A study of agrammatism with special reference to Hebrew

Thesis

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A STUDY OF AGRAMMATISM WITH SPECIAL REFERENCE TO HEBREW

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In memory of Isaac Richter
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ABSTRACT

The aim of the thesis was to test empirically Grodzinsky's account of agrammatism. Grodzinsky's account is based on Chomsky's Government and Binding theory and it claims that the comprehension deficit in agrammatism is due to the deletion of 'trace' present in passive and relative clauses. English and Hebrew speaking patients were tested. The experiment exploited a special feature of the Hebrew language in which it is possible to construct passive sentences without trace. In addition to passive and object relative clause sentences, other sentence types were also used. The results did not support the trace deletion hypothesis of Grodzinsky. An alternative version of his hypothesis, according to which sentences that require coindexation between two elements in the sentence are difficult for agrammatic aphasics did obtain support. The results also suggested that reversible sentences are particularly difficult for agrammatic patients.

Grodzinsky's account also claimed that in agrammatism governed prepositions are impaired and ungoverned prepositions are preserved. In order to test this part of the theory an indepth case study of a Hebrew speaking agrammatic patient who never used prepositions in her spontaneous speech was carried out. The study tested the hypotheses of Grodzinsky and Friederici and it concluded that Grodzinsky's hypothesis according to which governed
prepositions are impaired and ungoverned prepositions are preserved is not supported by the evidence. Meaningful prepositions as Friederici suggested, were more likely to be produced in certain tasks. Although this also cannot explain the total omission of prepositions of this patient. In addition to the preposition case study, the patient's ability to deal with the Hebrew verb system was investigated. Both the preposition and the verb study suggested that in agrammatism it is not the principles of Universal Grammar that are violated but the particular features of individual languages.
PREFACE

The present study is a contribution to discussions of agrammatism, an aphasic disorder in which the grammatical morphemes, the 'small words' of the language are impaired. The term agrammatism was coined at the beginning of the 20th century, when the principal features of the disorder were recognized and the first attempts at explanation were made. Already at that time the subject proved to be controversial. A second, more recent period of research began in the 1970s.

The opening chapter of the thesis provides some historical background. Its purpose is to sketch the origins of 'agrammatism', to show that agrammatism is not a natural given and that patients do not come with labels attached to them. The term agrammatism is theory laden and is conceptualized differently today than at the beginning of the century.

The modern literature on agrammatism which is the intellectual antecedents of this thesis, is critically examined in Chapter Three. As this period of research always relies to some degree on the linguistic theory of Noam Chomsky, Chapter Two describes and explains the linguistic concepts of Chomsky's Standard theory and of Government and Binding theory that are pertinent to this work.
The modern period of research on agrammatism since the 1970s, grapples with the view that agrammatism is a syntactic disorder. This view was put forward at first in an overgeneralized form without specifying what constitutes syntactic deficit. During this period linguistic concepts were used in research on agrammatism in a vague and undefined manner which created the illusion that an understanding of agrammatism and the organization of syntax inside the brain was not too far away. This optimistic view has changed in the 1980s.

At the same time, the work of Grodzinsky (but not only his) brought linguistic precision to the discipline. This has been facilitated by developments within the linguistic theory of Chomsky. The Government and Binding theory is very different from the Standard Theory which influenced research in the 1970s. The motivations for the changes within the theory and their consequences are explained in Chapter Two. Here only two significant developments are mentioned. The first is that Universal Grammar is not conceptualized in the Government and Binding theory as a system of rules but rather as a system of independent but interrelated principles or modules. The second is that the polarized distinction between syntax and semantics, familiar from the Standard theory, no longer pertains within the linguistic theory. Therefore, notions such as 'a syntactic disorder' or a 'semantic disorder' are either too general or incorrect.
Grodzinsky focused on the role of linguistic constructs, such as the trace and of other non lexical categories in the linguistic description of sentences and his theory claims that these elements are unavailable for the agrammatic patient and hence explain the deficits in comprehension and production that are observed.

Grodzinsky's claims are precise and testable and the present study is a conceptual and empirical examination of his theory. The comprehension of English and Hebrew speaking patients was tested on a variety of sentence types. The Hebrew language made a direct testing of the 'trace theory' feasible because in Hebrew it is possible to construct traceless passive sentences. Grodzinsky's alternative explanation for the comprehension deficit in agrammatism, the thesis of 'coindexation', was in the present work, distinguished from the 'trace theory' and it was possible, both in English and in Hebrew, to test also this latter formulation of the theory.

In addition to the group studies on comprehension that are presented in Chapter Four, the following two chapters deal with agrammatic deficits related to two lexical categories - prepositions and verbs - in one Hebrew speaking patient.

Chapter Five is a detailed case study of the preposition deficit in a patient who omits all prepositions in spontaneous speech. This patient was submitted to a wide range of experiments that investigated the preposition problem in different modalities and tasks. A major
objective of the study was to distinguish between the theories of Friederici, Rizzi and Grodzinsky in relation to prepositions. To do so it was necessary to analyze Hebrew prepositions into categories such as 'governed' and 'ungoverned' prepositions, 'Case assigning' prepositions, 'semantically motivated' prepositions. Furthermore, the particular qualities of Hebrew prepositions had to be considered because it appeared to have an effect on the patient's performance.

The same patient's ability to use verbs is reported in Chapter Six. Verbs are an even more complex category than prepositions. Little research has been carried out on the verb deficit in agrammatism, although its existence is well known. In Chapter Six the special characteristics of the Hebrew verb system are described and particular attention is paid to the errors the Hebrew verb system might induce in the agrammatic speaker. Consequently the notion that agrammatic patients do not make derivational errors is questioned by showing that nominalization and verb paradigm errors are frequent in the speech of the patient tested in this study. These data are used in order to comment on the organization of the lexicon of the agrammatic patient.

The experiments conducted in the case study were always carried out with a question in mind, whether the deficits observed in production tasks paralleled in comprehension or in other input tasks such as grammaticality judgement. In the case of this patient it was possible to compare
the production and the comprehension (or other input activity) of the same linguistic constructions and, therefore arrive at definite conclusions about the 'parallelism' of agrammatic deficits.

Finally, the use of Hebrew made it possible to test Grodzinsky's 'trace theory' directly. Over and above this, however, studying agrammatism in a patient who speaks a language other than English drew attention to the distinction made by Chomsky between core and peripheral grammar. Core grammar constitutes the universal principles shared by all languages while peripheral grammar describes the individual features of particular languages. The thesis raises the question as to whether agrammatic deficits are primarily due to the impairment of universal linguistic principles or rather the result of damage to the particular features of individual languages.
CHAPTER 1

AGRAMMATIC APHASIA - AN EARLY HISTORY

1.1 Introduction

Aphasia is an acquired language impairment occurring as a result of focal damage caused by stroke, infection, trauma or tumour to the perisylvian region of the left hemisphere (in the vast majority of cases). Acquired aphasia needs to be distinguished from congenital developmental aphasia; the 'central' language impairments of the aphasias need to be distinguished from speech (articulation) and hearing disturbances that are not considered aphasic impairments; and focal damage to the brain must be distinguished from widespread diffuse damage (although relatively restricted language impairment can occasionally result from relatively widespread anatomical damage).

There are cases of so-called 'global' aphasia where the extent of the damage is maximal, but most often the behavioural impairment is partial and some language functions remain (relatively) intact. The phenomenon of partial impairment makes aphasia a pertinent research topic for a number of scientific disciplines, such as neurology, psychology and linguistics.

The neurologist's aim is to reveal the internal organization of the brain and to identify the brain
structures that are the material substrate of specific psychological functions. Lesions found in one part of the brain, associated with a specific form of partial language impairment, suggest a connection between brain structure and the missing function (the strict 'localization hypothesis').

The psychologist is interested in learning about the mode of processing required for various linguistic activities, both 'global' like speaking or understanding language, and more specific, like using prepositions correctly, or formulating and comprehending passive sentences. For healthy people, the use of language is well coordinated and thus (slips of the tongue apart) it is difficult to perceive and identify the different components, stages and partial activities required in order to construct a passive sentence, for example. In aphasia it is possible to observe imperfect language. The aim is to recognize the missing elements or the missing processes in individual patients or patient groups and isolate them as components of language processing within some (eventually) well defined theory.

The linguist's aim is very similar to that of the psychologist. According to Chomsky (1986a), linguistic theory is a cognitive/psychological theory and, as such, it is conceptually undifferentiated from the psychological and neurological study of language. The linguist can test his or her theories by examining the impaired language of an aphasic patient in order to throw
light on the structure of normal language. In subsequent chapters there will be many examples of this type of work.

The work of the psychologist/linguist is in one sense prior to that of the neurologist. The neurologist can do little to investigate the internal functional organization of the brain without well worked out psychological and/or linguistic theories. The neurologist can only look anatomically or physiologically for what these theories suggest might be there behaviourally. Nevertheless, until not very long ago only neurologists studied aphasic patients. In order to achieve their objective of correlating brain structures with language functions, they could only rely on broadly defined language deficits, derived, for example, from 'school grammar'.

In the present chapter, the first achievements of neurologists at the end of the last century and the first quarter of this century will be reported. The history of this period has been chosen as an introduction despite the fact that the anatomical structuring of the brain plays no further part in this thesis. The aim in sketching the pre and early history of aphasia studies is to put the present work on agrammatism within a context. It is instructive to follow the thought processes and arguments of researchers of this period. There are indeed some striking similarities between their ideas and what prevails today, despite the 75 years of neurological,
psychological and linguistic progress that separate us from them.

1.2 The prehistory of the scientific study of aphasia

The interest in the internal organization of the brain with respect to language began with the scientific upheaval created by the controversial theory of the phrenologist Franz Joseph Gall (1758-1828). He claimed that the brain is not a unitary equipotential organ but consists of specialized areas for an almost endless number of cognitive abilities and dubious character traits. The theory was sensational at the time, unfounded and unscientific. Nevertheless it gave the impetus to the development of the neurological sciences that progressed in the direction Gall set in motion.

The demonstration by Paul Broca (1861) that in aphasia only some areas of the brain are lesioned, and not others, constituted the first supporting scientific evidence that the brain is structured by its functions, but not quite as the flamboyant theory of Gall suggested.

At first Broca examined the brains of two almost completely speechless patients and found the lesion situated in both cases in the anterior part, at the foot of the third convolution of the left frontal lobe (see figure 1.1).
The primary language areas of the human brain are thought to be located in the left hemisphere, because only rarely does damage to the right hemisphere cause language disorders. Broca's area, which is adjacent to the region of the motor cortex that controls the movement of the muscles of the lips, the jaw, the tongue, the soft palate and the vocal cords, apparently incorporates programs for the coordination of these muscles in speech. Damage to Broca's area results in slow and labored speech, but comprehension of language remains intact. Wernicke's area lies between Flesch's gyrus, which is the primary receiver of auditory stimuli, and the angular gyrus, which acts as a way station between the auditory and the visual regions. When Wernicke's area is damaged, speech is fluent but has little content and comprehension is usually lost. Wernicke and Broca areas are joined by a nerve bundle called the arcuate fasciculus. When it is damaged, speech is fluent but abnormal, and patient can comprehend words but cannot repeat them.
FIG. 12. Wernicke's language model. This model is depicted and described in Wernicke (1885, p. 828) after Wernicke (1874).

- a = centre of auditory images
- b = centre of motor images
- α = centre of optic images for letters
- β = centre of motor images for writing

A disturbance of a causes sensory aphasia, that of b motor aphasia. Conduction aphasia results from a disconnection of the route ab. A disturbance of α results in alexia, analogous to sensory aphasia. A disturbance of β causes agraphia, analogous to motor aphasia.

FIG. 13. The Wernicke–Lichtheim model. This model is depicted in Lichtheim (1885, p. 451).

- A: centre of auditory images (representations)
- M: centre of motor images
  - a: acoustic impressions
  - m: speech organs
- B: concept centre (Begriffe)
- O: visual images
- E: centre for innervation of writing movements (left hemisphere)
- E': centre for innervation of writing movements (right hemisphere). E and E' are connected by commissures; when there is some lesion of E, E' can come into action.
Initially Broca paid attention only to the fact that the lesion was found in the frontal lobe. Only later, having examined more cases, he realized that in all of them the lesion was in the frontal lobe on the left side of the brain, and drew the conclusion that the left hemisphere has the primary role in language processing. The patients examined by Broca had difficulty in speaking although they were able to understand simple speech. From this Broca deduced that the left third frontal convolution is the brain structure responsible for the motor programs that underlie the articulation of language. Throughout the years, both the locus of the lesion and the descriptive generalization of its behavioural manifestations have been somewhat altered and refined, but Broca's aphasia (or motor aphasia) is still used as a diagnostic term for patients with frontal damage and impaired motor speech (i.e. for patients who speak slowly and labouriously), but have relatively well preserved comprehension.

A decade later, Carl Wernicke (1874) identified the location of another lesion resulting in a different form of aphasia (sensory aphasia). He claimed that patients with a lesion in the left temporal lobe spoke fluently, and maintained normal intonational pattern. They made many errors (literal paraphasias) and used words that had no sense (neologisms) to the extent that their speech often conveyed little information. They also had severe problems in understanding language (see figure 1.1).
The discovery of two basic forms of aphasia, with associated lesions in two well defined locations in the brain, suggested to Wernicke that there are in the brain a number of centres responsible for language processing. In the normal brain they operate in co-ordination but, if one or more of the centres, or the pathways connecting them was damaged, some form of aphasia would occur.

This insight constituted the initial form of a model (Wernicke 1874) of how language is represented in the brain (see figure 1.2). In Wernicke’s model there are four centres. One is for audio-verbal images, responsible for comprehension; a lesion in this centre results in sensory/Wernicke aphasia. The second centre is for motor-speech images, underlying articulation; a lesion in this centre results in motor/Broca’s aphasia. Wernicke predicted a third aphasic syndrome occurring as a result of a lesion in the connecting paths (the arcuate fasciculus) between (a) and (b) in figure 1.2, between the centres for auditory and sensory images; this syndrome is known as conduction aphasia. These patients have a striking problem of repeating heard sentences, despite relatively good speech production and comprehension. The term is still used today. The two additional centres are for reading and for writing and a lesion in these centres results in alexia and agraphia respectively. The model has been improved upon by Lichtheim (1884) (see figure 1.3), and it is Lichtheim’s version that today constitutes the classical theory of aphasia.
In order to understand Wernicke's and Lichtheim's conception of the aphasic disorders it is necessary to take into account the prevailing philosophical/scientific outlook of their time.

Medicine in the late 19th century subscribed to a radical materialistic position called psychophysical parallelism. This claimed that the mind and the nervous system are related in a one-to-one fashion (that is, are isomorph). Unfortunately, the dominant theory of mind available at the time - the psychological theory of associationism of Wundt - held a very restrictive conception of language and language processing. Wundt's psychology of language, for example, described a word as consisting of the association of a concept, a motor image and a sensory image. Having an intact motor image facilitated the correct pronunciation of the word; an intact sensory image, its recognition upon hearing it; and an intact concept, its comprehension.

The associationism of Wundt and his school heavily influenced the work on aphasia of Wernicke and of his students (who had not read Wundt's more sophisticated writings on syntax). Broca found the location of the motor images in the third convolution of the frontal lobe, and Wernicke found the location of the sensory images in the temporal lobe. Lesions in these areas resulted in motor (production) and sensory (comprehension) disorders respectively. Wernicke's and Lichtheim's models of language representation in the
brain - consisting of separate centres for motor and sensory images that need to operate in combination - in order to produce and comprehend language - mirrors with precision the theory of mind of their time.

Broca’s and Wernicke’s point of departure was the lesions found in the brain of the patient, and the localization of lesions remains (for obvious reasons) a primary interest for neurologists. Lichtheim’s model, however, is not only a neurological model associating lesion sites with language functions, but also a psychological theory modelling language processing (just as the subtitle of Wernicke, 1874, is ‘A psychological study on an anatomical basis’).

In Lichtheim’s model, seven different types of aphasia were predicted (see fig 1.3). The motor (M) and the sensory (A) areas are connected with each other and both are connected with the concept centre (B). While the motor and the sensory centres had both psychological/functional roles and neurological substance, the concept centre had only a functional role, but no identifiable, (that is, discretely localized) brain structures. The cortex as a whole is the concept centre.

Damage to the motor and sensory centres results in cortical aphasias: cortical motor and cortical sensory aphasia; damage to the connecting pathways within the language area results in transcortical aphasias: conduction (M - A), motor (M - B), and sensory (A - B).
The language area of the brain - the motor and the sensory centres - are connected also to the peripheral mechanisms of the brain (the speech (m) and sensory organs (a)). Damage to these connecting pathways results in subcortical aphasias: pure word muteness (M - m) and pure word deafness (A - a).

This model had predictive power in the sense that certain forms of aphasia were described prior to their empirical discovery. For instance, Wernicke had earlier predicted that conduction aphasia should result from a lesion in the connecting path between the motor and sensory centres.

The Wernicke-Lichtheim's connectionist model is the first true theory of aphasia. Although it has been much criticised since its conception and although it is based on elementary neurological knowledge and an extremely limited linguistic theory, it has survived and proved successful in predicting lesion sites and in characterizing in broad lines the deficits of aphasic patients (Marshall 1982). In modern times, Benson and Geschwind (1971) employed the Lichtheim taxonomy as a basis for their clinical classification system, adding three more aphasic disorders (anomic aphasia, global aphasia and a combination of transcortical sensory and motor aphasias.

The Wernicke-Lichtheim model in its original form however, had no theoretical space for considering a specific grammatical deficit in aphasia. The reason for
this is that the psychological theory prevailing at the time had no theory of sentence construction. The theory explained only how we say and comprehend words by creating a reflex-like association between a concept, a motor and a sensory image. Attempting to conceptualize the grammatical deficit in aphasia had to wait until significant theoretical changes took place in linguistics and psychology (although it could, in principle, have been prompted by consideration of the later works of Wundt).

Although modern cognitive neuropsychology or linguistic aphasiology do not subscribe to the the Lichtheim model, much of the taxonomic terminology is still used although somewhat reluctantly. The problem is that Lichtheim's taxonomy is an integral part of a theoretical position that includes an outdated conception of language processing, and it classifies aphasic phenomenon into subgroups - motor aphasia, sensory aphasia, conduction aphasia etc. - in accordance with the internal logic of the theory. A taxonomic label always comes accompanied with a descriptive generalization, emphasizing characteristics that are motivated theoretically and omitting characteristics that cannot be explained by the theory. Today, therefore, when a taxonomy such as Broca's aphasia, Wernicke's aphasia or Conduction aphasia is being used, it is done loosely and without theoretical commitment, although it is difficult to escape the historical connotations of the terms. And the question asked by Marshall (1982), "can we buy the classical
taxonomy without also buying the classical theory?" (p.396) remains poignant.

1.3 The evolution of agrammatism

Modern aphasiology has inherited the conception of agrammatism as a production deficit associated, or identical with Broca's (motor) aphasia. Agrammatic patients were described as speaking slowly, effortfully, using only short simplified phrases including mainly content words and omitting most free and bound grammatical morphemes. The deficit was confined to the production modality; comprehension was said to be intact. Agrammatic speech was often compared to the language used in telegraphs and the claim was advanced that 'telegraphic speech' is used by Broca's aphasics as a strategic response to effortful motor speech. Thus agrammatism was not seen as a primary disorder, but rather as secondary to impaired motor speech.

Grammatical deficits in aphasia had been noted for the first time only at the very end of the 19th century. This recognition was facilitated by the declining influence of the psychology of Wundt and the appearance of the new psychology of Bühler. Also, there had been a change, at least for some neurologists, in the conception of the mind/brain relationship. The strong identity theory, adhered to by Wernicke and Lichtheim, had been abandoned in favour of the idea of psychophysical interaction, which allowed the emergence of a richer,
more flexible and more complex psychology. Nevertheless, the Wernicke - Lichtheim model remained the major theory of aphasia.

The term 'agrammatic speech' was used for the first time by Arnold Pick (1898), who was a neurologist with a particular interest in linguistics and was not a follower of Wernicke. At first he used the term to designate a general syntactic and grammatical problem rather than telegraphic speech per se. Pick located grammatical disturbances in the sensory language centre and emphasized that the grammatical deficit is a primary deficit and not a reaction to another problem. He also pointed out that agrammatism is rarely seen because it is frequently hidden by other aphasic deficits.

In this initial period of research, neurologists, like Bonhoeffer (1902) and Heilbronner (1906), tested the comprehension and metalinguistic abilities of their motor aphasic patients. Having found deficits in input modalities, they could not accept that agrammatism was only a strategic adaptation to 'poor speech initiative'. They claimed that the grammatical deficit of patients with lesions in the motor area is 'real', presumably meaning that it has its own underlying lesion (and its own functional place in the overall language system). The problem of a comprehension deficit in the motor area was left hanging in the air.
A few years later, Erich Salomon (1914), a follower of the ‘modified’ Wernicke school, found a solution to the problem of agrammatism in both output and input. Salomon had an impressive battery of tests for investigating agrammatism: grammaticality judgement tasks, classification of words according to parts of speech, completing sentences with missing prepositions, conjugation of verbs etc. and he presented a detailed case study of grammatical processing by an agrammatic patient. His battery of tests disclosed that he took the grammatical deficit in aphasia very seriously. Salomon, as a ‘Wernickean’ (as were Heilbronner and Bonhoeffer) located the grammatical deficit in the motor area (where indeed some of the patients did have their lesion). The problem, however, remained, of how to explain the syntactic comprehension deficit, as comprehension deficits cannot be explained easily by a lesion in the motor area. Salomon suggested that syntactic comprehension deficit occurs due to “an inadequate cooperation of the motor speech area with the sensory one”. This has become impossible due to damage of the motor speech centre” (De Bleser 1987 p.212).

On the other hand, Arnold Pick in his later writings (1913) claimed that the substrate of ‘real’ grammatical deficits was the (temporal) sensory area. He reinterpreted some of the cases of the previously mentioned neurologists as global aphasias in a stage of recovery where most of the sensory (comprehension) deficit had already disappeared, leaving only the
grammatical deficit together with a motor speech deficit. This gives an illusion of association between the motor component and agrammatism. In other cases, there is indeed only a motor impairment, but the grammatical impairment is not a true one and Pick explicitly calls it 'pseudo-agrammatism'.

Salomon suggested a way out of this confusing situation by saying "it might be more useful to talk about agrammatism in motor aphasia and agrammatism in sensory aphasia and to drop the terms real (for temporal lesions) and secondary (for motor aphasia). Motor aphasia involves agrammatism which is just as real" (De Bleser 1987 p.212).

Kleist (1914) tried to solve the arguments about frontal and temporal lesions in an even more radical fashion. He coined the term paragrammatism and defined both agrammatism and paragrammatism and the difference between them. Until that time, only the term agrammatism was used, although different forms of grammatical disorders had been recognized and there had been attempts to distinguish between the two on both psychological and anatomical grounds.

Kleist defined agrammatism as:

a simplification and a roughening of word sequences. Complex constructions with subordinate clauses do not occur. The patients only speak in short, primitive sentences...... Words which are not very necessary, especially pronouns and particles, are seldom used .......... conjugation, declension .......... practically never occur. .......... only major words, adjectives in the nominative, and verbs in the infinitive or
participle form remain.

and paragrammatism as:

The ability to construct word sequences has not been lost, but phrases and sentences are often incorrectly selected ....
(From De Bleser 1987 p.216)(omissions are mine).

Kleist located the source of the agrammatic deficit in the frontal lobe and the source of the paragrammatic deficit in the temporal lobe. In agrammatism, there is a loss of motor representations (motor engrams) but paragrammatism is the consequence of a disturbance of the auditory engrams in the temporal lobe.

Some problems, however, remained. One is the mixed occurrence of agrammatic and paragrammatic phenomena in the same patient, and the other is the occurrence of agrammatic comprehension in some patients. According to a strict Wernickean position, the motor and the sensory centres are conceptualized as distinct centres, one responsible for articulation and the other for comprehension. Agrammatic comprehension with agrammatic production accompanied by a frontal lesion was inconceivable for a neurologist like Kleist. Similarly, a mixture of agrammatic and paragrammatic utterances in the same patient would create a problem for Kleist and, even more so, the existence of patients with telegraphic speech and a lesion in the temporal area.

To solve the problem of 'mixed' patients, Kleist in 1916 changed his view of the agrammatic and the paragrammatic
dichotomy. The two remain functionally different deficits but have the same underlying anatomical substrate: a lesion in the temporal area. Agrammatism is conceptualized by Kleist as amnesia for function words and paraphrasmatism, like paraphasia, is seen as the incorrect selection of grammatical constructions. This amounts to denying the existence of a special grammatical/syntactic deficit and suggests that agrammatism is, in fact, a lexical deficit, similar to a word finding problem, that selectively affects grammatical morphemes. As such, it could be localized in the temporal area, lesions to which, as Wernicke had always stressed, often resulted in severe paraphasia.

The final word in this period of research is by Isserlin (1922). His is an attempt to achieve a synthesis and explanation.

Isserlin accepted
(a) the distinction drawn by Kleist between agrammatism and paraphrasmatism.
(b) the existence of agrammatic patients with a slight comprehension deficit
(c) the existence of agrammatic production without a comprehension deficit. Production and comprehension are therefore functionally independent.
(d) that agrammatism - both in production and comprehension - is associated with a motor area lesion, and paraphrasmatism with a sensory area lesion. The comprehension deficit is more severe in the case of sensory lesion (i.e. lesion to the temporal lobe).
(e) that the problem of the mixed occurrence of agrammatic and paraphrasmatic utterances remain unresolved (?).
Isserlin associates agrammatism with the motor area and suggests that the telegram style of the patients' speech is 'a language in need', 'an unconscious adaption' to the difficulty and effort that the patient experiences in trying to speak.

Paragrammatism is different and less puzzling within the Wernickean framework; it does not, therefore, require a strategic explanation, like the *economy of effort* hypothesis. These patients speak freely; the source of their erroneous speech is the disturbance of the auditory representations characteristic of sensory (Wernicke's) aphasia.

Conveniently for the Wernicke-Lichtheim model, this account by Isserlin need not assume a single locus in the brain underlying grammar. Since agrammatism is a mode of adaptation to motor aphasia, it will result from lesions underlying motor aphasia in the frontal lobe, while paragrammatism involves lesion of the temporal lobe.

Isserlin's theory of agrammatism was given the stamp of approval by Lenneberg (1973), and renamed as the *economy of effort* hypothesis. Its presence can still be felt in modern aphasiology. This is so despite the fact that the motivation for the theory, at the beginning of the century, was the need to accommodate a grammatical deficit in the Wernicke-Lichtheim model and localize it in the nervous system. The continuing fascination with the 'economy of effort' hypothesis (Kolk 1985, Heeschen
1985) is puzzling. It is possible that the reason for this is that patients whose speech is agrammatic often have good comprehension, including syntactic comprehension. It is difficult to conceptualize an output-only deficit as syntactic/grammatical. On the other hand, researchers who take the grammatical deficit seriously tend to argue for the existence of a parallel disorder, where the production deficit is accompanied by a comparable syntactic comprehension deficit.

In chapter 3, the arguments about agrammatism during the last 20 years will be described. De Bleser (1987), in an analysis that has been crucial to the organization of this chapter, has pointed out that some of the modern theories are strikingly reminiscent of the old ones. It is fascinating, for example, to follow Arnold Pick's attempts to distinguish the agrammatic from the pseudo-agrammatic. This is still an acute problem today. Despite the similarities between the two periods, it should be pointed out that researchers today are in a better position to study agrammatism by having available a well worked out linguistic theory. Some of the modern theories of agrammatism use linguistic concepts and therefore, it is not possible to describe the more recent theories of agrammatism without first discussing the linguistic theories that had a major influence on their development.
CHAPTER TWO

INTRODUCTION TO LINGUISTIC THEORY

2.1 Introduction

In the previous chapter it became apparent that progress in aphasiology depends on the availability of psychological and linguistic theories at any given time. During the 19th century, the syntactic and grammatical problems of aphasic patients were little recognized because the psychological theories of that time had little to say about sentence processing. In this respect there was some progress at the turn of the century and, consequently, the taxonomic term agrammatism came into use. This, however, still did not finally lead to the recognition of a grammatical deficit in aphasia and the truncated speech that is characteristic of these patients became conceptualized as a compensatory strategy for effortful motor speech.

In the next chapter, the literature of modern research on agrammatism from the early 70s is reviewed. All the studies conducted during this period benefitted to varying degrees from the insights of Noam Chomsky's linguistic theory. Chomsky's transformational theory had a revolutionary effect on all aspects of the study of the psychology of language: language acquisition, normal language processing and language impairment. This was
not accidental. Chomsky’s theory is intended to be not only a descriptively adequate linguistic theory, that is, a theory which describes correctly the facts of any individual language. Its aim is also to construct a theory of language which is parsable and learnable. This amounts to a linguistic theory that is at the same time a cognitive theory. The fact that Chomsky considers linguistics as a branch of the cognitive sciences makes his theory attractive for the psychologist interested in language processing. Any linguistic theory without a commitment to psychology cannot be exploited by the psychologist because the linguistic facts that are described are not meant to be related to psychological events.

This is not to say that Chomsky’s theory models in any simple way what happens in the brain when we say or understand a sentence. Chomsky very carefully distinguished between the levels of competence and performance and emphasized that his theory is about competence only. Performance factors in a psychological test often interfere and, therefore, it is not surprising that it is difficult to obtain empirical evidence for the claims of linguistic theory.

This is the reason why there have been ups and downs in the relationship between psychology and linguistics. At first, following the publication of Chomsky’s Standard Theory (1957, 1965) there was great enthusiasm among psychologists to test linguistic constructs, like
transformations, for example. But when the results were disappointing, linguistic theory became neglected by many psychologists. In the study of aphasia there were a few studies explicitly influenced by the transformational grammar of 1965. Most of the work done in the 70s, however, was inspired by the general framework of Chomsky's (1965) theory - the rigid distinction of grammatical levels, such as syntax, semantics and phonology - without making reference to any details of the theory, or indeed acknowledging it. Nevertheless, the influence, is apparent.

This changed in the 80s, a time when the theory of Chomsky has itself undergone significant alterations. Following Grodzinsky, a number of aphasia researchers use precise linguistic constructs of the Government and Binding (GB) theory, also referred to as the Principles and Parameters framework, Chomsky (1981, 1986a, 1988).

In order to facilitate the reading of both the literature review and the body of this thesis, a short exposition of the 1965 version of the theory, and a more detailed one of those aspects of GB theory that are essential for the understanding of the present work, will be presented.

2.2 The Standard Theory

In all the versions of Chomsky's theory, syntax has a role of primary importance. This is particularly prominent in the Standard Theory proposed in Aspects of the Theory of Syntax (1965). Chomsky distinguished three
components of the grammar: syntax, semantics and phonology (see figure 2.1).

The syntactic component contains subcomponents—phrase structure rules and transformational rules—that generate the sentences of a language. The phonological and the semantic components have only interpretive functions.

This is not the only possible way of dividing the components of a grammar. Grammars with a well worked out and active semantic component are a conceptual possibility and they do exist (the Case theory of Fillmore, for example). Furthermore, changes within Chomsky's theory itself have taken place throughout the years by altering the division between the various components and subcomponents of the grammar.
In the 1965 version of the theory transformations were needed in order to account for both the similarities (in 'who is doing what and to whom') and the differences (in the final word order structure) between such sentence types as the following:

a. Mary hit John.
b. John was hit by Mary.
c. Did Mary hit John?
d. Mary did not hit John

The Standard theory claims that sentences (b), (c), and (d) are all derived from one basic form, the deep structure form (a) by various transformations: passive, interrogative and negative respectively. Assuming a deep structure underlying surface sentences also accounts for ambiguous sentences, like: they are cooking apples. These sentences are analyzed by the theory as having two different deep structures. In the nominal sentence cooking apples is analyzed as an NP, and in the verbal sentence as a VP. The differences in sentence structure can be seen in the following two diagrams:
Thus, the Standard theory distinguished between two levels of the grammar, *deep structure* and *surface structure*. The deep structure of a sentence—the input to transformations—is abstract and unobservable but all elements of meaning are already present at this level. Transformations—movements of lexical items, insertions and deletions of structural markers—do not change meaning. The output of the transformations is the surface structure which represent the final order of words in a sentence. Surface structures are input to the phonological component. The semantic component has no access to surface structures and thus, meaning is determined at deep structure level.

