoning, difficulty with perseveration and irrelevant intrusions (Kaczmarek, 1984; Novoa & Ardila, 1987) and reduced verbal fluency (Novoa & Ardila, 1987; Milner, 1964; Benton, 1968) have been consistently reported.

The similarities observed between language problems in the focal frontal lobe lesion cases and the head injury population on the whole are obvious enough to suggest that at least some aspects of the communication problems seen following CHI are best interpreted as a consequence of frontal lobe pathology. Models of frontal lobe function (and impairment) are therefore useful as a conceptual framework with which to pursue an investigation of communication skills after CHI.

1.6. Research into Right Hemisphere (RH) Lesions and Language.

Another research area which is of relevance to an investigation of communication disorders after CHI, is that which addresses right hemisphere language issues. In their major review of frontal lobes and language, Alexander et al.(1989) incorporated literature which has investigated the role of the right hemisphere (RH) pathology in producing language disorders.

Investigations have mainly been via experimental group studies, using patients who have suffered unilateral cerebrovascular accident, although temporal lobectomy patients have also been included (Tompkins and Mateer, 1985).

While the main focus of these studies has been the question of laterality of language functions, Alexander et al.(1989) argued that most samples have included a substantial proportion of patients with either frontal lesions or subcortical lesions which would disrupt frontal connections. On the whole, perusal of the literature substantiated this claim. Most studies in which localising information was provided, reported a mixed group with a majority of frontal lesions, in isolation or combined with extension of the lesion into the posterior or subcortical regions. While the heterogeneity of such group studies makes it difficult to distinguish the particular role of the right frontal regions in language, the variety of approaches used has moved into the area of pragmatics and merits brief discussion.

The literature on the role of the right hemisphere in language has steadily accrued over the last 25 years. There are significant similarities between observations on this population and those described with frontal lobe or head injured cases. The verbose and tangential nature of speech of (RH) lesion cases has been described frequently (e.g. Weinstein, 1971; Gardner, 1975; Hecaen, 1978; Rivers & Love, 1980). This has also been substantiated quantitatively. Patients were found either to produce less information than controls with the same amount of output (Joanette, Goulet, Ska &

Nespoulous, 1986, Hillis Trupe & Hillis, 1985), or to produce more speech than controls including tangential and confabulatory intrusions (Wapner, Hamby & Gardner,1981; Roman, Brownell, Potter & Seibold, 1987; Mackisack, Myers, & Duffy, 1987). They were also found to have difficulty organising a coherent narrative when provided with the individual units in a scrambled order (McFie & Thompson, 1972; Delis, Wapner, Gardner & Moses, 1983; Huber & Gleber, 1982), although when asked to produce a procedural narrative spontaneously, there was no problem in sequencing found (Roman et al. 1987).

Such patients have also have been investigated for their capacity to comprehend non-literal and pragmatic aspects of language. They have been variously reported as having problems interpreting metaphors (Winner & Gardner, 1977), proverbs (Hier & Kaplan, 1986), abstract relationships between words (Brownell, Potter, Michelow & Gardner, 1984; Myers, Linebaugh & Mackisack-Morin, 1985), and appreciating the punch line of jokes (Gardner, Ling, Flamm & Silverman, 1975; Wapner, Hamby & Gardner, 1981; Brownell, Michel, Powelson & Gardner, 1983; Bihrle, Brownell, Powelson & Gardner, 1986). They have difficulty inferring motives of actors in complex narratives, (Wapner et al., 1981) or using information regarding interpersonal relations to infer communicative intention between speakers (Kaplan, Brownell, Jacobs & Gardner, 1990).

It has been intimated that RH damage leads to a generalised incapacity to derive inferential information from the verbal context above the level of the

sentence (Wapner et al., 1981; Tompkins et al.1985; Joanette et al.,1986; Molloy, Brownell & Gardner, 1990). However two studies which looked more analytically at this using a multiple choice paradigm (Brownell,Potter & Bihrle, 1986: McDonald & Wales, 1986) found that such patients were in fact deriving simple linguistic inferences normally, although they tended to uncritically accept incorrect choices as well. Brownell et al.(1986) found that when patients did make an incorrect inference, their errors reflected a failure to revise initial interpretations in the light of subsequent information. This pattern was also found by Molloy et al.(1990) and Hough (1990). This rigidity of thought processes is suggestive of frontal pathology and has also been commented on with single case studies of RH lesions in the frontal lobes (Alexander et al., 1984; Stuss, et al., 1978)

Experiments investigating RH patients' pragmatic understanding have also looked at indirect speech acts (Hirst, Le Doux & Stein, 1984, Foldi, 1987; Weylman, Brownell, Roman & Gardner, 1989). The results of these three studies vary in terms of the nature of the impairment found. While one study (Foldi, 1987) demonstrated that patients preferred literal interpretations of indirect speech acts, the other two studies did not, although their performance was significantly worse than controls. The implications of this area of research will be explored further in Chapter 7 of this thesis.

Finally, there have been a number of attempts to investigate RH lesion patients' ability to process conversational implicatures such as sarcasm (Weylman, Brownell & Gardner, 1988; Kaplan, Brownell, Jacobs & Gardner,

1990; Tompkins & Mateer, 1985). Constrained within a multiple choice design, the right hemisphere patients were able to interpret the context to identify sarcastic remarks normally (Kaplan et al.,1990). However, their understanding of the narrative as a whole was shown to be significantly poorer when the narrative included a sarcastic interchange (Tompkins & Mateer 1985). Research on sarcasm will be explored further in Chapter 8.

This review of the RH literature is relevant on two counts. First it reveals a range of clinical language investigations which have begun to venture into the realm of pragmatics. Many of these studies have appropriate control groups and are statistically supported. Some of the approaches used, were based on contemporary pragmatic theories (e.g. Hirst et al.1984; Foldi 1987; Kaplan et al.,1990). Others were more empirically oriented, designed to extend previous observations of the behaviour of this clinical population.

The second point is that the deficits revealed by these investigations are clearly similar to those described following frontal lobe injury, in particular CHI. According to Alexander et al. (1989) this reflects the inclusion of frontal lobe lesions in the majority of the groups studied, although they also make the point that more extensive lesions in the parietal and temporal cortex may be necessary for the full blown disturbances in communication to be seen following RH lesions.

The empirical work into RH lesions and language was motivated by a desire to delineate the role of right hemispheric processing in language, not the

frontal lobes. There was therefore little inclination to link the observed deficits, or the pragmatic principles underlying them, to current models of frontal lobe function. Furthermore, while some language studies attempting to differentiate between anterior and posterior RH lesions (e.g. Wapner et al., 1981; Hough, 1990) have reported qualitative differences, others (e.g. McDonald & Wales, 1986) have found none. The unavoidable overlap of lesion site between the groups makes such intra-hemispheric comparisons unreliable.

This does not mean that the RH literature is as incompatible with frontal lobe studies as it may seem. Theories concerning RH involvement in language are actually very similar to descriptions of certain frontal lobe functions. Weylman et al. (1988) reviewing the extensive work in their laboratories, have hypothesised that the right hemisphere is instrumental in the integration and synthesis of verbal and nonverbal contextual information. This includes the capacity to evoke conceptual relationships. It has also been suggested that the right hemisphere is responsible for monitoring, invoking and shifting between analytical processes performed in the left hemisphere (Gardner, 1983). Given that these functions are identical to those attributed to the frontal lobes, there is little theoretical conflict regarding the nature of language disturbance expected in either clinical population. Neuroanatomical localisation of function remains a vexed point. However, there is no unequivocal evidence as yet that exclusively posterior RH damage leads to the types of deficits reported. The function of the RH as described above may therefore be considered, at least in part, the function of the right frontal lobe.

1.7. Conclusion.

From this review it is apparent that there is considerable scope for the expansion of research into language disturbance following head injury. Firstly, non-aphasic language disturbances following CHI, while often disabling, are not being adequately assessed by conventional aphasia or cognitive assessment techniques. It is important that research strategies are extended to incorporate communication tasks in more realistic contexts.

The research which has attempted to do this has sensibly been guided by recent pragmatic theories. However there is a need to improve the methodology of investigation, using appropriate control groups and statistical analysis. One must verify that observed CHI language is outside the normal spectrum. It also needs to be established that differences in language style detected are, in fact, linked to perceived communication incompetence. Finally, studies into pragmatic skills need to be guided by neuropsychological considerations since it has been intimated that language disorders following head injury can be the consequence of other cognitive impairments.

The focus of discussion concerning CHI language impairment can profitably fall more consistently on the role of the frontal lobes in communication skills. The frontal lobes are frequently damaged in CHI populations. Furthermore, there is evidence in the literature that non-CHI, frontally impaired patients bear a close resemblance to CHI patients in their language presentations. As an adjunct to this there has also been a variety of clinical investigations into

pragmatic abilities after non-CHI RH damage. These have interpreted their findings in terms of laterality rather than frontal function, but none-the-less describe similar disturbances. Given that such studies incorporate a proportion of subjects with frontal impairments, and that the model of RH function evoked is similar to the frontal models described, the findings from this body of work are also relevant to the CHI population.

1.8. The Current Study.

The following series of research studies address these issues. Each experimental study was designed to observe CHI patients and matched controls deal with a range of communication tasks. The tasks and subsequent analyses were guided by current pragmatic theories taken from the psycholinguistic, linguistic and sociolinguistic literature. Because pragmatic theory is both broad and complex, theoretical reviews of particular models will be restricted to those applying to the tasks chosen and will be described within the relevant chapters. In all, six pragmatic tasks were developed, three that focused on expressive abilities and three that concentrated on comprehension. Within each of these domains the tasks move progressively from the direct to the indirect in terms of pragmatics, so the first task involves the production or comprehension of descriptive discourse and the subsequent tasks involve performative language of increasing indirectness.

Expressive language;

1. Describing a novel procedure
2. Making polite requests

3. Making a request in the form of a hint

Receptive language;

4. Anticipation of "naturalistic" speech on the basis of context

5. Comprehending indirect speech acts

6. Comprehending sarcasm

Hypotheses regarding difficulties the CHI patients were likely to experience were derived from an analysis of the relevant pragmatic theory, the patients' clinically observed impairments and predictions on the basis of theories of frontal lobe function.

It should be noted at this point that the initial concern of this thesis was to delineate communication disorders following closed head injury and to develop systematic and innovative methods for assessing them. It was not intended primarily as an empirical exploration of frontal lobe functions. There were two reasons for this. The first was practical since it is not possible to provide evidence of specific neuropathology premortem in CHI. Secondly, the approach taken is a cognitive neuropsychological one which is not essentially anatomical.

Never-the-less, reference to the systematic literature regarding frontal lobe injury is important as a source of hypotheses regarding the nature of communication disorders in CHI. The frontal lobe models advanced by Luria and refined and formalised by other authors (Stuss & Benson, 1986; Alexander et al. 1989; Shallice 1988), are particularly helpful as heuristics in

this process. The final discussion will therefore be couched in terms of a frontal lobe framework. As will be seen, this interpretation can also be used to refine a concept of frontal lobe involvement in language which may be useful for future specific empirical research.

The approach adopted was that of single case design, although it is important to note that this does not imply simple case description. All studies were constructed using basic experimental methods. A variety of techniques, procedural and analytic, and in most cases quite complex, were developed and applied to individual CHI cases. The same techniques were then used on matched control groups. Where possible, the results were subjected to blind scoring methods using multiple judges. Differences were substantiated using appropriate statistical comparisons.

There has been extensive debate in the recent literature concerning the validity of group versus single case studies in clinical research and the conclusions which can be drawn from them (Caramazza, 1984, 1986a, 1986b; Caramazza & Badacker, 1989; Caramazza & McCloskey, 1988; McCloskey & Caramazza, 1988; Caplan, 1981, 1986; Davis, 1986; Lemme, 1986; Marshall, 1986; Schwartz, 1986; Lesser & Reich, 1982; Shallice, 1979; Whitaker & Slotnick, 1988; Zurif, Gardner & Brownell, 1989; Kahn, Joanette, Ska & Goulet, 1990). For the purposes of this study it was felt that the subtle deficits in communication competence observed following CHI would be most amenable to single case design research. Group designs can be useful to demonstrate small quantitative differences in performance between normal

and abnormal populations. However, heterogeneity of lesion sites and concomitant deficits are inevitable in the CHI population. Statistical averaging across such a heterogeneous group would make it impossible to detect subtle qualitative disturbances which may be demonstrated by some but not all subjects. Since the motivation of this study was to fractionate the processes underlying particular observed behaviour, a single case approach was more suitable. Presumably this investigation will be but one of a continual expansion of experimental/ quantitative studies of individual cases that will allow more and more fractionation of the phenomena of communication disorders.

CHAPTER 2: SUBJECTS

2.1. CHI Subjects

There were two subjects chosen for this study, A.S. and P.B.. Both were adult males who had sustained severe closed head injuries in the past. At the time of this study they both had completed their rehabilitation programs. A.S. had returned to his family and previous employment for several years prior to this investigation. P.B. was more recently injured and was still in the process of reintegration.

These two subjects were chosen due to their salient and disabling communication disorders. Given the length of time post trauma in both cases, these communication problems represented stable residual impairments. While similar in some respects (and as exemplified by the findings of this study), A.S. and P.B. were chosen initially because they exhibited markedly different communication problems. A.S.'s problems appeared mainly due to a loss of impulse control, while P.B. had more difficulty with drive and activation with concomitant perseveration.

In neuropsychological terms both A.S. and P.B. had cognitive and psychosocial deficits which primarily reflected frontal lobe pathology. They were both able to learn simple verbal and nonverbal material and retain this over time. This indicated relative preservation of temporal lobe function. More complex new learning, while present to some degree, was compromised by frontal lobe deficits. Neither subject suffered primary deficits in perception, praxis or language.

The communication styles exhibited by both subjects were pathological, not idiosyncratic. This was obvious from interviews with their families as detailed under their neuropsychological profiles below.

2.1.1. A.S.: Neuropsychological Profile

2.1.1.1. History

Prior to his accident A.S. was an employed tradesman, whose major interest was motor bikes. He belonged to a social circle that revolved around this. He was well liked by family and friends. At the age of 21 years he was involved in a motor bike accident in which he sustained a severe closed head injury, a right colles fracture and multiple facial fractures. The period of unconsciousness is uncertain but was quite brief. He was admitted to casualty in a "semiconscious" state. The C.T. Scan performed at the time revealed "a small infarct in the left cerebral hemisphere". He initially had a mild right hemiparesis and ataxia which rapidly resolved. He was confused and disoriented for approximately 5 weeks.