In this formulation of the theory, the primary burden of most of the grammar was carried in the phrase structure rules.
S --> VP NP
NP --> Det N
VP --> V PP etc.,

creating deep structures and in the transformations, creating surface structures. In Standard Theory there were many transformations. Each syntactic structure, like passives, relative clauses, questions, etc. had its own transformation rules.

In addition to phrase structure and transformational rules, all the components of the grammar had to have access to the lexicon for assigning the meaning of words and their pronunciation, in order to accomplish lexical insertion. Items in the lexicon had *categorial information*, N(oun), V(erb) attached to them; *strict subcategorization* features, to distinguish between transitive and intransitive verbs (*read book, run fast,* verbs that passivize and verbs that do not (*kiss, resemble*) and to specify the special requirements of certain verbs (for example, *that hope requires a* sentential complement. The lexicon also contained *selection restrictions* that are concerned with choice of words in relation to other words occurring in the string. Nouns, for example, appeared in the lexicon with the following specifications: count or mass; animate or inanimate, human or nonhuman, male or female, abstract or concrete. It is these specifications that rule out *Colourless green ideas sleep furiously as deviant.*
The semantic component of the Standard Theory (Katz and Fodor 1963) was not a well worked out part of the grammar. It contained a dictionary that was, on the one hand, a duplicate of the lexicon in the syntactic component described above and, on the other hand, rules for combining the meanings of words. In the semantic component the deep structure phrase markers received their interpretation. This initial semantic interpretation did not change despite many structural changes occurring in the sentence due to transformational operations.

Surface structures were input in their final word order form to the phonological component where a phonological (or orthographic) representation of the sentence is produced so that the sentence can be pronounced or read.

It is a basic tenet of the Standard Theory that only deep structures are input to the semantic component; surface structures are input only to the phonological component and therefore cannot influence meaning. Meaning is determined solely by deep structures.

2.3 Motivations for changes in the theory

Since the publication of Aspects of the Theory of Syntax, (1965), Chomsky's theory has gone through many changes. The changes occurred gradually, as a result of further research, criticism and analysis. The purpose of the changes has always been to obtain greater explanatory adequacy and/or a more economic theory; e.g. to make the
grammar such that it will be easier for children to acquire.

The lexicon has become increasingly more important. In the Standard Theory, regular relations among words, as between destroy and destruction were treated transformationally in the syntax. Chomsky (1970) produced convincing arguments for placing these derivations within the lexicon. This served also the purpose of reducing the number of transformational rules.

Transformations became problematic for a number of reasons. It was discovered that it was untrue that transformations never affected meaning. In sentences containing universal quantifiers, transformations altered the scope of the quantifier, the focus of the sentence and thus its meaning. For example:

Few students read many books.
Many books are read by few students.

The second, passive sentence should be the exact paraphrase of the first sentence, but it is not, in the preferred reading of both sentences. A clearer example concerns the possibility of coreference between a pronoun and an NP:

A picture of John upset him.
He was upset by a picture of John.

While in the first sentence coreference relations between him and John are possible, this is not so in the passive sentence. These examples contradict a basic principle of
the Standard Theory, that transformations do not effect meaning.

In order to account for these discrepancies of meaning between the active sentence and its passive counterpart, it was no longer possible to exclude surface structures from semantic interpretation.

A second problem in relation to transformations was that there were too many of them and they were often too powerful, generating many kinds of possible sentences, including some ungrammatical sentences. The transformations had to be constrained if explanatory adequacy was to be achieved.

Two things happened in relation to the number of transformations. One was a gradual increase in the expressive power of the deep structure level. In the very first version of transformational grammar, in Syntactic Structures (1957), the *kernel sentences* (equivalent to the deep structures of the 1965 Standard Theory) took the form of simple sentences, because the phrase structure rules of this grammar could only generate simple sentences. A complex sentence like *John believes Bill knows Mary* was generated by invoking the transformational component. In the Standard Theory (1965), the phrase structure rules became more powerful and could generate a sentence like *John believes Bill knows Mary* directly in deep structure. This made it possible to eliminate some transformations. In later developments of the theory, the phrase structure rules were replaced by X-bar theory.
(see below) that generated even more complex base structures.

A second development was finding increasingly more abstract principles shared by a number of transformations. This led to the grouping together of transformations for a number of constructions. For example, one transformation—WH movement—accounted for question formations, relative clause formation and for the construction of cleft sentences. This together with developments in other parts of the grammar, gradually led to the abandonment of all transformations, save one, Move alpha.

The Government and Binding theory (Chomsky 1981, 1986a, 1988) is a very different grammar from the Standard Theory. This is so despite the fact that the changes were gradual and organic (Extended Standard Theory, Revised Extended Standard Theory). What happened is that instead of a theory of rules we have now a theory of general principles. Phrase structure rules for each type of phrase (NP, VP etc) were replaced by X-bar theory, which maintains that the structure of all phrases is the same and, therefore, only one rule is required. Transformational rules disappeared and what remained was a general 'permission' for movement (or deletion, or insertion). Movement is restricted by other parts (modules of the grammar). The two tier system—d(ep) and s(urface) structures remains, but the deep structure is less deep, because of a more powerful base component,
X-bar theory and a rich lexicon, and the marginalizing of transformations.

Government and Binding theory seems to be superior to previous formulations of the linguistic theory. It provides explanatory generalizations that could not previously be expressed and may be easier to incorporate into a plausible model of language acquisition.

2.4 Organization of the grammar in the theory of Government and Binding

In the theory of Government and Binding (GB theory), the grammar is reorganized in order to ensure that the s-structure includes all the information necessary for interpretation in both Phonological Form and Logical Form. In other words, d- and s-structures no longer diverge as in Figure 2.1. Instead, all the information available in the lexicon is preserved throughout the generation of the sentence through d-structure, move alpha and s-structure. This is the requirement of the Projection Principle. The basic organisation of GB grammar is shown in Figure 2.2.
2.4.1 The lexicon

The lexicon is an inventory of the language user's vocabulary. It contains fully explicit information about the meaning and phonological form of all lexical items, including category (noun, verb etc.) and details about thematic (semantic) role assignment for categories which assign such roles. This constitutes the theta grid, that replaces the earlier subcategorization features. The theta grid specifies the arrangements of the arguments around a verb: what must follow the verb (its complement) and what must precede it (the external argument, the subject, (underlined)). Finally, all information that is idiosyncratic to a vocabulary element is spelt out in the lexicon. Examples of possible entries in the lexicon include:
In d-structure, phrases and sentences are generated according to the principles of X bar theory, a much simplified formulation of the earlier phrase structure rules. Sentences at this level are in their base form. That is, all the lexical items are in their original position, as specified in the lexicon.

2.4.2 X-bar theory

X-bar theory is concerned with the internal structure of phrases and sentences. There are four major lexical categories: verbs, nouns, adjectives and prepositions and these in combination with additional lexical material, constitute the phrases: NP, VP, AP and PP. The head of an NP is a noun; the head of a VP is a verb, the head of AP is an adjective and the head of PP is a preposition.

An improvement of X-bar theory upon phrase structure rules is the recognition that all types of phrases (NPs, VPs, APs and PPs) have the same internal structure. Therefore, they are often referred to as XPs, when X stands for any lexical category. All phrases, in
principle, contain a head, a complement and a specifier (see below), although not all of these have to be lexically realized. This hierarchical structure, is maintained even when the phrase contains only the head.

Phrase structure in X-bar theory

Introducing X-bar theory into the grammar added to the descriptive power of the theory by increasing the hierarchical depth of phrases. This is achieved by an additional level of projection: X' (one bar). X stands for any major lexical category, a noun, a verb, an adjective or a preposition, and X'' (two bars) is a phrase: a lexical category, its specifier and complement. X' (one bar) is a lexical category and its complement, but without the specifier. The structure of any phrase is:

```
  X''
  |   |
  |   X'
  |     |
  |     X
  |     |
  |     complement
```

The highest position is the full phrase, the 'maximal projection', X''; the specifier is its 'daughter' and the 'sister' of X'. The daughter of X-bar is X (zero projection) and its complements. Translating this general structure of a phrase into an actual NP, we get:
In the above NP, the determiner *the* fills the position of the specifier, and the complement is a preposition phrase *of the teacher*.

A VP in a sentence such as *John may be reading the book* is analyzed similarly:

The specifier position is taken up by the aspectual auxiliary, *be* and the complement position by the direct object, *the book*.

An NP without so much lexical material will look like:

The structure remains complex to accommodate the possibility of substituting *the son of the teacher* in place of *John*.
There are many arguments supporting the existence of two levels of projections for lexical items (X' and X'''). The justification is based on the reality of N' son of the teacher, or V' be reading a book as a constituent, equivalent to N son, or V reading and N'' the son of the teacher, or V'' be reading a book.

Sentence structure in X-bar theory

X-bar theory was first developed for phrasal elements and only gradually did the system apply to whole sentences. In Government and Binding (1981) S' (S bar) was introduced as a higher projection of S(entence):

S' expands into --> COMP(lementizer) and S
S   expands into --> NP INFL(ection) and VP

S is the highest position of main clauses, while S' is the highest position of subordinated clauses. Under COMP a complementizer, such as that or which, is placed. In an English main clause this position remains empty, as can be seen in the diagram below. There are languages that introduce main clauses by an overt complementizer that is positioned underneath the top COMP node. In English, the empty (e) COMP node is required as a landing site for the WH word when movement occurs in WH question formation in a sentence like Who did she believe will come? Similarly, the inverted auxiliary in a question like Will he come? is also placed underneath the topmost COMP node. The second S' in the above structure
introduces the subordinated clause and, COMP, appropriately, houses the complementizer (see Figure 2.3).

Figure 2.3 The tree structure of the sentence *She believed that he will come.*

This presentation of sentence structure is not entirely satisfactory in the context of X-bar theory. The structure of phrases is better worked out than is sentence structure. In order to show the interrelatedness of N, N' and N'', for example, the term projection is used to designate the expansion of a lexical category into a phrase: N (zero projection), through N' (one bar projection) onto N'' (maximal projection). The head (N) is present throughout the projection line:
A similar analysis to the above is given for all the major categories, but clauses are not fully integrated into this system. A different structural treatment of clauses would wrongly indicate that they are entirely different entities than phrases. As the theory is aiming at maximum economy on the descriptive level, it was important to analyze clauses in the same system of projection lines as phrases. S and S' were seemingly unrelated to any part of the sentence underneath them, and there was no maximal, two bar projection. The system worked out in Barriers (1986b) corrects this situation and brings sentences fully into the X-bar system.

In this new system, INFL (I) and COMP (C) play an important part. I(NFL) is the zero projection of main clauses and C(omp) is the zero projection of subordinated clauses. Both have two projections, like the lexical categories: I, I' and I''; C, C' and C''. I'' is the equivalent of S(entence) in the previous system and C'' is the equivalent of S'. The system exemplifies the central role of inflection and of the complementizer in main and subordinated sentences.

In the following tree, there is a representation of the sentence *She believed that he will come* in a diagram.
using the notation from Barriers (1986b). This can be compared with the less developed structure in Figure 2.3.

![Tree structure diagram](image)

Figure 2.4: The tree structure of the sentence *She believed that he will come* according to Barriers (1986b).

There is a great deal of structure in this notation and the unfilled nodes are available for expansion in sentences with more lexical material, or are used when movement occurs as in *Does she believe that he will come?* One of the basic differences between the Standard Theory and the present theory is that the base structure generated by X-bar theory is fully developed. Transformations therefore do not add structure; they result in a rearrangement of the terminal nodes only.
2.4.3 Transformations: Move alpha

In GB theory, the transformational component is called move alpha to designate the idea that movement (or deletion, or insertion) of any element in the sentence is free in the sense that there are no transformational rules for particular constructions, like passives, interrogatives or relative clauses, as in earlier versions of the theory. Movement in GB is constrained by other principles or modules of the theory to be introduced below.

2.4.4 S-structure representation, traces and the Projection Principle

The outcome of the transformations is s-structure, the level at which all the structural information of a sentence is fully explicit. S-structure is different from d-structure only in the case of transformational sentences. Sentence structure is fully developed according to X-bar theory in d-structure and transformations are structure preserving. Moreover, s-structure representations contain all the information about changes occurring in the sentence as it evolves from d- to s-structure. This is a very important principle of the linguistic theory, formalized as the Projection Principle. This states that

Lexical requirements (viz. categorial, subcategorization and thematic properties) must be uniformly satisfied at all syntactic levels.
In order to safeguard the Projection Principle, traces are used in s-structure representations to show the place of origin of a moved element. Take for example, the moves necessary to derive a passive s-structure from a d-structure:

\[\text{d-structure: The girl hit the boy} \]
\[\text{s-structure: The boy was hit by the girl} \]

In d-structure, the boy is in post verbal position. When it moves to the beginning of the sentence in s-structure, it leaves a trace at its place of origin. This satisfies the Projection Principle, because the trace stands for the direct object of the verb (in the d-structure) and it is linked and coindexed with the boy.

The terminal nodes of the s-structure tree are labelled with specifications of lexical categories: N(oun), V(erb), A(djective), P(reposition) and a number of non-lexical categories: Det(ertex), INFL(ection), COMP(lementizer), PRO (empty, a place for the subject of an infinitival/gerund), pro(noun) and trace.

Underneath the categorial information, the actual lexical items are copied from the lexicon.

2.4.5 Phonetic Form and Logical Form

The Phonetic Form and the Logical Form are interpretive components of the s-structure representation (see Figure 2.2). They "constitute the 'interface' between language
and other cognitive systems, yielding direct representations of sound on the one hand and meaning on the other, as language and other systems interact." (Chomsky 1986a, p. 68) These components, as in the Standard Theory, do not interact (see Figures 2.1 and 2.2). An operation in the LF component cannot trigger the application of a phonological rule, nor can an operation in PF affect rules of LF. LF deals with the logical aspects of meaning: the scope of universal quantifiers, and problems of coreferentiality within a sentence (Binding theory).

The above is a very general description of the organization of GB grammar. In the following sections a detailed account will be given of those parts of the grammar that are essential for understanding the arguments and the claims of this thesis.

Particular emphasis is placed on Theta theory (see below) since this is essential for understanding chapter 4 on the comprehension of transformational sentences. In addition, in chapter 4, movement, traces and Case are often mentioned. For following chapter 5, the notion of Government is essential, as are Case and Theta theories. Chapter 6 relies more on the special features of Hebrew grammar than on Universal Grammar and the details required for following the arguments are presented in situ.
2.5 GB as a modular theory

In the GB framework, unlike in earlier versions of transformational grammar, there are no particular rules associated with different constructions; there is, for example, no passive transformational rule. Move alpha is a very general principle that states that in a language the movement of any item (alpha) from the original d-structure position is possible. Constraints are imposed on movement by independent principles, sub-theories, or modules of the grammar. These are general principles that have a wide applicability and, therefore, are very different from specific 'rules of grammar'. One of the advantages of replacing rules by general principles is that the claim for universality becomes more plausible. 'Principles', 'sub-theories' and 'modules' are used as synonyms. The notion of 'module' conveys the idea of the independence of 'theta theory' from 'Case theory', for example.

The grammar can be visualized as a jigsaw puzzle in which each piece can be handled and looked at individually, but the whole picture becomes meaningful only when the pieces are put together in the right way. The requirements of a module, like theta theory, or Case theory can be looked at in isolation, but each linguistic construction - a sentence - reflects the operation of several modules together. This is the reason why it is difficult to discuss one module without mentioning another one, and
the reader sometimes has to tolerate a little puzzlement for a short time.

2.5.1 Government

Because of its generality, the first module to be introduced is Government. Government is a structural relationship within the sentence; a relationship that defines the boundaries within which particular syntactic events, like Case assignment or Theta role assignment take place. It refers to a relationship between a 'governor' and an element that it governs.

All major categories, nouns, verbs, adjectives and prepositions and INFL(ection) are governors. INFL governs the subject. A relationship of government exists between elements of a sentence that are closely related. For example, in the sentence

\[ \text{John} \ [\text{took} \ Mary] \ [\text{to the cinema}], \]

\textit{took} governs \textit{Mary}, and \textit{to} governs \textit{the cinema}. On the tree structure the relationship of government is describable in terms of sisterhood, or of maximal projection. Government relates together all the elements immediately dominated by another element.

A formal definition of government is this:

Category \( X \) governs \( Y \), if \( Y \) is contained in the maximal projection of \( X \) and this maximal projection is the smallest maximal projection containing \( Y \), and \( X \) c-commands \( Y \).
C-command is, like government, a structural relationship. C-command covers a larger area within the sentence than government.

In the above sentence

```
C'
  
 C
    
    I''
    
    I'
    
    I
    
    V'
    
    V
    
    N''
    
    N'
    
    N
    
    tense
    
    John
    
    past
    
    V
    
    N''
    
    P''
    
    take
    
    Mary
    
    P'
    
    P
    
    N''
    
    to
    
    det
    
    N'
    
    the
    
    cinema
```

the domain of c-command of a category is defined by climbing the tree until arriving at the maximal projection of the category; everything underneath the maximal projection is c-commanded by the category.

*Take* c-commands everything that is within the VP (V''), *Mary to the cinema*, but nothing above it. The preposition *to* c-commands everything within P'', and *John* c-commands the whole sentence.
Government covers a more restricted area: no maximal projection can come between the governor and the governed: *take* governs *Mary*, but does not govern anything in *to the cinema*, because the PP intervenes. *To* governs *the cinema* as there is no intervening maximal projection.

Government is about relatedness within a sentence: those elements of a sentence that are joined in a relationship of Government are closer to each other, and there is more syntactic interaction between them, than with other parts of the same sentence. For example, as it will be seen later, a predicate governs its arguments, and Case is assigned under Government. A distinction between Complements and Adjuncts will further clarify the role of government within the grammar.

2.5.2 Complements and Adjuncts

Complements and adjuncts are two types of expansions of head categories. Structurally they are distinguished in terms of government.

Complements are closely related to their head categories and are governed by them. The head and a complement constitute a one bar constituent (X’) and with the specifier, a phrase, a maximal projection (X’’). For example, in
a. [NP the professor of English]
   of English is a complement of N and governed by N.

b. [VP put the book on the table],
   both the book and on the table are complements of V, and governed by V.

ADJUNCT is also an expansion of a verb or a noun, but its relationship to them is looser. For example, in

c. [NP the professor of English] [PP with white hair]),
   the PP is an adjunct and it is ungoverned by N or NP.

In

d. [VP put the book on the table] [PP in the morning]],
   the PP is, similarly, an adjunct and, therefore, ungoverned.

The tree structure of (a), an NP; a N with its Specifier and its Complement,

```
  N''
 /     \
/specifier  /N'
  the       /P'
    N        of English
    professor
```

The tree structure of (b), a VP; a V and its Complements,

```
  V''
 /     \
/specifier  /V'
  put       /N''
    V       /P'
    put the book on the table
```

The tree structure of (c) an NP (the professor of English) with its Adjunct (with white hair)
The tree structure of (d) a VP (put the book on the table) with its Adjunct (in the morning).

In order to accommodate adjuncts on the tree diagram, an additional N' or V' node is added to the structure (N' expands into N' and Adjunct). What is important to notice is that complements are always closer to their head category than are adjuncts. In a sentence that contains both a complement and an adjunct, the complement is always physically nearer than the adjunct to the head. For example:

The boy broke the window in the evening
* The boy broke in the evening the window
Mary gave the presents to the children in the evening
* Mary gave in the evening the presents to the children
* Mary gave the presents in the evening to the children

In the above sentences in the evening is an Adjunct; the window and the presents to the children are Complements. Only those sentences in which the Adjunct is in final
position and do not intervene between the head and its complement are grammatical, the rest are starred for ungrammaticality.

The head together with its complement is a constituent, and, therefore, they move together and are not easily separable. This is not so for adjuncts. For example:

Mary gave the sweets to the children in the evening
* To the children Mary gave the sweets in the evening
* The sweets Mary gave to the children in the evening
   In the evening Mary gave the sweets to the children

In the ungrammatical sentences only part of the complement of V moved to sentence initial position. This is not allowed. The adjunct, however, can move freely. Finally, the presence of a complement, but not of an adjunct, is obligatory. For example:

* Mary put the coffee.

2.5.3 Case theory

Cases in GB theory need to be distinguished from Cases in Fillmore's sense (1968). Fillmore's Case theory is a semantically based linguistic theory where Cases have semantic content. In GB theory the semantic roles of NPs in sentences are explicates in theta theory, while Case is a structural requirement.

Case is a licensing for referential NPs to appear in different sentential environments; it is a structural requirement that is related to meaning only insofar as
its assignment is a precondition for semantic interpretation. Only NPs with Case can be semantically interpreted. Sentences containing NPs without Case are totally unacceptable. For example, the following sentences are starred (for being ungrammatical) because the NP is not assigned Case:

* a. John is proud Mary.
* b. The farmers hoped rain.
* c. John to go home.....
* d. The enemy's destruction the city.

The correct forms are

a. John is proud of Mary.
b. The farmers hoped for rain.
c. For John to go home......
s. The enemy's destruction of the city.

Of and for are Case assigning prepositions in these contexts. They do not fulfil semantic functions. They assign Case to Mary, rain, John and city.

Case theory has been developed to account for the obligatory movement of the NP in passive (1) and of raising (2) in sentences like:

1. * -- was hit John.
2. * -- seems John to be sick

These sentences become grammatical only if John moves to sentence initial position. The problem, however, is, how to explain the obligatoriness of these movements in a theory in which all transformations are optional. There must be something inherent in these constructions that compels the NP to move.
In sentence (2) the verb is infinitival and an overt NP cannot appear as a subject of an infinitival verb (* John to come would be nice). This could explain the requirement for movement in sentence (2), although the fact that an infinitival cannot have an overt subject is puzzling too. In the first sentence, however, there is no infinitival, but, nevertheless, the movement is necessary. It has been suggested (Rouveret and Vergnaud 1980) that the problem in both sentences is that John has no Case and it must move in order to receive Case. The notion of Case explains a number of other curious linguistic phenomena. These will be better understood below, where the ways in which Case is assigned are explained.

There are languages in which Case is morphologically realized; in others it is not, or only in some NPs but not in others. English, for example, marks Case only in some pronominals: he (nominative), him (accusative), his (genitive). Morphologically unmarked Case is called Abstract Case; that is, the same as ordinary Case with case distinctions neutralized. The reason that English does not, as a rule, mark Case morphologically, can make Case theory and its role in the grammar difficult to perceive.

Case is assigned under government. This means that both the assigner of Case and the assignee must be part of one
maximal projection; the assigner must govern the assignee; and they must be adjacent.

An NP receives Case from a Case assigner category: verbs, prepositions, INFL(ection) and, in the later formulation of the theory, nouns and adjectives can also be Case assigners. The AGR(eement) features of INFL(ection)s assign nominative Case to subjects of tensed sentences; verbs assign accusative Case to their direct objects and prepositions assign oblique Case to their complements; nouns and adjectives are involved in genitive Case assignment.

The subject of a tensed verb is assigned nominative Case, and the (direct) object of the verb, accusative Case. These are structural Cases. John in John's book is assigned genitive Case. The object of a preposition (to the station) is assigned oblique Case. Genitive and oblique Cases, according to Chomsky (1986a) are inherent Cases that are assigned at d-structure. Structural Case, on the other hand, is assigned at s-structure. The reason for this distinction could be that genitive and oblique Cases are more closely related to meaning than the structural Cases, nominative and accusative.

Oblique Case is a general name for all Cases assigned by prepositions, for example 'dative'. GB theory, however, does not go into the details of naming different types of oblique Cases, and it must be emphasized repeatedly,
despite the comment above, that Cases are distinct from semantic roles. In *to the station, the station is assigned oblique Case* and locative semantic role.

The notion of Case explains, as mentioned above, a number of otherwise obscure grammatical phenomena. For example, the reason that infinitivals surface without overt subjects is that infinitivals, not having tense and agreement features, do not have an INFL node, and, therefore, the subject cannot be assigned Case. This is why PRO, an empty category (see below), which does not require Case, takes the place of the subject of the infinitival. For example:

> The children wanted PRO to play.

*Of*-insertion in structures like *proud of John* or *I persuaded John of the importance of going to college* is motivated by the need to assign Case to the NP following *of*. *Of* has no semantic relevance in these sentences and, therefore, the syntactic role of Case can be observed here without simultaneous semantic role assignment. In a sentence like *We went to Italy in the summer*, the prepositions *to* and *in* assign both Case and semantic roles of *direction* and *time* and, therefore, pure Case assignment is less visible. *Of*, however, assigns only Case.

It has already been pointed out that the impetus for movement in English passive sentences is the fact that the complement of the passive participle cannot receive
Case in its original position (the passive participle is said to absorb Case). No movement in the passive is required, however, in languages like Italian, Spanish and Hebrew, where the passive participle is able to assign Case.

In conclusion, Case theory is an abstract, general principle that accounts for a wide range of linguistic phenomenon that would otherwise require the inclusion of a number of unrelated and unmotivated rules within the grammar; rules like of insertion or obligatory movement in passives. Case theory thus makes the grammar simpler and easier to acquire.

2.5.4 Theta theory

Theta theory deals with the semantic roles of NPs (and pronouns) around the predicate. These are the arguments of a verb (or other category) and are assigned theta roles by the predicate.

Thematic roles became part of the theory when phrase structure rules became redundant and the lexicon became increasingly more important. In the lexicon, the listing of each predicate contains the full list of thematic roles that the predicate requires. This is the thematic grid of a predicate, or its argument structure. 'Theta' and 'thematic' are used interchangeably and both stand for 'semantic'. Chomsky in the Managua lectures (1988) used the term 'semantic' instead of 'thematic' or 'theta'.
['Theta' is simply the name of the Greek letter that is used to signify this notion].

Theta positions are also called A(rgument) positions. Each verb has a specific number of argument positions and these must be taken up by arguments. Arguments are the lexical requirements of predicates.

For example the following verbs lexically require the following arguments:

LAUGH: one external argument;
HIT: one external argument and one internal argument;
PUT: one external argument and two internal arguments;

The difference between external and internal arguments has been explicated by Williams (1981). External arguments are the subjects, and internal arguments are the complements of the predicate.

There is a one to one correspondence between arguments and theta positions. This means that if the verb hit assigns two thematic roles, (one for the person who is doing the hitting and one for the person who suffers the hitting), it has two theta positions, which have to be filled by two arguments. Similarly, arguments must be assigned theta roles and must be placed in theta positions. The argument structure of a verb (its theta grid) is specified in the lexicon and it is carried forward throughout all the derivations of a sentence.

Thematic roles designate semantic notions, with semantic content, like agent, theme, location, source, goal,
experiencer etc. Nevertheless, the theta criterion itself (see below) does not make explicit reference to the actual semantic roles to be assigned. The requirement is only that a theta role be assigned. The theta criterion, therefore, is a structural requirement that NPs around a predicate fulfil a semantic function. The two - the compliment with the structural requirement and the actual semantic role assigned - are one and the same thing; they cannot be separated.

The Theta Criterion

Each argument bears one and only one theta role, and each theta role is assigned to one and only one argument.

There are linguists, however, like Gruber (1965) and Jackendoff (1972), who maintain that distinguishing between the different theta roles is crucial for explaining seemingly unrelated syntactic phenomenon. In order to explain, for example, which verbs can passivize and which cannot, Jackendoff proposed the Thematic Hierarchy Condition, according to which Agent has the highest and Theme has the lowest position:

1. Agent
2. Experiencer, location, source, goal
3. Theme

Examples of theta roles in sentences are:

John bought the bread in the shop.
Agent Theme Location

John loves Mary.
Experiencer Theme.
John gave the flowers to Mary

Theme Goal

Theme is the most important thematic role. The predication is about the Theme.

Theta roles can only be assigned to NPs that have Case. This is the requirement of the visibility condition, according to which an element is visible for theta marking only if it is assigned Case.

2.5.5 The Projection Principle (PP)

The argument structure of verbs and of other predicates is specified in the lexicon. According to the Projection Principle, reproduced here again (from Section 2.3.4)

Lexical requirements (viz. categorial subcategorization and thematic properties) must be uniformly satisfied at all syntactic levels.

A lexical requirement is that a verb like hit requires a complement, as in hit the boy. According to the Projection Principle, the complement, the boy will be present at all levels, and the verb hit will never surface without it.

2.5.6 Trace theory

A major consequence of the Projection Principle is the presence of traces in the linguistic description of s-structures. Trace is an abstract entity that is essential for upholding the Projection Principle and theta theory.
Traces are required whenever transformation takes place and a lexical element moves from its original position specified in the lexicon. A constraint upon movement is that a trace must be left at the original position and the trace must be linked with the moved element at its landing site. Traces appear in all types of transformational sentences, but for our purposes the NP trace in passive sentences and the WH trace in relative clauses are important; sentences containing NP and WH traces are often used in testing the comprehension of aphasic patients.

For example:

The boy was hit by the girl.

The boy had to move to sentence initial position because of the inability of the passive participle to assign it Case (see Section 2.4.3). In order to comply with the Projection Principle, a trace is left at its original position where the boy also receives the thematic role of Theme. The trace with the moved NP is linked in a CHAIN through which the thematic role is transmitted to the boy.

2.5.7 Other Empty Categories

Traces are not the only empty categories in GB theory. PRO, the subject of an infinitival, is base generated and not the outcome of transformation (= Move alpha). It is required to satisfy the theta criterion in the following types of sentences:
a. Bill promised [PRO to go].

b. Bill persuaded Mary [PRO to go].

c. It is unclear what [PRO to do].

In Section 2.4.3 it has been explained that infinitivals cannot have overt subjects. Infinitivals lack agreement features and their INFL node, therefore, is unfilled. As a consequence, the subject of an infinitival would be without Case and thus ruled out. Instead, there is PRO, an empty category (that being empty does not require Case) that takes on the role of an argument (theta role) of the infinitival. This is necessary to comply with the Theta Criterion (see Section 2.5.4).

The distribution of PRO is dealt with in detail in Control Theory. In sentence (a) above PRO is controlled and its reference is determined by Bill, the subject of the matrix sentence; in sentence (b) by Mary, the object of the matrix sentence; and in sentence (c), PRO is not controlled and it has an arbitrary reference.

The third type of empty category is pro (little pro). It has a role only in languages like Spanish, Italian and Hebrew that allow subjectless sentences (the so called pro drop languages). It stands in for the subject of a tensed verb, as in the following Hebrew example:

\[
\text{pro axalti tapuax}
\]

\[
\text{I ate an apple}
\]
Traces, PRO and pro are similar in that they are all abstract, do not contain phonological material and therefore their presence can only be inferred. They are all conceptualised in the theory as NPs and their distribution at s-structure is determined by Binding and Case theories. Trace and PRO are in positions where no Case can be assigned and therefore no lexical N can appear; they are required, however, to comply with the Projection Principle and Theta Criterion.

2.5.8 Binding theory

The Binding principles operate in LF. They specify the structural conditions under which empty categories (trace, PRO), pronouns (we, him, yours etc), anaphors (myself, himself, each other), and names can be coindexed (co-referential) with their antecedents. Binding theory deals with sentences like

a. John shaved him. (pronoun)
b. John shaved himself. (anaphor)
c. John asked the boy to see him. (pronoun)
d. John wanted the boy to help himself. (anaphor)

and asks in what way clause structure determines that in (a) him cannot mean John, and in (b) it must mean John. In (c) it may mean John or somebody else, unspecified, but in (d) it cannot mean John, it can only mean the boy. Trace and PRO are described in Binding theory as being either pronominal or anaphoric: behaving either as a pronoun, or as an anaphor.
The Binding Principles maintain:

A: An anaphor is bound in a local domain
B: A pronominal is free in a local domain.
C: A referring expression (lexical NP) is free.

Thus an anaphor has to be close to its antecedent, a pronoun must not be structurally close to its antecedent.

2.6 Linguistic theory and aphasiology

The significance of the relationship between aphasiology and linguistics is unquestionable; aphasia, being a language disorder can be described adequately only in linguistic terms.

However, the linguistic theory in question here is GB theory, a theory that claims strong 'psychological reality'. It is therefore possible that the relationship between the two disciplines is far more profound. One unexpected link arose when data from aphasic patients were used to test the validity of some aspect of linguistic theory, or to choose among alternative theories. (Grodzinsky 1984a, 1984b, 1986, 1990 etc., Bleser and Bayer 1986, 1988, and Lapointe 1985).

Grodzinsky (1990) suggested adding an external constraint to the existing ones in order to reduce the number of possible grammars. A language has to be 'learnable' (Chomsky 1957) and 'parsable' (Miller and Chomsky 1963). To these, Grodzinsky added that it must also be
'neurologically adequate'; it must "meet the criterion of breakdown-compatibility" (Grodzinsky 1990 p. 111). A linguistic theory is breakdown compatible when its organization is such, that in the case of some patients, some well defined parts of the language are impaired and other, similarly well defined parts are retained. It is easier to understand this claim by giving an example from the work of Grodzinsky.