A.S. underwent inpatient rehabilitation for 18 months, after which he resumed his previous employment. He returned to live with his parents where he has remained for the ensuing ten years. The major ongoing problems he has faced as a result of his accident appear to be those of social isolation, due mainly to post-traumatic changes in his personality and communication skills.

Post-traumatically, A.S. had a rapid, fluent and tangential speaking style.

Almost all of his conversations would continue endlessly, skipping from topic to topic, despite cues from his co-conversant that they didn't want to listen. There was also an aggressive quality to this, and inappropriate reference to sexual needs and desires were frequent. A.S. was aware of his communication problems, possibly due to the feedback he has got from family and hospital staff over the years. He was unable, however, to use this information to alter his communication behaviour.

While his parents continued to care for him, he has been a major source of stress in their lives. They seldom have guests around for fear of what their head-injured son will say. He has no friends at all, and his work mates avoid working near him due to his incessant and irritating conversation. He does not have a relationship currently, nor has he managed to maintain one for any length of time in all the years since his accident.

2.1.1.2. Summation of Residual Neuropsychological Impairments (4 years post-trauma)

A.S. was assessed neuropsychologically at 4 and 10 months post-trauma and then re-assessed 4 years later. Description of the serial assessments and the summary data can be found in Appendix 1. At his final assessment A.S. was described as follows:

He had intact basic skills of perception and praxis. His capacity to learn new visuospatial material was excellent, and he also displayed intact new learning capacity for simple verbal material, although he was less efficient in

this mode. His problems mainly reflected frontal lobe dysfunction. Specifically he appeared to have a disorder of control (regulation of activity in Luria's terms). Conceptual and organisational skills on novel tasks (e.g. the Wisconsin Card Sorting Test, the Rey-Osterrieth Figure) were reasonable and he was able to shift flexibly between conceptual frameworks. Intellectually he could not be described as rigid, nor was his behaviour stimulus bound or perseverative. Activation and programming therefore appeared to be intact.

However his behaviour was characterised by poor impulse control. Despite an adequate plan, his approach to all tasks reflected careless, hasty execution. He failed to monitor his progress adequately and therefore became frequently sidetracked. Poor monitoring was also reflected in rule breaking despite knowledge of the correct procedure. Irrelevant and tangential associations characterised his attempts to learn more complex verbal material and interfered with this process. While A.S. was often able to detect errors in his performance and correct them, his impulsivity prevented him from doing this in an anticipatory fashion. His general level of insight was reasonable.

2.1.1.3. Aphasia Assessment (4 years post-trauma)

A.S. was tested formally on the Western Aphasia Battery (W.A.B.). Using the W.A.B.'s criteria, he scored within normal limits on content and fluency in spontaneous speech, comprehension, repetition and naming. Qualitatively, his response to the W.A.B. complex picture reflected his tangential speech pattern. Sentences ended in a manner grammatically and semantically

unconnected with the beginning. Writing was rushed and careless and reflected numerous spelling errors.

2.1.2. P.B.: Neuropsychological Profile

2.1.2.1. History

P.B. was trained as a metallurgist and worked as a successful sales executive. He was married with four young children. P.B. held a traditional paternal role in his family who relied on him heavily for all decisions. He was well liked by colleagues and friends alike. He was quite talkative as his job demanded and was a rapid speaker. According to his wife he was always "black and white" in his judgements and would not dwell on an issue.

At the age of forty, he was involved in a motor vehicle accident in which he sustained a severe closed head injury, a fractured right clavicle and fractured ribs. A C.T. scan at the time revealed a small subarachnial haemorrhage and an intracerebral haematoma in the right ventricular trigone.

P.B. was comatose for three weeks and in post traumatic confusion for a further three months. He initially suffered a mild right hemiparesis which gradually resolved, although he has been left with residual clumsiness on his right side. P.B. underwent inpatient rehabilitation for 12 months and continued to attend outpatient work rehabilitation for a further 12 months. He also attended other vocational retraining schemes and ultimately gained employment as a clerk in the Public Service. He has returned home to live with his family. While P.B.'s post-traumatic history was not as long as A.S.

at the time of writing this thesis, the impact of his post-traumatic impairments on his family, social and vocational relationships were readily apparent.

Like A.S., P.B. was over-talkative and he too became caught up in extended monologues. His speech however had a much more halting "retarded" quality. It was easier to interact with him than A.S. since his slow speech allowed one to "get a word in edgewise". In contrast to A.S. his conversation was repetitive and dull, and always incorporated his current preoccupation with some aspect of his everyday life. His comprehension was also superficial, taking everything he heard literally and failing to appreciate implication or innuendo. Unlike A.S. at this stage in his post-trauma existence, P.B. had no insight into his communication problems.

Post traumatically, his children became embarrassed to be in his presence in public. He was loud and inappropriate in his conversations e.g. making loud racist comments about another person standing in the next queue at the bank. If asked to keep quiet he would simply laugh. His choice of phrase had become childish and his interaction with people blunt. Whereas he did not allow swearing in his family before, he began to swear liberally. His family are constantly assailed with long repetitive conversations which focus and elaborate upon a minor issue. His future in the Public Service was doubtful. He was being encouraged to make the most of his "flexitime" and be absent from his post.

2.1.2.2. Summation of Residual Neuropsychological Impairments (1 year post-trauma)

P.B. was assessed 4 months post-trauma, on emergence from the period of post traumatic amnesia, and again at 12 months post injury. The description of his assessments, including data, can be found in Appendix 1. His residual impairments can be described as follows.

P.B. had preserved skills of perception and praxis. New learning capacity for both verbal and non-verbal material was good. Like A.S., his deficits were those attributable to frontal lobe function, although the particular constellation of impairments he experienced was different. P.B. had problems with activation and programming. His speech was slow and this reflected a general retardation of information processing in all cognitive spheres. His ability to assume the abstract attitude was reduced and his thinking was rigid and inflexible. Perseveration characterised his performances.

When faced with a problem solving task his analysis was superficial and his approach would be piecemeal and disorganised. His ability to monitor his behaviour was also deficient. Unlike A.S., P.B. was not impulsive, nor he was susceptible to irrelevant flights of ideas. In contrast, his errors reflected perseveration on a theme unchecked by accurate monitoring. Errors had to be pointed out to him and he frequently had to be pushed to complete tasks. P.B. was quite uncritical of his performances and had limited insight generally. When pushed for an explanation he would invent a superficial and

inadequate rationale, e.g. his secretary would be doing that sort of work for him so he need not bother.

2.1.2.3. Aphasia Assessment (4 months post trauma)

P.B. scored within normal limits on the Western Aphasia Battery and the Token Test. His language deficits were apparent on more complex material, however. He was tangential, confabulatory and circumlocutory in spontaneous expression. His speech was therefore poorly planned and inconcise. While his comprehension was adequate at a sentence level, P.B. had difficulty understanding abstract concepts or complex logico-semantic relationships. His ability to extract important features or facts from written material at the level of the paragraph was also reduced. His writing was characterised by poor monitoring which engendered grammatical errors.

2.2. Control Subjects

A control group of twelve non-brain-damaged (NBD) subjects was employed in the majority of studies to be described. The controls were matched on the basis of age and educational/ occupational background. Because both A.S. and P.B. were male, all control subjects were also male. They were recruited mainly from maintenance staff at Lidcombe Hospital and from staff working at the local College of Technical and Further Education. The characteristics of the head injured and control subjects are detailed in Table 1.1.

Estimates of the control subjects intellectual abilities were not established. They were in all probability lower on the whole in IQ than A.S. and P.B. who

had estimated intelligence quotients well above average. It could therefore be safely assumed that any uncontrolled effect of intelligence in the tasks chosen would be skewed in favour of the two head injured subjects. This would simply diminish the magnitude of any experimental effects.

Different control groups were used for study 1 of Chapter 4 as well as the study outlined in Chapter 6. These will be described separately in the appropriate section.

Figure 2.1. characteristics of the two closed-head-injured (CHI) subjects and the 12 matched non-brain-damaged (NBD) controls.

SUBJECT	AGE	TRAINING	OCCUPATION
CHI subjects			
1. A.S.	42	Metallurgist	Trade sales executive
2. P.B.	29	Fitter and turner	Railway worker
NBD subjects			
3. D.M.	42	Electrician	Trade instructor
4. I.N.	43	Fitter and turner	Trade instructor
5. G.W.	43	Engineer	Chief engineer
6. I.S.	44	Carpenter	Carpenter
7. B.N.	40	Electrician	Electrician
8. G.L.	38	Forester	Ranger, National parks
9. B.M.	34	Electronics	Electronics technician
10. B.K.	32	Electrician	Trades instructor
11. S.M.	33	Electrician	Trades instructor
12. M.H.	29	Tiler	Taxi driver
13. R.F.	27	Engineer	Biomedical engineer
14. C.S.	29	Untrained	Truck driver

CHAPTER 3: ABILITY TO DESCRIBE A NOVEL PROCEDURE.

3.1 Preamble

This study examines features of procedural discourse, that is discourse which is generated in the process of explaining a procedure. The texts produced by A.S., P.B. and 12 control subjects were subjected to a number of analyses, reflecting several theoretical positions. The purposes of these were two-fold. The first was to discover whether the texts produced by the closed-head-injured (CHI) subjects were perceptibly different to those produced by non-brain-damaged (NBD) subjects along pre-determined dimensions. This was achieved via subjective rating scales scored by blind raters. The second was to tease out which qualities in the text gave rise to perceived differences using post hoc linguistic and logical analyses.

These single texts were thus closely examined along a number of dimensions. Even so, there was evidence to suggest that these texts were quite representative of A.S. and P.B.'s normal output and were not idiosyncratic instances. During the course of this investigation several other procedural texts produced by them were transcribed and similarly analysed and similarities across the various productions were quite apparent.

A summary of the sequence of the analyses is as follows.

1. Subjective rating scales:
    A. Repetitiveness
    B. Amount of detail
    C. Clarity of explanation
    D. Organisation of explanation
    E. Effectiveness of explanation

2. Linguistic analyses :
    A. Amount of lexico-grammatical cohesion
        i. Chain formation
        ii. Chain interaction
    B. Type of lexico-grammatical cohesion
        i. Substitution, lexical reiteration and ellipsis
        ii. Endophoric and exophoric reference

3. Propositional analyses:
    A. Number of new and repeated propositions
    B. Order of essential propositions
    C. Sequence characteristics of all propositions

The analysis were motivated by the clinically observed features of CHI subjects' speech, and the implications these had for certain pragmatic theories of discourse. In the discussion the findings are re-orientated from these essentially linguistic frameworks and discussed in terms of models of frontal lobe function.

3.2. Grice's Cooperative Principle

Describing a novel procedure to a naive listener in an effective manner requires anticipating and meeting their needs. The information must be imparted in a way that is systematic and clear from their point of view. It is therefore an active process of communication, involving planning and monitoring. CHI and concomitant frontal lobe impairment may be expected to be disruptive to this ability.

In order to determine whether this was so, it was necessary to establish some framework by which the impact of the procedural narrative on the listener can be assessed. Snow, Lambier, Parson, Mooney, Couch and Russell (1986) discussed the possibility of evaluating procedural narratives by CHI patients using Grice's principle of cooperative conversation. This was considered to be an appropriate theoretical framework in which to cast this investigation.

Grice's principle (1975) stemmed from the notion that human communication is based on cooperation between speakers. As part of this cooperation the speakers implicitly recognise that any communicative act will follow four general maxims:

1. **Quantity:** the speaker will say as much as is necessary and no more;
2. **Quality:** the speaker will say only what he\she believes to be true and has adequate evidence for;
3. **Relevance:** the speaker will say only what is relevant; and
4. **Manner:** the speaker will communicate in a manner that is easy to

understand and will avoid ambiguity and obscurity.

As a sub-theme of the maxim of manner, Haviland and Clark (1974) and Clark and Haviland (1985) have argued that speakers adhere to the given - new contract. This contract ensures that the listener is able to identify the given information in any sentence and has a clear antecedent for it. It also ensures that the new information will be recognisable by the structure of the sentence and by the intonation.

Grice argued that the flouting of these maxims under certain circumstances is done purposefully to produce a conversational implicature (e.g saying something blatantly counterfactual may be interpreted as sarcasm or irony). In other circumstances failure to adhere to the maxims will result in clumsy, ineffective or failed communication. While Grice's thesis was concerned with the language of normal speakers, his framework was easily applied to an investigation of procedural narratives proffered by brain impaired subjects. The type of difficulties it was hypothesised that A.S. and P.B. would experience in relating a procedure can be defined within the framework of these maxims in the following way:

1. Quantity. Both P.B. and A.S have noticeable verbal disinhibition as witnessed clinically and evidenced on neuropsychological assessment (e.g. verbal fluency). P.B.'s problems stemmed from his disorder of drive, resulting in concreteness and perseveration, while A.S. had major problems of impulse control. So while both may be expected to say too much, the quality

may well differ. P.B. may be repetitive and over-elaborate details, while A.S. may be expected to skip onto tangential and peripheral information.

2. Quality. There was no priori reason to believe that the impairments both A.S and P.B. suffer would affect their capacity to say what is true. (While Damico (1985) in the development of his discourse analysis, expanded this maxim to incorporate the notion of inaccuracy, this is possibly better subsumed under the maxim of manner.)

3. Relevance. A.S. in particular was expected to have difficulty maintaining relevance, given his impulsive and tangential speaking style. However it was hypothesised that P.B. too, may have difficulty in this regard, since over-elaboration of minor points (something he did frequently) may artificially distort the centrality of that point in the broader context.

4. Manner. P.B. had proven on neuropsychological assessment to be disorganised in his approach to problem solving tasks. While A.S. was better able to plan, his execution was careless. Both subjects had difficulties monitoring their performances in any task and adjusting their progress in light of the desired goal. Such difficulties may therefore disturb their ability to adhere to the maxim of manner, producing procedural information in a disorganised fashion.

Combined with the intellectual difficulties outlined above, A.S. and P.B. had psychosocial deficits which were also relevant to their discourse. P.B. had a

significant impairment of insight and was extremely egocentric. He was virtually unable to appreciate a situation from another person's point of view. A.S. was better able to consider the feelings of others as an intellectual exercise, but in practice would not do so. He was also unable to adapt his behaviour to accommodate the other party's perspective even when he was aware of it.

These traits made it difficult for both A.S. and P.B. to appreciate the impact of their conversational style on others or to modify their style in the light of that consideration. It was predicted therefore that they would make errors of manner in their procedural discourse which would reflect a failure to appreciate the listener's point of view. The following task, involving the description of a novel procedure, was employed to test these predictions.

3.3. Method.

3.3.1. Description of task

The subjects were required to describe how to play a simple dice game. This game was originally described by Flavell (1975) in a study looking at the development of empathy in children. Although typical of many board games it was unfamiliar to the subjects. They could not therefore, rely on old skills in describing the process of playing it. In order to ensure that the subjects relied on verbal instruction, rather than gestural or visual cues, the third party to whom they were explaining the game was blindfolded. The third person was, on each occasion, also new to the task.

3.3.2. Game characteristics

The dice game consisted of a board with red, yellow and green stripes printed on it and divided down the centre by a black line. "Start" and "Finish" were written on either side of the central dividing line at one end. There were two toy cars, one red and one green, and a dice with sides painted red, green and yellow to match the board and one side that was black. The players alternated throwing the dice and moving their car to the stripe on the board that matched the colour showing up on the dice. If the black side of the dice came up the player missed a turn. They moved down one side of the dividing line and up the other to the finish. Because the last stripe before the finish was red the winning player had to end by throwing the dice with its red side faced up.

3.3.3. Procedure

The subject was seated in a quiet room with the clinician. It was explained to him that he would be shown how to play a game and then would be required to explain it to a third person who would be blindfolded. The clinician and the subject then played the game until the subject was quite clear about the rules. At no point did the clinician describe the game verbally. Once the subject agreed that he was sure about how to play, the game was removed and a third person, selected from hospital staff to act as a "stooge", was requested to enter the room. He/she was told that the subject was going to explain how to play a game. The third person was then blindfolded and the game replaced in front of the subject.

The explanation ended when the third person agreed that he/she understood how to play adequately. Subjects frequently asked the stooge if he or she understood but if he ended his explanation without seeking final feedback from the third person the clinician stepped in and asked if the stooge understood. Further interaction occasionally followed as a result of this. Once the third person was adamant he/she understood, the blindfold was removed and any comments he/she had about the actual appearance of the game were noted. All proceedings were tape recorded.

3.3.4. Transcription.

The fourteen descriptions produced by A.S., P.B. and the controls were transcribed verbatim from the audio tapes, including all hesitations, repetitions, false starts and comments made by the third person and the clinician. For the purposes of analysis the texts were divided into two sections. The first provided that main source of data for this study. It comprised the bulk of the explanation given by the subject up until he voluntarily terminated. This was signalled by such comments as, "Well that's about it", "Do you understand?", or simply an extended pause terminated by the intervention of the clinician. The second part of the text was normally the third person seeking further clarification, giving feedback etc.

In the majority of texts the stooge said very little until the subject had completed his explanation (to his satisfaction if not theirs). However in three of the control texts, the stooge chose to take a very active role right from the beginning and the text reflected a question-answer interaction. It was felt

that in such texts the order and type of explanation given by the subject was qualitatively different from the rest and therefore cross comparisons would be difficult. These three texts were therefore excluded from the analyses. Transcription of the first part of the texts for the remaining nine control and two CHI subjects are set out in full in Appendix 2.1.

3.4. Analyses 1: Subjective Rating Scales.

In order to assess whether the subjective quality of the head injured texts was noticeably different from the controls, a set of five 7-point rating scales was developed. After initial pilot work, it was decided that these scales, in order to make sense to the raters, were best focused on the maxims of Quantity and Manner as well as the overall effectiveness of the communication. An investigation of the relevance of the texts was left for later analyses. The scales were as follows.

1. Quantity:	Scale 1.	Repetitiveness (from 1,"not at all repetitive" to 7,"extremely repetitive").
	Scale 2.	Detail (from 1, "too little detail" to 4, "enough detail" to 7, " too much detail")
2. Manner:	Scale 3.	Clarity (from 1, "easy to understand" to 7, "confusing").
	Scale 4.	Organisation (from 1, "very organised" to 7, "haphazard")
3. Effectiveness:	Scale 5.	Effectiveness (from 1, "effective" to 7, "ineffective")

Scale 5 was included as a check of whether or not A.S. and P.B. were **overall** more or less effective than the control subjects in their attempt to explain the dice game, regardless of whether the more specific hypotheses regarding the quality of their performances were upheld.

Nine judges performed the ratings. Judges were either psychologists or speech pathologists. The judges were not informed that any of the subjects were head injured. They were simply asked to make ratings evaluating communication skills generally. The nature of the rating scales were explained to the raters. They were asked to read all eleven texts before commencing. The texts were randomly ordered. Instructions to raters can be found in Appendix 2.2.

3.4.1. Results

3.4.1.1. Inter-rater Reliability

Inter-rater reliability was calculated using intra-class correlations for k judges as outlined by Shrout and Fleiss (1979) and Cronbach, Gleser, Nanda, and Rajaratnam (1972). The reliabilities for the five scales are displayed in Table 3.1.

ICC, case 2 for 9 judges i.e. ICC (2,9) is the criterion whereby the 9 judges are considered as a random sample selected from a larger population of judges. Intra-class correlations, case 3 for 9 judges i.e. ICC (3,9), is defined as the inter-rater reliability between 9 judges when those judges are the only judges of concern.

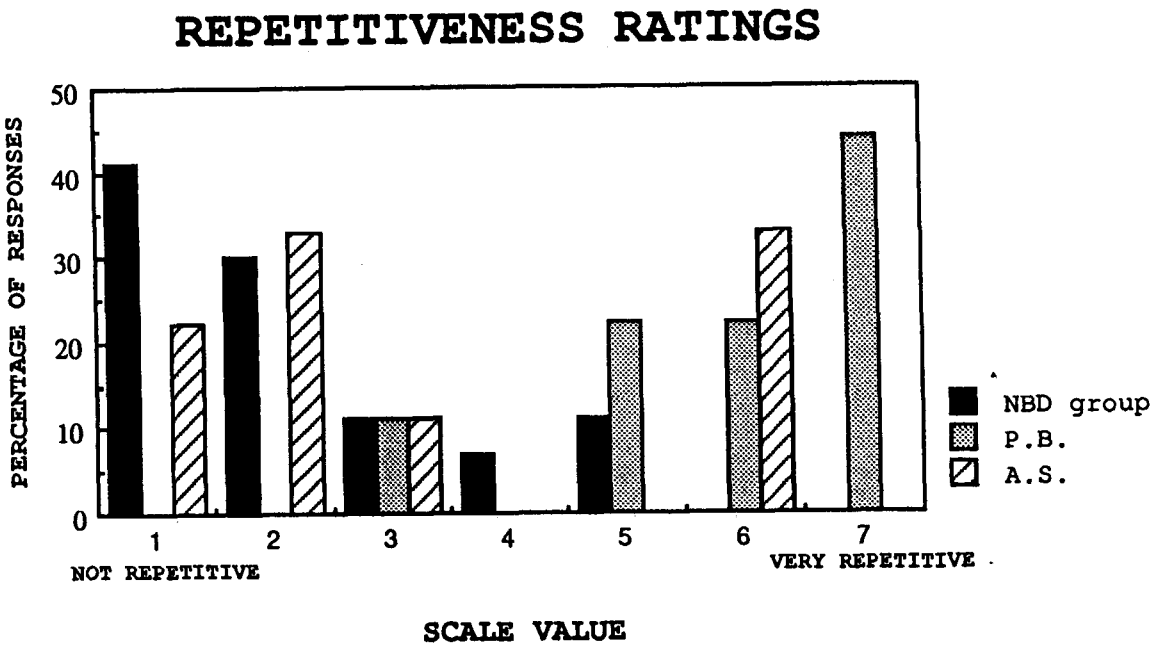
Table 3.1. Intra-class correlations estimating inter-rater reliability for the 9 judges rating 14 texts on 5 scales.

SCALE	ICC (2,9)	ICC (3,9)	SIGNIFICANCE
1. Repetition	.84	.86	p <.025
2. Detail	.88	.90	p <.001
3. Organisation	.90	.91	p <.001
4. Clarity	.88	.90	p <.005
5. Effectiveness	.91	.93	p <.001

All inter-rater reliabilities expressed as global estimates were significant. There were several occasions however, where particular judges would differ in their appraisal of particular subjects. Some of these deviations were quite informative and are discussed under the relevant sections below.

3.4.1.2. Repetitiveness

The frequencies with which the raters assigned values 1-7 on the "Repetitiveness" scale are depicted in Graphs 3.1. for A.S. and P.B. individually compared to the non brain damaged group as a whole. Because the comparisons are between different sample sizes, the frequencies are expressed as the percentage of total responses. Full details of rating scores can be found in Appendix 2.3.



Graph 3.1. Frequency, in percentages, with which raters assigned scores on the **Repetitiveness** scale to texts of the NBD group compared to A.S. and P.B. individually.

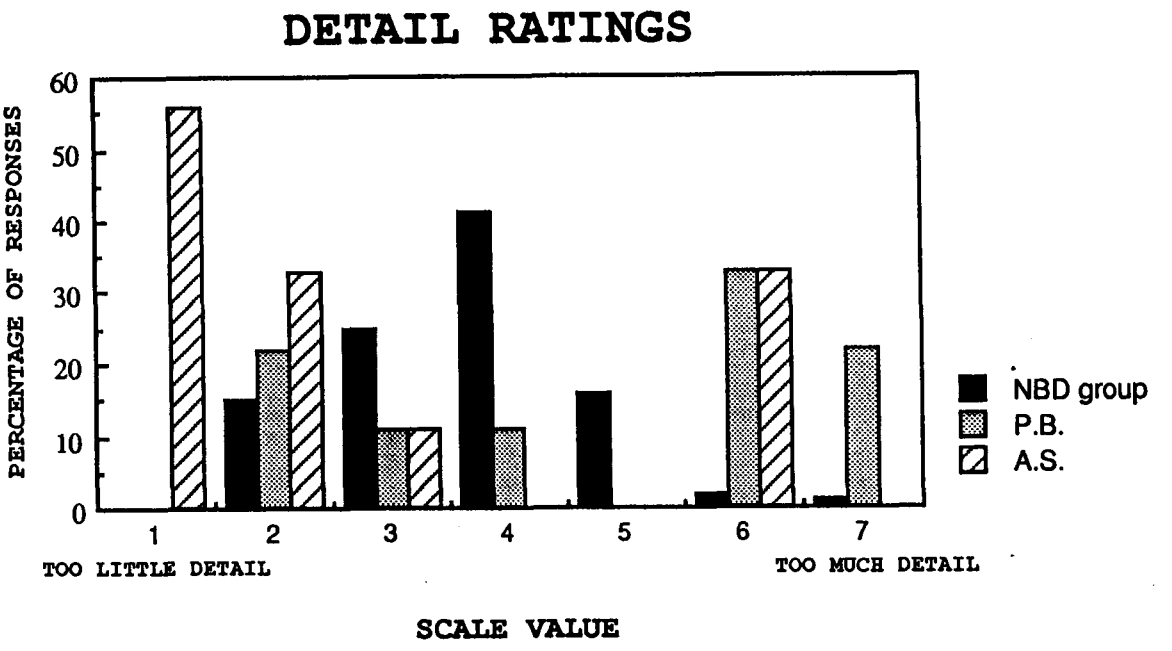
As can be seen, the majority of scale values assigned to the controls were in the low range. No control was given a repetitive score above 5. The ratings assigned to the CHI subjects were noticeably different to this. Differences between the CHI subjects and the control group were tested using independent t-tests for planned comparisons based on random data permutation (Edgington, 1980). These analyses make no assumptions regarding the distribution of scores. They simply indicate the statistical probability of a particular score occurring outside a given range. According to this t-test there was no significant difference between the two CHI subjects and the controls. On closer inspection however, this was found to be due to individual differences between the two subjects in their repetitive ratings.

P.B. was considered highly repetitive by all raters, with the exception of one rater who found him to be moderately repetitive. His profile contrasted markedly with those of the controls. Converting the values to Z scores it was found that his mean repetitive rating value (5.9) was more than two standard deviations above the NBD group mean and was therefore significantly different. ($Z = 3.61$, $p < .01$).

The raters differed in their opinion regarding the repetitiveness of the text provided by A.S.. Six judges rated him as not repetitive or at most only slightly so. Three judges considered him to be **very** repetitive. A possible reason for this discrepancy can be found by perusal of A.S.'s text (Appendix 2.1). Section 1 of the text supplied by A.S. was, in fact, relatively brief, with few procedural steps. It would appear therefore that while six judges were rating repetitiveness on the basis of repetition of instructions and therefore considered A.S. not repetitive, three judges seem to have focused on repetitiveness of lexical items and in particular the terms "coloured" or "colours", which together occurred 5 times in three consecutive statements. Overall the average repetitive rating assigned to A.S. was within the range of normal values.

3.4.1.3. Detail

The frequencies of the different rating values assigned to the head injured and control subjects on the "Detail" scale are depicted in Graph 3.2.



Graph 3.2. Frequency, in percentages, with which raters assigned scores on the **Detail** scale to NBD texts compared to A.S. and P.B. individually.