GB theory distinguishes between verbal and adjectival passives, while Lexical Functional grammar analyzes them as similar to each other. According to Grodzinsky, agrammatic patients are able to understand sentences containing adjectival passives but fail with verbal passives. Thus the grammar which analyzes adjectival and verbal passives differently is breakdown compatible, and thus superior to the grammar which does not.

To what extent this approach can be successfully developed, remains to be seen. To a large extent this depends on determining the level of the grammar at which the agrammatic impairment is manifest. The following subsection presents some suggestions in this direction.

2.6.1 The syntax/semantics distinction

In the aphasia literature, the question whether an impairment in a certain group of patients is semantic, syntactic, phonological or morphological is often asked. This question was legitimate within the Standard theory model. However, it is not so in the framework of a
theory like Government and Binding. Government and Binding theory is a highly structured modular theory, but the structuring is not along syntactic/semantic lines.

A number of components of the grammar (the lexicon, Theta theory and Logical Form) are all involved in what was traditionally considered semantics. They all deal with different aspects of meaning but, at the same time, all are closely linked to sentence structure.

Theta theory is concerned not only with the assignment of semantic roles to NPs around the predicate, but is also a structural requirement. Furthermore, it is related to Government, X’ theory, trace and PRO - syntactic notions. The Projection Principle is an overall requirement of the grammar to uphold at all levels the theta roles specified in the lexicon.

Binding theory - operating at LF - deals with aspects of meaning expressed by syntactic means. The referents of pronouns (him, her, he, I, etc.) and of anaphors (herself, each other, himself) in a particular sentence are determined by syntactic means, by sentence structure (by the structural distance between the referent and the pronoun or the anaphor).

The consequences of the interrelatedness of configurational and semantic notions in the grammar for aphasia research, is this: within a GB framework, certain explanations, like an explanation of comprehension impairment in terms of mapping between the
syntactic and semantic component (Saffran et al 1980), is theoretically unmotivated. Within the Standard Theory, one could argue that the syntactic processing of the patient is unimpaired, and only the output of the syntactic processor cannot be semantically interpreted. This is not possible in a GB framework.

2.6.2 The modules of Universal Grammar

Within GB theory there are other ways in which a selective impairment (such as agrammatism) can be characterized. GB theory is modular in structure. Therefore, in principle, any of the modules could be impaired independently of the others. Rizzi (1985) suggested characterizing the impaired and retained elements in agrammatism in terms of the thematic module. According to this hypothesis, only those vocabulary elements that participate in the thematic module are retained, the remainder are impaired (more about Rizzi's hypothesis will be presented in Chapter 5). Grodzinsky (1984, etc.) put forward the hypothesis that non lexical categories including traces are deleted from the s-structure representation of the agrammatics' sentences (Grodzinsky's hypothesis will feature throughout the remainder of this thesis). The present work takes the modular hypothesis seriously and looks for ways for testing it empirically. In related work, Ouhalla (1991) tries to account for the 'word order' problem in
agrammatism by arguing that a deficit affecting functional categories (non-major category vocabulary elements) has wide-ranging consequences for identifying the Agent and the Theme in reversible active and passive sentences.

2.6.3 The parametric variation of Universal Grammar

In addition to arguments presented previously in this Chapter, there is a further reason why Chomsky's linguistic theory provides an interesting theoretical framework for thinking about aphasia. The theory concerns the internalized linguistic knowledge of human beings, speakers of any language. This is Universal Grammar (UG), and the above description of the grammar is assumed to be correct for all languages. Children do not need to learn the principles of UG from experience; they come to the world already equipped with them and are therefore capable of learning any language. However, although particular languages are similar in matters of general principles, they are also dissimilar in many respects (and not only in their vocabulary). In order to account for the dissimilarities, UG comes equipped with a limited number of parameters that have to be switched in order to be compatible with a particular language. A much quoted example is the pro drop parameter. In English, all sentences must have subjects, but in Spanish and Italian subjectless sentences are acceptable. Spanish and Italian are thus pro drop languages. The
presence/absence of subjects in UG remains open for parametric variation and children must learn from experience whether their language is of the English or the Spanish/Italian type and switch the parameter accordingly (see Section 2.5.7). Another well known parameter is the head first parameter that is concerned with the order of the head and its complement: in English, the head is first and the complement follows (the lecturer of English and not *of English the lecturer), in Japanese, however, the order is reversed. It needs to be emphasized that the parameters are not item specific: switching the pro drop or the head first parameter in a certain way has additional consequences within the grammar. Thus GB theory, or rather, Principles and Parameters, has a framework of parameters for theorizing about differences among languages.

It is possible, in principle, that some form of aphasic disorder could be selective along the UG and parametric variation demarcation line. It could take the form of a patient with preserved UG principles, but those aspects of language that are subject to parametric variation would be impaired. For example, it is conceivable (just) that a Spanish aphasic could lose the ability to use subjectless sentences. This possibility needs to be kept in mind, especially, when crosslinguistic studies are carried out. The question can be asked: are one or more of the principles of UG impaired, or is it that some (or all) of the parameters become wrongly 'switched' as a consequence of brain damage?
2.6.4 Core grammar or periphery

There is still another distinction in linguistic theory between the *core* and *periphery*. The core is UG and the parametric variations; the periphery constitutes the individual features of any particular language and those irregularities that core grammar cannot account for. For example, idiosyncratic prepositions, irregular verbs, idioms etc. This is not a well worked out area in GB theory and it is unclear which features of the language belong here. From the perspective of UG it might seem an insignificant part of the grammar, although important for the second language learner and, perhaps, for the agrammatic whose deficit might affect this portion of the grammar: the identity and use of inflections, prepositions and other grammatical markers. There may be nothing wrong with UG and its parametric variation in agrammatism; rather, only certain peripheral features of the individual language are affected.

In order to make use of these ideas, the boundaries between what belongs to the parametrized version of UG and what is an idiosyncratic feature of an individual language needs to be further explored.

In recent years there has been an upsurge of interest in crosslinguistic studies of agrammatism; some of these studies yielded new insights that could not have been obtained on the sole basis of English language studies.
The study of Grodzinsky (1984a) for example, altered the distinction between agrammatism and paragrammatism (see Section 1.3) by considering the attributes of Hebrew language. Agrammatic patients are said to omit bound grammatical morphemes and pronounce instead bare stems (= agrammatism). Grodzinsky (1984a) pointed out, however, that the omission hypothesis cannot be universally true, as in Hebrew this is not a possible way to err. The Hebrew stem consists of three consonants that are unpronounceable unless inflected. The inflections are a complex combination of affixes, suffixes and infixes; the latter are the vowels that make pronunciation possible. Grodzinsky argued that if agrammatic patients were indeed omitting inflections, the Hebrew speaking agrammatic would be completely speechless. However, this is not the case: Hebrew speaking agrammatics are not speechless, they do not omit inflections, but they often use them wrongly. Substitution of inflections (traditionally called paragrammatism) is a better way of describing the agrammatics' way of dealing with the problem. This substituting behaviour is also characteristic of Italian speaking aphasics. In Italian, the uninflected stem is phonologically pronounceable but it is a nonword and agrammatics do not usually use non words in their output.

The upshot is that the differences observed among languages have led to some important observations and new generalizations. Even if English speaking aphasics tend to omit bound grammatical morphemes, the correct generalization is that agrammatics will wrongly use bound
grammatical morphemes. They will omit bound grammatical morphemes only if the omission does not result in a nonword; otherwise, they will make substitution errors. The traditional division between agrammatism and paragrammatism, thus, might not be as criterial as had been assumed.

This is a significant generalization that could be obtained only from crosslinguistic studies. The ultimate question when a crosslinguistic study is carried out is, which level of the grammar is being tapped: is it UG with its parametric variation or is it the idiosyncratic features of an individual language (the periphery of language). If the answer is the latter, this suggests that the agrammatic impairment is on this level and not on the level of UG that would predict a more widespread and more serious deficit.

The present study is crosslinguistic and has been carried out with these questions in mind.
CHAPTER 3

MODERN THEORIES OF AGRAMMATISM

3.1 Introduction

In Chapter 1 the introduction of the term agrammatism and its early history was described. Already, then, agrammatism aroused much controversy and subsequently provoked a flurry of interesting ideas. Similarly, in the last twenty years, among all the aphasic syndromes, agrammatism has been the most favoured research topic. The main reason is that the cluster of impairments and preserved linguistic abilities in this syndrome appears to cut along theoretically significant lines and can therefore be exploited for learning about the components of normal language. This is the shared assumption of most of the studies reported in this section. They are all very different from studies conducted within the framework of the 'economy of effort' hypothesis discussed in Chapter 1, which assumed that the phenomenon of agrammatic speech is not the disorder per se but rather a response to it. Another possible approach to aphasia claims that, as a result of the lesion, there is a reorganization of brain functions, and therefore,
agrammatism cannot teach us anything about normal language processing.

Both these attitudes are rejected by psycholinguists and cognitive neuropsychologists who explore the agrammatic phenomenon because of its implications for normal language processing. Agrammatism is seen as a window through which one can observe the language processor in a manner which is impossible with normal subjects. These patients’ particular difficulty with grammatical morphemes but a relatively well preserved content word vocabulary suggests the presence of an interesting dissociation between some well defined components of the grammar: between syntax and semantics, or between the lexicon and syntax, or between morphology and content word vocabulary.

The major theoretical positions of the last 20 years of aphasia research will be reported here. All are attempts to describe and explain agrammatism either in linguistic or in language processing terms. One important research question has concerned the level of the grammar that is effected in agrammatism: semantic? syntactic? morphological? phonological? or what? The relationship between comprehension and production abilities has been another much disputed issue. Finally, the question of whether agrammatism per se is a theoretically justified category has been discussed.
Perhaps arbitrarily, this account of modern studies and theories starts in 1972 with the publication of Zurif Carammazza and Meyerson's study of the metalinguistic abilities of agrammatic patients. Subsequently, a number of theories have been put forward to account for agrammatism. A decade later, the papers published in the book on Agrammatism (edited by Kean, 1985) are already an indication of the end of an optimistic era of research. A number of papers in this book, instead of putting forward new hypotheses, or consolidating old ones, are critical of or sceptical about previous ones. Subsequent work up to the present day has often been of this kind. The positive aspect of this less bold research is that more empirical data are being collected and, therefore, new theories should be better informed.

Before discussing the studies themselves, it should be pointed out that many of them use linguistic terminology too loosely and pretheoretically. Other, mostly later work employs the precise theoretical language of GB, but the theory itself is not, or is only partially, exploited. Only the work of Grodzinsky is based entirely on GB theory and even he needs an auxiliary device, a cognitive strategy, to supplement his explanation.

The principal deficit in agrammatism is the omission of grammatical morphemes. Although this appears to be a
well defined diagnostic criterion, there have been many different attempts to generalize over the presumed deficit: the 'small words' of the lexicon are affected; non-referential elements; non-content words; structure providing elements. Perhaps this is not surprising, because the category of grammatical morphemes is mixed. It includes free standing and bound morphemes, prepositions, articles, pronouns, inflections, connectives, complementizers, question words and some adverbials.

3.2 A phonological theory

Kean (1977, 1979, 1980) argued that only within phonology do grammatical morphemes constitute a homogeneous category; the deficit in agrammatism is therefore best located at the phonological level of the grammar. The unifying feature of all grammatical morphemes, both free and bound, is that being non-phonological clitics they do not receive primary stress. This is the reason why they are not perceived and not produced by agrammatics. Kean's theory thus makes a generalization about the presumed missing elements in agrammatism in phonological terms. All and only those elements that do not receive primary stress are implicated in agrammatism. Kean's theory is parallelistic, suggesting that the deficit is apparent both in production and in comprehension.
According to Kean’s theory, the reason for the comprehension failure in passive sentences, for example, is that the passive morphology of the verb and the by of the passive by phrase are unstressed and therefore not perceived.

Kean’s theory has been criticized on a number of grounds (Kolk, 1978). One is that the comprehension failure is not restricted to sentences that contain grammatical morphemes. Object relatives without a relative pronoun (the cat the dog chased was black) are (at least) as difficult as object relatives that do contain a relative pronoun (the cat that the dog chased was black). Another objection concerns derivational morphology. Some derivational morphology (happy -> happily, happiness) is phonologically similar to inflectional morphology (play -> played, plays), and therefore, is expected to be impaired. This is said not to be the case. Perhaps, the strongest argument against Kean’s theory comes from a language like Hebrew where verb inflections are not simply attached to the end of the verb stem, but actually alter the phonological form of the whole verb. In a language like this one cannot neatly distinguish between phonological words and non-stressed non-phonological clitics.
3.3 A lexical access theory

Bradley, Garrett and Zurif (1980) attempted to explain the grammatical morpheme deficit by distinguishing between open and closed class vocabulary elements. Open class words include major lexical items like nouns, verbs and adjectives. Closed class words are the function words, a limited and fixed group of vocabulary elements, relatively immune to language change and growth.

Bradley (1978) found that in a lexical decision task, normal subjects accessed closed class words differently from open class words. Latencies for open class words, but not for closed class words, were correlated with frequency. Bradley et al. (1980) applied the same test to Broca's aphasics and did not find this difference in frequency effects. They found that for Broca's aphasics reaction time latencies increased when a word was less frequent both for open and closed class items. This suggested to the authors that Broca's aphasics lack a 'device' normals have for processing function words efficiently. This theory did not claim that function words are not available at all for Broca's aphasics; it only claimed that access to them was not normal. The theory is parallelistic. It assumes that the omission of grammatical morphemes in output will be echoed in an input task like lexical decision. Bradley et al.'s theory has been rejected mainly because the results of the
original experiment could not be replicated (Gordon and Caramazza 1982, Segui, Mehler, Frauenfelder and Morton 1982).

3.4 A syntactic theory

The first modern study which indicated that agrammatism could be characterized in syntactic terms was Zurif, Caramazza and Meyerson (1972).

The study used a method developed by Levelt (1970), a psycholinguist studying language processing in normal subjects, in which he asked subjects for their linguistic intuitions about which parts of sentences ‘went together’. Zurif et al asked aphasic patients (Broca’s and Wernicke’s aphasics) about their linguistic intuitions concerning the constituent structure of sentences. The task was based on Chomsky’s theory of phrase structure (1965) and the research question was whether or not aphasic patients retained normal intuitions about the phrase structure of sentences. The question and the task were very much in the spirit of the linguistic theory. The experiment itself was complex and is described in detail in chapter 5.

The results indicated that the syntactic intuitions of agrammatic patients were not normal and reflected their difficulties with grammatical morphemes in their speech. Often the grammatical morphemes were not used by the
agrammatic patients to create a phrase. For example, in a sentence like *The dog chased the cat* the article *the* would not be integrated with the noun *dog* to create an NP, *the dog*. Instead the agrammatics would be just as likely to group together the words *dog* and *chased*. Following this experiment, 'syntactic deficit' became part of theoretical discourse about agrammatism.

In an attempt to explain why some grammatical morphemes were better integrated within a phrase than others, Zurif et al resorted to an explanation in terms of informational value and meaningfulness. A grammatical morpheme, like *my* in *my shoes* is better preserved than *the*, because more 'meaning' is attached to the possessive pronoun than to the definite article.

This early study thus already shows the prevailing tendency in subsequent research on agrammatism to use linguistic theory to some extent in the explanation and then complement it with various auxiliary devices like meaningfulness, pragmatics, knowledge of the world and cognitive strategies.

The first modern study of comprehension in agrammatic patients was Caramazza and Zurif (1976). This study established that agrammatism is not only a production but also a comprehension deficit.
The experimenters used a picture pointing method in which the patients listened to a sentence and looked at two pictures, one of which correctly described the sentence. Along with the target picture there were different foils. In the crucial condition the foil depicted reversed thematic roles. There were also various lexical foils.

The test sentences were reversible center embedded relative clauses (a), contrasted with irreversible (b) and improbable sentences (c) of the same structure. The control sentences were simple active sentences (d).

a. The cow that the monkey is scaring is yellow.
b. The apple that the boy is eating is red.
c. The horse that the girl is kicking is brown.
d. The girl is kicking the green ball.

These test sentences directly reflected the hypotheses of the researchers. In order to comprehend reversible center embedded relative clauses (object relatives), syntactic parsing is required, and this was expected to be impaired in Broca's aphasic patients. The other sentences could be comprehended by relying on pragmatic knowledge, on heuristics. One does not need to parse syntactically sentence (b) above in order to know that boys eat apples and apples do not eat boys. Agrammatic patients were therefore not expected to make errors on these sentences. The results of the experiment supported the predictions.
Today this study has mainly historical value, although it has been criticised quite recently (Grodzinsky and Marek 1988). The truth, however, is that this study has generated research for almost a decade and everyone has learnt from its weaknesses. It should be pointed out, however, that, due to the design of the experiment, there were only a few responses that provided direct evidence for asyntactic comprehension. There were in the experiment 8 reversible relative clauses (a), out of which only 2 sentences were presented with foils depicting reversed thematic roles. The rest of the reversible relative clauses were presented with various lexical distractors. As five Broca's aphasics participated in the study, there were only 10 responses which could demonstrate that Broca's aphasics had asyntactic comprehension. Nevertheless, the researchers concluded that Broca's aphasia is not merely an output deficit but a central syntactic deficit which affects both output and comprehension.

The conclusions of the paper were exaggerated, as is well known today. It was claimed that, for Broca's aphasics, the ability to parse sentences syntactically has been lost and that comprehension is achieved only by using lexical knowledge and heuristics, including knowledge of the world. The generalization from the failure to comprehend object relatives to failure to comprehend all syntactic forms is unjustified and it cannot be taken as
evidence for a complete failure of the syntactic processor that is responsible for the syntactic side of both speech production and comprehension. Furthermore, Caramazza and Zurif made an explicit link between the comprehension deficit and the agrammatic speech of the patients and thus laid the foundation for the notion of parallelism. How production and comprehension are related, however, was not explained.

3.5 The strong and weak formulation of the parallelistic position

Parallelism is usually taken to mean that there is a single underlying deficit which is responsible for impairments in both production and comprehension. For agrammatics the assumption would be that an underlying syntactic deficit explains both the failure to produce grammatical morphemes in speech and the failure to comprehend grammatical morphemes in sentences. The position that grammatical morphemes which are omitted in speech will be unavailable for syntactic analysis in comprehension too is the strictest formulation of parallelism. Kean's phonological theory, and the lexical theory of Bradley explicitly subscribe to this position. In some of their earlier papers Caramazza and Zurif claim that

the Broca's tacit knowledge of his language is limited in precisely the same manner as is his production (Caramazza and Zurif 1976 p.574).
Increasingly, however, it appeared that the presence of grammatical morphemes is not the only cause of comprehension failure.

For example, in a study conducted by Goodglass, Blumstein, Gleason, Hyde, Green and Statlender (1979) patients were presented with two types of sentences. One was a relative clause without a relative pronoun, *The man greeted by his wife was smoking a pipe*, and the other sentence type was an expanded version of the same message but in a syntactically simplified form, *The man was greeted by his wife and he was smoking a pipe*. The expanded version of the sentence proved to be easier for Broca's aphasics although it included an equal number of grammatical morphemes.

This experiment indicated that "factors other than (or in addition to) a failure to process the grammatical morphemes are involved in patients' difficulty with the center-embedded constructions" (Berndt and Caramazza, 1980, p. 246).

Schwartz, Saffran and Marin (1980) provides even better evidence against the strict formulation of the parallelistic position. This study was a sentence/picture matching experiment with reversible active and passive sentences. For the present argument about strict parallelism, the interesting finding is that
some agrammatic patients made reversal errors even in active sentences. As English active sentences do not necessarily contain grammatical morphemes at all, it seemed clear that grammatical morphemes are not the only cause of agrammatic comprehension.

These findings led to the acceptance of a weaker notion of parallelism, according to which agrammatic speakers have a comprehension deficit which is not "simply the result of poor parsing due to the failure to process function words" (Berndt and Caramazza, 1980 p.271). The two deficits were still conceptualized as related, but not in a simplistic, straightforward, mirror-like manner. The agrammatic deficit, both in speech and in comprehension, was now explained as the result of a disrupted syntactic parsing mechanism.

This weaker version of parallelism was held by Caramazza and his colleagues until 1985, capitalizing on the asyntactic speech of agrammatic patients and on their asyntactic comprehension. It was parsimonious to relate the two and to hypothesize that there is an underlying syntactic processor which is responsible both for syntactic speech and syntactic comprehension. The main criticism of this theory is that it is grossly under specified. The researchers gave only a vague notion of the form of a syntactic deficit and how it should be manifest in speech and comprehension.
3.6 Developments of syntactic theories

Within the framework of the syntactic explanation of agrammatism, a number of developments occurred. Other researchers deviated from the very general claims of Caramazza and his colleagues and tried to be more precise in defining the nature of the syntactic deficit.

Interestingly, from the early 80s until very recently, researchers were mainly interested in the comprehension abilities of the patients. This occurred despite the fact that agrammatism is defined on the basis of a special production deficit in the speech of the patients; it was, after all, the omission of grammatical morphemes in speech that generated the idea of a syntactic deficit in the first place. Nevertheless, it was thought that the notion of an overriding syntactic deficit could only be supported on the basis of a complementary comprehension impairment. Therefore, it was important to establish that a comprehension deficit indeed existed. Agrammatic speech, without a comprehension deficit, would suggest a more peripheral explanation in terms of phonology or morphology.

3.6.1 A syntactic/semantic theory

A comprehension study by Schwartz, Saffran and Marin (1980) included reversible active and passive sentences
and reversible prepositional sentences. The original purpose of the study was to test Kean's phonological hypothesis. According to Kean, active sentences are not expected to create comprehension problems as these sentences do not contain crucial non-phonological clitics (inflections or function words). The interpretation of passive sentences was predicted to be reversed by the patients because they would fail to perceive the passive morphology and the by of the passive by phrase. The results of the experiment did not support Kean's hypothesis and revealed a very fundamental deficit, prior to syntactic parsing. The authors concluded that

these agrammatic subjects have a syntactic mapping defect such that they are unable to utilize a fixed and principled set of procedures to recover relational structure of spoken sentences. Furthermore since this deficit emerges even with simple active declarative sentences manifesting the canonical S-V-O structure of English, it can not be explained by reference to phonological structure (p.261).

On the basis of this paper only, it is difficult to understand the intended interpretation. The notion of mapping is further explicated, however, in subsequent work (and has also changed its meaning a number of times).

In a companion paper to the above, Saffran, Schwartz and Marin (1980) tested the word order of agrammatic patients in a production task in which patients were asked to describe a picture of a simple event with two
participants. There were pictures with action relations containing two animate nouns (a), pictures with one animate and one inanimate noun (b), pictures with locative relations containing two inanimate nouns (c), and pictures with one animate noun and one inanimate noun (d).

(a) The girl runs to the man
(b) The girl runs to the house
(c) The pencil is in the sink
(d) The bird is in the sink.

It was found that agrammatic patients made word order errors when describing the pictures in which both NPs were similar in terms of animacy, the (a) and (c) sentences. For instance, they might have described the (a) picture by the sentence *The man runs to the girl*. For the (b) and (d) pictures animacy usually, but not always, determined which noun would be used first; at other times, the authors suggested, the more 'potent' or 'salient' participant in the picture was chosen as the first noun. The results, however, were not clear cut and could have been interpreted in different ways, as is shown by the critique of Caplan (1983).

Nevertheless, the authors concluded that for the agrammatic, animacy (and/or saliency) is a more important factor than agency in choosing the first NP of a sentence.

We are led, therefore, to propose a more radical hypothesis for the agrammatic deficit, in which
agrammatic speech is generated without underlying structures that represent logical relations. We assume that the agrammatic speaker is capable of representing the to-be-verbalized relations in some cognitive form. What he lacks are mediating linguistic structures that correspond to the arguments of the relation: both very abstract ones, like subject/predicate and even semantic categories, like agent/patient. Mapping into language occurs without benefit of such abstractions (p. 278).

As can be seen, in this earliest formulation of the mapping deficit, agrammatic patients' language is very seriously impaired. But in a later summary paper Saffran (1982) describes the mapping deficit differently. The claim is that "there is a problem in the semantic interpretation of the structural representation by the parsing process" (Saffran 1982 p. 325). The comprehension impairment is in mapping from the syntactic to the semantic, and in production from the semantic to the syntactic level. This is unlike the earlier formulation, where the deficit was said to be in mapping from the cognitive to the linguistic level.

An example can show that syntactic/semantic mapping is relatively easy in an active sentence and more complex in a passive sentence. The following active sentence

The boy kissed the girl

has a canonical S(subject)V(erb)O(object) word order, which is the predominant word order in neutral sentences in English. In other languages there can be a different
predominant word order, or word order can be free (or relatively so).

Subjects and objects are syntactic notions that have to be distinguished from the semantic notions of Agent and Theme. In a comprehension task the recovery of the semantic notions is required; we want to know who kissed whom; who is the Agent and who is the Theme. In order to comprehend the above sentence, some kind of mapping between the Subject and Agent and between the Object and Theme must occur. In an active sentence it needs to be recognized that the subject, the boy, is the Agent and the object, the girl, is the Theme. The mapping process is expected to be easy in active sentences where canonical word order is preserved. Mapping is more difficult in passive sentences like,

The boy was kissed by the girl

Here the subject of the sentence, the boy, is not the Agent, but the Theme. The Agent is expressed by the indirect object in the PP, by the girl.

This notion of mapping can explain why passive sentences are more difficult than active sentences, but it is not very good for explaining the word order problem in reversible active sentences. The comprehension problem in active sentences remains controversial, and in subsequent years the issue has been dropped.
The above formulation of the mapping deficit - between the syntactic and the semantic level - has been confirmed by a much quoted study of grammaticality judgements (Linebarger, Schwartz and Saffran, 1983). In this study agrammatic patients with asyntactic comprehension were asked to give grammaticality judgements on sentences that contained a variety of syntactic errors. Their very good ability to do so demonstrated, according to the authors, that syntactic parsing, when no interpretation (mapping between subjects/objects and Agents/Themes) was required, was intact.

In that paper, another possible interpretation of the data was suggested by the authors that there is "in agrammatism a tradeoff between syntactic and semantic processing, so that subjects achieve their optimal performance in one domain only by sacrificing accuracy in the other" (p. 388).

A third version of the mapping deficit is related to verbs. It is well known that verbs are a difficult category for agrammatics. Verbs are often missing from their spontaneous speech, or appear in a nominalized form. Saffron and her colleagues, early in their inquiry (1980), noted the possibility that word order errors might be due to the difficulty of recovering the argument structure of a verb. Recovering the argument structure of a verb includes knowing the difference in meaning
between, for example, *give* and *receive*. The subject of *give* is an Agent (or Source) and its object is a Goal (the second object is the Theme), while the subject of *receive* is the Goal and the object is Theme and the indirect object is Source.

1. **GIVE**

   AGENT           GOAL           THEME
   John           gave           Mary a book

2. **RECEIVE**

   GOAL           THEME           SOURCE
   John           received       a book from Mary

This version of the mapping deficit explains word order errors in active sentences and it has been further explored in Byng (1988), and Jones (1982 and 1986). However, the verb mapping hypothesis is not so useful in explaining the very frequent discrepancy in performance between the comprehension of actives on the one hand and more complex sentences like passives and object relatives. There are many patients who do not have any comprehension problems with active sentences, while passives remain difficult for them. These patients are not likely to have a *verb mapping* deficit.

A *procedural mapping* deficit is explicated in Schwartz, Linebarger, Saffron and Pate (1987). In this study, patients were given the following types of sentences to judge for semantic plausibility.
a. The puppy dropped the little boy.
b. It was the little boy that the puppy dropped.
c. The puppy ran around excitedly and accidentally dropped the little boy onto the wet grass which upset Louise.

The results showed that agrammatic patients did not have problems with the simple active (a), or the 'padded' (c) sentences, but they made frequent errors with the object cleft sentences (b). The authors argued that in order to make plausibility judgements on the 'padded' sentences (c), a great deal of syntactic parsing is required, and therefore syntactic parsing is not necessarily impaired in agrammatism. The problem with the cleft sentence is different because this is a sentence-type in which one of the arguments of the verb (*the little boy*) has been moved from its original deep structure position. Thus the deep structure of (b) would have been *The puppy dropped the little boy* and in its surface structure there would be a trace left at the position of origin: *It was the little boy that the puppy dropped*. The authors claim that these sentences cause a mapping problem for agrammatic patients, as mapping (between subject and Agent and object and Theme) is not 'transparent'.

The main contribution of Saffran’s group of researchers is the drawing of a distinction between *syntactic parsing* and *mapping* between *grammatical functions* (subjects/objects) and *semantic roles* (Agents, Themes). They claim that syntactic parsing is unimpaired in
agrammatic patients, and thus, grammatical functions can be recovered. It is only mapping onto semantic roles which is problematic, especially in sentences where mapping is not transparent, in transformational sentences.

The plausibility of the hypothesis depends crucially on the reality of the mapping process. In GB theory grammatical functions - subjects/objects - although used informally, do not have a theoretical status as an independent level in the grammar. In a different theoretical framework, mapping between the semantic and the syntactic levels could be a possible stage of processing, but not in GB theory.

The problem is that Schwartz et al analyze passive and relative clause sentences with traces (a GB analysis) and so it is difficult to see where mapping takes place. In GB theory, in passives and other transformational sentences, the trace must be linked or coindexed with the moved element. This is a different process from mapping between different levels of representation.

In relation to parallelism between comprehension and production, in Saffran et al, 1980 and in Schwartz et al, 1980, the mapping disorder was said to be parallel. However, in Schwartz et al, 1987 this is rejected on empirical grounds:
"in view of the fact that the literature contains descriptions of agrammatic speakers who do not have comprehension deficits, it is not possible to conclude that agrammatism in speech is invariably associated with a procedural mapping deficit. Nor is the procedural mapping deficit invariably associated with the agrammatic speech pattern" (p. 107).

3.6.2 A linear strategy theory

David Caplan and his colleagues have conducted an extensive range of comprehension studies, testing the comprehension abilities of individual agrammatic patients and also of groups of unselected aphasics. Many sentence types have been studied. Furthermore, by using a puppet manipulation task (instead of a picture pointing task), they allowed their subjects to err in their own particular way; in picture pointing tasks it is the experimenter who predetermines the possible errors. Thus, these researchers have a very large database of empirical research upon which to construct their theories. The data, both in terms of subjects and sentence types, reveal a great deal of variability in comprehension ability among aphasics in general and Broca's aphasics in particular. As a result, although Caplan is not in favour of dismantling the category of agrammatism (see below, Caramazza and Brendt 1985), he has ceased to consider the comprehension deficit as a necessary part of the agrammatic syndrome.
The vast amount of material makes it difficult to review the work and to do justice to all its aspects. Only two typical case studies will be considered here; the group studies are overlooked.

Caplan and Futter (1986) describe and interpret the performance of SP, a mildly agrammatic patient on a variety of reversible sentences with one and two verbs. The authors were interested in the patient's ability to assign thematic roles.

Caplan and Futter arrived at the conclusion that the patient's responses were not the result of normal grammatical analysis, but rather revealed the interpretation of linear sequences of nouns according to a 'strategy'. Even sentences which were consistently interpreted correctly were not credited as normally comprehended, only that the output of the 'strategy' happened to correspond to the correct response. A few aspects of the syntactic structure of sentences were said to be preserved. This include the morphological marking of the passive, the preposition in passive sentences and the argument structure of verbs. Nouns and verbs, however, are represented as single lexical categories only, as the corresponding phrasal nodes are not created.

According to Caplan and Futter, sentences are interpreted by assigning the thematic role of Agent to the first
noun, the thematic role of Theme to the second noun and
the thematic role of Goal to the third noun (if the
argument structure of the verb allows a third noun, as in
dative sentences (The monkey gave the frog to the
elephant). Otherwise, in two verb sentences, the third
noun was interpreted as the Theme of the second verb,
while the Agent of this verb was either the first noun
or the second noun (The frog chased the monkey and bumped
the bear). This, then, is the linear 'strategy' which
involves going through a sentence word by word, assigning
thematic roles in a linear order.

Caplan and his colleagues usually use sentences with a
variety of structures and work out the way the strategy
is employed after the event (i.e., by searching for
recurring patterns in the data). They noted that SP
responded differently to different sentence types. There
were sentences that were perfectly well comprehended,
others with incorrect but consistent responses, and
sentences with random responses. The pattern of the
strategy is worked out on the basis of sentences with
consistent interpretations.