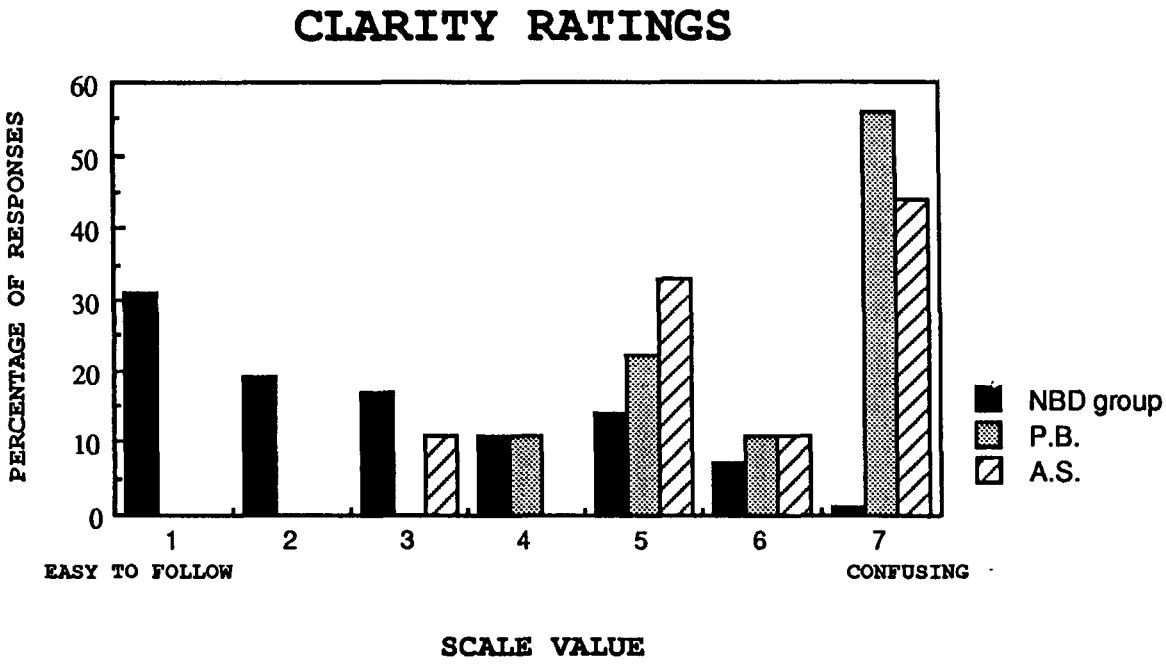
This scale differed from the others in the sense that point 4 on the scale was the "good" score. To score lower or higher reflected too little or too much detail respectively. As would be expected, the majority of the scores assigned to the control subjects clustered around 4, falling off at the upper and lower ends. In order to determine whether the CHI subjects performed differently to this, a random data t-test was employed comparing the two CHI subjects' detail ratings to those of the NBD subjects. The difference was found to be not significant. Perusal of the data indicated that once again, this was due to a difference between the individual CHI subjects.

The ratings assigned to A.S. differed markedly from the NBD subjects' pattern. The majority of scores assigned to his text were in the 1-2 range and no values were above 3. His mean rating on the "Detail" scale was 1.6, which was more than two standard deviations below the group mean. In terms of Z scores this was significantly lower ($Z= 3.73$, $p<.01$).

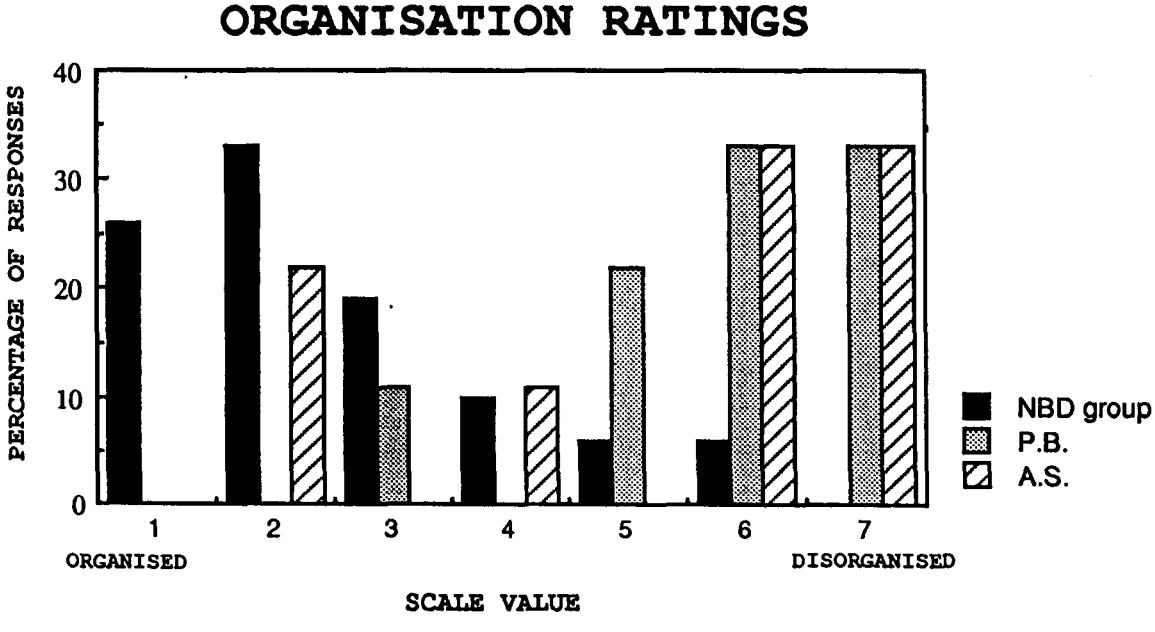
P.B.'s text was rated quite differently to that of A.S. The majority of judges (6) rated him as giving too much detail. Three judges, however, rated him as giving too little. Overall, the average rating assigned to P.B. on the "Detail" scale was not outside the normal range. The discrepancies between raters regarding the amount of detail given by P.B. probably reflect the confusing quality of the text (discussed in the next section) which obscured the amount of detail he gave.

3.4.1.4. Clarity, Organisation and Effectiveness

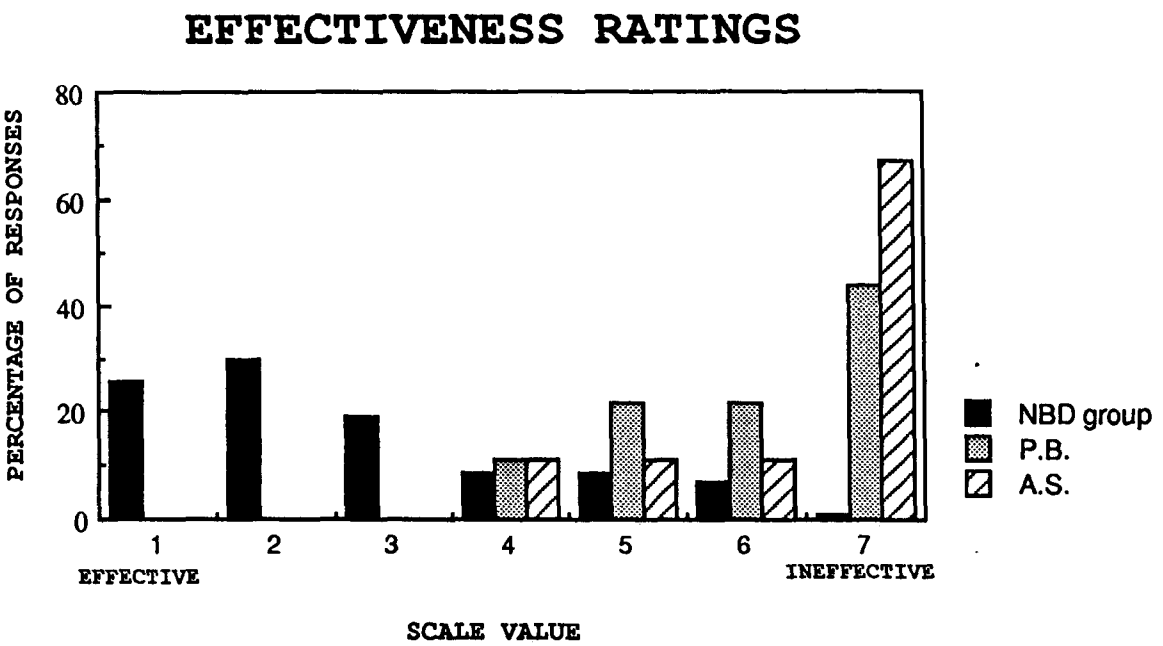
The pattern of scores on these three scales was very similar. Frequencies with which raters assigned NBD and CHI subjects values on the three scales of "Clarity", "Organisation" and "Effectiveness" are depicted in Graphs 3.3., 3.4. and 3.5. respectively.



Graph 3.3. Frequency, in percentages, with which raters assigned scores on the **Clarity** scale to texts of the NBD group compared to A.S. and P.B. individually



Graph 3.4. Frequency, in percentages, with which raters assigned scores on the **Organisation** scale to texts of the NBD group compared to A.S. and P.B. individually.



Graph 3.5. Frequency, in percentages, with which raters assigned scores on the **Effectiveness** scale to texts of the NBD group compared to A.S. and P.B. individually.

In each scale the majority of the judges gave the CHI subjects ratings in the 6-7 range, i.e. their texts were considered to be very confusing, very disorganised and ineffective. The majority of NBD scores were in the 1 - 3 range on all scales. Although judges very occasionally gave a score of 7 to control subjects, no one subject received consistently poor scores. Random data t-tests on the three scales showed that the CHI subjects as a group were significantly worse than the NBD control group on all three scales. ($p = .018$, 1 tailed for each scale respectively).

3.4.2. Discussion

These findings were consistent with the hypotheses that the nature of cerebral impairment suffered by both A.S. and P.B. would impact upon their capacity to provide a procedural discourse. Their particularly poor performance on the "Effectiveness" scale confirmed that these influences contributed to a less effective communication overall.

While A.S. and P.B. were considered similar in this general sense, they were viewed as different in others. Whereas A.S. was clinically considered over-talkative in many social situations, he was not in this context. He provided a very short verbal explanation of the game with very little detail. P.B. performed on this task in a manner more in keeping with behaviour observed elsewhere. His explanation was very long-winded and repetitive. While both A.S. and P.B. failed to adhere to the maxim of quantity, one did so by providing too much information and the other too little. Their texts also had much in common in terms of the level of disorganisation and lack of clarity which would also have reduced the effectiveness.

The results of the rating scales thus supported the notion that the procedural discourse of the two head injured subjects contravened Grice's maxims of quantity and manner. They also confirmed that the CHI subjects were perceptibly inferior to NBD controls in this. What is yet to be determined is the specific characteristics of the productions that contributed to these perceptions.

It would be pertinent, at this point, to consider the texts in terms of psychological theories regarding the cognitive processes involved in discourse production. There are none however, that make specific predictions upon which measurement can be based. As an alternative, there have been recent linguistic advances into discourse analysis with associated methodologies. These types of analyses are essentially focused on the structure of the discourse product rather than the process of its creation. Even so, such analyses may produce valuable information concerning the source of the raters' perceptions on the five scales. Because the texts were rated in a transcribed form the differences between them must lie in their linguistic structure, underlying logic or both, rather than intonational, gestural or other contextual factors. Furthermore the results of a linguistic investigation may yield some insights into the nature of the underlying cognitive processes. For these reasons a detailed analysis of linguistic and logical parameters of the transcribed tests was undertaken.

3.5. Analysis 2. Linguistic Features of the Text.

3.5.1. Amount of Lexico-grammatical Cohesion.

According to the "Clarity" rating scale, the discourse provided by both A.S. and P.B. was perceived as very confusing. What linguistic features were contributing to this?

Both Armstrong (1987) and Ulatowska and North (1981) have used "clarity " scales not dissimilar to the one used in the previous section, as a measure of the linguistic cohesion of texts of aphasic (CVA) patients. Cohesion was

defined in both cases as that proposed by Halliday and Hasan (1976) and developed further in later writings (Halliday, 1985, Halliday & Hasan, 1985, Hasan 1980, 1984). A fuller description of the theory behind textual cohesion can be found in Appendix 2.4.

Hasan (1985) described textual cohesion in terms of the nett effect of a number of lexical and grammatical devices which operate to make a text a unified whole rather than simply a string of unrelated sentences. These devices comprise a network of semantic relationships linking lexical items which may be within the same clause or may be found in clauses distributed widely throughout the text. One device is the use of lexical ties in which the same or similar lexical items are used repeatedly throughout the text to refer to the same entity e.g. the cat...the pet (co-reference) or to separate entities within the same domain of meaning e.g. the cat... the dog (co-classification). Another device which might be seen as a subcategory of co-reference involves the use of a pronoun or another substituted phrase to refer to a previously mentioned or known referent (anaphoric reference) e.g.

(1) You take the dice and throw **it.**

Yet another mechanism is the deliberate non-inclusion of key elements in a clause whose presence must therefore be implied, usually by reference to the previous text e.g.

(2) the sailor unwound the rope and (**the sailor**) dropped the anchor.

In this sentence the subject in brackets is implied not stated. This type of device is known as ellipsis and may be used to implicate any grammatical

part of the clause (subject, verb phrase, object) or even larger informational units.

By decoding such devices and identifying the original referent, multiple chains of semantically related lexical items can be discovered running through normal (coherent) discourse. Hasan (1985) has argued that while the semantic continuities formed by such devices are necessary for cohesion, they are not **sufficient** to make a text coherent. Items manifesting lexico-grammatical cohesion must also stand in grammatical relationship to each other. A text which has little cohesion by these definitions would be expected to be fragmented and difficult to follow i.e. confusing.

Hasan (1984) developed a method by which the semantic chains and their grammatical interactions in any given text could be identified. An estimate of the relative cohesion could then be derived, know as the Cohesive Harmony Index.

Ulatowska and North (1981) used their clarity scale to gain an estimate of cohesion, but they did not provide an independent measure of cohesion as formally described by Hasan (1984, 1985). Armstrong did a detailed cohesion analysis based on Hasan's methodology adapted for use with an aphasic population. She found significant correlation between her measures of the Cohesive Harmony Index and ratings of individual subjects on a four-point clarity scale.

Two of the few studies exploring procedural discourse in CHI subjects, Mentis and Prutting (1987) and Wyckoff (1984 as cited in Mentis & Prutting, 1987) used principles of lexico-grammatical cohesion in their analysis. While the Wychoff findings have not as yet been published, Mentis and Prutting (1987) found that NBD subjects used more cohesive devices than their CHI counterparts. It was also found that the control subjects tended to use more lexical cohesive devices compared to the head injured. The CHI subjects, in contrast, preferred pronominal reference and ellipsis. Mentis and Prutting did not, however, provide any independent measure of the impact these cohesive strategies had on listeners. It was therefore of interest to determine whether the perception of lack of clarity in the CHI texts in this study was indeed associated with reduced cohesion.

3.5.1.3. Procedure for Cohesion Analysis, Stage 1: Chain Formation

The method used with these texts followed that described by Armstrong (personal communication), who developed her procedure in cooperation with Hasan. For a fully detailed description of the cohesion analysis used including examples, the reader is referred to Appendix 2.5. A brief description of the method follows.