The claim is that the patient, having lost the
hierarchical organization of sentences, operates on the
basis of a primitive grammar which uses terms like first
noun, second noun etc. Sentences are represented as a
linear organization of individual lexical categories.
This is, of course, a speculation based on the assumptions introduced by the researchers themselves using notions like *first noun* and *second noun* in describing the sentence comprehension of SP.

In addition to the consistent errors of the patient that could be explained by the linear 'strategy', Caplan and Futter noticed that responses to certain sentences, like simple passives, object-subject relatives and cleft object sentences, did not follow the strategy; the patient responded to them randomly. There is no satisfactory explanation for this within the above framework. The problem is especially acute for passive sentences, in which a linear strategy should result in systematic reversal of thematic roles which does not happen. It seems that the passive morphology is registered, but no explanation is offered as to what effect this has on the process of comprehension.

In this paper Caplan and Futter are critical of Caramazza and Zurif (1976) and Saffran et al (1980). Caplan believes that these latter authors suggested wrongly that agrammatics have lost all syntactic abilities, although the database is too limited to make such sweeping claims.
3.6.3 A linguistic processing account

In Hilderbrant, Caplan and Evans (1987) a different picture emerges. In this paper, a patient (KG), who has better comprehension abilities than SP, was tested on a wide range of sentences. The sentences were chosen in close conjunction with GB theory, and in particular, Binding theory which deals with the coindexation of NPs, both overt NPs and empty ones such as traces and PRO (see Chapter 2, Section 2.5.8).

In a preliminary testing session this patient made errors in some sentences that contained empty categories, but not in others. KG made errors on dative passives, The monkey was given t to the elephant by the goat, and object relatives, The monkey that the elephant kicked t kissed the goat, while he performed well on passives, The monkey was kissed t by the elephant, cleft subjects, It was the monkey that t kicked the elephant, and cleft objects, It was the monkey that the elephant kicked t. Therefore, he seemed a good candidate for further testing. The aim of the research was to obtain a more complete linguistic description of the observed deficit and to see if the deficit was truly related to empty categories in certain sentence types.
All the sentences that were difficult for KG contained empty categories, but not all of the sentences containing empty categories were equally difficult, and some of them not at all. The simple passive, for example, created no difficulties. The authors considered in detail the pattern of impairment and preservation in this patient and came to the conclusion that it is impossible to isolate a single cause for failing to assign thematic roles in a normal fashion. The coindexation of the trace with the moved NP is difficult, but only in the context of some additional complexity in the sentence. For example, KG scored 9/12 on a sentence type like, *Patrick was believed by Joe to be dancing*, but 4/12 in a sentence with a similar structure but a reflexive added at the end, *Patrick was believed by Joe to have kicked himself*.

Hildebrandt et al. considered the workings of the Berwick and Weinberg parser, a parser constructed in accordance with GB theory and tried to show where and why KG's parser failed him. Theirs is a processing account that closely follows linguistic theory:

.....even if KG's deficit is solely due to processing limitations, the factors which make for processing complexity are specifically linguistic and include recognition of different types of empty categories (p 301).

It is extremely difficult to evaluate the work of these researchers, mainly because of the vast amount of data,
and the complexity of the sentences they use. The question that needs to be asked is whether their account is distinguishable from a 'theory' which merely proposes that more complex sentences are more difficult to comprehend. If trace and other empty categories are not by themselves causal for comprehension failure, how meaningful is it to say that they contribute to comprehension failure?

These are only questions and not criticisms. It is possible that this type of work will eventually contribute to further development of the linguistic parser, and a better understanding of the factors underlying sentence comprehension.

Caplan's view of agrammatism is not parallelistic. It has been already mentioned that, according to him, a comprehension deficit is not a necessary feature of the diagnosis of agrammatism. The reason for rejecting a parallelistic position is that in their extensive studies of comprehension abilities in aphasia, Caplan and his colleagues did not find a unique pattern of comprehension deficit characteristic of all agrammatic patients. On the contrary, a great deal of variability was found, more than sufficient to "preclude the possibility that a single functional disturbance underlies the syntactic-comprehension impairments in many individual patients with agrammatism" (Caplan and Hilderbrandt, 1988, p. 72).
Also, although agrammatic patients often do have a comprehension deficit, there have been reports in the literature of agrammatic speakers without a comprehension deficit; agrammatic output is thus functionally separable from a comprehension deficit (Miceli, Mazzucchi, Menn and Goodglass 1983, Nespoulous, Dordain, Perron, Ska, Bub, Caplan, Mehler and Lecours 1988 and Kolk, van Grunsven and Keyser 1985).

3.7 Grodzinsky's parallelistic theory

Among all the theories presented in this chapter, Grodinsky's work on agrammatism (1984b, 1986a, 1990) is the most closely related to current linguistic theory. In this introductory section, only the general aspects of Grodzinsky's theory will be described, mainly his attitude towards parallelism. His work on comprehension and on prepositions is fully discussed in later chapters of the thesis.

Grodzinsky presents a fully explicit parallelistic theory in syntactic terms. The advantage of his account is that he assumes minimum impairment, while still accounting for the observed deficits. In his account, the agrammatic representation of sentences is similar to normal sentence representations but incomplete. His approach, if correct, thus bring us nearest to the original aim of learning about normal language.
Grodzinsky's thesis does not postulate an impaired underlying syntactic processor that is responsible for both syntactic comprehension and agrammatical speech production. Rather, the claim is that both the production and the comprehension deficits are describable on one linguistic level, the syntactic (s-structure) level in GB theory.

According to Grodzinsky, in the agrammatic representation of s-structure, all the lexical terminal nodes are fully labelled, but the non-lexical terminal nodes (functional categories) are left unspecified. Traces, COMP, DET, INFL, PRO are unavailable for both output and input processing. This incomplete s-structure representation thus affects both the ability to produce grammatical utterances and the comprehension of certain types of sentences. The thesis says nothing about how and why this is so. It is not claimed that the transformational component (movement from d-structure to s-structure) is impaired, or that any of the nodes in the tree structure of a sentence are missing. The claim amounts only to saying that at s-structure, non-lexical terminal nodes are unidentifiable for the agrammatic. The parallelistic hypothesis amounts to the claim that both the production and the comprehension deficits occur at the same level (s-structure) and that the reason for both deficits lies in the unavailable identities of the non-lexical nodes.
What we are presented with is not a 'theory of agrammatism'. Grodzinsky's thesis does not attempt to offer an explanation but rather, a correct descriptive generalization that is motivated by GB theory on the one hand and data from agrammatic patients on the other.

The description accounts for the preservation of lexical categories (verbs, nouns and adjectives), for the impairment of bound and free grammatical markers (not including prepositions), and for the comprehension problem in sentences containing traces. Prepositions in GB theory are classified as a major lexical category; therefore, the preposition deficit needs an account separate from that given for other grammatical markers. This impairment is also dealt with by Grodzinsky on the level of s-structure representation.

Grodzinsky's parallelistic position underlies his whole theory. Traces (implicated in comprehension) and functional categories (implicated in production) are both defined as being non lexical categories. The same explanation is applicable to both deficits: that non lexical categories are unavailable for the agrammatic. This, however, is subject to the definition of what is lexical and what is non lexical.

In GB theory there are two definitions of what is lexical (Chomsky 1981, 1986b; Grodzinsky 1984b). Only according to one of those definitions are traces considered as non
lexical. Grodzinsky (1984b) pointed out that the definition of *what is lexical* is relevant to the question of parallelism. Comprehension and production deficits are parallel if function words, inflections, traces and other empty categories constitute a homogeneous group within linguistic theory in that all are non-lexical. A parallelistic position is not supported by the second definition of *what is lexical*, according to which function words and traces do not constitute a homogeneous group.

Grodzinsky (1990) in a short paragraph withdrew from his parallelistic position:

"Given that the characterization of the patterns in each modality cannot be collapsed, we are forced to claim that the deficits in production and comprehension are not parallel" (p. 107).

Grodzinsky did not justify or explain this change of mind. One can only presume that the reason concerns a preference for the second definition of *what is lexical*.

There is, however, a second reason why Grodzinsky's theory must be parallelistic. It has been claimed that specific terminal nodes are unspecified in the agrammatic's s-structure representation of sentences. Surely, any element that is absent from the agrammatic representation of s-structure cannot be available for either production or comprehension. That is exactly the argument Grodzinsky (1990) usually adopts. For example:
“In agrammatism, governed prepositions are deleted, all others are retained. This characterization apparently accounts for the deficit in both the production and comprehension of prepositions” (p. 61).
Grodzinsky (1990 p. 106) has put forward a non-parallelistic version of his theory according to which there is a separate s-structure representation underlying production and another separate s-structure representation underlying comprehension. This might account better for the empirical data available today (Miceli et al 1983; Kolk et al 1985; Nespoulous et al 1988), but it makes Grodzinsky’s own theory unrecognizable. It is also rather doubtful whether there is theoretical space within linguistic theory to accommodate two different s-structure representations.

At other times Grodzinsky (1986a etc, 1990) defends a parallelistic position in the face of much evidence to the contrary. Here Grodzinsky speculated that a patient without syntactic comprehension deficit is not ‘truly’ agrammatic, irrespective of the quality of his or her speech. It is possible that there is a ‘special quality’ to the speech output of those who are truly agrammatic and that these patients will necessarily present a comprehension deficit. This position is more in line with Grodzinsky’s theory as a whole, but it is circular.
The question is how to define this special quality of the speech of the true agrammatic.

After twenty years of research, the approach towards agrammatism is currently sceptical. There are two main positions. One position gives up on the hope that agrammatism can teach us anything about normal language processing and takes up a modern version of the economy of effort hypothesis (Heeschen 1985, Kolk et al 1985) whereby agrammatism in output is seen as a response to the disorder but not the disorder itself. The second position concerns fractioning the agrammatic category. This position claims that agrammatism does not 'constitute a natural kind category' (Caramazza 1984, Badecker and Caramazza 1985, Caramazza and Berndt 1985, Badecker and Caramazza 1986).

3.8 Modern versions of the economy of effort hypothesis

According to Kolk, van Grunsven and Keyser (1985), and Kolk and van Grunsven (1985) whose theory originates in Isserlin, 1922 (see chapter 1, Section 1.3), the omission of grammatical morphemes in agrammatism is not the deficit itself, but the manner in which the patient adapts to the deficit. The deficit is not loss of knowledge, but 'delay' in the processes that underlie sentence production. Furthermore, the adaptation is not
a necessary consequence of this 'delay'. The adaptation results from a decision (possibly unconscious) that the aphasic patient makes in order to make communication possible or at least easier. Otherwise, the patient's speech would be extremely slow as search continued for the items that are difficult to retrieve. Kolk et al formulated their theory to account for the performance of patients who were agrammatic in spontaneous speech but had good syntactic comprehension and good performance in specially designed production tasks such as 'Close' procedures. According to Kolk et al, these patients' performance could not be explained by a theory that implied loss of knowledge of linguistic structures.

Heeschen's (1985) position is very similar to Kolk et al's. His theory was formulated in reaction to the alleged polarity between Broca's and Wernicke's aphasia. This is another way of criticizing the theory of 'impairment of the syntactic processor', because the latter theory can only be correct if the comprehension of all agrammatic patients is similarly impaired and if these patients are sufficiently different from patients with Wernicke's aphasia.

3.8.1 The dichotomy between agrammatism and paragrammatism

Traditionally (see chapter 1), Broca's (motor) aphasia is associated with the omission of grammatical morphemes and
Wernicke’s (sensory) aphasia with their substitution. Kleist (1916) thus distinguished between agrammatism and paragrammatism. Agrammatism refers to the phenomenon of omission of grammatical morphemes and paragrammatism refers to wrongly using and substituting grammatical morphemes. Until not very long ago (Grodzinsky 1984a), the polarity between the phenomenon of agrammatism (omission) and paragrammatism (substitution) was firmly maintained. Grodzinsky, however, pointed out that the omission of bound grammatical morphemes (plural -s, third person -s, past tense -ed) is plausible only in a language like English, because inflections in English are added to words. This form of agrammatism is not a possible option, however, in languages, like Italian, where the inflections are added to stems that are not words. The situation is even more complex in Hebrew, where the stem is a sequence of consonants that are unpronounceable until they are inflected. If agrammatics omit grammatical morphemes, the Hebrew speaking agrammatic must be mute.

Today most researchers are aware that omissions and substitutions of grammatical morphemes can and do co-occur in one patient. This was noted already in Kleist’s time, but given the Wernickean theoretical framework of the period, the phenomenon could not be explained. The rejection of the distinction between paragrammatic and agrammatic patients, however, does not have to lead to a
rejection of the syntactic theory, or to a rejection of
the category of agrammatism. Grodzinsky's own work is a
demonstration that a syntactic theory can tolerate
certain similarities between Broca's and Wernicke's
aphasia.

This is not so, however, for researchers who are critical
in one way or another of syntactic theories. Goodglass
and Menn (1985) and Heeschen (1985), both oppose the
rigid, classical distinction between agrammatism and
paragrammatism in Broca's and Wernicke's aphasia
respectively. They deny that there is a significant deep
difference - that Broca's aphasia is a syntactic and
Wernicke's aphasia a semantic disorder - between the two
groups of patients.

3.8.2 A psychological theory of agrammatism

Heeschen (1985) put forward the avoidance hypothesis as
an explanation for the agrammatic phenomenon. According
to Heeschen, both Broca's and Wernicke's aphasics are
syntactically impaired in a yet undefined but similar
way. The difference between the two groups is how they
respond to the impairment. The difference concerns the
degree of their awareness of the deficit. Broca's
aphasics have a high level of specific awareness, i.e.
they do not only know that they have a language deficit,
they also know what is their particular weakness. The
Agrammatism of Broca's aphasics is the consequence of avoiding those elements of the sentence which they know to be difficult. This is why grammatical morphemes are omitted. The reason for the different output of Broca's and Wernicke's aphasics is that Broca's aphasics are aware of their handicaps and Wernicke's aphasics are not. Broca's aphasics are often depressed in contrast to Wernicke-type patients who indeed may be slightly manic. In Heeschen's account, depression thus becomes an explanatory feature for a particular linguistic output.

Heeschen's interpretation of the comprehension deficit of agrammatic patients brings back the notion of pragmatics. The seemingly good comprehension of agrammatics was explained by the syntactic theory (Caramazza and Zurif 1976) as a resort to pragmatic and contextual cues to compensate for the lack of syntactic parsing. Heeschen maintains that passive sentences presented for comprehension out of context are difficult because the passive voice is unmotivated. Broca's aphasics have "a pathological interaction of syntax with pragmatics" (p.223) which means that they cannot deal with sentences that require syntactic processing (reversible sentences, pragmatically deviant sentences) without a motivating context. According to Heeschen, when the use of a passive sentence is contextually motivated, agrammatics have no problem in comprehending them.
Kolk and his colleagues and Heeschen reject the syntactic explanation of agrammatism; in fact they go to great lengths to avoid using in their accounts any terms that are remotely linguistic. Instead, psychological terms like *avoidance*, *adaptation*, *depression*, *decision*, *motivation* are used in the attempt to explain a linguistic deficit. It is difficult not to sympathise with their position, knowing that the subjects of our studies are human beings. The problem, however, is that this kind of approach closes the door on the interesting research questions about knowledge of language and language processing; the theories are furthermore difficult to test.

While Kolk et al and Heeschen reject the syntactic explanation of agrammatism, they do not reject the diagnostic category itself. Agrammatics respond differently to their impairments and thus constitute an identifiable diagnostic category. Other researchers responded otherwise to the findings of variability in agrammatism.

3.9 The case against parallelism

One of the first studies which questioned the parallelistic version of a syntactic deficit was the study of Linnebarger, Schwartz and Saffran (1983). In this experiment, patients were given grammatical and
ungrammatical sentences with various syntactic structures and were asked to indicate whether the sentences were correct or not. Most patients made correct judgements for most sentence types.

There were also comprehension studies which showed that some patients with the familiar agrammatic output had no (or very slight) syntactic comprehension problems (Miceli, Mazzucchi, Menn and Goodglass 1983; Kolk, van Grunsven and Keyser, 1985; Nespoulous et al 1988). These results seriously damaged the parallelistic syntactic theory. If patients can be found with agrammatic output but not agrammatic comprehension, this is an indication that agrammatic production is not functionally related to agrammatic comprehension: the two can be dissociated. The production impairment and the comprehension impairment are independent of each other.

These findings are damaging to a parallelistic syntactic theory, but they do not necessarily affect agrammatism as a syndrome or as a diagnostic category. It is still possible to go back to an earlier position and argue that agrammatism is only a production disorder, thus abandoning both the parallelistic position and the syntactic impairment explanation.
3.9.1 The case against agrammatism as a diagnostic category

An additional development in agrammatic research has been the documentation of the variability in the output of allegedly agrammatic patients.

Miceli, Mazzucchi, Menn and Goodglass (1983) presented two agrammatic patients without syntactic comprehension problems. One patient was non-fluent and a typical Broca's aphasic, and the second was relatively more fluent, but agrammatic. Both patients omitted grammatical morphemes and had problems with verbs. The first patient was mildly impaired in relation to the clitic pronoun system and other morphological markers but he used disjoint sequences of phrases, omitted main verbs and much of his output could not be reliably segmented into sentences. The second patient had a longer mean length of utterance (MLU) and, in general, his sentences were better structured than the first patient's sentences. On the other hand, his use of the Italian clitic pronoun system and of auxiliary verbs was very severely impaired (100% omissions).

The authors interpreted their results by claiming that Case 1 had a syntactic deficit and a mild morphological deficit. Case 2, on the other hand, was said to have an almost pure morphological deficit.
The major problem with the conclusions of this study is that the division into syntactic and morphological deficits is arbitrary. In order to make such a claim, we need a linguistic theory which distinguishes between syntactic and morphological phenomena. Miceli et al rightly point out that Chomsky's theory does not have a separate morphological level. The reason for this is that morphological markers are an integral part of the syntactic representation. It is difficult to envisage a sentence that is syntactically correct in which obligatory morphological markers are missing. For example, the agreement features of verbs assign Case to the subject noun. Although Case morphology in Case inflected languages is a 'morphological' phenomenon, sentences containing nouns without Case are syntactically unacceptable. It might be true that the earlier versions of Chomsky's theory did not pay enough attention to morphological phenomena but this is now being gradually corrected (Chomsky, 1986a, Borer, 1984; Ouhalla, 1991). The theory now assigns more importance to the contribution of the functional categories to syntactic structure. Functional categories, among them bound grammatical morphology, determine the grammaticality of sentences. More discussion of this issue can be found in chapter 6.
Another problem with distinguishing between a morphological and a syntactic disorder is that the dichotomy cuts across bound and unbound grammatical morphemes. Free standing grammatical morphemes are not part of morphology, which is the component of the grammar that deals with derivational and inflectional word formation. It is not clear what would be the status of free standing grammatical morphemes (e.g. prepositions) in such a scheme.

A study by Brendt (1989) of six Broca's aphasics similarly comes to the conclusion that Broca's aphasics are not a homogenous group of patients. She found that structural abnormalities and the omission of grammatical markers were not always found together in one patient. Further, an association was found between the impairment of syntactic comprehension and structural simplification, suggesting that the two may be functionally related.

In a subsequent paper, Miceli, Silveri, Romani and Caramazza (1989) tested the production of 20 so called agrammatic patients on a variety of 'spontaneous speech' tasks and analyzed the results in terms of fluency, utterance length, rate of speech, omission and substitution errors, both in general and in relation to a particular set of grammatical morphemes (like articles, prepositions, clitics and auxiliaries). The study also
looked at the subjects' use of verbs and their ability to observe agreement requirements.

Again the findings showed a great deal of variation among the patients on all the variables. The study, for example, shows that agrammatism is not necessarily associated with reduced fluency. Patients varied in relation to their omission and substitution rates of free and bound grammatical morphemes. No intelligible pattern could be found in the omission/substitution patterns of the various grammatical morphemes. Some patients displayed difficulties with some but not other morphemes, and other patients had a different pattern of problems. No consistent rank order of difficulty could be found. Another interesting finding was a dissociation in individual patients between difficulties with free and bound grammatical morphemes.

These findings further emphasized the problems brought out in the previous study (Miceli et al, 1983) that documented variability in agrammatism. They support the notion that agrammatism does not "constitute(s) 'a natural kind' category representing those patients with deficit to a single, well defined component of the language processing system" (p.474). This position is forcefully argued in Caramazza, 1984, Badecker and Caramazza, 1985, Caramazza and Berndt, 1985, Badecker and Caramazza, 1986, and in many other papers. The claim is
that agrammatism as a clinical category is not a well defined syndrome and therefore the language data of these patients as a group cannot be used for testing models of normal language processing. Instead, single case studies should be employed in an effort to isolate the units that participate in language processing.

One cannot but sympathise with arguments that call for more precision, for better definitions, and more careful characterizations of classification criteria. The question is whether this requires us to give up the category of agrammatism altogether or rather to try to improve the practice of patient selection. Caramazza and his colleagues obviously think that the notion of agrammatism is bankrupt from the point of view of psycholinguistic research. Caplan has a different point of view (Caplan 1986). According to Caplan, agrammatism is a production deficit in which (primarily) grammatical morphemes are affected. This impairment is not an arbitrary deficit but is motivated both by linguistic and psycholinguistic theory. Grammatical morphemes can be characterized in phonological (Kean, 1977, 1979, 1980), morphological (Lapointe 1983) and syntactic (Grodzinsky 1984b, 1990; Rizzi 1985) terms. Furthermore, Garrett (1984) was able to show that in a normal language processing model, grammatical morphemes are accessed and operated on at the 'positional level' and this is the
point at which agrammatic sentence processing breaks down.

Caplan feels that it is important to explore the meaning and implications of the high level dissociation between the content word and the function word vocabulary and therefore that it is worthwhile to keep the syndrome of agrammatism intact. Caramazza and his colleagues, on the other hand, concentrate on documenting the variation among patients. In so doing the level of homogeneity expected from a unified syndrome disappears. One is faced with a great deal of detail and many dissociations that are not understood and cannot be accounted for.
CHAPTER FOUR

THE COMPREHENSION OF REVERSIBLE SENTENCES

4.1 Introduction

The question whether agrammatic Broca's aphasia is only a production deficit or whether it is also necessarily accompanied by a parallel comprehension deficit has been a controversial issue. An obvious reason for this controversy is that many Broca's aphasics appear to have good comprehension. There are other reasons too, however. At the beginning of the century, the Wernicke-Lichtheim model (see chapter 1) and its underlying anatomical substrate could not conceptualize any form of comprehension deficit after lesion to the motor (Broca's) area. Modern studies on aphasia are not constrained by this model and the syntactic comprehension ability of agrammatic patients has been subject to considerable research activity, as described in chapter 3.

The first modern comprehension studies were conducted at the beginning of the 70s. These first attempts to demonstrate a special form of comprehension deficit associated with Broca's aphasia were unsuccessful insofar as the results did not distinguish between Broca's and Wernicke's aphasics (Parisi and Pizzamiglio 1970, Shewan and Canter 1971). Wernicke's aphasics have well
documented comprehension deficits and unless it can be shown that the comprehension deficit of Broca's aphasics is of a different kind - syntactic and not lexical/semantic - the whole research project will have missed the point (Goodglass and Menn 1985). The above studies were not well designed in order to demonstrate a syntactic comprehension deficit, as many items in the experiments could be interpreted on the basis of lexical knowledge, or/and the knowledge of the world.

In order to resolve this problem, reversible sentences of the following types have been used to test the syntactic comprehension of agrammatic patients:

a. The boy kissed the girl. (active)
b. The girl was kissed by the boy. (passive)
c. It was the boy who kissed the girl. (subject cleft)
d. It was the girl that the boy kissed. (object cleft)
e. The boy that kissed the girl is tall. (subject relative)
f. The girl that the boy kissed is tall. (object relative)

Such sentences cannot be interpreted solely by relying on lexical or on pragmatic knowledge, or on the knowledge of the world. In order to interpret these sentences syntactic processing is required.

4.2 The source of the comprehension problem - various theories

Throughout the decade a number of hypotheses have been put forward in explanation of the response pattern of Broca's aphasics in comprehension tasks:
1. The crucial factor determining whether a sentence will be understood or not, is 'complexity'. Agrammatic patients will make more errors on more complex sentences. (Goodglass and Menn 1985). But the problem, of course, is how to give a meaningful definition of complexity.

2. Broca’s aphasics are unable to carry out syntactic parsing (Caramazza and Zurif 1976).

3. They are able to carry out syntactic parsing but they cannot exploit the output of syntactic parsing for semantic interpretation (Linebarger, Schwartz and Saffran 1983).

4. They cannot assign hierarchical structure to sentences. Instead of interpreting sentences hierarchically, they rely on the linear arrangement of lexical items and assign an Agent role to the sentence initial noun (Caplan and Futter 1986).

5. Their sentence representation lacks traces and therefore the semantic role of the NP whose interpretation is dependent on coindexation with its trace remains uninterpretable (Grodzinsky, in various papers since 1984).

6. A version of the above: traces are present at s-structure representation, but the coindexation between two distant elements in the sentence is problematic (Grodzinsky in various papers). This hypothesis has different predictions from the previous one and the
differences between the two versions and their significance is discussed later.

7. Traces are problematic but they are not the only causal factor in the comprehension failure. The presence of a trace in addition to other factors creates the problem. Simple passives, despite their trace can be well comprehended (Hildebrandt, Caplan and Evans 1987). Traces make sentence comprehension more difficult but not impossible (Schwartz, Linebarger, Saffran and Pate 1987).

This chapter concentrates on hypotheses (5) and (6) and to a lesser degree on (4).

4.2.1 Traces in the comprehension of sentences by agrammatic patients

In the aphasia literature the first mention of trace as a factor in the comprehension of passive and relative clause sentences was in the doctoral thesis of Grodzinsky (1984b). Today, 'trace' is part of the vocabulary of comprehension research in aphasia.

It is well established that sentences with optional transformations are more difficult to understand than basic active sentences. Passives and relative clauses which are the results of transformations were thus considered as more difficult to process in earlier formulations of transformational grammar (Chomsky 1957, 1965). In the past, transformations were considered to take up real processing time. As has been shown in
chapter 2, GB is very different from the earlier versions of Chomsky's theory and, in particular, the transformational component is much simplified. One of the consequences of the changes in linguistic theory is that psycholinguists no longer focus on the transformation process when trying to explain why certain sentences are more difficult than others. Instead they look at the representations that are the output of the transformation, Move alpha: the s-structure representation.

Because GB theory analyzes transformational sentences as containing traces, a number of researchers have singled out trace as the possible locus of the comprehension problem. This form of explanation cannot account for erroneous interpretation of active sentences as these do not contain traces.

4.2.2 Transformational sentences in GB theory

In GB theory, passives, relative clauses, cleft sentences, questions and other types of sentences are transformationally derived from basic d-structure representations by the application of Move alpha. In passives and in raising sentences (John seems ill today), there is NP movement; in questions, relative clauses and cleft sentences there is WH movement. NP and WH movements are somewhat different but are sufficiently similar to suggest that they have a similar effect on the comprehension of agrammatic aphasics.
4.2.3 The formation of passive in GB theory

Passive sentences are transformationally derived from a d-structure representation of the following form:

\[ \text{was kissed the girl (by the boy)} \]

It is assumed in GB theory that the passive verb preserves the subcategorization features (the argument structure or the theta grid) of the original active verb. Thus the verb \textit{kiss} has the following lexical entry:

\[ \text{kiss} \quad \text{V [ NP]} \]

Consequently the direct object NP \textit{the girl} cannot disappear from the representation, despite the morphological change on the verb from an active to a passive participle. This change has two effects:

1. The verb in its active form assigns an external theta role (the theta role of Agent in subject position, and it has the ability to assign objective Case to its direct object. However, in the passive, the passive participle (\textit{was kissed}) absorbs the external theta role of Agent and this can be transmitted optionally to the 'by' phrase. The result of this absorption is that the position of the subject remains empty and is available for another element to move into.
2. The second effect is that the passive participle loses its ability to assign Case. While the active verb kiss assigns Case to its direct object the girl, the passive participle is unable to do so; the girl cannot remain in a position where Case assignment is impossible, and must therefore move from its original post-verbal position to a position where it can receive Case. The NP moves into the pre-verbal position that is empty due to the absorption of the Agent theta role by the passive participle.

The motivation for the movement is the inability of the passive participle to assign Case. The movement is made possible by the absorption of the external thematic role of Agent that made the preverbal subject position vacant. The consequence of the movement is a trace left at the original position of the moved NP, the girl, to comply with the Projection Principle, and so we obtain the following s-structure representation:

\[S[NP the girl] [INFL was] [VP kissed t][PP by the boy]\]

The NP (the girl) receives Case from the INFL node, but retains its original theta role of Theme by remaining associated (linked in a Chain) with its trace. The trace is, therefore, instrumental in obtaining a semantic interpretation for this NP. Unless it is linked with the trace, we cannot tell what is its thematic role: is it an Agent or a Theme? The passive participle, was kissed,
lost its ability to assign Case to its object but retains the ability to assign a thematic role of Theme. This is assigned now to the trace and will be transmitted via the chain to the moved NP, the girl.

4.2.4 The psycholinguistics of passive sentences

Descriptively, passives are different from actives in:

a. verb morphology
b. the presence of the preposition by
c. deviation from canonical word order.
d. the presence of an empty category the 'trace'.

Any of these factors could, in principle, cause difficulty in comprehending passive sentences.

(a) and (b): By definition, agrammatic patients have difficulties in the production of both free and bound grammatical morphemes. It might be that this problem is not confined to production but is also manifested in comprehension. In that case, patients would have an impoverished representation of passive sentences, which would therefore appear to them as actives. Instead of perceiving

The girl was kissed by the boy.

they would perceive

girl kiss boy.

This would lead to a reversal of Agent and Theme. If the above explanation is true, agrammatic patients should consistently reverse the thematic roles of the NPs in
passive sentences. This is, however, not invariably the case. From what is known about the comprehension of passive sentences by agrammatic Broca's aphasics, they must often be sensitive to the marking of the passive, because they respond to passive sentences differently than to actives, i.e. they are not always incorrect but perform at chance level, rather than making consistent reversal errors.

c. The claim that in passive sentences there is a deviation from linear canonical word order is descriptively true, but is too vague to explain the difficulty with passive sentences (Caplan and Futter 1986). Trace (and the linguistic reasoning behind it) gives a principled formulation to 'deviation from canonical word order' and is a good candidate for the causal factor in the comprehension problems of agrammatic patients.

(d) Grodzinsky's presentation of the 'trace theory' is clear and therefore testable. Other researchers also acknowledged the role of the trace in creating comprehension problems, but Hilderbrandt, Caplan and Evans (1987) and Caplan and Hildebrandt (1988) claimed that according to their evidence, the presence of trace by itself is not sufficient to create a comprehension problem. Only when additional factors together with the trace are present, will there be a breakdown in comprehension. Schwartz et al (1987) argue that in
sentences containing a trace, thematic roles assignment is not direct, therefore not transparent and therefore more difficult. The difference between their position and Grodzinsky's position is that, according to Grodzinsky, sentences containing traces cannot be processed by an agrammatic whereas Caplan and Hildebrandt and Schwartz et al only claim that sentences containing traces are more difficult to process.

In the work of Grodzinsky (1984b, etc.) 'trace theory' has a very precise formulation. In his earlier work he proposed that the trace (together with other non lexical categories) is deleted from the s-structure representation of the agrammatic. A more favoured formulation in his more recent work is that the trace is not deleted but a link (chain) between the trace and the moved NP cannot be created. As a result, the thematic identity of the moved NP as a Theme cannot be established.

Despite the fact that by putting forward the 'trace theory' Grodzinsky's intention was to characterize a limited and well defined deficit, the 'trace deletion' claim has, in fact, unintended grave implications for the language abilities of the agrammatic patient. This has been pointed out by Sproat (1986) and recognized by Grodzinsky himself (1985). As is explained in Chapter 2, traces are required in the s-structure representation of transformational sentences in order to safeguard the Projection Principle. Thus, deletion of traces in the s-
structure representation of agrammatics would constitute a violation of the Projection Principle. This would constitute a major deficit for which there is no evidence in agrammatism. This is, probably, the reason why a second formulation of the hypothesis has been suggested according to which the Chain between the trace and the moved element cannot be created. This would imply either a processing deficit (Grodzinsky 1985), or a knowledge deficit of or part of Binding theory (Grodzinsky 1986b). According to Grodzinsky’s suggestion, all sentences containing trace should create a comprehension problem for the agrammatic patient. Conversely, sentences without traces (and without a need for coindexation) should cause no special difficulty.