The eleven texts were divided into clauses on the basis of the presence of one verb per clause. All pronouns, substitutions and ellipses were then identified and redefined in terms of their original referents. Prepositional groups, conjunctions, conversational idioms etc. were removed. In line with Armstrong's methodology, direct repetitions of individual lexical items which

were juxtaposed without contributing to meaning were also removed from the text to avoid artificially boosting estimates of cohesion. Paraphrasing, false starts, and repetitions of concepts which were interspersed with other structures were retained.

All lexical items which referred to the same referent were then collected into lists which Hasan termed "Identity Chains". All lexical items which referred to different entities within the same class of meaning were formed into "Similarity Chains". Lexical items were referred to as "tokens". A chain had a minimum membership of two tokens. According to Hasan's terminology, items entering into chains were referred to as "Relevant Tokens" (R.T.) while items not in chains were called "Peripheral Tokens". The proportion of tokens tied by lexico-grammatical cohesive devices could then be estimated as the percentage of Relevant Tokens versus all tokens.

3.5.1.2. Results

A. Inter-rater reliability

Cohesion analysis is a time-consuming process. It was therefore not possible to request a second rater to perform the analysis on the entire 10 pages of text. A measure of inter-rater reliability was achieved, however, by independent analysis of one text by both the author and a speech pathologist trained in cohesion analysis. Initial agreement regarding the identification of relevant items was acceptably high (73%). Upon discussion agreement reached 100% with the discrepancy mainly due to the second analyst having

overlooked a handful of items. There was no disagreement concerning class membership.

B. Results of Cohesion Analysis, stage 1: chain formation

The results of analysing the lexical tokens into similarity and identity chains is depicted in Table 3.2. R.T. refers to "Relevant Tokens".

Table 3.2. Features of the cohesion analysis (stage 1)

SUBJECT	NO. CLAUSES	NO. CHAINS	NO. TOKENS	NO. R.T.	% R.T.
NBD subjects					
1. DM	22	17	100	93	93
2. BK	18	12	56	47	84
3. BN	22	17	100	88	88
4. IS	17	14	59	53	90
5. RF	38	21	141	133	94
6. BM	33	20	119	107	90
7. GL	35	21	122	108	89
8. GW	27	13	108	91	84
9. SM	23	15	105	96	91
CHI subjects					
1. A.S.	14	12	49	40	82
2. P.B.	68	20	222	204	92

From Table 3.2. certain features of the performance of A.S. and P.B. can be noted which support their ratings on the scales of "Repetitiveness" and "Detail". P.B. proffered a text which contained almost twice as many clauses as did any control subject. In contrast A.S. gave an explanation which had fewer clauses than anyone else. Together the two CHI subjects were not significantly different to the controls in terms of the amount of lexico-

grammatical ties present in their texts. Individually however, it was found that P.B. used Relevant Tokens at a frequency in keeping with the normal range but A.S. used proportionally fewer than his NBD counterparts ($Z = 2.06$, $p < .02$).

3.5.1.3. Procedure for Cohesion Analysis, Stage 2: Chain Interaction

The next stage in estimating lexico-grammatical cohesion, required analysing the interweaving of Relevant Tokens via the formal grammatical relationships within the text. At least two members of any one chain must stand in the same grammatical relationship to two members of another chain for coherence to be considered to have occurred. Items thus defined, which form both lexico-grammatical and formal grammatical relationships, are known as **Central Tokens**. The percentage of Central Tokens over all tokens can then be used as a composite measure of the cohesive harmony of the text i.e. the Cohesive Harmony Index (Hasan, 1984).

The methodology again closely followed that described by Armstrong (1987), supplemented by personal communication. A condensed summary of the procedure is outlined below. A more detailed account can be found in Appendix 2.5.

All clauses were sequentially numbered. Tokens which were in either Identity Chains or Similarity Chains were then listed along with the number of the relevant clause from which they were derived. The chains were then scanned to find any two members of one chain which formed a similar grammatical

relationship to two members of another chain. This was done by referring back to the original text. Typical grammatical relationships included "actor - action", "action - goal", "action - location" and "attribute - attribuand". The number of tokens entering grammatical and semantic relations with three others according to these criteria (Central Tokens) was then expressed as a percentage of all tokens to achieve an estimate of the Cohesive Harmony Index.

3.5.1.3. Results

A. Inter-rater reliability

In order to estimate inter-rater reliability, the author and a speech pathologist analysed one text, independently for chain interaction. Agreement on chain interaction was 100%

B. Results of cohesion analysis stage 2: chain interaction

The results of the chain interaction analysis are displayed in Table 3.3. Both the number of Central Tokens and the percentage of Central Tokens over all tokens which gives an estimate of cohesion, are shown. Since the purpose of this analysis was to investigate whether lack of cohesion contributed to the relative lack of clarity of the CHI texts, the individual mean scores on this scale as well as the effectiveness scale are depicted in the same table. It should be noted that whereas a high % C.T. value means greater cohesion, it is lower scores on the two scales that reflect greater clarity and effectiveness.

Table 3.3. Features of the cohesion analysis, stage 2, (chain interaction) and mean scores on the "clarity" and "effectiveness" scales for individual NBD and CHI texts.

SUBJECT	"CLARITY"	"EFFECT-IVENESS"	NO. C.T.	% C.T.
NBD subjects				
1. DM	2.0	1.4	70	70
2. BK	3.0	3.0	25	45
3. BN	3.4	2.8	40	40
4. IS	3.1	3.7	30	51
5. RF	3.8	3.2	113	80
6. BM	2.8	2.8	79	66
7. GL	2.6	2.2	64	55
8. GW	2.1	1.8	52	49
9. SM	3.3	3.1	66	63
CHI subjects				
1. A.S.	5.8	6.3	20	42*
2. P.B.	6.1	6.0	160	72*

As the starred items in Table 3.3. show, the results of the cohesion analyses did **not** illuminate the nature of the problem experienced by A.S. and P.B. There was a wide variety in the percentage of Central Tokens i.e the Cohesive Harmony Indices derived from analysis of the individual texts. The two CHI subjects attained scores within the range of normal values. Furthermore there appeared to be little association between estimates of clarity on the rating scale and the Cohesive Harmony Indices. Spearman rank order correlation coefficients between the % C.T. scores and the mean scores on both the "Clarity" and "Effectiveness" scales for individual NBD and CHI subjects were not significant confirming this lack of association.

3.5.1.5. Discussion

The findings of this analysis, although in one important respect negative, are interesting on two counts. Firstly, while Hasan has suggested that the Cohesive Harmony Index (percentage of Central Tokens) needs to be more than 50% for the text to be considered cohesive, several of the above texts (including A.S. and three of the controls) were less than this. Even so these same texts, with the exception of A.S., were not necessarily regarded as either the most confusing nor the least effective of the texts.

The reason for this lack of correlation may stem from the nature of the text. As mentioned at the beginning of this chapter the texts under examination are procedural rather than descriptive. Speakers may use different strategies when relating a procedure compared to other types of discourse. Many of Hasan's examples (1985) used to expound her theory of coherence stem from either narration (story telling) by children or conversational exchanges. Armstrong's study, in which she found Cohesive Harmony Indices to correlate with subjective estimates of clarity, was based on raters' perception of eighteen different texts provided in response to six widely varied discourse contexts.

The second point of interest is the fact that higher Cohesive Harmony Indices appeared to be related to longer texts. In order to verify this a Spearman rank order coefficient was performed to analyse the relationship between number of clauses and the individual Cohesive Harmony Indices. Because the CHI subjects were not significantly different to the controls according to the

estimates of cohesion, it was legitimate to treat all subjects as one group for this analysis. The correlation was significant (r_s =.71, p<.01) and confirmed the above observation. The reasons for this correlation can be shown to be due to the nature of the measurement.

The insistence that **two** members of a chain must stand in the same grammatical relationship to two members of another in order to be considered central to the cohesive harmony introduces a measurement artefact. Hasan has argued that it is necessary to make this a minimal requirement, otherwise any token, by virtue of the grammatical relations it shares within a clause, would have to be considered central to the cohesive harmony. However the consequence of this is that the number of Central Tokens does not increase in a unitary fashion, but rather in steps of four. The longer the text, the higher the likelihood that a set of four elements will be formed which fit the criteria of Central Tokens. Relevant Tokens on the other hand, are accrued one, or at most two, at a time. Expressing the number of Central Tokens as a percentage of all Relevant Tokens, is therefore an averaging exercise which does not adequately compensate for the quantal nature of accruing Central Tokens. Unless a means of circumventing this measurement artefact is found, measures of cohesive harmony will be strongly influenced by length.

It is also of interest to note that the difference reported by Mentis and Prutting (1987) in the number of cohesive devices produced by head injured and control subjects was supported only partially by this study. P.B. used

proportionally as many cohesive ties as did the normal group. A.S. used fewer than controls but in reality this was still quite high proportionally (82%) and represented a difference of only 2% below that of the lowest scoring control. The mean number of cohesive ties quoted by those authors were averaged over three narrative texts, which were quite varied in their content (describing the days program, playing a favourite sport and changing a tyre or baking a cake). The differences in the discourse requirements between that study and this may well have proven to be a major source of variation.

3.5.2. Type of Lexico-grammatical Coherence

The analysis reported above has shown that the sheer **amount** of lexico-grammatical cohesion was not strongly related to either the type of subject (CHI versus NBD) or to the ratings of effectiveness or clarity. The question was raised however, whether the **type** of cohesive devices used, differed between the two groups and whether this contributed to the perception of clarity.

3.5.2.1. Frequency of Substitution, Lexical Reiteration and Ellipsis as Cohesive Strategies

Mentis and Prutting (1987) speculated that the preferential use of lexical cohesion by NBD subjects compared to the CHI subjects in their study, indicated a normal communication practice of re-introducing key elements on a regular basis in order to avoid confusing the listener. The failure of the head injured subjects to do this with the same frequency may well have

reflected an incapacity to "put themselves in the shoes" of the listener. If the head injured subjects in this study were indeed incapable, or uninclined, to consider the need of the listener,as was hypothesised in Section 3.1, they too may abandon this practice.

Conversely ellipsis, which was used proportionally more by Mentis and Prutting's CHI subjects compared to the controls, could easily become disruptive to a text if used too frequently. In such a situation the listener is forced constantly to fill in the gaps by inferential reasoning. Similarly preferential use of pronouns and substitutions rather than lexical reiteration over the length of the discourse places a strain on the listener's memory. Over-reliance on either of these devices might occur if the head injured subjects are not considering the demands they are placing on the listener. Frequency of use of these three devices was therefore investigated.

3.5.2.2. Procedure

The lexical, substituted and elliptical devices identified in the lexico-grammatical cohesion analysis formed the basis for this analysis. Definitions of devices were as follows:

1. **Lexical tie**: Reiteration of same or similar lexical item to refer to the same entity as mentioned elsewhere in the text (co-reference) or to refer to an entity within the same domain of meaning as that mentioned elsewhere in the text (co-classification).
2. **Substitution**: The use of a pronoun or other item(s) to refer to an entity previously mentioned in the text (co-reference).

3. Ellipsis: The omission of a lexical item whose presence must be inferred by reference to the rest of the text (co-reference or co-classification).

3.5.2.3. Results of Analysis

The number of devices used in the different categories by individual CHI and NBD subjects are shown in Table 3.4, along with the percentage of all devices that lexical ties represented.

Table 3.4. Number of substituted, lexical and elliptical devices used by individual NBD and CHI subjects.

SUBJECT	SUBSTIT-UTION	LEXICAL TIE	ELLIPSIS	TOTAL	% LEX.
NBD subjects					
1. DM	14	77	0	91	84.6
2. BK	9	37	3	49	75.5
3. BN	17	68	6	91	74.7
4. IS	11	44	0	55	80.0
5. RF	27	105	0	132	79.5
6. BM	18	89	3	110	80.9
7. GL	19	91	0	110	82.7
8. GW	18	73	3	94	77.6
9. SM	12	84	3	99	84.8
CHI subjects					
1. A.S.	10	29	2	41	70.7
2. P.B.	49	149	3	201	74.1

The two CHI subjects used significantly fewer lexical ties proportionally than did the NBD group (random data t-test, p= .018, 1 tailed). Even so, they did use this type of device more than any other, as did the controls.

It might be speculated that, in general, relatively high use of lexical reiteration would be associated with higher estimates of clarity as measured on the "Clarity" scale. In order to test this a Spearman rank order correlation was performed on percentage of lexical ties and clarity ratings for individual NBD subjects. This correlation was not significant although it should be noted that there was relatively close correlation between the two measures for all but two subjects, GW and SM. GW was considered very clear but with few lexical devices while SM was the reverse. Thus lexical re-iteration was associated with clarity for some but not all subjects. A larger sample size may have substantiated this correlation.

3.5.2.4. Discussion

A.S. and P.B. used proportionally fewer lexical ties than their NBD counterparts although this was still their most frequently used cohesive strategy and the differences were not large. This finding supports the prediction that the head injured subjects would fail to provide all the necessary information to the listener. The lack of significant correlation between lexical reiteration and clarity ratings on the NBD texts, indicated that lexical reiteration was not necessarily linked to clarity. Even so, the fact that the majority of subjects were ranked closely on both dimensions

suggested that at least in some cases lexical reiteration was a factor contributing to clarity. Possibly another study incorporating a larger number of control texts would confirm this observation.

It is clear from Table 3.4 that ellipsis, as defined in this study was used infrequently by all subjects including the two CHI subjects. The reasons for the discrepancy between these findings and those of Mentis and Prutting (1987) can probably be explained on methodological grounds. Mentis and Prutting commented that the high elliptical use by the head injured was characterised by a tendency to use the conversational partner's utterances as a scaffold for their own discourse. i.e. the elliptical device used was often tied to the other person's utterance. Since this analysis was only performed on the initial section of the game description, which was almost entirely the subject explaining the game without interruption, there was no opportunity for this type of elliptical strategy to be observed.