4.3 Grodzinsky’s account of the comprehension of sentences containing traces by agrammatics

Below are listed three types of sentences all of which have traces in s-structure representation, (a) passive, (b) object relative and (c) object cleft.

a. The boy was hit \( t \) by the girl.  
b. The cat that the dog is chasing \( t \) is black.  
c. It was the cat that the dog chased \( t \).

Grodzinsky’s theory assumes that the first, pre-verbal NP is not assigned any thematic role by the grammar of the agrammatic. The reason is that these NPs have been moved from their original d-structure position where a trace has been left. The trace is, normally, linked with the moved NP and the original theta role of Theme is
transmitted from the trace to the moved NP through the chain. This does not happen in the sentence representation of the agrammatic and so the NP remains without a theta role assigned by the grammar. As such the moved NP is uninterpretable.

4.3.1 The Default Principle

This breakdown within the grammar is the point where Grodzinsky's Default Principle comes into operation. The Default Principle is a strategy which assigns a thematic role to an NP which has not been assigned a thematic role by the grammar. This principle is comparable to Bever's (1970) cognitive/perceptual strategy, and is based on the fact that the canonical word order in English active sentences is Agent Verb Theme. The Default Principle assigns an Agent role to the initial NP in all the above sentences. But a theta role of Agent has been assigned to the second NP too - by the grammar. In sentence (a) the girl is assigned Agent theta role by the preposition by, and in sentences (b) and (c) the dog is assigned Agent theta role by the verb.

If the Default Principle is in operation, assigning an Agent theta role to the first NP as well, the situation is that the agrammatic patient has two Agent roles in one sentence. He/she has no choice but to guess which noun to select for the Agent role. The consequence is the observed chance performance of agrammatics in interpreting passives and other types of sentences with traces.
4.3.2 Two parts of Grodzinsky's theory: the structural linguistic and the cognitive strategic

It is important to distinguish between two parts of Grodzinsky's account. First, there is the linguistic description of NP and WH movement and the role of the trace in the s-structure representation of sentences that have undergone NP or WH movement. This is the structural account based on GB linguistic theory that pinpoints the reason why the agrammatics' comprehension breaks down in passive, object relative and object cleft sentences. This part of the theory suggests that the agrammatics' grammar has no means of assigning a theta role to the moved NP.

The Default Principle is the second part of Grodzinsky's theory. This is needed to complement the causal structural explanation in the first part by indicating how an agrammatic attempts to remedy the linguistic deficit. The Default Principle is similar to the linear strategy put forward by Caplan and Futter (1986) in the way that it relies on the canonical order of active sentences in English. The difference is in the conditions under which this strategy is activated. According to Caplan and Futter (1986), the linear strategy is operative irrespective of the sentence structure to be comprehended. Agrammatics' responses to all types of reversible sentences emanate from the linear strategy. The consequence is that in all cases, a sentence initial NP is interpreted as the Agent.
In Grodzinsky's theory, the linguistic structural account lays down the conditions under which the strategy is called into action in agrammatism. Agrammatics are expected to comprehend active sentences normally according to grammatical principles. Even in passives, the NP in the by phrase is interpreted normally as the Agent. It is only when the first NP has to be linked with the trace and interpreted as the Theme that the grammar of the agrammatic breaks down, resulting in the first NP lacking any thematic role. It is only at this point that a cognitive strategy becomes necessary to supplement the linguistic deficit by assigning a second Agent role to the first NP in the sentence according to the linear strategy. By introducing the strategy together with the structural account, Grodzinsky is able to explain this curious phenomenon of agrammatics' chance performance on sentences with traces as being due to the presence of two conflicting Agents roles in the same sentence.

The structural account and the Default Principle together explain the observed behaviour of agrammatic patients, but they are conceptually separable: one can be right while the other is wrong. It is possible that the structural account is correct, but there is no strategy, or a different strategy. Or, it is possible that the structural account is wrong, or that patients do not process sentences by exploiting their structural properties.
4.3.3 How the Default Principle relates to linguistic processing

Grodzinsky assumes a modular syntactic parser that is inpenetrable to cognitive operations (Fodor 1982). Consequently, the cognitive strategy only comes into operation when the linguistic parser has completed its task. The strategy is 'aware' of which NP in a sentence does not have a thematic role, but it has no access to any linguistic principles. It is the lack of intercommunication between the linguistic module and the cognitive strategy which allows the cognitive strategy to assign the Agent role to the moved first NP, despite the fact that there is already a linguistically assigned Agent in the sentence (in the by phrase). The explanation is that only the linguistic system (and not the cognitive strategy) 'knows' the argument structure of a verb [kiss: Agent Theme], and the theta criterion according to which a verb can only have one Agent.

Because the linguistic system is claimed to be autonomous and encapsulated, the linguistic and cognitive systems can work side by side but not together. This creates an irrational and misleading situation. The cognitive strategy comes to help agrammatics and instead it leads them into the trap of dealing with a sentence in which there are two nouns with conflicting Agent roles, one allocated by the grammar and the other by the Default Principle. The need to select randomly between two Agents, based on the independent operation of linguistic
and cognitive modules, created a potentiality for confusion which Grodzinsky considers accounts for agrammatics' chance performance.

4.3.4 How the Default Principle operates

Grodzinsky tested the assignment of Agent role to the sentence initial NP by the Default Principle (1990) by presenting patients with the following types of sentences:

a. The book is covered by the newspaper.
b. The man is adored by the woman.

In sentence (a) the grammar assigns the following thematic roles

\[
\text{The book is covered } t \text{ by the newspaper}
\]

\[
\text{Theme Instrument}
\]

and in sentence (b)

\[
\text{The man is adored } t \text{ by the woman}
\]

\[
\text{Theme Experiencer}
\]

Because of the failure to make the link between the first NP and its trace, the grammar of the agrammatic patient cannot assign a thematic role to the book and to the man. The question is then what thematic roles the Default Principle would assign to these NPs. According to a linear strategy, the first preverbal NP should always be allocated an Agent theta role. In agentive passives, like The boy was kissed by the girl, this will result in two NPs with potential Agent roles. But sentences (a) and (b) above are different from agentives — because
there are no Agent theta roles in the argument structure of the verbs.

Grodzinsky argued that chance performance only occurs when the theta roles of the two NPs in a sentence are the same (two Agents, two Instruments, two Themes) or on the same hierarchical level. The Thematic Hierarchy Condition (see Section 2.4.4) is reproduced here for easy inspection:
1. Agent - the highest
2. Experiencer, Location, Source, Goal, Instrument
3. Theme - the lowest

When the first theta role is in a higher position than the second, reversal of theta roles would occur. The following sentence representation

\[ \text{The book is covered by the newspaper} \]
\[ \text{Agent} \hspace{1cm} \text{Instrument} \]

would result in a consistent reversal of theta roles because Agent is on a higher position in the hierarchy of thematic roles. Patients, however, responded at chance levels, indicating that they assigned the same thematic roles to both NPs (remembering that the newspaper is correctly assigned Instrument role by the grammar):

\[ \text{The book is covered by the newspaper} \]
\[ \text{Instrument} \hspace{1cm} \text{Instrument} \]

Thus, Grodzinsky deduced, in the case of non agentive sentences, no Agent theta role is assigned by the Default Principle.
In contrast to the non-agentive passives with inanimate NPs, passives with psychological verbs

\[
\text{The man is admired by the woman} \\
\text{Theme} \quad \text{Experiencer}
\]

yielded below chance results, i.e. patients consistently reversed the thematic roles of the NPs. These results are only possible if the first NP \textit{the man}, has a higher thematic role in the hierarchy of thematic roles than the second NP \textit{the woman}. This implies that the agrammatics' representation of the passive with a psychological verb is not

\[
\text{The man is admired by the woman} \\
\text{Experiencer} \quad \text{Experiencer}
\]

This representation, similarly to the passives with the agentive passives (kiss), would result in chance performance. The fact that the patients reversed the thematic roles implies that the representation of the sentence is the following

\[
\text{The man is admired by the woman} \\
\text{Agent} \quad \text{Experiencer}
\]

From these two sets of results Grodzinsky concluded that the Default principle, being a cognitive strategy, operates on the basis of knowledge acquired through experience and is, as argued earlier, 'divorced from linguistic knowledge'. In sentences with verbs requiring animate nouns (agentive verbs and psychological verbs), patients assign an Agent role to the first NP. In
sentences with inanimate NPs, however, no Agent role is assigned because assigning the role of an Agent to an inanimate noun is nonsensical to the cognitive system which operates the strategy.

4.3.5 A critique of the Default Principle

Two problems in relation to the Default Principle need to be raised, one general and one particular. First the general problem.

It is difficult to assess the workings of a cognitive strategy which is required to supplement syntactic processing. The problem is how to define the limits of syntactic processing itself. Caramazza and Zurif (1976), Saffran, Schwartz and Marin (1980) and Caplan and Futter (1986) all assumed that, since their subjects had lost all syntactic processing abilities, their responses had to be strategic, depending on psychological factors like knowledge of the world, animacy/potency, linear word order. Unfortunately, without conclusive evidence that no syntactic processing takes place, these cognitive strategies are ad hoc explanations.

The particular problem is concerned with the question whether a cognitive strategy can be so misleading as to suggest that there are two Agents in a situation involving chasing and cat and dog, like in the sentence: The dog is being chased by the cat. Even if the language
system is encapsulated and therefore the cognitive strategy is unaware of the argument structure of the verb chase.

\[
\text{chase} \quad [\text{V} \quad \text{NP}]
\]
\[
\text{Agent} \quad \text{Theme}
\]

other aspects of the situation are available to the cognitive system: there are two pictures in front of the patient; in one picture, the dog is chasing the cat and in the second picture, the cat is chasing the dog. The patient listens to the sentence:

The dog is being chased by the cat.

The task is to point to the right picture. We know, (according to Grodzinsky) that the linguistic parser obtained a correct interpretation of Agent for the cat and, that the dog is uninterpretable by the linguistic parser. This knowledge - the output of the syntactic parser - is available to the cognitive strategy. It seems unlikely that it would be so blind to the situation described in the pictures that it would interpret the dog too as the Agent. This is especially so when, as seen above, by Grodzinsky's own evidence, the cognitive strategy is able to make some sophisticated decisions, such as not to assign an Agent role to an inanimate noun. Information about the argument structure of the verb is indeed linguistic information, but behind the linguistic knowledge there is knowledge about the world and thematic roles do relate to events in the
world. In this context, the world is the set of pictures in front of the patient.

Perhaps it is not too bizarre to imagine a chasing situation with both the cat and the dog chasing another body. This picture could be added to the foils of a standard comprehension test of passives. For example, accompanying a sentence, the boy is being chased by the girl, the patients could be shown three pictures; in one picture, the girl is chasing the boy, in the second picture, the boy is chasing the girl and in the third picture, the boy and the girl together chase something else.

Would patients choose the third foil, instead of guessing between the correct picture and its reverse. A task of this kind could test the workings of the strategy, as patients would be given the opportunity to solve the dilemma of two Agents, instead of reverting to guessing.

Frazier and Friederici (1991) report precisely this kind of study, - although for a different purpose and using active sentences - in which the patients were asked to interpret sentences - by choosing the right picture - of the following type:

The men take photographs of the boys.
The men and the boys take photographs.

Broca's aphasics made no errors in this task.

Cognitive strategies are useful and successful, because they are so versatile and evasive. Change the situation
only slightly, and the strategy will operate differently. So perhaps it is not surprising that there is no theory of strategies. A theory of strategies might be a contradiction in terms. It is difficult to produce reliable and convincing evidence for their presence and even more difficult to show their absence.

4.3.6 Two versions of the 'trace theory' explanation of the comprehension deficit

As explained above, the 'trace theory' is the linguistic structural part of Grodzinsky's explanation. According to the linguistic description of transformational sentences, during transformation an argument of the verb moves from its original position and receives its theta role from a distance, by being linked in a chain with the trace left in its place of origin. The claim is that in agrammatism the assignment of the theta role of the moved NP is impaired. In consequence, the comprehension of reversible passive, relative clauses and cleft sentences is at chance level.

According to one version of Grodzinsky's theory, traces are deleted from the s-structure representation of the agrammatic. As a result theta role assignment to the moved NP cannot occur.

According to a second version of Grodzinsky's theory, traces are not deleted from the s-structure representation, but theta role assignment is still impossible because the link cannot be created between the
moved NP and the trace that is assigned by the verb the theta role of Theme (see Section 4.2.4 for rationale).

It is possible to distinguish between the two versions of the theory. The first version is applicable only in the case of sentences containing traces. The second version has a wider scope: it is applicable not only in the case of sentences containing traces but also in sentences without traces but which require theta role assignment by creating a link (chain) between two distant elements in a sentence. For example, a sentence like:

As for the horse, the zebra photographed him

does not contain trace, as the argument structure of the verb is satisfied by the presence of the pronominal him, [Photograph: AGENT, THEME]. However, the horse, in the dislocated first part of the sentence is not assigned a theta role until it is coindexed with the final pronounal, him. It is only after this coindexation that the horse is interpreted as the Theme of the action. It is an interesting test sentence, because it is active and has no embedding (as in relative clauses). The only grammatical difficulty is the non canonical word order and theta role assignment via coindexation with him.

Another possibility for distinguishing between the two versions of the theory is in Hebrew. In Hebrew, it is possible to construct relative clauses without and with a resumptive pronoun. In English there are not resumptive pronouns. The Hebrew relative clause without resumptive
pronoun is a word by word translation of the English relative clause. In the second sentence, following the verb there is an accusative pronoun *oto* (*him*) that refers back to the sentence initial noun phrase. This is the resumptive pronoun.

An object relative without a resumptive pronoun:

Ha- Soter Se- ha- xayal cilem t hu gavoha the policeman that the soldier photographed he (is) tall

An object relative with a resumptive pronoun:

Ha- Soter Se- ha- xayal cilem oto hu gavoha the policeman that the soldier photographed him he (is) tall

The resumptive pronoun *oto*, (*him*) is assigned the theta role of Theme by the verb and the moved NP the policeman, has to be coindexed with the pronoun in order to get the same thematic interpretation. While the first Hebrew relative clause contains a trace, the second one does not. This provides a very direct way to find out which version of the trace theory is correct. This test was suggested by Grodzinsky (1984) but has not yet been carried out.

4.3.7 The predictions of Grodzinsky's trace theory

Grodzinsky's formulation of the trace theory is very clear and uncompromising. As has been already pointed out, it is very different from the latest position of Caplan and of the Saffron group. In their formulations it would be difficult to know what weight the 'trace' or 'theta role assignment from a distance' carries in the overall difficulties of a sentence for an agrammatic.
Therefore, it is difficult to test, or to further elaborate, their position. Grodzinsky's predictions, however, are put forward in a testable form:

1. Sentences without a trace will be understood above chance.

2. Passives, object relatives, object cleft sentences, all of which have a trace, will result in chance performance. Passives with psychological verbs will result in below chance performance.

3. No dissociation will be found between the comprehension of passive and object relative clause sentences. Both contain traces and the theory has no way of distinguishing between them. No patient should be found who is able to process passives but fails in object relatives.

4. The passive morphology by itself is not the cause of the difficulty in passive sentences. A comparison carried out by Grodzinsky and Pierce (1987) between sentences containing adjectival passives, *The doctor was annoyed with the boy*, and sentences containing verbal passives, *The boy is pushed by the man*, demonstrated that despite the similarities in morphology, sentences with adjectival passives were well understood, while sentences with verbal passives were at chance. The difference is that verbal passives contain trace while adjectival passives do not.
THE EXPERIMENTAL STUDIES

4.4 General introduction

The comprehension abilities of agrammatics are usually tested with reversible active, passive and relative clause sentences. In the studies reported here further manipulations of sentence structure in English and Hebrew were employed in order to test specific hypotheses. These will be explained in the reports of the relevant experiments. In all the experiments, pictures were used. In some experiments, the subjects had to point to the correct picture out of four, and in others, out of two.

In the English experiments the sentences were read and recorded by a male native English speaker and in Hebrew they were read by the experimenter.

THE EXPERIMENTS WITH ENGLISH SPEAKING APHASICS

4.5 Subjects in the English experiments

The relevant biographical and neurological details of the patients who participated in the English experiments are given in Table 4.1
TABLE 4.1

Biographical and neurological details of the patients who participated in the English experiments

<table>
<thead>
<tr>
<th>init.</th>
<th>age</th>
<th>sex</th>
<th>post-lesion</th>
<th>type</th>
<th>locus</th>
<th>right hemiplegia</th>
<th>classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 BM</td>
<td>68</td>
<td>M</td>
<td>4 year</td>
<td>R</td>
<td>CVA</td>
<td>F-T</td>
<td>+</td>
</tr>
<tr>
<td>2 BN</td>
<td>47</td>
<td>M</td>
<td>4 year</td>
<td>R</td>
<td>CVA</td>
<td>F-T</td>
<td>+</td>
</tr>
<tr>
<td>3 MR</td>
<td>66</td>
<td>M</td>
<td>11 yr</td>
<td>R</td>
<td>CVA</td>
<td>F-T</td>
<td>+</td>
</tr>
<tr>
<td>4 P</td>
<td>28</td>
<td>M</td>
<td>4 yr</td>
<td>R</td>
<td>CVA</td>
<td>F-T-P</td>
<td>+</td>
</tr>
<tr>
<td>5 TW</td>
<td>60</td>
<td>M</td>
<td>8 yr</td>
<td>R</td>
<td>CVA</td>
<td>F-T-P</td>
<td>+</td>
</tr>
<tr>
<td>6 CH</td>
<td>48</td>
<td>F</td>
<td>4 yr</td>
<td>R</td>
<td>closed head injury</td>
<td>---</td>
<td>+</td>
</tr>
<tr>
<td>7 RP</td>
<td>59</td>
<td>M</td>
<td>13 yr</td>
<td>R</td>
<td>CVA</td>
<td>F</td>
<td>+</td>
</tr>
<tr>
<td>8 MW</td>
<td>46</td>
<td>F</td>
<td>6 yr</td>
<td>L</td>
<td>CVA</td>
<td>F-P</td>
<td>+</td>
</tr>
<tr>
<td>9 MH</td>
<td>42</td>
<td>F</td>
<td>6 yr</td>
<td>R</td>
<td>CVA</td>
<td>F</td>
<td>+</td>
</tr>
<tr>
<td>10 SB</td>
<td>73</td>
<td>M</td>
<td>3 yr</td>
<td>AMB.</td>
<td>CVA</td>
<td>right left sided hem. weakness</td>
<td></td>
</tr>
<tr>
<td>11 JB</td>
<td>58</td>
<td>F</td>
<td>7 yr</td>
<td>R</td>
<td>CVA</td>
<td>F-T-P</td>
<td>+</td>
</tr>
<tr>
<td>12 EM</td>
<td>155</td>
<td>F</td>
<td>14 yr</td>
<td>R</td>
<td>CVA</td>
<td>F</td>
<td>+</td>
</tr>
</tbody>
</table>

CVA: Cerebro-Vascular Accident
F : Frontal
T : Temporal
P : Parietal

The diagnostic classification of aphasia was obtained from the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan 1972).

(See the Rating Scale Profile of Speech Characteristics of the patient in Appendix A)
4.6 Experiment I: The comprehension of active and passive sentences

Introduction

The aim of the experiment was to test the ability of English speaking agrammatic patients to assign thematic roles to NPs in reversible sentences of various constructions.

The experiment assessed the relative importance of passive morphology and the ordering of the NPs in sentences. Two types of active sentences and two types of passives sentences were used. In both sentence types either the Agent or the Theme was in sentence initial position:

Active sentences:
1. Active: The fat man is painting the thin man
2. As for: As for the Chinaman, the Eskimo is hitting him

Passive sentences:
3. Passive: The bear is being shot by the tiger.
4. Focused by: By the zebra the horse is being photographed.

Sentences (1) and (2) are actives; in sentence (1), the Agent is, and in sentence (2), the Theme is in sentence initial position. Sentences (3) and (4) are passives, i.e. both contain passive morphology and trace. In sentence (3), however, the Theme is the first NP, while in sentence (4), the Agent.
The following hypotheses were tested

I. The role of passive morphology in the comprehension problems of Broca's aphasics:
   if sentence (2) is as difficult as sentences (3) and (4), passive morphology is not the only cause of the comprehension problem in passives.

II. The causal role of the trace (first version of Grodzinsky's hypothesis), or of the need for coindexation (second version of Grodzinsky's hypothesis, see Section 4.3.6) in the comprehension deficit of agrammatics:
   if sentence (2) is as difficult as sentences (3) and (4), the second version of Grodzinsky's hypothesis is supported. According to the 'trace theory', only sentences (3) and (4) should be difficult. However, sentence (2), although without trace, may cause problems of coindexing the 'Chinaman' and the pronoun 'him'.

III. The role of the linear arrangement of NPs in the comprehension of sentences by agrammatics (Caplan and Futter, 1986):
   a. if sentences (1) and (4) obtain significantly better results than sentences (2) and (3), the claim of Caplan and Futter is supported, i.e. that agrammatics tend to interpret the first NP as the Agent and the second as the Theme.
b. if sentence (4) obtains better results than sentence (2), then, Caplan and Futter’s linear hypothesis is supported.

IV. The operation of the Default Principle:

if sentence (4) obtains scores as good as sentence (1), the operation of the Default Principle as described by Grodzinsky is supported. In sentence (4), the by phrase is in sentence initial position. Both the grammar and the Default Principle would allocate this NP the Agent role, exactly as in an active sentence.

Method and materials

There were 64 sentences in the experiment and each sentence was accompanied by four pictures: the target picture, a picture with reversed thematic roles, a lexical foil and a picture with reversed roles for the lexical foil.

There were 4 sentence types (see above), 16 sentences of each type. The 64 sentences were divided into four parts. In each part there were 16 sentence, 4 of each type, presented in a quasi random order. The subjects were tested individually in a quiet room in the day centre they come to for speech therapy each week. Only 16 sentences were presented in any one testing session.

The subject heard each sentence twice and were asked to choose one picture out of four that best fitted the sentence. (The test sentences and examples of the pictures are in Appendix B)
Results

The results of the comprehension test for two types of active and two types of passive sentences are presented in Table 4.2

TABLE 4.2

The results of the comprehension test for two types of active and two types of passive sentences. Number of times (out of 16) subjects pointed to the correct picture.

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>SENTENCES</th>
<th>Active</th>
<th>As for</th>
<th>Passive</th>
<th>Focused 'by'</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. B.M.</td>
<td></td>
<td>13</td>
<td>9</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>2. B.N.</td>
<td></td>
<td>15</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>3. M.R.</td>
<td></td>
<td>15</td>
<td>15</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>4. P.</td>
<td></td>
<td>15</td>
<td>12</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>5. T.W.</td>
<td></td>
<td>13</td>
<td>12</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>6. C.H.</td>
<td></td>
<td>13</td>
<td>15</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>7. R.P.</td>
<td></td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>8. M.W.</td>
<td></td>
<td>13</td>
<td>8</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>9. M.H.</td>
<td></td>
<td>13</td>
<td>8</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>10. S.B.</td>
<td></td>
<td>15</td>
<td>5</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>11. J.B.</td>
<td></td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>12. E.M.</td>
<td></td>
<td>15</td>
<td>9</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>13.7</td>
<td>10.9</td>
<td>10.8</td>
<td>10.8</td>
</tr>
</tbody>
</table>

The data were analyzed using a one factor repeated measures analysis of variance. The variable was sentence type with four levels (active, as for, passive and focused by). Planned comparisons were made between the active sentences and all the others; and between the as for, passive and focused by. Active sentences obtained
significantly higher results than all the other types of sentences $F(1, 33) = 15.068, \ p< 0.0005$. No significant differences were found between the other types of sentences ($F < 1$).

Discussion

The implications of the results in relation to the hypotheses are the following:

1. As no difference in the scores between the *as for* (2) sentences and the two types of passives (3 and 4) was found, the claim that passive morphology is not the sole cause of the comprehension failure in passive sentences, can be confidently maintained.

2. For the same reasons it cannot be claimed that the deletion of trace per se is the causal factor for the comprehension deficit. The results, however, are congruent with the second version of Grodzinsky's hypothesis according to which the need for coindexation between a moved NP and the element that is the recipient of the thematic role in situ creates the comprehension deficit or contributes to it.

3. The results do not support the hypothesis that patients do not process sentences syntactically but rather employ a linear strategy in all sentence types, including active sentences. If the latter hypothesis were the case, we would expect sentence type (4) in which
the *by* phrase is focussed to obtain scores as high as actives.

4. For the same reason the Default Principle is not supported.

4.6.1 The breakdown of the results for individual patients

There is considerable variability among the patients despite the fact that they were all diagnosed as Broca's aphasics.

a. Patients 2, 3 and 11 demonstrate good comprehension in most sentence types. These are the now well documented Broca's patients without significant comprehension deficit.

b. Patient 7 shows a comprehension deficit across all sentences. He is the only patient who is at chance on active sentences.

c. Patient 9 was the only subject who performed below chance on passive sentences, i.e. she reversed thematic roles, and thus interpreted passive sentences as if they were actives.

d. Patients 1, 4, 8, 10, and 12 show a pattern of above chance on active and chance performance on passive sentences. This pattern of results is characteristic for agrammatics (almost 'diagnostic') according to
Grodzinsky's theory. Chance in the present test, with 16 possible correct scores and 2 relevant pictures to choose from, in a bimodal test, is 4-12. Only scores above 12 are above chance and below 4, below chance. It should be pointed out, however, that 16 items are not sufficient to calculate truly reliable chance levels. The present experiment is methodologically weak in this sense (for interpreting scores of individual patients), but so also are most experiments in the literature on the comprehension deficit in Broca's aphasia. In most experiments no more than 16, and, at times, fewer than 16 items were given in any one condition.

4.6.2 The subset of Broca's aphasics who respond at above chance level on active sentences and at chance level on passive sentences.

Introduction

In Grodzinsky's system, agrammatics are predicted to have above chance performance on active sentences and chance level performance on passives. Grodzinsky's theory does not make any claim about subjects who score at chance level on actives, or below chance on passives. This is the justification for looking at the data of a subgroup of patients - who are under the scope of Grodzinsky's theory - separately. The performance of these patients on the other sentence types (as for, and focused by), is relevant for testing Grodzinsky's hypothesis.
Results

The results of the comprehension test for two types of active and two types of passive sentences for those subjects only who in Experiment 1 were at above chance level on actives and at chance level on passives are shown in full in Table 4.3.

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>SENTENCES</th>
<th>Active</th>
<th>As for</th>
<th>Passive</th>
<th>Focused 'by'</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.B.M.</td>
<td></td>
<td>13</td>
<td>9</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>4.P.</td>
<td></td>
<td>15</td>
<td>12</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>8.M.W.</td>
<td></td>
<td>13</td>
<td>8</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>10.S.B.</td>
<td></td>
<td>15</td>
<td>5</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>12.E.M</td>
<td></td>
<td>15</td>
<td>9</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>14.2</td>
<td>8.6</td>
<td>9.6</td>
<td>8.4</td>
</tr>
</tbody>
</table>

The data were analyzed using a one factor repeated measures analysis of variance. The variable was sentence type with four levels. Planned comparison were made between actives and the rest of the sentences and between passives, as for and focused by sentences. There is a significant difference between actives and all the other types of sentences, actives being the best
\[ F(1,12) = 29.29, \ p < 0.001. \] There is no significant difference between the other sentence types \( F < 1. \)

Discussion

The results are not different for this more homogeneous subgroup of Broca's aphasics. This group of patients responded to actives and passives according to Grodzinsky's stipulation, and, therefore, it was particularly interesting to see how these patients responded to the sentence manipulation in the present experiment and how the hypotheses related to Grodzinsky's theory fared.

Hypothesis 2: Trace (its deletion) per se does not appear to be the causal factor for the comprehension failure. This can be seen from the fact that passive sentences did not obtain significantly lower scores than as for sentences. Consistent with the conclusions arrived at from the data of the whole group, coindexation between distant elements in the sentence may create the difficulties.

Hypothesis 4: The present data does not support the implications derived from the Default Principle (that active and focused by sentences should be equally easy). Performance in sentence type (4) in which the by phrase is focused is on a lower level than the level of performance on active sentences.
4.6.3 The results of the retest

In the winter of 1988, a subgroup of the subjects was retested on the previous task. The following results, presented in Table 4.4, were obtained. In brackets the results of the earlier test are given for easier comparison:

TABLE 4.4

The results of the retest of four patients in comparison with their previous scores (in brackets). Number of times (out of 16) subjects pointed to the correct picture

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>SENTENCES</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>As for</td>
<td>Passive</td>
<td>Focused 'by'</td>
<td></td>
</tr>
<tr>
<td>1.B.M.</td>
<td>10 (13)</td>
<td>9 (9)</td>
<td>10 (10)</td>
<td>3 (5)</td>
<td></td>
</tr>
<tr>
<td>6.C.H.</td>
<td>15 (13)</td>
<td>16 (15)</td>
<td>16 (13)</td>
<td>16 (10)</td>
<td></td>
</tr>
<tr>
<td>7.R.P.</td>
<td>14 (9)</td>
<td>10 (7)</td>
<td>7 (8)</td>
<td>6 (9)</td>
<td></td>
</tr>
<tr>
<td>8.M.H.</td>
<td>11 (13)</td>
<td>4 (8)</td>
<td>3 (2)</td>
<td>13 (9)</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>12.5 (12.0)</td>
<td>9.8 (9.8)</td>
<td>9 (8.3)</td>
<td>9.5 (8.3)</td>
<td></td>
</tr>
</tbody>
</table>

A 2 × 4 repeated measure analysis of variance was carried out. For the factor test versus retest, the main effect is not significant (F < 1), and no interactions between test/retest and the four sentence types are significant (F < 1).
Discussion

The group results are not different from test to retest, which indicates a degree of stability in the patients’ performance level among all sentence types.

Some individual changes in performance levels need to be commented on nevertheless, while acknowledging that 16 sentences per sentence type is not really sufficient for analysis as a case-series.

Subject (6) C.H. who responded above chance on most sentence types on the previous occasion improved to almost perfect performance. Spontaneous (and perhaps therapy-driven) recovery has taken place.

R.P., (7) was the only patient in the present sample who at the first testing made reversal errors in active sentences (Schwartz et al 1980). At the second testing, however, he was above chance like the majority of non fluent patients.

These changes, especially in R.P., warn that only limited reliance can be placed on differences between ‘above chance’ and ‘chance’ performances. There may be considerable variation from testing session to testing session, even in long term patients; these changes may remove the ground from under otherwise plausible claims.
4.6.4 General Discussion of Experiment 1

a. This experiment is a test of the 'trace deletion' hypothesis versus the later coindexation version of Grodzinsky's theory. The sentences with the focused by phrase,

   By the zebra the horse is being photographed.

contain trace like any other passive sentence and, therefore, if Grodzinsky is right, the error rate is due to the presence of a trace in the construction. The as for sentences,

   As for the zebra, the horse photographed him

are not passives and do not contain a trace.

Nevertheless, in order to assign a thematic role to the initial dislocated NP, the zebra, it (the zebra) has to be coindexed with the final pronominal him. Errors in the comprehension of these sentences may indicate a failure in coindexation. This possibility is included in Grodzinsky's theory as an alternative to 'trace deletion.' Therefore, a failure in interpreting the as for sentences provides support to the second version of Grodzinsky's theory.

b. Errors in active sentences

A small but consistent deficit in the comprehension of reversible active sentences is found. This can be seen
in Table 4.2 where all the 12 patients made at least one error on the active sentences.

Within the framework of GB theory, using trace as a causal factor in the comprehension deficit, errors in active sentences are not expected: active sentences do not contain trace.

Grodzinsky distinguished between three types of responses: above chance, chance and below chance, (but see discussion in Section 4.4.6) and claimed that a few errors in active sentences are theoretically insignificant. They are found with all aphasic patients and may be due to experimental artefacts, or such factors as inattention.

It is important to decide whether this argument is acceptable or not. In order to accept the 'trace theory' there must be a significant difference between the results of active and passive sentences. If a few errors in actives are overlooked and treated as experimental artefacts - as Grodzinsky suggested - a few 'random errors' in the passives must be allowed too and this could change the relationship between above chance and chance level scores. Thus, considering the errors in the active sentences is not pedantry but statistical necessity.

Consequently, it might be necessary to look for an explanation as to why Broca's aphasics make one, or a few errors in active sentences.
c. Broca's aphasics with relatively intact syntactic comprehension

Three patients out of 12 (B.N., M.R. and J.B.) demonstrated good syntactic comprehension. Their scores on any sentence type were never lower than 14/16, and usually higher, 15 or 16. All these patients were diagnosed as Broca's aphasics and their verbal output was indeed typical of Broca's aphasia. It seems now that Broca's aphasics with relatively intact syntactic comprehension do exist alongside other patients who may have a syntactic comprehension problem and, in particular, who are at chance on passives.

d. The chance level scores at the two 'unusual' sentence types (as for and focused by) suggest that both passive morphology (present in the 'focused by' sentences) and non canonical word order (present in the as for sentences) are detrimental to comprehension by Broca's aphasics.

In conclusion, two forms of responses by subjects in this experiment question Grodzinsky's hypothesis. First those subjects whose syntactic comprehension is unimpaired question any parallelistic position, including Grodzinsky's. The implications of the existence of these patients are still open for discussion. Whether there are means of distinguishing between patients who do have or do not syntactic comprehension problems on any basis
other than their syntactic comprehension abilities remains unclear.

Second, for the few errors that most subjects make in the active sentences, Grodzinsky has no good explanation. The other results — of those patients who responded at chance level on the passives — are in accordance with Grodzinsky's claims (but also, of course, with other proposals). As already noted, it is only the Hebrew experiment that can directly test the trace deletion hypothesis.

4.7 Experiment II: Active and passive questions

Introduction

The second experiment is a further manipulation of the usual picture pointing experiment with reversible sentences. The aim is to test the effects of truncated passives on performance levels. Truncated passives are ordinary passives without the optional by phrase:

    The cat is being chased t.

At first Grodzinsky suggested that in truncated passives performance is expected to be below chance, i.e. agrammatic patients will consistently reverse the thematic role of the moved NP from the correct Theme to Agent. The reason for this pattern of performance is the non-existence of a second NP. The moved NP the cat is not assigned a thematic role by the grammar and
consequently the Default Principle assigns it an Agent role. As there is no other competing NP, no guessing occurs and the cat consistently interpreted as Agent.

This form of analysis, however, is probably wrong. Jaeggli (1986) analysed truncated passives as implicitly containing an Agent argument and, therefore, chance performance is still likely in these constructions. In this case truncated passives would be indistinguishable from full passives and this has been accepted by Grodzinsky (1990).

In the literature there is conflicting evidence concerning truncated passives. Martin, Wetzel, Blossom-Stach & Feher (1989) did not find difference in performance levels between full and truncated passives; both were on chance level, as predicted above. The second piece of evidence is less expected. Badecker, Nathan and Caramazza (1991) found that their subject performed significantly above chance on the truncated passives, while full passives and (reversible) actives were at chance.

The present experiment aimed to investigate this problem further. Active and passive questions of the following form were used as stimulus material:

1. Asking for the Agent: Who is kissing somebody?
2. Asking for the Theme: Who is being kissed?
The following hypotheses were tested:

Assuming that Jaeggli's analysis of the truncated passive is correct and that Grodzinsky's theory is correct:

1. There will be a significant difference between the active questions and the passive questions: active questions will score higher (above chance) than passives (chance).

2. No differences between the comprehension of full passive sentences (in Experiment 1) and between the results of the passive questions should be found. Both scores will be at chance level.

If, however, factors other than those proposed by Grodzinsky's hypothesis have an effect, the prediction is the following:

3. Even if truncated passives are analyzed as implicitly containing an Agent argument, truncated passives are not reversible sentences. It is predicted, therefore, that the truncated passive questions will obtain higher scores than the passive sentences in Experiment 1.

Method and Materials

Four subjects from the previous experiment (B.M., R.P., M.H., E.M.) looked at individual pictures taken from the previous experiment and then were asked a
relevant question. They had to answer by pointing to one of two figures drawn on the response sheet; these represented the NPs taking part in the action described in the pictures. (The test sentences and examples of the pictures are in Appendix C)

Results

The results of the active/passive questions experiment in comparison with the results in the comprehension task (sentences) in experiment 1 are presented in Table 4.5

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>SENTENCES</th>
<th>QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td>1. B. M.</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>7. R. P.</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>12. M. H.</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>12. E. M.</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Mean</td>
<td>10.75</td>
<td>12.5</td>
</tr>
</tbody>
</table>

A 2 x 2 repeated measures analysis of variance was carried out. The planned comparisons between active and passive questions is not significant F (1, 3) = 1.88; sentences versus questions, n.s. (F < 1), and the interaction is F (1,3) = 3.65, n.s.
Discussion

According to hypothesis one, there should be a significant difference between active questions and passive questions. This did not happen; there is an improved performance in passive questions in comparison to passive sentences and a decline in performance levels in the active questions in comparison to the active sentences; this brought the scores closer and no significant difference was reached.

All the other comparisons were similarly non significant. While the first 'no difference' results are against Grodzinsky's theory, 'no difference' between questions and sentences overall, supports it. The fact that there were no differences in performance between active and (truncated) passive questions indicates that in this sentence structure passives do not cause particular problems as compared with actives. Grodzinsky's theory cannot explain the disappearance of differences in performance levels between active and passive questions. The structural difference between the two types of questions - according to a theory like Grodzinsky's - must have an effect on performance levels. This is why an overall 'no difference' between sentences and questions supports Grodzinsky's theory. In Grodzinsky's theory, the mode of presentation - whether the stimuli is in a form of a sentence, or in a form of a question - is not expected to make a difference in the results.
The third hypothesis, which suggested that the non-reversibility of truncated passives may help Broca's aphasics in sentence comprehension, was not supported; the passive questions did not obtain significantly better results than the passive sentences.

In conclusion, the results of Experiment II are somewhat contradictory. There is no indication that (truncated) passive questions were treated significantly differently from passive sentences, individual patients' scores imply that passive questions are treated (by some patients) differently from passive sentences.

Three out of the few patients who participated in Experiment II improved their scores in the truncated passive questions in comparison to the comprehension of passive sentences. One patient obtained above chance level scores with the truncated passive questions while none of them were above chance in the full passive sentences. Naturally, individual scores can only be treated as suggestive, as the numbers of items in each condition do not allow individual analysis of the data. Nevertheless, considering the results of the present experiment and of Badecker, Nathan and Caramazza (1991), it seems that Broca's aphasics comprehension of truncated passives needs further investigation as to whether truncated passives are interpreted differently, and whether reversibility is a crucial factor contributing to
the comprehension deficit of Broca's aphasics in typical comprehension tests.

4.8 Experiment III: The comprehension of existential sentences

Introduction

The aim of this experiment was to provide further test of Grodzinsky's theory using a different set of sentences than the usual reversible sentences.

Existential sentences in the form of 'There is a ....', using verbs like 'eat', 'drive' 'cook', etc., verbs which can be used both transitively and intransitively. The contrast can be shown in the following examples:

a. There is a chicken eating in the garden.
   b. There is a chicken being eaten in the garden.

In the active sentence (a), the verb is used intransitively and in the passive sentence (b) transitively. The object of the passive participle has been moved, as in all passives, into preverbal position and a trace has been left at its original postverbal position.

Thus, in these sentences the subjects' ability to process passives is tested without using reversible sentences. The picture contrasts are a reflection of the different argument structures of the verbs and not of reversed
thematic roles. In the present task, in the active sentences, the intransitive version of the verb is used and in the passive sentences, its transitive version:

1. eat
   [AGENT]
   There is a chicken eating in the garden.
   There is a woman driving in a car.

2. eat
   [THEME], (AGENT) optional
   There is a chicken being eaten in the garden.
   There is a woman being driven in a car.

The pictures like the sentences, are not mirror images of each other. The contrasting pictures in the previous experiments differed only in terms of the thematic roles of the participants in the action: the bear shot the tiger, the tiger shot the bear. In this experiment, instead there was a picture of a chicken gathering food in the garden and of a boy eating a chicken leg. Therefore, if reversibility (both of the sentences and of the pictures) is a contributing factor to the comprehension failure of, at least, some patients, better performance is expected in this task than in the comprehension task in Experiment I.
Method and Materials

22 sentences (11 pairs using 11 different verbs) were each accompanied by two pictures depicting situations described in the two sentences. Subjects were asked to point to the correct picture upon hearing each sentence. (The test sentences and examples of the pictures are in Appendix D)

Results

The results of active and passive existential sentences are presented in table 4.6.

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>SENTENCES</th>
<th>Active</th>
<th>Passive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. B.M.</td>
<td>40%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>3 M.H.</td>
<td>60%</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>3. E.M.</td>
<td>90%</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>4. R.P.</td>
<td>80%</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>70%</td>
<td>70%</td>
<td></td>
</tr>
</tbody>
</table>

A repeated measures t-test was carried out to compare performance levels between the active and passive existential sentences. The difference is not significant ($t < 1$).

Discussion

The mean results are equal for actives and passives. Thus the results for these sentences are different from the results obtained in Experiment I. One patient, for
example, obtained better results in the passive sentences than in the actives. It seems that when the sentences used in an experiment are different from the usual reversible sentences (truncated passives in experiment II or the existential sentences in this experiment), the difference between actives and passives disappears.

EXPERIMENTS WITH HEBREW SPEAKING APHASICS

The aim of the experiments in Hebrew is to provide a specific test of Grodzinsky's hypotheses in relation to the comprehension of sentences which are analyzed in linguistic theory as containing trace.

4.9 Subjects in the Hebrew experiments

Personal and neurological details of the patients who participated in the Hebrew experiments, including a few examples of their speech, are presented here.

1. S. L. is a 64-year-old woman. She is a native Hebrew speaker, with secondary school education, who worked as a secretary prior to her stroke. Left hemisphere C.V.A., of embolic origin, was sustained 5 years prior to testing. No CT scan is available, but there is pronounced right hemiparesis. S. L.'s speech is described in detail in Chapters 5 and 6.
2. C.D. is a 33-year-old right-handed man. He was born in Spain but has been in Israel from the age of 13. C.D. is a restaurant owner with 10 years of formal education. He sustained a C.V.A. of embolic origin 8 months prior to testing. CT scan shows left opercular infarction with involvement of the temporal and parietal lobes. There is right hemiplegia. C.D. produces very little spontaneous speech and the following examples are taken from a picture description task:

Aba ... aba ... yeled ... aviron ..... dofek
father father boy aeroplane knocks
A little boy breaks a toy aeroplane while the father looks at him angrily.

ciyur, proxim, SemeS, iSti, lo, iSa
a drawing, flowers sun my wife no woman
A woman is sitting in the garden and drawing flowers.

hu ............ zevel
he rubbish
a man is sweeping up the rubbish

3. E.F. is a 40-year-old left-handed man. He is a native Hebrew speaker, with secondary education, who was an army officer prior to injury. E.F. sustained cranio-cerebral damage due to penetrating missile injury 16 prior to testing. CT scan shows damage to left frontal, temporal and parietal areas. There is right hemiplegia. Examples of spontaneous speech follow:

1. ani lo rei
   I no mirror
   I did not have a mirror.
   lo haya li rei.
   was to me
2. ani xaver tov
   I friend good
   I have a good friend
   YeS  li xaver tov
   there is to me

3. David axot
   David sister
   My sister
   Axot Seli
   my

4. G.H. is a 59-year-old, right-handed architect. He was born in Poland but has lived in Israel from the age of 18. C.V.A. was sustained 10 years prior to testing. CT scan showed a very large ischemic infarction on the left hemisphere, involving frontal, temporal, and parietal regions. There is right hemiplegia. G.H. has little spontaneous speech and the following passages are taken from his attempts to describe the Cookie Theft picture from the Boston Diagnostic Aphasia Exam.

1. Sokolad o ugiyat be-bat exat
   chocolate or biscuit at once
   There is a chocolate or biscuit there

2. ni .... ni ... me .. nigavti, aval ..
   I dried but
   The mother is drying up the dishes

3. ani medaber ve-hitkalkel
   I speak and went wrong
   My speech went wrong

4.10 Experiment IV: The comprehension of relative clauses

The main purpose of this experiment is to test the difference between object relatives with and without a resumptive pronoun (see Section 4.3.6) This test is not
possible in English (a language that does not normally use resumptive pronouns). It is, however, suitable for deciding between the two versions of Grodzinsky's trace theory: one, that traces are deleted from the s-structure representation of agrammatic patients; and two, that traces are present, but no link can be formed between the trace and the moved element; therefore, normal thematic role assignment is not possible for the moved NP. In English it is not possible to distinguish between the two versions of the theory using sentences that are maximally comparable. The results for the as for sentences in Experiment I showed that coindexation between the dislocated NP and a pronoun that is assigned the thematic role of that NP could create comprehension difficulties. As for sentences, however, are not passives (and not relative clauses) and there are other differences too. In Hebrew, two versions of an object relative can be constructed, in the first (1), the presence of a resumptive pronoun oto (him) obviates the necessity for trace. Sentence (2) is exactly like an English object relative clause and contains trace. Examples of object relatives with and without resumptive pronouns (reproduced here from Section 4.6.3) are:

1. With a resumptive pronoun:

Ha-Soter Se- ha- xayal cilem oto hu gavoha
The policeman that the soldier photo- him he (is) tall
graphed

2. Without a resumptive pronoun:

Ha-Soter Se- ha- xayal cilem t hu gavoha
the policeman that the soldier photographed he (is) tall
This experiment contained subject relatives and actives for comparison with the two forms of object relatives. There is no difference between the formulation of subject and object relatives (without a resumptive pronoun) in Hebrew and English. It is known from English language experiments that agrammatic patients respond differently to subject relatives than to object relatives. While object relatives are difficult, subject relatives give results similar to active sentences, despite a more complex sentence structure.

Grodzinsky's (1986a) has two possible explanations for this. Either the s-structure representation of subject relatives do not contain trace in the first place. Or, if they do contain trace, since word order remains canonical, thematic role assignment by the Default Principle coincides with the normative assignment. Errors should therefore not arise with subject relatives any more than with actives.

Examples of subject relatives and active sentences are as follow:

Subject relative:

Ha- asir Se- Sokel et ha- tabax hu Samén.
the prisoner that weighs acc. the cook is fat.

Active:

Ha- dov mecalem et ha- sus.
the bear is photographing acc. the horse.
The following hypotheses were tested:

1. If no significant differences in performance levels between subject relatives and object relatives are found, Grodzinsky's theory is not supported.

2. If object relatives with a resumptive pronoun are comprehended normally by patients who are at chance on object relatives without a resumptive pronoun, this would constitute evidence that the presence of trace in the s-structure representation is crucial for the normal comprehension of transformational sentences. If, however, both object relatives are equally difficult, this suggests that the cause of the problem is not the trace per se but rather the coindexation between the trace and the moved NP.

Method and Materials

64 sentences were used as stimulus material:
1. 16 active sentences
2. 16 subject relatives
3. 16 object relatives
4. 16 object relatives with resumptive pronoun
(The sentences and examples of the pictures are in Appendix E)

The sentences were presented in a semi-random order in four sessions, 16 sentences in any one testing session. Each sentence was accompanied by four pictures and the subjects had to choose the correct one. For the active sentences only two pictures were crucial: the target
picture and the same picture with the actors reversed (thematic roles reversed). The remaining two pictures were a lexical distractor and the same picture with the actors reversed. For the relative clauses, however, all pictures were relevant, as here not only thematic role assignment was tested but also the allocation of adjectives to their heads. Thus, for a sentence, such as The cook that is photographing the policeman is thin.

1. there was the target picture:
   a thin cook is photographing a fat policeman.
2. correct thematic roles with the wrong adjectives:
   a fat cook is photographing a thin policeman.
3. wrong thematic roles but the right adjectives:
   a fat policeman is photographing a thin cook.
4. wrong thematic roles and wrong adjectives:
   a thin policeman is photographing a fat cook.

The subjects were asked to look carefully at the pictures, than they heard each sentence twice and only then did they make their response.

The difference between the present experiment and other experiments in the literature is that here, in the case of the relative clauses, subjects had to choose the correct picture out of four relevant pictures. In standard experiments on relative clauses, subjects only need to choose between two contrasting pictures, one the target and one the picture with reversed thematic roles. The present experiment was more complex because subjects had also to make decisions in relation to the adjective. This made the task difficult. Nonetheless, in a sentence like,
The girl that the woman is photographing is tall

it does seem a natural requirement to determine who is tall.

Results

The results of the Hebrew relative clause experiment are shown in Table 4.7

---

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>SENTENCES</th>
<th>active</th>
<th>subject rel</th>
<th>object rel</th>
<th>object rel with res. pronoun</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.L</td>
<td></td>
<td>16</td>
<td>13 (13)</td>
<td>6 (16)</td>
<td>8 (16)</td>
</tr>
<tr>
<td>C.D</td>
<td></td>
<td>12</td>
<td>2 (11)</td>
<td>12 (16)</td>
<td>15 (15)</td>
</tr>
<tr>
<td>E.F.</td>
<td></td>
<td>16</td>
<td>11 (16)</td>
<td>4 (8)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>G.H.</td>
<td></td>
<td>11</td>
<td>5 (7)</td>
<td>4 (7)</td>
<td>5 (9)</td>
</tr>
</tbody>
</table>

Mean 13.8 7.75 (11.8) 6.5 (11.8) 7.25 (12)

The numbers outside the brackets in the columns of the relative clauses are the correct responses with the four pictures: both thematic role assignment and adjective assignment must be correct (chance performance: 0 - 7 (binominal test)). The numbers in brackets indicate correct thematic role assignment only (chance performance 4 - 12 (binominal test)).
The data were analyzed using a one factor repeated measure analysis of variance. One analysis was conducted using the scores outside the brackets, the scores representing correct answers both in terms of thematic role assignment and adjective attribution. A second analysis was conducted using the scores inside the brackets corresponding to the more lenient marking for thematic role assignment only (adjective attribution could be wrong).

The analysis of variance on the lenient scores does not show a significant difference between the sentence types, $F < 1$.

However, using the scores of the more stringent marking, there is a significant difference in the planned comparisons between actives (1) and the other sentences (2, 3, 4). $F (1, 9) = 5.9, \ p < 0.04$. No significant difference was found between subject relatives (2) and the two types of object relatives (3 and 4), $F < 1$. Finally, there is no significant difference between the two types of object relatives (between 3 and 4), $F < 1$.

Discussion

1. The fact that no significant difference in performance levels was found between object and subject relatives goes against Grodzinsky’s theory according to which subject relatives are expected to obtain results as good as active sentences.
2. The experiment did not decide between the two versions of Grodzinsky's hypothesis; the difference in scores on object relatives without resumptive pronoun and object relatives with resumptive pronoun is non-significant. The direction of difference (albeit non-significant) favoured the version in which traces are not necessarily deleted, but rather the coindexation between two dependent and distant elements in a sentence cannot take place.

4.11 Experiment V.

Testing the trace theory in Hebrew passives

Introduction

In English, it is not possible to construct passive sentences without a trace. The best possible test of the 'trace deletion' hypothesis in English, is a comparison between verbal (the boy was kissed by the girl) and adjectival passives (the boy was interested in the girl) (Grodzinsky and Pierce 1988). In a GB analysis verbal passives are transformational and, therefore, contain trace. Adjectival passives are morphologically similar to verbal passives, but are analyzed in GB theory as lexically derived and therefore, without a trace. What is unique in Hebrew, is that it is possible to construct verbal passives with and without the trace. This
possibility, therefore, offers a direct test of the trace theory.

The passive with trace in Hebrew is analyzed in a GB framework in the same way as the English passive. There is a difference, however, between the English passive participle and the Hebrew passive verb. In both English and Hebrew, the passive absorbs the subject theta role and the subject position remains empty. The difference is in the Case assigning properties of the passive verb. The English passive participle is unable to assign Case in a postverbal position and this forces the NP into a preverbal position, where it can be assigned Case (See Chapter 2, Section 2.5.3). The Hebrew passive verb differs insofar as it can assign Case postverbally. This is a feature of ergative (unaccusative) verbs in languages like Hebrew, Italian and Spanish, and also passive verbs in Hebrew which are ergatives.

Because of this property of the Hebrew passive verb, passive sentences in Hebrew can be derived in two ways. They may be generated without a subject position preverbally and the NP can remain in the postverbal position. This gives rise to the following s-structure representation:

\[
(S \ [VP \ huka \ [NP \ yeled]])
\]

\[
\text{was hit} \quad \text{boy}
\]

\[
\text{a boy was hit}
\]

Alternatively, passives can be generated with a preverbal subject position that is empty, as in English; in that
case, the postverbal NP the boy moves into preverbal position and leaves a trace:

[S [NP yeled (VP huka t)]]
boy was hit
a boy was hit

In the first form of the Hebrew passive, the NP the boy can remain at its base generated position where it is assigned its thematic role locally by the verb. As no movement occurs, there is no trace and no problem of thematic role assignment from a distance through the chain. According to the predictions of the 'trace theory' no comprehension problems should arise for agrammatic patients.

A task which would compare agrammatics' ability to comprehend the two forms of passives is the most direct way to date of testing the 'trace theory'. Although there are some differences between the two sentence forms, both of them are verbal (not adjectival) and both of them contain passive morphology (unlike the as for sentences in the English Experiment 1)

The following hypotheses were tested:

1. Grodzinsky's theory is supported if the following results are obtained:

Active: above chance
Passive with a trace: chance
Passive without a trace: above chance.

2. The following results would count against Grodzinsky's position:
b. Active: above chance
   Passive with a trace: chance
   Passive without a trace: chance

Method and Materials
48 Hebrew sentences were presented to each subject: 16 actives, 16 passives with trace, and 16 passives without trace. Each sentence was read aloud to the subjects, who responded by pointing to one of two pictures. In each case, the foil picture depicted the same action with reversed thematic roles.

The passive sentences without a trace did not include definite articles. They were introduced by saying: 'Look what happened?' (Tire, ma karo) and were read with story telling intonation. Such a form of presentation is necessary as this word order is used primarily in narratives and some linguistic material (a lead-in sentence or an adverbial, for example) is required in front of the verb.

The only difference in the surface structure of the two passive forms lies in word order and the presence or absence of a definite article. In the passive with trace the structure is NP V by NP; in the passive without trace the structure is Look, what happened? V N by N.

Sentences with the same lexical material were presented in active voice and in the two passive forms. Testing took place in three separate sessions; 16 sentences were given in semi-randomized order on each occasion.
Results

The results are presented in Table 4.8

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>SENTENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
</tr>
<tr>
<td>1. S.L</td>
<td>16</td>
</tr>
<tr>
<td>2. C.D.</td>
<td>16</td>
</tr>
<tr>
<td>3. E.F.</td>
<td>16</td>
</tr>
<tr>
<td>4. G.H.</td>
<td>13</td>
</tr>
<tr>
<td>Mean</td>
<td>15.3</td>
</tr>
</tbody>
</table>

The data were analyzed by a one factor repeated measures analysis of variance. Planned comparisons were carried out between the active sentences (1) and the two passives (2 and 3). The first comparison was significant, actives were significantly better than passives, F (1, 6) = 10.3, p < 0.02. There were no significant differences, however, between the two types of passive, F < 1.

Discussion

All the subjects were above chance on the active sentences and 2 out of 4 were also above chance on the passives (with or without trace). These are the agrammatic patients without serious comprehension
problems. Patients of this type were found in the English experiment too and their existence questions any theory that claims a parallel impairment of comprehension and production.

For testing Grodzinsky's hypothesis about the involvement of trace in the comprehension problems of agrammatic patients, the most interesting results are those of subjects 2 and 4. They are at chance on both types of passive sentence, with and without trace, and their results are thus especially damaging to the 'trace hypothesis'. That their response to passives without trace is so poor seems to indicate that problems with trace per se are not the principal causal factor responsible for the breakdown of syntactic comprehension in agrammatism.

The description of the Hebrew passive used here is taken from the analysis in Borer and Wexler (1987). This paper deals with language acquisition within a GB framework. The fact that young children, acquiring either English or Hebrew, do not use the verbal passive is interpreted in terms of a failure to create the chain between the moved NP and its trace. Yet Borer and Wexler have also observed that young Hebrew-speaking children do not use passive without trace either. And they suggest that this form is difficult because it requires Case assignment postverbally. Thus Borer and Wexler claim that both processes - creating the chain and assigning Case
postverbally - are difficult and young Hebrew-speaking children are unable to do so.

If this is the case, it could always be argued against the evidence of the present experiment that in the Hebrew passive without trace, there is an additional and different complication. Patients make errors in the passives that contain trace because they cannot interpret thematically the moved NP, and they make errors in the passives without trace because of the difficulties involved in Case assignment postverbally.

The explanation given by Borer and Wexler might be correct for the problems they describe: the production of passive sentences by young Hebrew-speaking children. In the present experiment, however, the situation is different: it is a comprehension test and it is unlikely that complications in Case assignment should affect comprehension. Case theory is concerned with licensing NPs to appear in sentences and it is independent of theta theory, which deals with thematic role assignment (the meaning of NPs).

4.12 General conclusions

4.12.1 The effects of trace

Grodzinsky's original theory was that the presence of trace in transformational sentences is causal for the comprehension problem evidenced in Broca's aphasia.
Patients are predicted to be on chance level on sentences that contain trace and on above chance level on sentences without trace. Traces are said to be deleted from the s-structure representation of agrammatic patients and therefore the moved noun phrase cannot be interpreted thematically. In this case, Grodzinsky assumes that the Default Principle will be triggered in order to identify the first NP as the Agent which leads to chance performance in passives sentences.

The trace deletion hypothesis was not supported by the results of the experiments reported in this thesis.

In Experiment I, sentences like *As for the Chinaman, the Eskimo is pinching him*, resulted in as poor a performance as passives although these sentences do not have trace. Similar results were obtained in the Hebrew speaking experiments. In Experiment IV, no differences in performance were found between the object relatives with and without a resumptive pronoun, although only the latter sentence has trace. Finally, in Experiment V, there were no significant differences between Hebrew passives with and without a trace.

4.12.2 Coindexation

Grodzinsky has put forward a second formulation of his theory. According to this, traces are not deleted from the s-structure representation of agrammatic patients, rather a link (Chain) between the trace and the moved
element cannot be created. Because no link can be created between the moved noun phrase and the trace, the moved NP in a passive cannot be thematically interpreted. Despite the similarities between the two versions of the theory, they are very different from each other linguistically and they make different empirical predictions (See discussion in Section 4.2.4 and 4.3.6).

The results of the experiments in this study provide empirical support in favour of the second formulation of Grodzinsky's theory. Sentences that contained no trace, for example, as for sentences and the Hebrew object relatives with a resumptive pronoun, but required coindexation between the moved noun phrase and the pronoun were as difficult for Broca's aphasics as the sentences with trace. This could imply that coindexation between two distant elements in a sentence is a process which is difficult for some Broca's aphasics.

It must, however, be taken into account that the results in these experiments are also congruent with a theory that maintains that sentences with a non-canonical word order are particularly difficult for agrammatic patients because they interpret sentences by a linear strategy rather than syntactic analysis. The results on one sentence type in Experiment I, sentences with focused by phrase, like by the man the woman is being kissed, argue against the 'linear strategy' hypothesis. If patients were relying mainly on a linear strategy and hence
interpret the first NP as the Agent, why were not they more successful on these sentences?

4.12.3 The effects of reversibility

In most experiments that test the syntactic comprehension abilities of aphasic patients, reversible sentences are used as input sentences in order to prevent the use of semantic and pragmatic cues by the patients. There is a possibility, however, that reversible sentences, while solving one problem for the experimenter, create another for the patient.

In the present studies, Experiments II and III did not use reversible sentences. Experiment II included active and passive questions. In these items, although a second participant was implied, it did not surface in the question of the experimenter nor in the reply that was required. The existential sentences in Experiment III were also not reversible. This experiment exploited the different argument structures of identical verbs, like the transitive and intransitive uses of *eat*, *drive* and *walk*. The advantage of these sentence types is that the pictures too were non-reversible: in one picture a dog is walking in the park and in the second picture, a boy is walking the dog.

Looking at the results of all five experiments, significant differences between actives and passives were
only found in the experiments which used reversible sentences. There were no significant differences between actives and passives in Experiment II and III. The few errors made by most patients in active sentences, sentences in which there is no passive morphology, nor non-canonical word order, no trace and no need for coindexation, might indicate that reversibility has a detrimental effect on the comprehension abilities of Broca’s aphasic patients. Further studies which explore the effects of reversibility are needed with more subjects and more sentence types that are non-reversible.

4.12.4 Individual differences and the question of parallelism

Not all the Broca’s aphasics who participated in this study demonstrated a comprehension deficit. Both in the English and the Hebrew experiments there were patients who were at above chance level on all the sentence types. The existence of Broca’s aphasics (agrammatics) without comprehension problems is today a well documented phenomenon. There is evidence in this study and in others that it is possible to be agrammatic in production while having relatively intact comprehension. In subsequent chapters of this study the question of parallelism between production and comprehension will be further discussed.
CHAPTER FIVE

THE PREPOSITION DEFICIT IN AGRAMMATISM

5.1 Introduction

Prepositions, *in, to, under, with* etc., are a particularly complex lexical category within the grammar. They fulfil a number of functions in sentences and it is not always easy to distinguish between one or another function. For example:

a. The students filled in the forms.
b. Most people hope for peace.
c. She lives in a nice big house.
d. The translation of the book is very good.

In sentence (a), the preposition *in* is an integral part of the verb, a particle rather than a real preposition. In sentence (b), *for* is a preposition which is the head of the PP *for peace*. The presence of the preposition and its idiosyncratic identity (*for*) is required by the verb (*hope*) and is specified in the lexical entry of the verb. In sentence (c), *in* is a locative preposition with a locative meaning attached to it. The use of *in* in this case is not arbitrary but has a specific meaning. In sentence (d), *of* is not a true preposition, but a Case marker; *of* assigns Case to the *book*; it has no semantic
function in the sentence.

In the traditional account of agrammatism, within the framework of the 'economy of effort' hypothesis, grammatical morphemes, the 'small words' of the language, are omitted in order to save effort. This account had no motivation for distinguishing among the different types of prepositions: grammatical morphemes in general were said to be omitted because they carry little informational value.

Similarly, Kean's phonological account (1977, 1979, 1980) and Bradley, Garrett and Zurif's (1980) lexical explanation of the grammatical morphemes deficit did not distinguish between the different types of prepositions, or between prepositions and other grammatical morphemes.

Later studies paid attention to the fact that not all prepositions are equally difficult for agrammatic patients and attempts were made to distinguish between the different types of prepositions (Zurif, Caramazza and Meyerson 1972, Zurif et al., 1976; Saffran, Schwartz and Marin 1980; Friederici 1981, 1982). This trend culminates in the work of Grodzinsky who approached the preposition deficit within GB theory. In this theory prepositions are analyzed as a major lexical category akin to verbs and nouns, unlike other grammatical morphemes (inflections, pronouns, complementizers, adverbials etc). GB theory makes a distinction among
different types of prepositions according to their position within the sentence.

The present chapter critically examines previous accounts and hypotheses concerning the preposition deficit in agrammatism and reports a detailed case study of S.L., a Hebrew speaking agrammatic patient who omitted all prepositions in spontaneous speech. She is, therefore a particularly suitable subject for an in-depth study of the preposition deficit.

5.2 Previous studies

Zurif, Caramazza and Meyerson (1972) suggested that meaningfulness or 'informational value' determine the availability of grammatical morphemes for Broca's aphasics. In their metalinguistic task patients were asked about their intuitions concerning the constituent structure of short sentences. They were asked which two words in a sentence like Gifts were given to John and Gifts were given by John went best together.

A sentence was presented to the patients both aurally and visually and it remained in front of them throughout the whole procedure. Following the reading of the sentence, subjects were given three words taken from the sentence: gifts, given, by; given, by John; gifts, were, given; etc. The patients were required to choose the two words out of the three that they felt went best together in
relation to the sentence from which they were taken.

The research question was to investigate how the patients grouped words together, whether on syntactic, semantic or linear grounds. The authors assumed that, if the linguistic intuitions of the patients were intact, they would put together words according to principles of bracketing in linguistic parsing, for example, words that constitute phrases: [PP by John]; [VP were given]; [NP the boy]; . Normal controls tended to do so.

The authors found that the patients were able to bracket [to John] and [by John] and [my shoes], in where are my shoes? They failed, however, to bracket [the dog] in the dog chased the cat and to bracket [to eat] in she likes to eat candy. Neither the article nor the infinitive (to) play a vital role in the meaning of the sentence.