3.5.2.5. Frequency of the use of Exophoric versus Endophoric Reference

Co-reference, as described previously, referred to the use of a lexical or substituted items or ellipsis to indicate an element which has its source of identity elsewhere. Three devices were described: pronoun substitution, lexical ties, and ellipsis. There is also a fourth means by which co-reference is achieved. Halliday and Hasan (1976) described formation of a co-referential relationship by the use of grammatical devices such as the definitive article ("the") and possessive and demonstrative pronouns ("his", "its", "those",

"that", etc.) to specify that the object of discussion is known to the listener. In all co-referential relationships, the source of the objects identity may be either elsewhere within the same text (endophoric) or external to it, i.e. to be found in the context (exophoric) for example:

(3) "You throw the dice and look at **its** upper face" (endophoric)

(4) "**This** (meaning the game) is very simple" (exophoric).

In the investigation described by Mentis and Prutting (1987) a special category of co-reference called "incomplete ties" was created to describe those instances in which a referring item was used in absence of its referent within the text. Mentis and Prutting reported that the head injured subjects used these reasonably often and the controls not at all. From these authors' description it may be surmised that incomplete ties were in fact instances of exophoric reference. Exophoric reference should not on its own, however, be problematic, provided the listener is privy to the contextual information which is the source of the reference. The problem observed by Mentis and Prutting must therefore have been due to the head injured subjects using exophoric reference for which the contextual source was unknown to the listener.

It has already been established that A.S. and P.B. use relatively less lexical reiteration to clarify the source of their referent within the text. It may also be hypothesised that if they are disregarding the listener's needs, they might also display a disproportionately high reliance on exophoric reference unsupported by adequate background knowledge in the listener.

3.5.2.6. Procedure

All pronouns identified as substitutions for lexical items in the previous analysis were included in this analysis. All possessive pronouns, demonstrative pronouns, definite articles, and comparative terms were then extracted from the original eleven texts. Any lexical (i.e. content) items which were introduced into the text without explanation and whose presence was not self evident from the rest of the text were also included. The items were then classified as endophoric if the source of the reference was available within the text or alternatively exophoric if the source of reference was not within the text.

Within the exophoric category, the items were further subdivided depending on whether or not the listener could reasonably have been expected to understand the source of the reference from the immediate context. Given the third person was blindfolded at the time of the explanation the only exophoric reference considered appropriate was that which assumed that the third person was aware there was a game in very general terms and was aware of their own and the speaker's identity. Exophoric reference to parts of the game i.e. introducing the part for the first time as though the person had heard of it before, was not considered appropriate e.g. "we take **the** dice...".

As a final step inappropriate exophoric reference was divided into three subcategories, defined as follows (abbreviation used to refer to categories in Table 3.5 is shown in brackets):

1) reference which assumed the third person could see (see);

2) reference that assumed that the third person had specific knowledge outside the immediate context (has info.);

3) reference that was simply ambiguous as to its source i.e. the source could well have been within the text but this was impossible to determine (ambig.).

3.5.2.7. Results

The number of grammatical devices thus identified under each category are listed in Table 3.5. The abbreviations used to define categories are explained above.

Table 3.5. Number of devices used by individual subjects which signalled endophoric and exophoric reference

SUBJECT	TYPE OF REFERENCE					
	Endophoric	**Exophoric**				**Total**
		Known	Unknown			
			1.see	2.has info.	3.am-big.	
NBD subjects						
1. DM	36	1	1	0	0	38
2. BK	24	1	0	0	0	25
3. BN	45	2	0	0	0	46
4. IS	24	2	0	0	0	26
5. RF	65	3	0	0	0	68
6. BM	41	2	0	0	1	44
7. GL	51	3	0	0	0	54
8. GW	34	1	0	0	0	35
9. SM	39	2	0	0	0	41
CHI subjects						
1. A.S.	18	2	3	0	1	24
2. P.B.	89	3	3	1	3	99

The total number of devices used by all subjects varied relatively directly as a function of the length of the text (Spearman rank order correlation for NBD subjects only, r_s =.76, p<.025; all subjects, r_s=.89, p<.001). The control subjects used hardly any reference which was not traceable to a textual or contextual source. In contrast both A.S. and P.B. used both ambiguous references and references which assumed that the third person was not blindfolded and could actually see. P.B. also used reference that assumed privileged knowledge on the part of the listener. Specifically, he consistently used the term "33" (Ward 33) as a means to indicate direction but provided no information to explain its relevance in the discourse. The differences in the amount of unexplainable reference, between the NBD and the CHI groups was significant (random data t-test, p =.0183, 1 tailed).

Because of the floor effect caused by the lack of unexplained reference used by controls, it would not have been meaningful to correlate the proportional use of this reference with the clarity ratings. However it was surmised that the use of unexplained reference must contribute to lack of clarity in the texts.

3.5.2.8. Discussion

The foregoing data show that the CHI subjects tend to generate ambiguous text and that they rely on information that the third party could not see. P.B. seemed to do this more than A.S. though quantitative comparisons are difficult given the different lengths of the texts. These results were consistent with those found by Mentis and Prutting (1987).

3.5.5. General Summation of Findings of Linguistic Analyses A and B, Exploring Correlates of Perceive Clarity.

The findings on the linguistic correlates of "clarity" can be summarised as follows:

1. P.B. used as many Relevant Tokens as did the controls. While A.S. used proportionally fewer than the NBD subjects, in real terms this was not a large difference. Overall the CHI subjects thus displayed a similar amount of lexico-grammatical chaining to controls for this particular discourse.

2. The estimates of cohesive harmony i.e. lexico-grammatical cohesion, for the two CHI subjects were within the range of normal values.

3. Individual estimates of cohesive harmony were not correlated with subjective estimates of either clarity or effectiveness.

4. The two CHI subjects used proportionally fewer lexical ties than their NBD counterparts. The amount of usage of lexical ties was not demonstrated to be positively correlated to the perception of clarity, although small numbers may have affected this correlation. Qualitative features suggested that for some subjects there was an association between lexical reiteration and clarity.

5. The total amount of cohesive reference devices used by all subjects varied directly as a function of the length of the text. The head injured subjects were normal in the density of reference they used.

6. The two CHI subjects used more unexplained references than the control who used virtually none. These included (i) reference which presumed the third person was not blindfolded, (ii) reference which presumed the third

person had knowledge outside the immediate context and (iii) ambiguous reference. Unexplained reference was surmised to contribute to the confusing quality of the CHI texts.

7. Finally, as a methodological issue, it was found that estimates of cohesive harmony were significantly correlated to the length of the individual texts as measured by number of clauses.

3.6. Analysis 3: Propositional Analysis

The preceding linguistic analyses were undertaken to explore linguistic correlates of raters' perception of clarity of the texts as measured on the "Clarity" scale. The analyses which follow were performed to explore what features of the CHI texts in particular, contributed to the raters' perceptions that they were disorganised. The analyses focused on the organisational structure of explanations of the dice game from a logical rather than linguistic point of view. The amount and breadth of information in the descriptions of the dice game varied from one subject to the next although most explanations appeared to have a core of information in common. It was therefore of interest to look at the organisation of this informational content in terms of the propositions expressed.

This type of analysis has been used to investigate the quality of aphasic procedural discourse (Ulatowska, North and Macluso-Haynes; 1981). The aphasic subjects were required to explain how to perform three familiar routines (changing a tyre, slicing bread, playing bowls). The productions were analysed in terms of the procedural steps required for an adequate

explanation. This approach seemed appropriate for this analysis also, but with a difference. When one explains how to change a tyre on a car it is not normally necessary to introduce the listener to items like jacks, wheel nuts etc. The explanations of the dice game on the other hand, involved not only procedural steps, but also description of the playing pieces. The analysis was therefore made somewhat broader than that of Ulatowska et al.(1981).

3.6.1. Procedure

A list of propositions was generated to represent all information contained in the eleven explanations, yielding a total of 51 propositions. Not all propositions were mutually exclusive, but presented different aspects of the same information. They were divided into six categories:

1. Global description of game, playing pieces and procedure
2. Detailed description of the cars.
3. Detailed description of the board
4. Detailed description of the dice
5. Detailed description of the procedure
6. Irrelevant or peripheral information proffered by not more than one subject.

There were several ways in which information concerning the direction of movement was introduced. It could be done while explaining the board, describing the cars or during the procedural explanation. Because all approaches were logical, they were represented by the inclusion of three sets of roughly equivalent propositions in each category. If more than one set of

equivalent propositions were mentioned this was considered a repetition. The propositions in the transcripts have been identified via a numbering system in Appendix 2.1. The full list of propositions has been presented in Appendix 2.6.

3.6.2. Results

3.6.2.1. Total Number of Propositions

The total number of propositions, the number of original propositions and the number of repeated propositions for each subject is shown in Table 3.6.

Table 3.6. Number of original and repeated propositions given in the explanations by the NBD and CHI subjects.

SUBJECT	PROPOSITIONS		
	Different	Repeated	Total
NBD subjects			
1.DM	19	4	23
2.BK	6**	0	16
3.BN	24	0	24
4.IS	15**	2	17
5.RF	18	1	28
6.BM	24	1	25
7.GL	26	2	28
8.GW	20	2	22
9.SM	22*	3	25
CHI subjects			
1.A.S.	13***?	1	14
2.P.B.	26**???	28	54

Each * denotes the inclusion of a proposition which was inferred rather than stated. The symbol ? denotes the inclusion of an ambiguous proposition which was relegated to the category of best fit.

Several interesting observations can be made concerning Table 3.6. Firstly, the texts analysed in terms of number of propositions, revealed a clear differential between the performances of the CHI subjects and their NBD counterparts. The CHI subjects produced a total number of propositions outside the normal range (random data t-test, $p = .036$, 2 tailed). While they were performing differently to the controls they were also performing differently to each other. A.S. produced fewer total propositions to anyone else and P.B. produced more.

The two CHI subjects together were not significantly different to the controls in regards to the number of repeated propositions. This was because A.S. had only one repeated proposition and was similar to some controls in this regard. In contrast P.B. had 28 repeated propositions. Converting the values to Z scores, this number was more than two standard deviations above the group mean ($Z = 8.33$, $p < .001$). The two CHI subjects together were also not different to the controls in terms of the number of different propositions they expressed. This was again due to the fact that one subject, in this case P.B., produced a number of different propositions within the normal range. A.S. on the other hand, produced fewer propositions than any other subject ($Z = 2.14$, $p < .02$) and several of these were inferred not stated, or simply ambiguous.

The texts analysed in terms of propositions thus helped to explain the source of raters' perception regarding the level of repetition and the amount of detail. P.B. was repetitive at a propositional level although he gave no more

detail than controls. A.S. gave fewer details in terms of propositions but was not repetitive.

3.6.2.2. Essential Propositions

A. Number of essential propositions

There were eight basic topics which were covered either directly or indirectly by all control subjects and the CHI subjects. Four of these were to do with describing the elements of the game and four were related to the procedure. These are set out in Figure 3.1.

Figure 3.1. Eight topics essential to an explanation of the dice game and the propositions which dealt with them.

TOPIC	PROPOSITION
Elements	
1. The playing pieces	4. The game has two cars as playing pieces.
2. The board	17. The board is painted across the width in coloured stripes.
	18. The stripes go red, green, yellow, red, green, yellow.
3. The dice	30. The dice has different colours on its sides which relate to the colours on the board.
	31. There are two red sides.
	32. There are two green sides.
	33. There is one yellow side.
4. The black side	34. There is one side of the dice which is black.
Procedure	
5. Throwing the dice	38. The first person throws the dice.
6. Seeing the colour	39. Whatever colour the dice shows up.
7. Moving the car	40. His car is moved to the first stripe of that colour that he comes to on the board.
8. Missing a turn	41. If black shows up on the dice he misses a turn.

The fact that both A.S. and P.B. covered these basic points as did all control subjects demonstrated that they were capable of analysing the situation to be explained in terms of its most rudimentary requirements. The next point of interest was the **order** in which the essential elements were introduced by NBD and CHI subjects.

B. Order of Essential Propositions

The order in which the topics were introduced by individual subjects is depicted in Table 3.7.

Table 3.7. Eight essential propositions and the order in which they were introduced by NBD and CHI subjects.

TOPIC	CONTROL SUBJECTS									CHI SUBJECTS	
(PROP.)	DM	BK	BN	IS	RF	BM	GL	GW	SM	A.S.	P.B.
Elements											
1.(4)	1	1	2	1	1	1	2	1	1	1?	1
2.(17-18)	4	2	1	6	2	3	1	2	2	2*	7
3.(30-33)	2	3	3	2	3	2	3	3	3	3	2
4.(34)	3	7*	7	3	7	7	4	4	4	4	3
Procedure											
5.(38)	5	4	4	4	4	4	5	5	5	6	4
6.(39)	6	5	5	7	5	5	6	7	6	8	5
7.(40)	7	6	6	8	6	6	7	8	7	7	6
8.(41)	8	8	8	5	8	8	8	6	8*	5	8

Apart from minor variations, the NBD subjects overall, were consistent in the order in which they introduced key propositions. Using Page's test for ordered means (Seigel & Castellan, 1988) this correlation in ordering the

propositions was significant (L = 1,788, p< .001). Furthermore, every sequence used by the NBD subjects had an inherent logic. In most cases all the playing pieces were described, followed by the procedure in its natural temporal order. An alternative approach was to introduce most playing pieces first but to leave a particular element (e.g. the black side of the dice) until its role in the procedure came up.

The CHI subjects differed from these approaches. While A.S. introduced the elements before the procedure in a normal fashion, he then described the procedure in a sequence which was quite at odds with the real order of events. P.B. on the other hand, erroneously forgot to describe a part of the game that was necessary to understand the procedure. Unlike A.S., he did manage to describe the procedure in its logical order.

3.6.2.3. Comment

Both A.S. and P.B. deviated from normal sequences in their introduction of key elements. It is surmised that these deviations contributed to the perceived disorganisation of the text. However the order in which the information was presented was not random. Outside of the specific deviations both A.S. and P.B. did follow the common sequence. They thereby demonstrated that they had retained some sensitivity to the inherent structure of the procedure and were partially able to reflect this in their discourse.

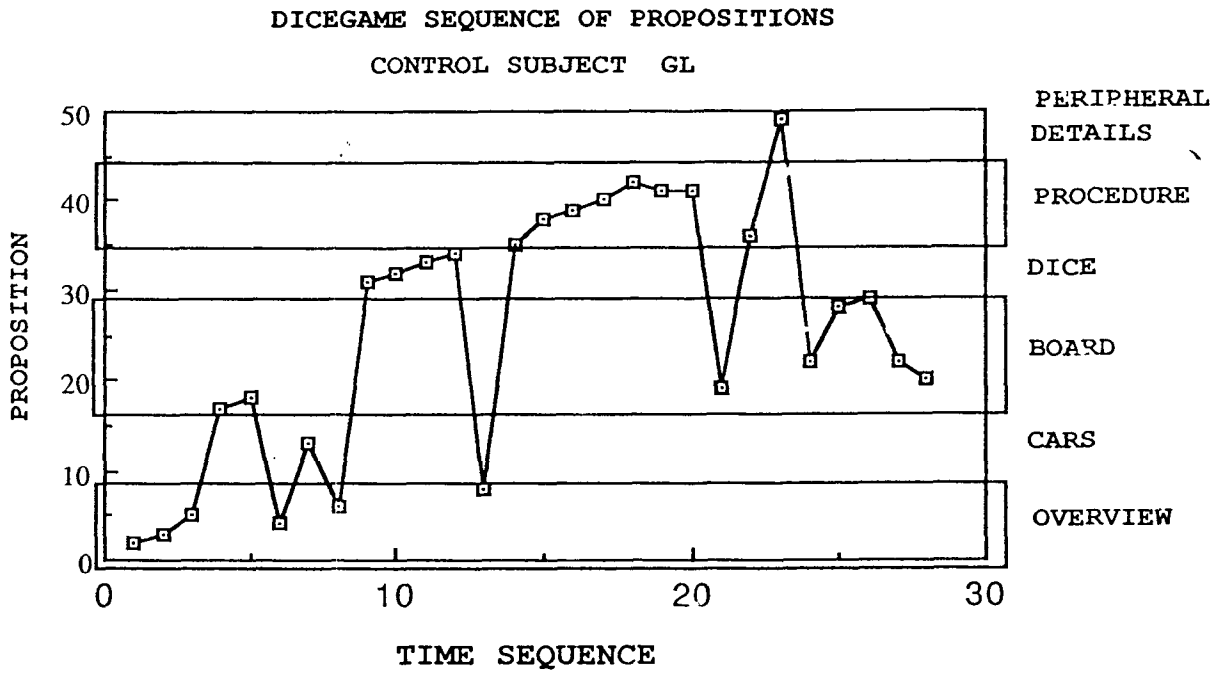
In providing an explanation of the game, mentioning the key elements is obviously not the complete story. Most texts elaborated the basic details and incorporated many non essential propositions. Presumably this was done to make the communication a more effective one. But extra information would not automatically improve the communication. It would only be effective provided it was also structured in a way that made sense to the listener. It was therefore of interest to make a qualitative assessment of the entire sequence of propositions in the CHI productions compared to some of the controls.

3.6.2.4. Sequencing Characteristics of all Propositions

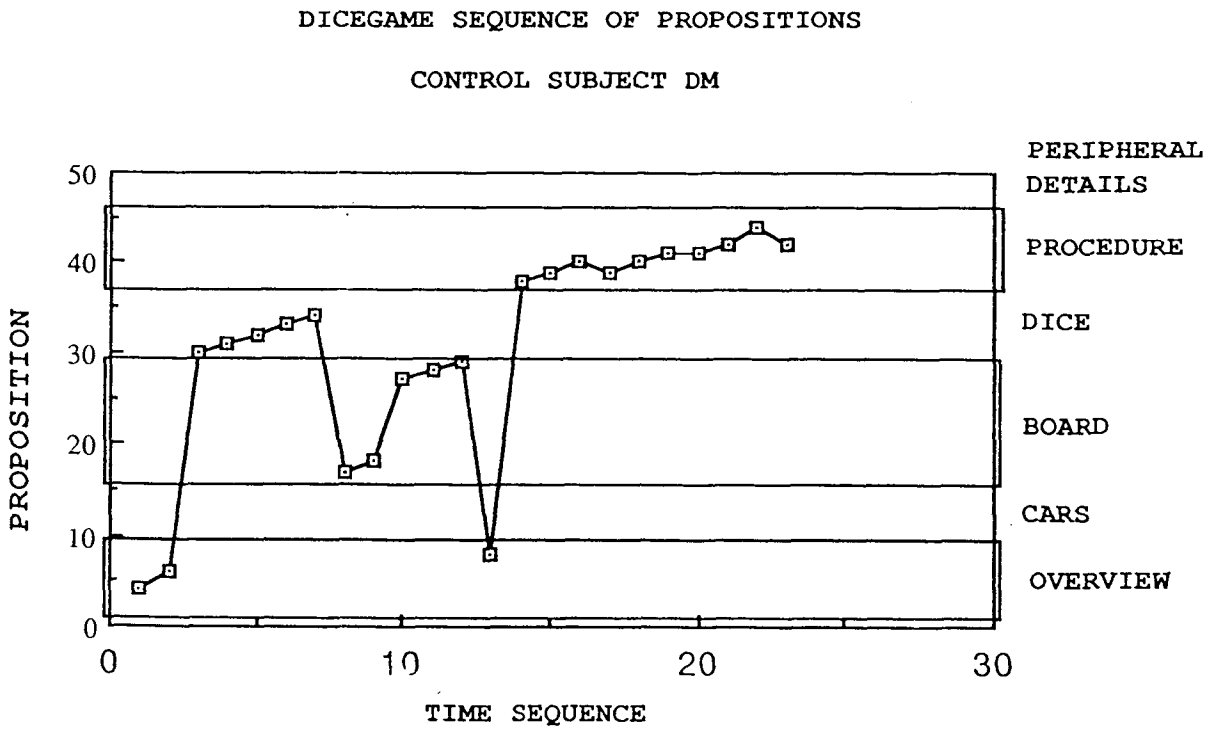
In order to exemplify the unfolding of the entire procedural texts over time, the series of propositions were depicted graphically. The X axis in each graph denotes the sequence in time, the Y axis denotes the numerical value of the proposition. The numbers on the Y axis commence at the top of graph, representing the introductory propositions and proceed down through car, board and dice description and then the procedure proper. The Y axis ends with the irrelevant propositions at the bottom.

P.B.

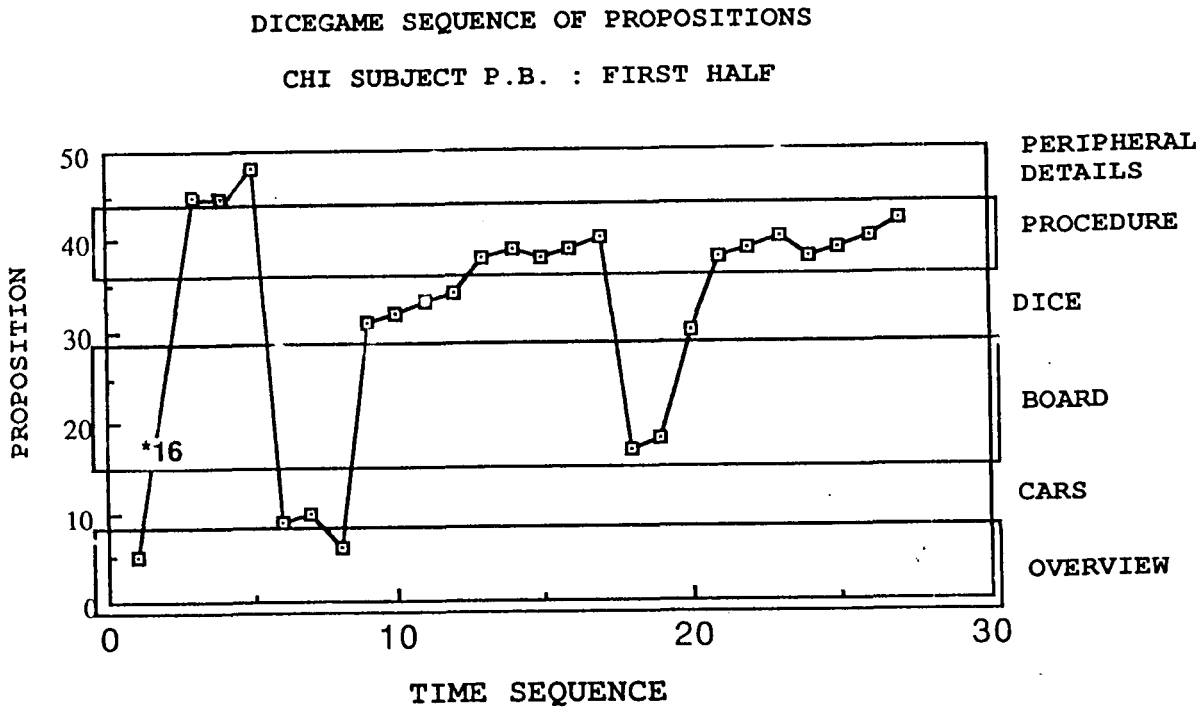
In order to compare the organisation of the text produced by P.B., the texts produced by GL and DM were used as a model. These were rated as the most highly organised. They were also among the longer control texts in terms of number of propositions. Graphs 3.6, 3.7, 3.8. and 3.9. represent the texts produced by G.L., D.M. and P.B. (parts 1 and 2) respectively.



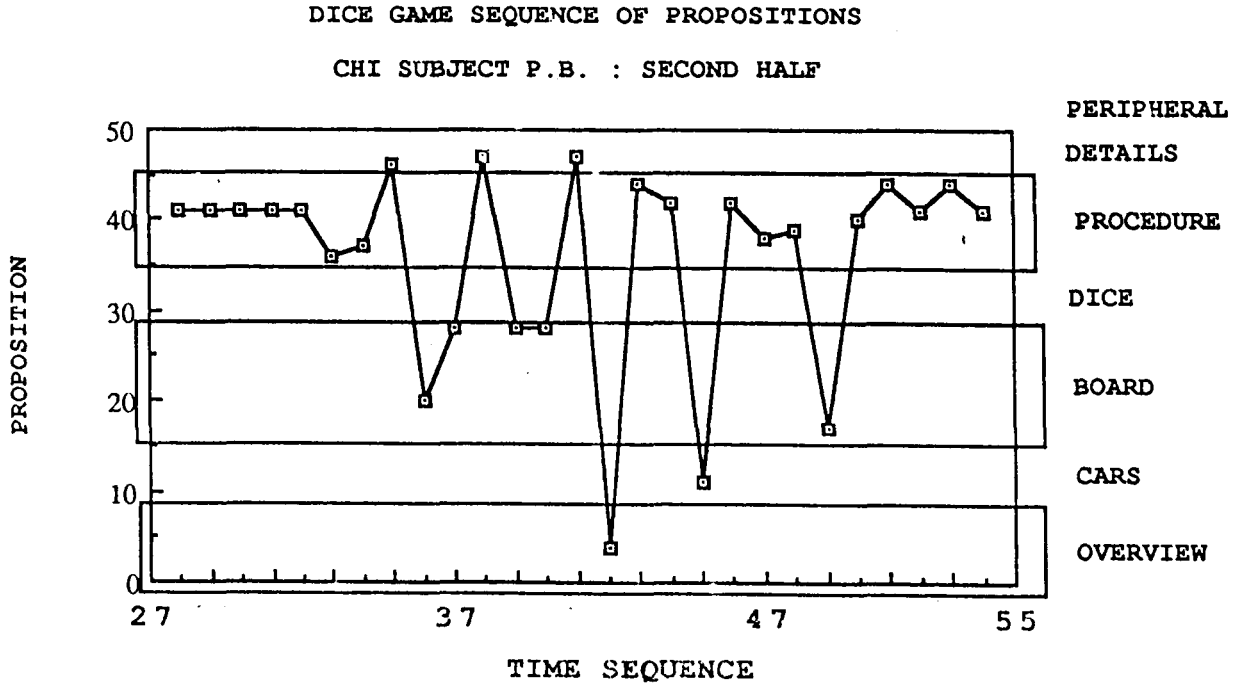
Graph 3.6. Sequential depiction of propositions underlying explanation of game by GL.



Graph 3.7. Sequential depiction of propositions underlying explanation of game by DM.



Graph 3.8. Sequential depiction of propositions underlying explanation of game by P.B. (part 1)



Graph 3.9. Sequential depiction of propositions underlying explanation of game by P.B. (part 2)

Both control texts followed a similar step-like pattern of introducing one element at a time and completing its description (if one was given) before moving on to the next. Once all playing pieces had been introduced, described and elaborated in this manner, both subjects made an introductory remark about the procedure and described it systematically. DM did not return to any previously mentioned element once he had completed describing it. While describing the procedure, he did reiterate some procedural steps in an order which mimicked the actual playing of the game. GL described the entire game in detail and then returned to describe some non-essential features of the board.

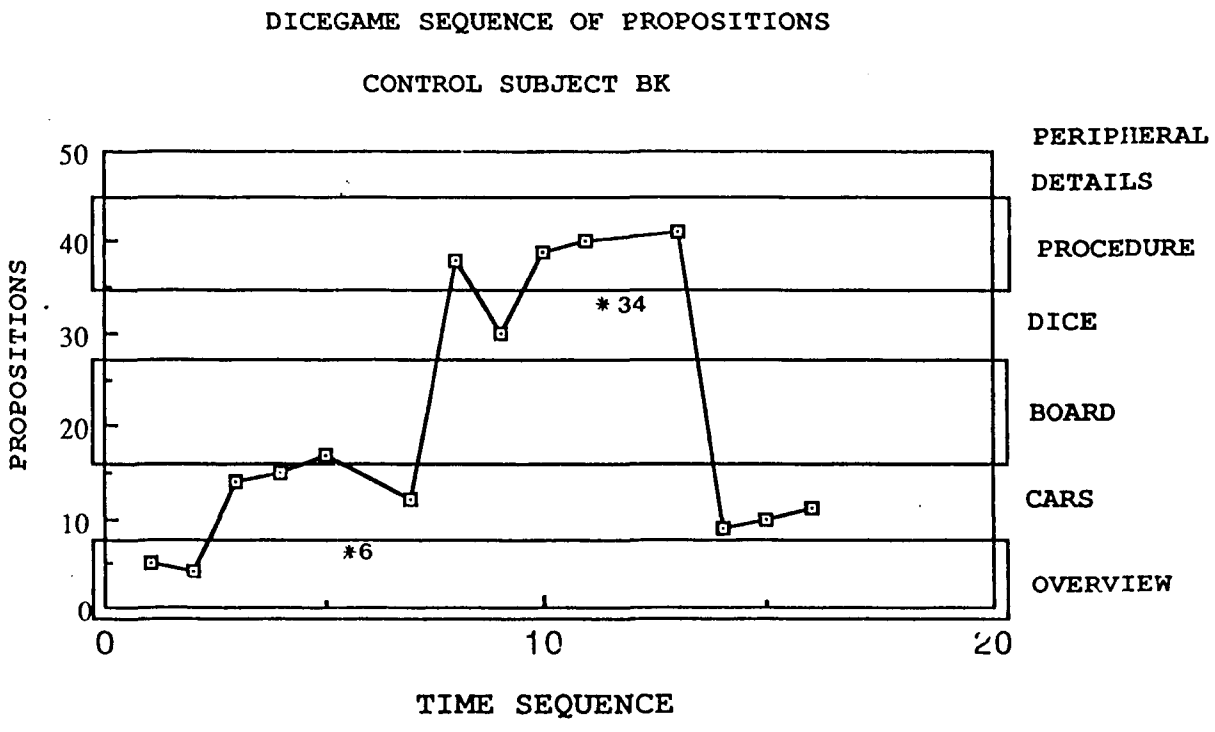
These two patterns were fairly well adhered to by all control subjects. P.B. also followed this general structure but with two major deviations. The first deviation was the introduction of "red herrings". While he began by introducing the board, he became rapidly sidetracked, focusing on irrelevant and misleading information regarding the spatial orientation of the board relative to ambiguous reference points. Having then returned to the elements of the game he proceeded in a similar vein to others. The second deviation was his omission of important information about the board. This error was realised and corrected at a later stage but had a major impact on the flow of information.