This finding was interpreted to mean that Broca's aphasics have an underlying problem affecting their grammatical intuitions about constituent structure that is signalled mainly by function words. Some but not all the function words were ignored by the patients and the variable determining preservation was informational value (semantic function) within the sentence. Those functors that carried more informational value were more likely to remain unimpaired in Broca's aphasics. Articles were more impaired than possessive pronouns and both were more impaired than the prepositions to and by.
The authors argued that articles (a house, the house) and possessive pronouns (my house) have relatively little informational value attached to them. In contrast, prepositions which signal the thematic roles of John i.e. to John (Goal) and by John (Agent), have a major function in determining the meaning of the sentence. This is why these prepositions were better preserved than articles and possessive pronouns. To, however, as an infinitival in to eat, has no meaning and therefore was overlooked by the patients; the required link between to and eat could not be created.

Interestingly, Saffran, Schwartz and Marin (1980), using a different task, arrived at different results and conclusions. The authors tested the ability of eight agrammatic subjects to comprehend a wide range of syntactic structures, among them prepositional sentences, in a picture pointing task (1978). In Saffran et al (1980) the theoretical implications of the results are discussed. One of the claims were that the patients had difficulties with 'case marking prepositions' - "(following semantically inclined linguists like Fillmore 1968 and Chafe 1970)" - "exemplified in structures like a phone call to the boy versus a phone call from the boy." The subjects participating in the study had problems in comprehending sentences of the above type. In order to explain the results, the authors suggested
that the case marking prepositions in Fillmore's grammar are 'semantically empty'.

Both the finding, and the explanation of Saffran et al are exactly opposite to that of Zurif and Caramazza. In Zurif and Caramazza's experiment the prepositions, like to the boy and from the boy obtained better results than other grammatical morphemes, and the authors suggested that this was because these prepositions were functional for determining the meaning of the sentence. Saffran at al made a very different interpretation of their data, and of Fillmore's grammar:

"The principal difference between the case marking morphemes and the other morphemes (not prepositions) that we tested is that these prepositions are semantically empty; they serve only to mark the relation which the noun phrase bears to the verbal element (in the previous example, whether the boy is the initiator of the phone call - the agent of the implicit verb - or the recipient.)" (p.237)

Contrasting these two experiments and the conclusions derived from them demonstrates the confusion that prevailed in aphasia research in matters linguistic just 10 years ago. That was the time when linguistic concepts started to mingle with memories of school grammar. Terms like syntax, semantics, syntactic, semantic, syntactic level and semantic level were freely used as if they were self explanatory and unproblematic concepts rather than the building blocks of a theory that required definitions. This is the reason why it is possible that
one type of prepositions, that for Zurif et al carried meaning, were semantically empty for Saffran et al. In GB terminology, the prepositions in question in both experiments are thematic role assigners and thus, crucial for the semantic representation of the sentence.

5.3 Friederici’s theory: a syntactic deficit

Friederici (1981) examined how aphasic patients dealt with prepositions in different modalities in order to determine the linguistic level that is impaired in Broca’s and Wernicke’s aphasia. She tested 6 Broca’s and 6 Wernicke’s aphasics. In experiment one, the availability of prepositions as single items, and in experiment two, prepositions as parts of sentences were tested. In both experiments, pictures were shown to the subjects depicting situations that required locative and directional prepositions (e.g., the ball is in the box, the ball is behind the box).

In experiment one, in the first condition, the subjects looked at individual pictures and were asked to produce the relevant preposition. In the second condition they were shown individual pictures and had to choose the correct preposition out of four different prepositions presented to them.

In experiment two, a sentence with a missing preposition was presented together with the picture. In condition one, the subjects had to produce the preposition and in
condition two, they had to choose the correct preposition out of four prepositions.

The results commented upon here deal only with Broca's aphasics. No significant difference was found between the first conditions of the two experiments. The production of prepositions was equally difficult when the requirement was to produce just a preposition without a sentential context, and when the task was sentence completion.

Significant differences were found, however, between the two conditions in both experiments. Producing the correct preposition was more difficult than recognizing the correct preposition out of four presented prepositions. This difference was predicted from two assumptions: one, that the deficit in Broca's aphasia is syntactic and second, that for production, syntactic and phonological processes are required, whilst for choosing the correct preposition out of four, semantic processes are only needed. The results of the experiment confirmed the predictions and strengthened the assumptions on which they were based in a very circular manner indeed:

"Adopting the point of view that Broca's aphasics' deficit is a syntactic and/or phonological one, we take their performance to reflect the necessity of syntactic computation in the production and perception of prepositions. Syntactic processes are more emphasized in production than in those perception tasks where temporal constrains are less evident. The perception performance in these tasks seems to be supported by semantically based processes which increases Broca's aphasics'
The conclusion of the paper is that the difference in performance levels between production and comprehension in Broca's aphasics is due to the different demands of the two tasks. The deficit is the patients' inability to use their 'syntactic knowledge source'. They have difficulty in accessing function words which serve to assign syntactic structure during sentence processing. Broca's aphasics are able, however, to process the same prepositions in an input recognition task, because here semantic processes help the patients to select the correct preposition.

A second study (Friederici 1982) compared the availability of locative and of obligatory prepositions, in a production and in a judgement task. Locative prepositions are semantic prepositions, prepositions that convey some meaning. Obligatory prepositions, according to Friederici, are subcategorized by the verb; the verb cannot surface without them, but their identity (whether it is in or on or something else) is arbitrary.

The subjects were 12 German speaking Broca's and 12 German speaking Wernicke's aphasics. In the production task there were 28 sentences with a missing preposition that the subjects had to fill in. In the judgement task the subjects listened to sentences containing correct and
incorrect prepositions and they had to indicate whether the sentence was correct or not.

The study distinguished between locative prepositions, *Peter stands on l'aufl the chair* and idiosyncratic obligatory prepositions, *Peter hopes for l'aufr the summer*. The study also discussed the difference between the 'idiosyncratic obligatory' prepositions, *hope for, interested in, believe in* etc.) and verb particles, *look up*, but no sentences with verb particles were included in the experiment.

Theoretically, the distinction in this experiment was based on the different functional roles of morphologically identical prepositions: 'semantic' prepositions (locative, temporal) and 'obligatory' prepositions with idiosyncratic identities. Locative prepositions are said to carry semantic information, and assign a locative thematic role, while obligatory prepositions (*hope for the summer, afraid of dogs, interested in politics* etc.), according to Friederici's analysis, fulfill only a syntactic role, like Case assignment.

It was predicted that Broca's aphasics would show more difficulties with the 'syntactic' (idiosyncratic) prepositions. This prediction was borne out in the production task (sentence completion). Broca's aphasics produced more correct locative prepositions than
Idiosyncratic prepositions. In the judgement task the functional role of a preposition had no significant effect upon performance.

This is the first experiment which offers some form of linguistic analysis of the different functional roles prepositions fulfill in a sentence. The paper, however, like the previous one, presents a number of 'taken-for-granted' statements about syntactic and semantic processes that are allegedly required in certain tasks and not in others. The conclusions, therefore, appear far fetched.

It is not obvious that the difficulty in producing (in a sentence completion task) an obligatory preposition is due to 'difficulty in assigning syntactic structure during production' (p. 256). What is the source of the confident claim that:

"Since we take omissions and substitutions across categories to reflect a certain inability to use the syntactic knowledge source, this result provides supporting evidence for the view that Broca's aphasics are unable to assign structure during production." (p257).

These are the 'sweeping claims' of an optimistic era. Moreover, terms like 'semantic' and 'syntactic' are used without being defined and no distinction is made between the linguistic representations obtained and the psychological processing required to obtain those
representations. The assumption that, in order to produce a 'syntactic' obligatory preposition, syntactic processing is required and, that in order to produce a 'semantic' locative preposition, semantic processing is required, is simply an assumption.

In her 1981 paper Friederici established that prepositions are a problematic category for Broca's aphasics. She also found that the production of prepositions is more impaired than the recognition of correct prepositions. In her 1982 paper Frederici compared two types of prepositions: locative ones, like those used in the 1981 paper, and 'syntactic' ones (idiosyncratic obligatory) prepositions, like 'dream of the summer'). In the 1982 paper Friederici found that 'syntactic' prepositions are more impaired than 'semantic' prepositions.

Both papers conclude that Broca's aphasics have a syntactic deficit. But this is far from obvious. How can one reconcile the fact that not only 'syntactic' prepositions are difficult for Broca's aphasics but also 'semantic' prepositions? The two papers contradict each other. In the first paper it is claimed that producing prepositions per se requires syntactic processing; in the second paper the claim is that producing 'syntactic' prepositions demands syntactic processing, while other prepositions can be successfully produced by semantic processing.
Nevertheless, Friederici established two claims: one is that prepositions are a problematic grammatical category for Broca's aphasics and the second is that certain prepositions are more easily available for these patients than others. This latter finding, perhaps, overshadowed the first finding and subsequent workers concentrated on finding the right formula for defining the dividing line between the 'easier' and the more 'difficult' prepositions.

5.4 Rizzi's hypothesis

Rizzi (1985), a linguist working within a GB theory framework characterized the agrammatic deficit in terms of the thematic module. Only lexical items that are either assigners or assignees of thematic roles are preserved in agrammatism. Verbs, verb phrases, some nouns, some adjectives and some prepositions are assigners of theta roles, and referential NPs are the assignees of thematic roles. All these categories are preserved and all other categories are impaired. Rizzi's account distinguishes, for example, between predicative (The weather is nice) and attributive adjectives (nice weather). The adjective in the first sentence is a thematic role assigner, but in the second phrase, it is not. According to Rizzi's hypothesis, the former, the predicative adjectives, are preserved, while the latter, the attributive adjectives, are impaired. In relation to prepositions, according to this account only prepositions that are not theta role assigners are impaired, i.e. in
English, only of and the infinitival to. All other prepositions are retained.

5.5 Grodzinsky's theory

In GB theory, prepositions are analyzed separately from inflections and other grammatical morphemes. Prepositions are a major lexical category, not unlike verbs, nouns and adjectives, while inflections, determiners and some other closed class elements are not lexical.

According to Grodzinsky's account, grammatical morphemes are unavailable for agrammatic patients, because they are non-lexical (see Chapter 3 Section 3.7). This explanation, however, cannot be used for prepositions because these are analyzed in the linguistic theory as a lexical category. The preposition deficit, therefore, requires a separate account.

In Grodzinsky's work emphasis is placed on the distinction between preserved and impaired prepositions. Grodzinsky claimed that Friederici's observation about 'syntactic' and 'semantic' prepositions was on the right track but needed more precise theoretically motivated definitions. More importantly for Grodzinsky's account, Friederici's work provides empirical motivation for giving separate accounts of the preposition deficit and the grammatical morpheme deficit. Grammatical morphemes are always erroneously used or omitted; prepositions are
sometimes omitted and sometimes correctly used, depending on the type of preposition. One of the consequences of the two separate accounts is that a dissociation between a grammatical morpheme deficit and a preposition deficit is theoretically possible. In principle, one should be able to find a patient who has only one of the deficits: only inflections and determiners etc. are impaired but not prepositions, or the other way round.

Friederici distinguished between 'semantic' prepositions and 'obligatory' prepositions. Semantic prepositions are locative and temporal prepositions. Obligatory prepositions are required by the verb, their identity is idiosyncratic and specified in the lexicon; the verb cannot surface without them.

The arbitrary nature of these prepositions becomes evident when they are translated into a different language. This can be seen in the example used in Friederici's experiment or, if we compare angry with David in English with Koes al David in Hebrew. Al has a basic locative meaning of on and is used also in contexts where about is required in English. The difficulties involved in learning to use correct idiosyncratic prepositions is well known to anybody who tries to learn or teach a foreign language.

Grodzinsky (1988) distinguished among the following types of prepositions, presented in Figure 5.1
Figure 5.1 The classification of prepositions

Particles (a), go out, look up, ring up, run up etc. are not true prepositions as they do not head a phrase. Consider the contrast between:

I. Look up [NP his telephone number].
Look his telephone number up.

II. The mother is looking \{PP after [NP the boy]\}.

- The mother is looking the boy after.

The preposition in (I) is a particle; it is not the head of the PP and, therefore, can be separated from the NP: *up his telephone number* is not a phrase. The preposition in (II) is a true preposition; *after the boy* is a PP, and, therefore movement of the preposition out of the phrase is not allowed. Particles are reanalyzed in the grammar as an integral part of the verb and agrammatic patients are not expected to have difficulties with particles. As far as is known, no data exists to confirm or reject this claim. In the present context, particles will not be dealt with further.

Most prepositions are theta role assigners (b). As explained in Chapter 2 Section 2.5.4, theta roles are the semantic roles of NPs in sentences: agent, theme, goal, source, location, direction etc. By being theta role assigners, prepositions are part of the semantic representation of the sentence (e.g. *sit on the chair*, *write with a pencil*). There are, however, 'prepositions' that do not convey any meaning (c) and their role is purely syntactic. In English *of* and the infinitival *to* are prepositions which are not theta assigners. There are linguists who refer to these as Case assigners and not prepositions proper.
Among the theta assigning prepositions (b) there are obligatory (d) and optional (e) prepositions. In the sentence *John played tennis on Saturday*, the temporal preposition phrase is optional (e). The sentence remains syntactically adequate without the PP. In the sentence *Boys are interested in cars and John lives in London*, the PP is obligatory;

The obligatory prepositions (d) are further subdivided into

(f) idiosyncratic

(g) semantically determined prepositions

Examples of idiosyncratic prepositions include: *rely on, count on, apply for, interested in*. These are obligatory prepositions, whose lexical identity is semantically unmotivated. They assign thematic role to the NP they head, but the identity of the thematic role is unclear.

Semantically determined obligatory prepositions are found in sentences like *John put the book on the table*, where a certain type of preposition (for example, a locative preposition: *in, under, on* etc.) is required by the verb and the preposition assigns a locative thematic role to the NP that follows: the preposition is semantically determined.

Throughout this discussion prepositions are said to assign thematic role to the NP in the phrase they head.
This might not be accurate. It is possible that only optional prepositions assign thematic role; obligatory prepositions - prepositions that head phrases that are part of the argument structure of the verb - do not assign thematic role, but transmit the thematic role made available by the verb. This does not need to make difference to the argument.

Unfortunately we do not know the exact sentences Friederici used in her experiments since she only gave one example of each type. One type, her 'syntactic' preposition was, probably 'obligatory idiosyncratic' (f), hope for the summer. The second type, her 'semantic' preposition, could have been both optional (e) or obligatory/semantically determined (g), stood on the chair. For Friederici, the most important distinction is between semantically motivated (e & g) and semantically idiosyncratic (f) prepositions. For Grodzinsky, the dividing line is different and only overlaps partially with Friederici's distinction.

Grodzinsky's approach to the preposition deficit in agrammatism is completely different from Friederici's. Grodzinsky put forward two accounts, both of which are configurational, i.e. related to sentence structure. It is not the identity of the preposition, and not even its functional role in relation to meaning that determines whether it will be retained or not; rather its position
in the sentence is critical. More precisely, its closeness to the verb.

Grodzinsky' account of the preposition deficit is based on the linguistic analysis of GB theory described in Chapter 2, Sections 2.4.2, 2.5.1 and 2.5.2). According to the first formulation of Grodzinsky's hypothesis (1984b), prepositions which are complements of the verb, (daughters of the VP, VP PPs) are deleted from the S-structure representation of the sentence and therefore, are unavailable for agrammatic patients:

![Diagram of S-structure](image)

Prepositions that are daughters of S(entence) node - adjuncts - (S(entence) PPs) are unimpaired:

![Diagram of S-structure](image)

Only optional prepositions (e) occupy this latter position. All other prepositions (c & f & g) in Figure 5.1 are positioned within the VP and therefore impaired.
In Grodzinsky's account only optional prepositions are preserved, like John played tennis on Sunday. All other prepositions, including preposition like put the letter in the drawer, are impaired. These type of prepositions would be expected to be intact in Friderici's account because they are 'meaningful'.

Further examples of optional and obligatory PPs:

a. A sentence containing an optional preposition, preserved, according to Grodzinsky:

I wrote the letter in the office.

A newer formulation of the hypothesis is given in Grodzinsky (1988). This formulation uses the notion of Government and claims that governed prepositions are
impaired and ungoverned prepositions are retained.

Government (see Chapter, Section 2.5.1) is a structural relationship in GB theory, between a governor (one of the major categories) and a governed element: here, between the verb and the preposition. A verb governs a preposition that is inside its maximal projection, a part of the VP, like in the sentence *John lives in London*. A preposition that is not a constituent of the VP is ungoverned by the verb; like in the sentence *John played tennis on Sunday*, *on* is not governed by the verb. The new formulation covers the data in exactly the same way as the earlier one. This is because obligatory prepositions are analysed as a VP constituent; optional prepositions always occupy a position outside the VP. Governed prepositions are impaired and ungoverned prepositions are preserved.

5.5.1 How to decide whether a PP is governed or not?

To decide whether a PP in a certain context is governed or not is complex and is, at times, controversial among linguists. There are no definite rules, only guidelines, available for deciding whether a preposition is governed - a Complement of the verb - or whether it is ungoverned, i.e. an adjunct (see Chapter 2 Section 2.5.2).
1. a PP that is required by the verb is a governed PP; a PP that is part of the argument structure of the verb is governed. For example:

1. PUT Agent, Theme, Location
2. GIVE Agent, Theme, Goal
3. SEND Agent, Theme, Goal
4. STEAL Agent, Theme, Source

*Put, give, send and steal* are three arguments verbs. The underlined argument is the external argument, the subject argument. The external argument is part of the argument structure of the verb but is analysed as not part of the VP; it is external to the VP. The third arguments - Location, Goal and Source - are arguments introduced by a preposition, and these are part of the predicate, VP PPs, i.e. PPs that are part of the maximal projection of the verb:

\[
\begin{array}{c}
\text{give} \\
\text{the book} \\
\text{to the boy}
\end{array}
\]

These PPs are governed, and, in (1) and (2), their omission creates ungrammaticality:

* John gave the book.
* Mary put the coffee.

The situation is more problematic, however, in (3) and (4):

John stole the book.
Mary sent the book.
where the absence of the PP, the Source and Goal arguments do not create ungrammaticality. Nevertheless, these arguments seem closely related to the verb, they are the arguments of the verb. Thus, when they are present, they are analysed as governed by the verb.

In order to account for the different ways in which a verb relates to its arguments, for example put and send, Grimshaw (1988) suggested a distinction between obligatory and optional arguments. All the arguments of put are obligatory, but the Goal argument of send is optional. An optional argument is still an argument and part of the VP like an obligatory argument and when present, is analysed within the VP and is governed.

2. Temporal PPs are usually not part of the argument structure of the verb; the verb does not require their presence. Therefore, they are analysed outside the maximal projection of the verb; they are adjuncts, and hence un governed. For example:

He left after dinner.

```
NP       S       VP       PP
  he     left     after dinner
```
4. Dresher (1981) suggested that temporal PPs (ungoverned PPs) prepose freely:

After dinner he left.

This is not so in the case of governed prepositions. This can be seen in the following example of an ambiguous sentence:

John decided on the boat.

Two interpretations are available for this sentence:

a. John decided while standing on the boat.

b. John decided to buy the boat.

If the sentence means (a) the PP is ungoverned. If it means (b) the PP is part of the argument structure of the verb and governed. When preposing the PP,

On the boat John decided, only the ungoverned (a) interpretation of the sentence is available; the sentence is no longer ambiguous.

5. Another diagnostic suggested by Dresher concerns locative prepositions that are part of the argument structure of the verb (governed prepositions). The example of Dresher is:

The man dashed into the post office.

Dresher claims that such sentences contrast with sentences in which the PP is ungoverned (The man left after dinner. This is because governed locative PPs cannot simply prepose:

* Into the post office the man dashed

The ungrammaticality can be corrected by inversion:
Into the post office dashed the man.
The rationale is that the whole VP (including the PP) dashed into the post office, has been preposed and then inversion has taken place.

6. The 'do so' test:
   a. The girl is going [with the boy.]
   b. The girl is going [to the boy.]

   a. The girl is going with the boy and the dog is doing so with the cat.
   b. The girl is going to the boy and the dog is doing so to the cat.

By applying this diagnostic, we can see that in sentence (a) the PP is an adjunct; the verb and the PP are separable from each other (and, therefore, doing so with the cat is grammatical). In sentence (b) the PP is a complement and thus cannot be separated from the verb (and, therefore, doing so to the cat is ungrammatical).

7. Another possible test concerns ordering.
Complements - being governed by the head category - always occur closer to their heads than Adjuncts (that are ungoverned):

   a. The girl is going to the school with the dog.
   b. The girl is going with the dog to the school.

Sentence (b) is not ungrammatical, but the word order is marked, because the complement of the verb is separated from it. The more natural word order is in sentence (a),
where the complement is adjacent to the verb.

Even with these guidelines, it is not always easy to decide whether a certain preposition is governed or not.

5.5.2 Grodzinsky's experiment

Grodzinsky (1988) compared the ability of four agrammatics, four Wernicke's aphasics and four normal subjects to make grammaticality judgements on 60 sentences: There were 30 sentences with prepositions correctly used and 30 sentences with incorrect prepositions. The following sentence types were used:

a. active sentences with idiosyncratic/obligatory prepositions (f) (see Figure 5.1):
   I. The boy counts on the girl
b. adjectival passives with idiosyncratic/obligatory prepositions (f):
   II. The boy is interested in the girl.
c. verbal passives with an optional PP (e):
   III. The boy is pushed by the girl.

According to Grodzinsky's hypothesis, for the agrammatic patients, the (I) and (II) sentences are predicted to be impaired, as in these sentences the preposition is governed. The (III) sentences are ungoverned and therefore predicted to be unaffected. The results of Grodzinsky's experiment (for the agrammatic patients only) are presented in Table 5.1
TABLE 5.1

<table>
<thead>
<tr>
<th></th>
<th>grammatical condition</th>
<th>ungrammatical condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>active</td>
<td>.15</td>
<td>.50</td>
</tr>
<tr>
<td>adjectival passive</td>
<td>.10</td>
<td>.68</td>
</tr>
<tr>
<td>verbal passive</td>
<td>.25</td>
<td>.23</td>
</tr>
</tbody>
</table>

From Grodzinsky (1988 p. 127-128)

Grodzinsky interpreted these results as supporting his predictions, although his interpretation of the data is not the only possible interpretation. In fact, the experiment does not provide evidence for his hypothesis. The sentences used in his experiment were of two types:

1. sentences containing optional prepositions:
   verbal passives (III)

2. sentences containing obligatory, idiosyncratic prepositions:
   in adjectival passives (II)
   in sentences with verbs that require certain prepositions, like count on (I)

The contrast was not the intended contrast between governed and ungoverned prepositions, but rather the same contrast that Friederici (1982) had used between semantically motivated and semantically unmotivated prepositions (stand on the chair, hope for the summer).
The prepositions in type (2), were semantically unmotivated and idiosyncratic. In type (1), in the verbal passive, *by* is semantically motivated insofar as it consistently assigns Agent role in a passive sentence.

In order to test Grodzinsky's hypothesis, different sentences must be used in the experiment. They must exemplify the crucial contrast between governed (d) and ungoverned (e) prepositions (see Figure 5.1). Moreover, they have to be made comparable by using sentences in which both the governed prepositions and the ungoverned prepositions are semantically determined.

For example:

**governed preposition (d):** John put the book on the table.
**ungoverned preposition (e):** John played tennis on Sunday.

A further problem with Grodzinsky's experiment is that, according to his own hypothesis, governed prepositions are deleted from the s-structure representation of agrammatic patients and are therefore totally unavailable for any form of processing. If this is true, for the governed prepositions (actives and adjectival passives in his experiment) in all conditions (grammatical and ungrammatical) the results should be at chance.

Grodzinsky's claim that the s-structure representation of sentences for the agrammatic patient lacks specification for the node of a governed preposition and hence the identity of the preposition is unspecified. For example,
for the agrammatic the tree structure of the sentence, the boy counts on the girl is the following:

```
NP  
INFL
VP
   V
     P
       PP
         NP
```

the boy present count ? the girl

Grodzinsky's account, therefore, cannot explain why the grammatical condition obtained better results than the ungrammatical condition (see results in table 5.1). In the ungrammatical condition, there is a real difference in performance (proportion of errors) between the active (.50) and adjectival passives (.68) on the one hand, and the verbal passives on the other (.23). In the grammatical condition, performance was better for all sentence types, and the difference disappeared (.15, .10, and .25). In fact, the proportion of errors was slightly higher in the verbal passives. The results in the grammatical conditions and the difference between the two conditions are inexplicable in Grodzinsky's system, which demands by its nature robust and straightforward results. Moreover, in a similar experiment in Hebrew (Grodzinsky 1984b) there were no significant differences between any of the preposition types.

The grammaticality judgment task is useful for testing linguistic material that cannot be assessed otherwise.
but it has problems. In grammaticality judgement tasks, the results are often better in the grammatical condition then in the ungrammatical condition. Why? It might be that in order to reject a sentence confidently, it is not enough to feel that the sentence is incorrect, but also to compare it with its correct version. In the grammatical condition, this is not necessary. Another reason could be that patients might generally prefer to say yes, a response bias, which is the correct response for the grammatical sentence and is erroneous in the ungrammatical condition. In a grammaticality judgment task it is certainly wrong to overlook the results in the grammatical condition.

It seems that Grodzinsky's experiment has too many problems to regard it as providing compelling evidence in favour of the hypothesis that governed prepositions are impaired and ungoverned proposition are preserved. The design of the experiment and the wrong choice of the sentences did not allow a real test of the hypothesis. The question whether government is an important factor in the preservation or impairment of prepositions remains an open question.

A short summary of previous research

In summary, the following hypotheses have been suggested in the last 20 years as an explanation for the preposition deficit:
1. Prepositions, like other grammatical morphemes, are non phonological words, and unstressed in a normally intonated sentence. Agrammatics have lost their sensitivity to these unstressed items and, therefore, these morphemes are unavailable both for production and for comprehension (Kean 1977, 1980).

2. Bradley, Garrett and Zurif (1980) suggested a processing account for all closed class lexical elements (grammatical morphemes). This theory proposed that function words are normally accessed in a specialized lexical store but in Broca's aphasia this special store has been damaged and therefore the patient must access function words in the same general-purpose lexicon used for content words. This retards the availability of function words.

3. It has been repeatedly suggested that the lack of informational value in prepositions is the reason for their impairment in Broca's aphasia (Zurif et al. 1972, Saffran et al. 1980 and Friederici 1981, 1982). According to this account, 'meaningful' prepositions, are preserved.

4. Rizzi's theory is linguistically formulated. Those prepositions which assign thematic roles are preserved and those that do not are impaired. The problem with this
theory is that it predicts that most prepositions will be unimpaired and this has been shown not to be the case.

5. The configurational hypothesis of Grodzinsky maintains that governed prepositions are impaired and ungoverned prepositions are preserved. One problem with testing this theory is that it is not always clear which preposition is governed and which is not: linguistics often disagree on this question. Another problem is related to the question of parallelism. The hypothesis was presented in a parallelistic framework "In agrammatism, governed prepositions are deleted, all others are retained. This characterization, apparently accounts for the deficit in both the production and comprehension of prepositions." (Grodzinsky 1990 p.61). It is not clear how such an account could hold if the deficit is found not to be parallel.
THE PRESENT STUDIES

The present study aims to test the theories of Friederici, Rizzi and of Grodzinsky by examining in detail the availability of a wide range of different prepositions in different modalities in one agrammatic patient. The research question is: What are the factors contributing to difficulty: meaningfulness?, government? or something else? What, in particular, determines the presence/absence of a preposition in spontaneous output, in reading, in sentence completion, in writing, in repeating, in comprehension and in sentence judgement tasks?

5.6 A case study

S.L. is a 64-year-old right-handed woman. She is a native Hebrew speaker, with secondary education, who worked as a secretary prior to her stroke. A left hemisphere C.V.A., of embolic origin was sustained 5 years prior to testing. No CT is available, but there is a pronounced right hemiparesis.
5.6.1 The spontaneous speech of S.L.

102 utterances were recorded and transcribed. The shortest ones consists of two words and the longest of 10 words. There are very few grammatically perfect utterances. Most contain errors and omissions, but all are comprehensible, or become so following attempts at self correction.

In order to give some idea of the quality of S.L.'s speech, details of the number and type of errors she made in the 102 utterances follow:

1. Word order errors: in 8 utterances
   examples:
   a. Paam orex din yoter pikxit ani
      once solicitor more clever I
      Once I was more clever than a solicitor
      Paam hayiti yoter pikxit me-orex din
      I was from
      than
   b. Ani xoSevet oSirim ha- horim Sela.
      I think rich the parents her
      I think her parents are rich
      Ani xoSevet Se-ha- horim Sela oSirim
      that

2. Errors related to verbs:
   missing verb: in 17 utterances
   use of the wrong verb: in 6 utterances
   nominalization of verb: in 7 utterances
   using the wrong verb form: in 6 utterances
   wrong tense, person, gender: in 18 utterances
   auxiliary missing: in 9 utterances
Verbs are a difficult category for this patient but there were instances when verbs were correctly used, mostly in the present tense, sometimes in the first person past, but never in the future tense. It should be noted that verbless sentences are possible in Hebrew in the present tense. Many examples of S.L.'s errors in relation to verbs are given in Chapter 6.

Other errors that could be detected (because the omission appears when the item is obligatory) are:

3. Subordination is not formulated in 10 utterances

4. Definite article is missing in 11 utterances

5. Personal pronouns are missing in 6 utterances.

6. Agreement between noun and adjective or wrong gender in nouns and adjectives in 9 utterances

7. The accusative marker, *et* is never used, missing in 9 utterances

8. The genitive case marker *Sel* is never used, missing in 2 utterances
9. The possessive I have is missing in 6 utterances

10. Prepositions are never used, missing in 37 utterances

The only preposition noted in this corpus is in be-ragez (in anger, meaning: be on bad terms with). It seems that the preposition is used as an unanalyzed part of the content word.

5.6.2 Examples of utterances with missing prepositions

The format of presentation of utterances line by line, will be as follows:

1. each utterance transcribed in Hebrew;
2. translated word by word into English
3. translated into an English sentence
4. the correct version of Hebrew sentence
5. any new material added was further translated into English, thus showing the missing words in the original spoken sentence by the patient.

A comparison between line 4 and line 1 shows all errors including errors of substitution. Materials in brackets are additions by the researcher, made to clarify the meaning.

1. Lo meuSeret Rina ha-horim Sela not happy Rino the parents her
   Rino was not happy with her parents
   Rina lo hayta meuSeret im ha-horim Sela was with

2. Kol ha-zman yoSevet sefer, yoSenet all the time sits book sleeps
   All the time sits with a book or sleeps
   Kol ha-zman yoSevet im sefer o yoSenet with or
3. Halaxti ha- Suk
   I went the market
Halaxti la- Suk
   to the

4. Lo, Yosi mitgareS Rina
   no, Yosi divorce Rina
   no, (I want) that Yosi will divorce Rina
lo, (ani roca) Se-Yosi yitgareS ml-Rina
   that will divorce from

5. Xaval xayım Yosi
   pity life Yosi
   It is a shame to waste Yosi's life
   pity on Yosi's life
   Xaval al ha- xayım Sel Yosi
   on the of

6. mora ciyur
   teacher drawing
   art teacher
   mora le-ciyur
   for

7. Mozmin xatuna
   invites wedding
   She invited me to (the) wedding (of her son)
He hizmina oti lo- xatuna (Sel ha-ben Sela)
   she invited me to the of the her

8. hizmini oti xatuna
   invite (imp.) me wedding
   She invited me to the wedding
He hizmina oti lo- xatuna
   she me to the

9. Xaveron lo mistaderet David xaveron
girlfriend not get on girlfriend
   hix girlfriend does not get on with David's girlfriend
   ha-xaveron Selo lo mistaderet im ha-xaveron Sel David
   the his with the of
10. Yosi xatuna mazmin
Yosi wedding invite
Yosi invited her to his wedding
Yosi hizmin oto la- xatuna Selo
her to the his

11. Self correction of the above:
Yosi hizmin oto xatuna
invited her wedding
wrong non existent past tense form
Yosi hizmin oto la- xatuna Selo
to the his

12. Karov Bat Yam
near Bat Yam
near to Bat Yam
Karov le-Bat Yam (name of place)
to

Given the total omission of prepositions in spontaneous speech, it is important to know how prepositions fare in other modalities and in a variety of linguistic tasks. The questions that will be asked are the following:

1. Are some prepositions more difficult than others?
2. Are some tasks more difficult than others?

Since S.L. omits all prepositions in spontaneous speech, the question of whether some prepositions are more difficult than others cannot be raised with respect to this corpus. There is, however, the possibility that such degrees of difficulty for prepositions could be investigated in other
tasks. The following tasks were therefore given to the patient:

EXPERIMENTAL STUDIES

a. Experiments involving single prepositions

In these experiments, the availability of prepositions as individual lexical items was tested.