While the first part of P.B.'s text was otherwise structurally similar to the control subjects, it began to change significantly after the first 20 or so

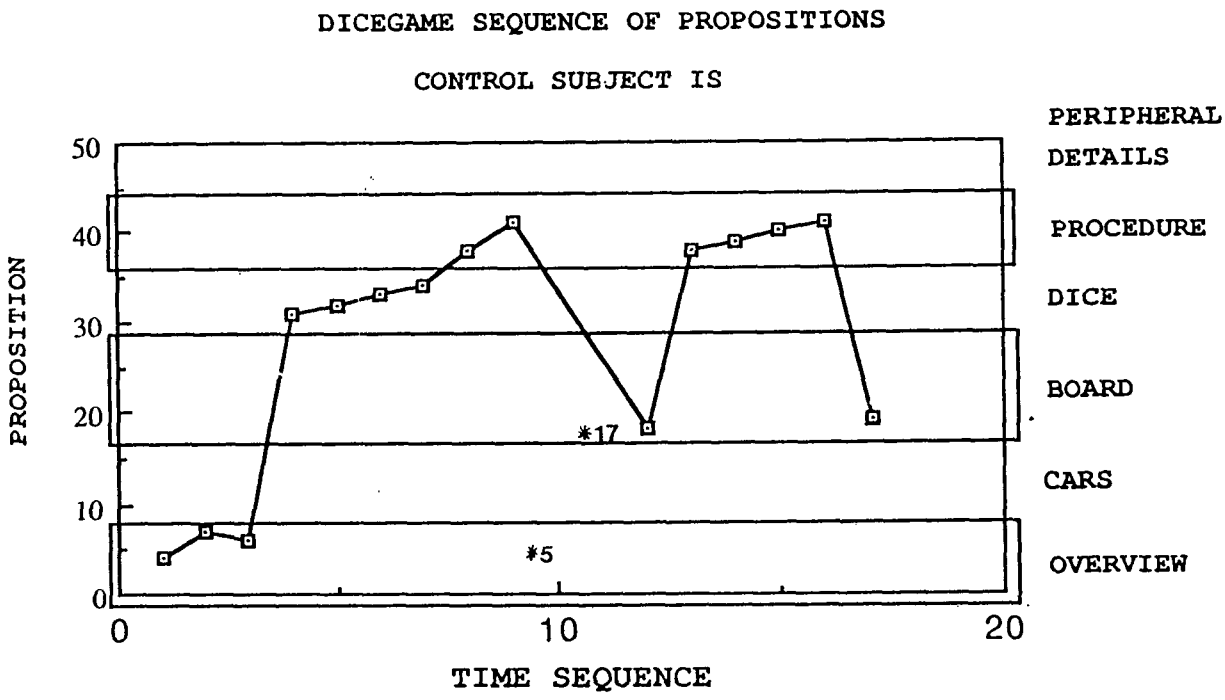
propositions, becoming extremely repetitive and nonproductive. By way of illustration, in the first 20 propositions he made 18 novel propositions and repeated himself twice. In the next 34 propositions he made a total of 8 new propositions and 26 repetitions. He connected his discourse well grammatically at the beginning, with only three apparently non-connected propositions in the first twenty propositions. In stark contrast, the last twenty propositions, 16 of which were repetitions, were mostly isolated remarks.

A.S.

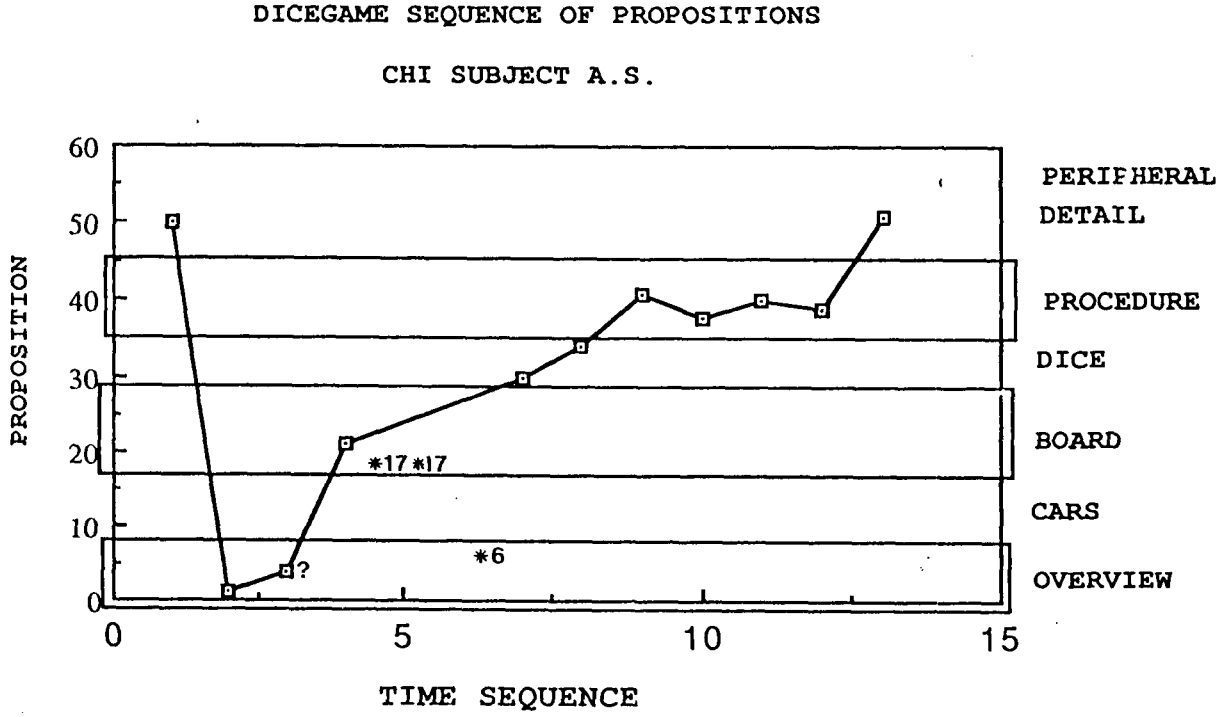
The short text produced by A.S. can profitably be compared to two other short texts, BK and IS, which though imperfect according to the rating scales, were significantly better than that of A.S.. Graphs 3.10, 3.11 and 3.12. represent the texts produced by BK, IS and A.S. respectively.



Graph 3.10. Sequential depiction of propositions underlying explanation of game by BK.



Graph 3.11. Sequential depiction of propositions underlying explanation of game by IS.



Graph 3.12. Sequential depiction of propositions underlying explanation of game by A.S.

Both of the shorter control texts relied on a certain amount of inferential understanding. Both short texts tended to skip from one element to another more than was seen in the longer texts. Reference to the original transcripts, indicated that this was partly a measurement artefact resulting from the particular strategies used by both subjects. In their efforts to be brief, they tended to introduce several features of the game, including playing pieces and procedural steps, simultaneously via the one clause or clause complex. Despite these differences both subjects followed the general pattern of introducing the playing pieces and then moving on to a systematic elucidation of the procedural steps. IS did deviate from this, describing the board last as a deliberate strategy to explain why black meant miss a turn. The rest of his procedure followed the temporal sequence.

The text produced by A.S. deviated from these two control texts in a number of regards. He gave less information than either IS or BK. Yet within the five non-essential propositions he gave, two were irrelevant. He began his explanation by focusing on the irrelevant fact that the cars were facing the wrong way and only later went on to introduce the game or its pieces. His explanation also ended on an irrelevant issue.

Both IS and BK used non-essential propositions to orientate the listener to the presence of two of the playing pieces and inferred the third, AS did not introduce any of the elements directly. Their relevance to the game was only implied.

3.6.3. General summation of findings of the propositional analyses

The preceding section examined the quality of the CHI texts which gave rise to the perception of disorganisation i.e. transgression of the maxim of manner. In the course of this examination features pertinent to the maxims of quantity and relevance were also uncovered. The findings were as follows:

1. The proposition analysis indicated that perception of the amount of detail and repetition on the rating scales were reflected in the number of different and repeated propositions the subjects produced.
2. In the two head injured texts there were features which indicated similar discourse practices to that seen in the controls:
    A. Both CHI subjects correctly identified the crucial elements necessary to explain the dice game.
    B. Both CHI subjects, like the controls, were able to sequence some of the essential elements indicating that they retained a partial sensitivity to the inherent structure of the discourse.
3. The two CHI texts also had features in common which distinguished them from the NBD subjects;
    A. Both subjects made discrete errors in the sequencing that contributed to the perceived disorganisation.
    B. They both began their explanation by focusing on irrelevant propositions. This presumably reflects a failure to adhere to the maxim of relevance.
4. P.B.'s text had several unique qualities.

A. The initial segment of his discourse, approximately the same length as the entire text proffered by most controls, had many similar features to the control subjects and was not repetitive.

B. The second segment which was 150 % as long again, contained virtually no new information and was grammatically unintegrated.

C. He omitted crucial information in error which disrupted the order of his explanation. He was however able to identify and correct this.

5. A.S. produced a text best compared with other short texts, but it too had distinctive features;

A. the order of the essential elements, while condensed in a manner which was also characteristic of the other short texts, was quite different to the actual temporal sequencing of the events being explained. This was not corrected or clarified.

B. He had fewer propositions than anyone else and two of these were distracting and irrelevant and one was ambiguous. He did however have very few repetitions.

C. He produced fewer non essential items than anyone else and proportionately, more of these were actually irrelevant than those produced by anyone else.

D. Unlike the other short texts he failed to introduce the essential elements clearly.

3.7. Conclusion

Analyses performed on the explanation of the dice game demonstrated that both CHI subjects had substantial difficulty meeting the informational needs of a third person. Qualities of their performance reflected a failure to adhere to Grice's conversational principles of quantity, manner and relevance. P.B. produced a text which was overly long and A.S. produced one which was too short. The manner in which they made their explanation was perceived as both confusing and disorganised. This was detectable in both the linguistic texture and the logical flow. While their performance exhibited common problems there were also distinct differences.

P.B.'s text incorporated as many linguistic cohesive devices as the NBD subjects. However there was an over-reliance on inadequate types of devices. In particular he used unexplained or ambiguous reference and failed to re-introduce elements to maintain their identity. These features made the text confusing for the listener. The organisation of the information he imparted was also disturbed and he incorporated irrelevancies which added to this perceived disorder. Most of these conversational inadequacies may be explained by reference to particular frontal lobe impairments.
Investigation of the propositional content of his text revealed that P.B. was able to formulate a communication plan. This plan appeared relatively normal with features in common with many of the controls. However his difficulties arose in its execution. He commenced with it only to become derailed by his attempts to elaborate minor and irrelevant points. He was

able to correct this and return to his original theme, however the effect was disastrous for the listener since it disrupted the logical flow.

Thus his major problem appeared to be at the point of monitoring his output in order to keep his explanation on track towards the desired goal. This appeared to reflect only partial disruption, since he was able to correct himself and return to his original plan only to be sidetracked again. Such faulty monitoring may also have contributed to the length and deteriorated quality of the latter part of P.B.'s explanation. Being unable to evaluate the success of his explanation or judge a suitable point to terminate, his explanation continued well beyond the limits of his original plan, and thereby lost all semblance of structure. Perseveration of thought processes was also apparent, although this was a secondary phenomenum, since it was not apparent in the first portion of his explanation. Repetition and perseveration only occurred when his plan had run out.

P.B.'s relatively high use of unexplained exophoric reference and failure to utilise lexical reiteration may also be explained by the same impairment. Without accurate monitoring, mistakes of presumption regarding the third persons knowledge base would occur.

A.S.'s performance was quite different. His explanation was too short to enable the listener to clearly grasp the principles of the game. While cohesion analysis revealed that A.S.'s text was no less linguistically cohesive than other NBD subjects, he too relied on inadequate types of cohesion strategies

which made his explanation confusing. In terms of its logical structure the order of his explanation was also seriously compromised.

The brevity of his explanation makes it difficult to discern a difference between competence and performance as was apparent with P.B.. However it seems likely that A.S.'s problems were also at the level of execution. His initial comment was an irrelevant, logically disconnected and impulsive intrusion. While he offered fewer propositions than anyone else, proportionally more of these were distracting and irrelevant. Although he demonstrated a sensitivity to the various important aspects of the game the order was aberrant. These features are probably best explained as reflecting A.S's ongoing disorder of control. In the absence of any positive evidence that his explanation followed a logical sequence, some impairment of planning might also be suspected.

Like P.B., A.S. had problems in the accurate evaluation of his performance although in his case this seemed more complete. He did not correct or clarify any of his statements and in no other way indicated that he was aware that his explanation might be less than adequate. His use of unexplained reference may be explained in a similar vein to that of P.B., being due to this lack of self evaluation.