Experiment I: Repeating single prepositions
Experiment II: Reading single prepositions
Experiment III: Writing single prepositions to dictation

b. Experiments involving prepositions within sentences

These experiments tested the availability of prepositions within sentences, including prepositions of all types: semantically motivated and unmotivated, governed and un governed.

Experiment IV: Repeating sentences containing prepositions

In this task all the prepositions were semantically motivated, some were governed and some were un governed.

Experiment V: Reading sentences containing prepositions
Experiment VI: Comprehension of spoken sentences in a picture pointing task

In this task all the prepositions were semantically motivated, some were governed and some were un governed.

Experiment VII: Grammaticality Judgement task

In this task there were all types of prepositions and Case assigners. S.L. had to choose the correct sentence out of four.

Experiment VIII: Verbal production in response to 'prepositional' situations

In this task S.L. had to produce spoken sentences to describe situations in which actual objects were placed inside and outside boxes etc.

Experiment IX: Sentence completion task

S.L. had to say (or write) the missing preposition.

In this task there were all types of prepositions and Case assigners.

5.7 Experiments involving single prepositions

The purpose of this group of experiments was to discover whether S.L. could respond to the input of single prepositions in these simple tasks. The question is: Is S.L. physically capable of expressing prepositions?
5.7.1 Experiment I: Repeating single prepositions

The purpose of this experiment was to test S.L.'s ability to produce prepositions when the input is spoken.

Materials and Method

The patient was asked to repeat twice 19 individual prepositions in two sessions.

Results

S.L. had no problem in repeating prepositions. All 19 prepositions were correctly produced on both occasions.

5.7.2 Experiment II: Reading single prepositions

This task investigated whether S.L. could recognize and read prepositions when the input is their written form.

Method and Materials

The test contained 69 instances of prepositions. The most common prepositions in Hebrew appeared in the test a number of times.
Results

S.L. read correctly 36 prepositions, about half of the total number of items presented. An analysis of her errors is presented in Table 5.2 and a list of the prepositions correctly read in Table 5.3.

Her problem with prepositions seen in spontaneous speech is apparent in this task too. It is different, however, because in the present task she managed to read at least once every single preposition, including those prepositions that assign Case only, Sel (of) and et (acc. marker), prepositions that are considered difficult by all researchers.

Of the 67 instances of prepositions 31 errors were made. The errors included omissions, when S.L. failed to respond; substitution errors, when she read instead of the target preposition another grammatical morpheme, or a content word; wrong pronunciation and the use of suffixed prepositions instead of the required bare preposition. Adding a suffix to the prepositions is a special characteristic of the Hebrew language and, therefore requires explanation. In Hebrew all prepositions can be pronominalized by adding to
the preposition a pronominal suffix. When a pronominal suffix is added to a preposition, the preposition acquires features signifying person, number and gender. For example:

<table>
<thead>
<tr>
<th>the preposition:</th>
<th>its suffixed form</th>
</tr>
</thead>
<tbody>
<tr>
<td>et</td>
<td>acc. marker ot1, otxa me, you (acc.)</td>
</tr>
<tr>
<td>Sel</td>
<td>of Sel1, Selxa mine, yours</td>
</tr>
<tr>
<td>lifney</td>
<td>in front of lefanenu in front of us</td>
</tr>
<tr>
<td>ol</td>
<td>on alay on me, about me</td>
</tr>
</tbody>
</table>

Adding a suffix to a preposition proved to be a recurring error of S.L. and therefore, will be discussed in greater detail in Section 5.10.1).
TABLE 5.2

S.L.'s errors in reading single prepositions

<table>
<thead>
<tr>
<th>THE TYPE OF ERROR</th>
<th>NUMBER OF TIMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. omission, no response</td>
<td>14 times</td>
</tr>
<tr>
<td>preposition no. of times</td>
<td></td>
</tr>
<tr>
<td>al yad</td>
<td>next to</td>
</tr>
<tr>
<td>al</td>
<td>on</td>
</tr>
<tr>
<td>min</td>
<td>from</td>
</tr>
<tr>
<td>klapey</td>
<td>towards</td>
</tr>
<tr>
<td>im</td>
<td>with</td>
</tr>
<tr>
<td>meal</td>
<td>from</td>
</tr>
<tr>
<td>mi-</td>
<td>from</td>
</tr>
<tr>
<td>le-</td>
<td>to</td>
</tr>
<tr>
<td>be-</td>
<td>in</td>
</tr>
<tr>
<td>b. substitution of another grammatical morpheme</td>
<td>8 times</td>
</tr>
<tr>
<td>target</td>
<td>substitution</td>
</tr>
<tr>
<td>bli</td>
<td>without</td>
</tr>
<tr>
<td>bilsvil</td>
<td>for</td>
</tr>
<tr>
<td>left</td>
<td>according to</td>
</tr>
<tr>
<td>taxot</td>
<td>under (2 times)</td>
</tr>
<tr>
<td>be-</td>
<td>in</td>
</tr>
<tr>
<td>et</td>
<td>acc marker (2 times)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>c. substitution of content word</td>
<td>4</td>
</tr>
<tr>
<td>misaviv</td>
<td>around (2 times)</td>
</tr>
<tr>
<td>mi-</td>
<td>from</td>
</tr>
<tr>
<td>al yad</td>
<td>next to</td>
</tr>
</tbody>
</table>
d. the use of suffixed prepositions instead of bare prepositions 4

axarey after (2 times) axaray after me
lifney before lefonay before me
Sel of Seli mine

e. pronunciation error 1

bifney in front of nifney

Total errors 31
TABLE 5.3

Prepositions correctly read by S.L.

<table>
<thead>
<tr>
<th>Preposition</th>
<th>no. of times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biglal</td>
<td>3</td>
</tr>
<tr>
<td>ad</td>
<td>3</td>
</tr>
<tr>
<td>baad</td>
<td>1</td>
</tr>
<tr>
<td>et</td>
<td>2</td>
</tr>
<tr>
<td>le-</td>
<td>1</td>
</tr>
<tr>
<td>im</td>
<td>3</td>
</tr>
<tr>
<td>ol</td>
<td>4</td>
</tr>
<tr>
<td>el</td>
<td>1</td>
</tr>
<tr>
<td>ecel</td>
<td>2</td>
</tr>
<tr>
<td>beyn</td>
<td>2</td>
</tr>
<tr>
<td>axgrey</td>
<td>1</td>
</tr>
<tr>
<td>mul</td>
<td>1</td>
</tr>
<tr>
<td>likrat</td>
<td>1</td>
</tr>
<tr>
<td>mi-</td>
<td>1</td>
</tr>
<tr>
<td>Sel</td>
<td>1</td>
</tr>
<tr>
<td>neged</td>
<td>2</td>
</tr>
<tr>
<td>lifney</td>
<td>1</td>
</tr>
<tr>
<td>mitaxat</td>
<td>2</td>
</tr>
<tr>
<td>taxat</td>
<td>1</td>
</tr>
<tr>
<td>kemo</td>
<td>1</td>
</tr>
<tr>
<td>bisvil</td>
<td>1</td>
</tr>
<tr>
<td>meal</td>
<td>1</td>
</tr>
</tbody>
</table>

Total prepositions correctly read 36

In general, S.L. demonstrated an ability to read prepositions although she produced none in spontaneous speech. She made errors on 31/67 items. The types of errors made will be discussed when evaluating S.L.’s preposition deficit as a whole.
5.7.3 Experiment III: Writing single prepositions to dictation

In this experiment S.L. was asked to write single prepositions dictated to her by the researcher.

Method and Materials

The same 19 prepositions that were used in Experiment 1 (and Experiment 2) were dictated to S.L., twice each, in two sessions and she was asked to write them down.

Results

In 24 out of 38 trials S.L. wrote the correct preposition. With one exception, all the errors were of writing a suffixed form (see Section 5.7.2) instead of the dictated bare form of the preposition.
5.7.4 Discussion of experiments with single prepositions

The tests of reading, writing and repeating of single prepositions indicate that individual prepositions can be produced. Immediate repetition is perfect; S.L. was able to read approximately 50% and write to dictation 65% of the prepositions presented. Her writing to dictation is thus somewhat better than her reading.

5.8 Experiments involving prepositions within sentences

Given, then, that individual prepositions can be produced, the next question concerns their comprehension and their production in sentential context. While in the tasks involving single prepositions, the functional role and configurational position of the preposition within the sentence was irrelevant, in sentences the functional role of the preposition, whether it assigns only Case, or thematic role too, and its configurational position, whether it is in a governed or ungoverned preposition, is clearly indicated.
5.8.1 The following hypotheses are tested:

1. Prepositions that do not assign thematic role, i.e. prepositions that have only Case assigning role are very difficult (Rizzi 1985). Examples in Hebrew are: et, Sel and le- when used as Case assigner.

2. Friederici claimed that 'semantic' prepositions are preserved and 'syntactic' prepositions are impaired. Thus, all the non-thematic role assigning prepositions (Rizzi's category) plus all the non-semantically motivated prepositions (idiosyncratic) are impaired and the rest are preserved.

3. According to Grodzinsky, the crucial distinction is between governed prepositions (i.e. governed by the verb) and ungoverned adjuncts (see Chapter 2, Section 2.5.2). His claim is that all governed prepositions are impaired and ungoverned prepositions preserved. Thus all the prepositions that are governed by the verb: the Case assigning only prepositions (Rizzi's category), the non-semantically-motivated, idiosyncratic prepositions (Friederici's 'syntactic') and the semantically motivated prepositions that are part of the argument.
structure of the verb are impaired and the rest are preserved.

In Table 5.4 a summary of the predictions of Rizzi, Friederici and Grodzinsky in relation to the impairment or preservation of the various preposition types in agrammatism is given:

TABLE 5.4

<table>
<thead>
<tr>
<th>A summary of the predictions in relation to the preposition impairment in agrammatism</th>
<th>IMPAIRED</th>
<th>PRESERVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case assigning only</td>
<td>Rizzi</td>
<td>Friederici</td>
</tr>
<tr>
<td>prepositions</td>
<td></td>
<td>Grodzinsky</td>
</tr>
<tr>
<td>Sel, et, le-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of acc. marker, dative to.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semantic, thematic role assigning, optional prepositions:</td>
<td>Rizzi</td>
<td>Friederici</td>
</tr>
<tr>
<td>played tennis on Sunday</td>
<td></td>
<td>Grodzinsky</td>
</tr>
<tr>
<td>Idiosyncratic prepositions</td>
<td>Grodzinsky</td>
<td>Rizzi</td>
</tr>
<tr>
<td>dream about; interested in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'Semantic' obligatory prepositions:</td>
<td>Grodzinsky</td>
<td>Rizzi</td>
</tr>
<tr>
<td>put the book on the table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>go to school</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
All researchers agree that the Case assigning prepositions are very difficult for agrammatic patients. They have, however, different reasons for believing so. Rizzi argues that these prepositions do not have a function in the thematic module and in agrammatism the linguistic elements that are not part of the thematic module are impaired. Friederici maintains that only prepositions with 'meaning' are preserved and Case assigning only prepositions by definition have no meaning. According to Grodzinsky, these prepositions are impaired because they are governed.

Similarly, all researchers agree that optional prepositions are retained in agrammatism. These prepositions are thematic role assigners; they are 'meaningful' and ungoverned.

There is disagreement concerning the idiosyncratic prepositions and the obligatory prepositions with meaning. The idiosyncratic prepositions are thematic role assigners (or transmitters), and therefore, Rizzi would predict their preservation in agrammatism. Friederici considered them as 'syntactic', without meaning, and therefore claimed that they are impaired. These prepositions are
obligatory/governed, and therefore, according to Grodzinsky, impaired.

The obligatory 'semantic' prepositions are particularly interesting, because in this case the positions of Friederici and Grodzinsky diverge. This class of prepositions assigns a thematic role (Location, in the examples in Table 5.3). Therefore both Rizzi and Friederici would predict their preservation. They are, however, governed by the verb as the PP is part of the argument structure of the verb and the verb cannot surface without it. Grodzinsky, therefore, predicts their impairment in agrammatism.

To investigate further S.L.'s preposition deficit and to test the predictions of Rizzi, Friederici and Grodzinsky the following experiments were conducted:

Experiment IV: Repeating sentences containing prepositions

Experiment V: Reading sentences containing prepositions

Experiment VI: Comprehension of spoken sentences in a picture pointing task
Experiment VII: Grammaticality Judgement task
Experiment VIII: Verbal production in response to
   'prepositional' situations
Experiment IX: Sentence completion task
5.8.2 Experiment IV: Repeating sentences containing prepositions

In a preliminary testing session, S.L. was given 24 spoken sentences to repeat aloud. She reproduced only four prepositions out of 20 and three out of 8 accusative markers. She made other errors, such as omitting circa 50% of the definite articles, and making various errors in repeating the verbs in the sentences. Her most frequent error, however, is the omission of prepositions while the rest of the sentence is repeated well. Nonetheless, she did repeat some prepositions, among them the accusative marker, which is undoubtedly governed and has no meaning attached to it.

Materials and Method

12 sentences containing locative, 'semantic' prepositions selected from the sentences used in Experiment VI (see below) were given. S.L. was required to repeat each sentence verbatim immediately after hearing it once.
Results

The results are shown in Table 5.5 in the following form:

line one: the sentence to be repeated in Hebrew
line two: translation into English
line three: S.L.'s response if different
line four: errors, omissions

In front of the sentence, G indicates that the prepositions in the sentence governed and UG that it is un governed.

<table>
<thead>
<tr>
<th></th>
<th>S.L.'s repetition of sentences with prepositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. G</td>
<td>Ha-yareax nimca me-al ha-ananim.</td>
</tr>
<tr>
<td></td>
<td>the moon is found from above the clouds.</td>
</tr>
<tr>
<td></td>
<td>Ha-yareax nimca al ha-ananim.</td>
</tr>
<tr>
<td></td>
<td>above is a complex preposition consist of</td>
</tr>
<tr>
<td></td>
<td>mi- and al; (from and on). Only one part,</td>
</tr>
<tr>
<td></td>
<td>on is produced.</td>
</tr>
<tr>
<td>2. UG</td>
<td>Ha-buba yoSevet lifney ha-kufsa.</td>
</tr>
<tr>
<td></td>
<td>the doll is sitting before(in front of) the box.</td>
</tr>
<tr>
<td></td>
<td>correctly repeated.</td>
</tr>
<tr>
<td>3. UG</td>
<td>Ha-ofnoo noseo mul ha-mexonit.</td>
</tr>
<tr>
<td></td>
<td>the motorbike is travelling opposite the car.</td>
</tr>
<tr>
<td></td>
<td>ofnoo ofnoo nosaat mul mexonit.</td>
</tr>
<tr>
<td></td>
<td>bike bike travel opposite car</td>
</tr>
<tr>
<td></td>
<td>def art. gender def art.</td>
</tr>
<tr>
<td></td>
<td>missing wrong missing</td>
</tr>
<tr>
<td></td>
<td>the flowers are on the tree.</td>
</tr>
<tr>
<td></td>
<td>praxim al ha-ec.</td>
</tr>
<tr>
<td></td>
<td>def. art. dummy verb (hem = they)</td>
</tr>
<tr>
<td></td>
<td>missing missing</td>
</tr>
</tbody>
</table>
5. **UG** ha-mexonit nosaat misaviy le-beyt ha-sefer.
the car is travelling around to the school.
mexonit nosaat beyt sefer, mexonit nosaat.
def. art. complex preposition (around to)
missing missing

6. **G** ha-naalayim nimcaim ba-aron.
the shoes are found in the cupboard.
naalayim nimcaim aron.
def. art. preposition
missing missing

7. **UG** ha-aviron tas taxat ha-ananim.
the aeroplane is flying under the clouds.
ha-aviron tas mi-taxat ananim.
from under def. art.
correct. missing

8. **UG** ha-yalda raca im ima.
The girl is running with mother.
ha-yalda raca ima. ha-yalda ima.
gender prep. verb prep.
wrong missing missing

9. **UG** ha-yalda raca me- ha-yeled.
the girl is running from the boy.
ha-yalda raca ha-yeled.
prep.
missing

10. **UG** ha-dov yoSev al yad ha-buba.
the bear is sitting next to the doll.
ha-dov yoSev, ha-dov yoSev.
the whole PP
missing

11. **G** ha-temuna nimcet al ha-Sulxan.
the picture is found on the table
temuna moce al ha-Sulxan
def. art. verb form
missing wrong
12. UG  ha- ec gadel me-axorey ha- bayit.
the tree grows behind the house.
correct repetition

Total : 4 governed prepositions
8 ungoverned prepositions

TABLE 5.6
The prepositions S.L. correctly repeated

<table>
<thead>
<tr>
<th>The preposition and its translation</th>
<th>The context</th>
</tr>
</thead>
<tbody>
<tr>
<td>al (above)</td>
<td>governed</td>
</tr>
<tr>
<td>lifney (before)</td>
<td>ungoverned</td>
</tr>
<tr>
<td>mul (opposite)</td>
<td>ungoverned</td>
</tr>
<tr>
<td>al (on)</td>
<td>governed</td>
</tr>
<tr>
<td>mitaxat (under)</td>
<td>ungoverned</td>
</tr>
<tr>
<td>al (on)</td>
<td>governed</td>
</tr>
<tr>
<td>meoxorey (behind)</td>
<td>ungoverned</td>
</tr>
</tbody>
</table>

TABLE 5.7
The prepositions that S.L. omitted in the repetition task

<table>
<thead>
<tr>
<th>The preposition and its translation</th>
<th>The context</th>
</tr>
</thead>
<tbody>
<tr>
<td>misaviv (around)</td>
<td>ungoverned</td>
</tr>
<tr>
<td>ba- (in the)</td>
<td>governed</td>
</tr>
<tr>
<td>im (With)</td>
<td>ungoverned</td>
</tr>
<tr>
<td>ml- (from)</td>
<td>ungoverned</td>
</tr>
<tr>
<td>al yad (next to)</td>
<td>ungoverned</td>
</tr>
</tbody>
</table>

S.L. produced 7 prepositions out of the 12 required. In two cases there was a small alteration to the target
preposition: 'al' (on) instead of 'meal' (above) and 'mitaxat' (from under) instead of 'taxat' (under). In the first case she shortened the preposition and changed its meaning; it is therefore an error. In the second case, she lengthened the preposition and, colloquially, it is acceptable.

Discussion

The repetition of sentences with prepositions is difficult for S.L. compared with her perfect repetition of single prepositions in Experiment I. Nevertheless she does produce 7/12 prepositions.

Prepositions are not the only lexical items affected but they appear to be very difficult for her. She was, however, equivalently impaired in repeating definite articles (14/22). The repetition task does not distinguish between the various types of prepositions, as they were all 'meaningful' and she failed to repeat some governed and some ungoverned prepositions. In the preliminary test she repeated a few times the accusative marker that is governed and has no meaning but only a structural role in the sentence. Thus it seems that the repetition task does not differentiate between the different types of prepositions.
5.8.3 Experiment V: Reading sentences containing prepositions

The sentence reading experiment was designed for testing S.L.'s ability to read verbs in a variety of forms. Only some of the sentences contained prepositions. Nevertheless it was decided to report the experiment here because it offers an opportunity for direct comparison between S.L.'s ability to read single prepositions and prepositions within sentences.

Method and Materials

S.L. was required to read aloud 26 sentences 9 of which contained prepositions. In addition to these 9 bare prepositions, there were in the sentences 6 suffixed prepositions (see Section 5.7.2 for examples) too. The sentences were presented to her singly, written on individual cards, during four sessions.
Results

All prepositions (9/9) and accusative markers (2/2) were omitted. Four out of six pronominalized prepositions were produced. The required prepositions and their roles in the sentence are given in Table 5.8.

<table>
<thead>
<tr>
<th>The preposition</th>
<th>Role in the sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. le- to,</td>
<td>locative, governed</td>
</tr>
<tr>
<td>2. mi- from, (afraid of)</td>
<td>governed</td>
</tr>
<tr>
<td>3. al yad next</td>
<td>locative, ungoverned</td>
</tr>
<tr>
<td>4. be-od in another,</td>
<td>temporal, ungoverned</td>
</tr>
<tr>
<td>5. be- in,</td>
<td>temporal, ungoverned</td>
</tr>
<tr>
<td>6. al yadey passive by,</td>
<td>ungoverned</td>
</tr>
<tr>
<td>7. be- with</td>
<td>ungoverned</td>
</tr>
<tr>
<td>8. le- to dative Case assigner</td>
<td>governed</td>
</tr>
<tr>
<td>9. be- in,</td>
<td>temporal, ungoverned</td>
</tr>
<tr>
<td>10. et accusative marker 2/2</td>
<td>Case assigner governed</td>
</tr>
</tbody>
</table>

The suffixed (pronominalized) forms of et, the accusative and Sel, the genitive, and le-, the dative marker, obtained better results (4/6 correct). The pronominalized forms
appearing in the sentences and her responses were the following:

otı    me          correct
selo   his         omit
Sell    mine        correct (at first reads anı, I)
OTAX    you acc    me, and correct
OTo    me          correct
IOdu    to us      omit

S.L.'s reading is in general effortful and many items other than prepositions were omitted or wrongly read. Her other errors are presented in Table 5.9

TABLE 5.9

<table>
<thead>
<tr>
<th>Errors other than prepositions made by S.L. in the sentence reading task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definite articles</td>
</tr>
<tr>
<td>Verbs</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Infinitivals</td>
</tr>
<tr>
<td>Nouns</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Personal Pronouns</td>
</tr>
</tbody>
</table>
Discussion

Reading aloud sentences is clearly too difficult for S.L. She makes errors on all types of lexical items, verbs being the most difficult among the content words. There is, however, an important difference between content words on the one hand and prepositions and definite articles on the other. With content words, S.L. made errors, but she never omitted them. In contrast, prepositions and articles were omitted completely in the reading task. Prepositions and articles were similarly treated, but this is not so in spontaneous speech, where definite articles are often appropriately used, but preposition are always omitted.

5.8.4 Experiment VI: Comprehension of spoken sentences in a picture pointing task

In a comprehension task only picturable, 'semantic' prepositions can be used. These prepositions, according to Friederici's (and Rizzi's) hypothesis, are not expected to be impaired. In many of the selected sentences, however, the prepositions were governed by the verb and, therefore, these (according to Grodzinsky) are predicted to be unavailable for the agrammatic patient.
Methods and Materials

The patient looked at 4 pictures per trial and listened to a sentence containing a locative, or another, similarly picturable preposition, and was asked to point to the picture depicting the sentence. The foil pictures contained the same objects as the target picture in a different spatial arrangement. There were 36 sentences in the test that were presented to the patient in three testing sessions of 12 sentences each. Each target preposition appeared three times in the experiment, but only once in each testing session.

The following sentences (presented here in English translation) were used. The prepositions appropriate to the foil pictures are shown in brackets. For example, the first sentence, *The moon is above the cloud*, was accompanied by four pictures:
1. the target picture,
2. a picture in which the moon is under the cloud,
3. a picture in which the moon is beside (next to) the cloud,
4. a picture in which the moon is in the cloud.
(Examples of the pictures are in Appendix G)

The tests sentences

In front of each sentence listed below the configurational position of the PP is specified in the following form:
G: the PP is governed;
UG: the PP is ungoverned;

1. G-The moon is above the cloud. (under, next to, in)
   G-The picture is above the table. (next to, under, on)
   UG-The aeroplane is flying above the cloud. (in, next to, under)

2. G-The flowers are under the tree. (in front of, around)
   G-The picture is under the table. (above, next to, on)
   UG-The aeroplane is flying under the cloud. (above, in, next to)

3. UG-The doll is sitting in front of the box (in, under, on)
   UG-The bear is sitting in front of the doll. (behind, opposite, next to)
   UG-The doll is sitting in front of the box. (in, under, on)
4. **UG**-The motorbike is 'travelling' opposite the car.
   (behind, next to, around)

**UG**-The motorbike is 'travelling' opposite the car.
   (behind, next to, around)

**UG**-The bear is sitting opposite the doll. behind, next to
   in front of

5. **UG**-The motorbike is 'travelling' around the car.
   (opposite, behind, next to)

**UG**-The flowers are around the tree. (under, in front of, on)

**UG**-The car is 'travelling' around the school.
   (in front of, from, to)

6. **6**-The moon is in the cloud. (above, under, next to)

**6**-The shoes are in the cupboard. (under, on, next to)

**UG**-The tree grows in the house. (in front of, next to, behind)
7. UG-The doll is sitting on the box. (in front of, in, under)
   G-The flowers are on the tree. (under, in front of, around)
   G-The picture is on the table. (above, under, next to)

8. UG-The car is 'travelling' from the school. (to, around, in front of)
   UG-The car is 'travelling' from the school. (to, around, in front of)
   UG-The girl is running from the boy. (to, with, behind)

9. G-The girl is running to mother. (in front of, after, with)
   G-The car is 'travelling' to the school. (from, around, in front of)
   G-The girl is running to mother. (from, in front of, behind)

10. G-The shoes are next to the cupboard. (in, under, on)
    G-The shoes are next to the cupboard. (in, under, on)
    UG-The bear is sitting next to the doll. (opposite, behind, in front of)

11. UG-The girl is running with mother. (to, in front, after)
    UG-The girl is running with mother. (to, in front, after)
    UG-The girl is running with the boy. (behind, from, to)

12. UG-The girl is running behind the boy. (with, from, to)
    UG-The tree grows behind the house. (in, in front of, next to)
    UG-The tree grows behind the house. (in, in front of, next to)

The PPs are governed in 13 sentences and un governed in 23 sentences.
Results

The patient had no difficulty in completing this task without errors. The comprehension of these picturable, 'semantic' prepositions, whether they were governed or ungoverned, did not cause any problems for her.

Discussion

The prepositions in this experiment are the prepositions claimed to be easy by most researchers (Friederici, 1982, Rizzi 1985); prepositions with meaning, 'semantic' prepositions, 'theta role assigning' prepositions. These prepositions, however, are not always ungoverned. The governed prepositions (13 in this task) are predicted by Grodzinsky to be impaired. According to Grodzinsky's account governed prepositions are deleted from the agrammatic's s-structure representation and therefore should be unavailable for these patients. The patient should therefore resort to guessing. This did not happen; performance was excellent.
5.8.5 Experiment VII: Grammaticality Judgement task

For testing prepositions in the input modality, the grammaticality judgement task is the only way of testing the availability of a wide range of sentences with prepositions, not all of which can be shown in a pictured form.

Method and Materials

In order to reduce the problems associated with grammaticality judgement tasks, the patient was not presented with individual sentences, which she had to accept as grammatical or reject as ungrammatical. Rather, she listened twice to four 'sentences', one grammatical and three ungrammatical. These were read out to her with normal speed and intonation and she had to choose the correct one. Chance in this task, is thus 1:4.

There were 86 trials (i.e. blocks of four utterances) in this task. The availability of the following seven different Hebrew prepositions was tested:
In one sentence (out of four) the correct preposition appeared. In the remaining three sentences, incorrect prepositions were randomly chosen from the above list. The order of the sentences was randomly determined. For example, item one from the test (in English translation) is:

This year we go *in* Elyat in the summer.
This year we go *from* Elyot in the summer.
This year we go *acc. marker* Elyat in the summer.
This year we go *to* Elyat in the summer.

The prepositions appeared in different sentence structures. In some sentences the PP was governed and in others ungoverned. In some sentences the preposition was semantically motivated and in others idiosyncratic. The classification of the sentences and their numbers in the experiment are shown in Table 5.10 and one example of each sentence type is given below.
TABLE 5.10

<table>
<thead>
<tr>
<th>GOVERNED</th>
<th>UNGOVERNED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case assigners</td>
<td></td>
</tr>
<tr>
<td>accusative</td>
<td>8</td>
</tr>
<tr>
<td>dative</td>
<td>11</td>
</tr>
<tr>
<td>Idiosyncratic</td>
<td>17</td>
</tr>
<tr>
<td>Semantically motivated</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>

Sentences with governed prepositions:

1. Case assigners
   a. with accusative Case assigner, et
      
      Ani crixo lixtov et ha- mixtov ha-ze.
      I have to write acc. the letter this.
      I have to write this letter.

   b. with dative Case assigner, le-
      
      Yeladim crixim laazor la- horim Selahem
      Children have to help to the parents their
      Children must help their parents.

2. with idiosyncratic preposition
   
   Dani lo ohev lehiStameS be-sabon.
   Dani no likes to use in soap
   Dani does not like using soap.
3. With semantically motivated governed preposition

Rami tipes al ha-har.
Rami climbed on the mountain
Rami climbed up the mountain

With un gover ned preposition

Be-yom rison hu mesaxek te nin im ha-xaver Selo.
on Sunday he plays tennis with the friend his

(See the Hebrew test sentences in Appendix H)

Results

Overall S.L. made 10 errors out of 86 items. The results are shown in the following Tables (5.11, 5.12, 5.13).

<table>
<thead>
<tr>
<th>Type</th>
<th>no. of sentences in the task</th>
<th>no. of errors</th>
<th>percentage of errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>un governed</td>
<td>29</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>governed</td>
<td>57</td>
<td>9</td>
<td>15%</td>
</tr>
</tbody>
</table>

TABLE 5.11
### TABLE 5.12

<table>
<thead>
<tr>
<th>type</th>
<th>no. of sentences</th>
<th>no. of errors</th>
<th>percentage of error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case assigners</td>
<td>19</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>idiosyncratic</td>
<td>17</td>
<td>6</td>
<td>4%</td>
</tr>
<tr>
<td>semantically motivated</td>
<td>21</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>

### TABLE 5.13

<table>
<thead>
<tr>
<th>The sentence and its English translation</th>
<th>The error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I-efSar lismox al (on) ha-banaim Se-yigmeru et ha-avoda ba-zman.</td>
<td>It is impossible to rely on the builders that they will finish the work on time no response</td>
</tr>
<tr>
<td>2. Ani mitpalet al (on) ha-omec Sel ha-xoyalim.</td>
<td>I am surprised about the bravery of the soldiers.</td>
</tr>
<tr>
<td>3. Ima xola, ha-ozeret metapelet ba-yeladim.</td>
<td>Mother is ill, the daily woman is looking after the children.</td>
</tr>
<tr>
<td>4. Ha-mora koeset al (on) Dani.</td>
<td>The teacher is angry with Dani.</td>
</tr>
</tbody>
</table>
5. Lama ata lo sam lev le-(to) ma Se-ani omeret
   Why don’t you pay attention to what I say.

6. Dani lamed lenagen ba-(in) kinar.
   Dani learns to play the violin
   colloquially acceptable

7. Rami metapes al (on) ha-har
   Rami is climbing up the mountain

8. David mitvakeax tamid al (on) politika
   David argues always about politics

9. Ba-kayic tamid xam le-(to) Rina
   In the summer Rina is always hot

10. Ha-ir ho-zot nivneto al yadey (by) ho-romaim
    The city was built by the Romans

Discussion

S.L. completed the task quickly and with confidence. Only occasionally did she hesitate and her error rate is low. Lapses of attention and, in some cases, a lexical inability to identify the correct idiosyncratic preposition may be indicated. S.L. made 10 errors, i.e. on 10 occasions she chose as correct a sentence with the wrong preposition. One error was in a passive sentence where the PP by phrase is analysed as ungoverned. That the majority of the wrong Judgements (9/10) were in sentences in which the PP was
governed agrees with Grodzinsky's hypothesis (1988). However, if the results are analysed more carefully, a different picture emerges. The idiosyncratic prepositions (a subgroup of the governed prepositions) can be seen to have a considerably higher error rate than the governed prepositions in general. This suggests that it is not government in itself which causes problems; rather it is the presence of an idiosyncratic preposition which is the decisive factor for failing in this task. This distinction will be followed up in Experiment IX.

5.8.6 Experiment VIII: Verbal production in response to 'prepositional' situations

The aim of this experiment was to conduct a systematic investigation of S.L.'s ability to produce appropriate prepositions in response to situations. Because there was no linguistic input, this experimental situation was the nearest to spontaneous speech but the researcher controlled the situation and tried to enforce the use of prepositions.

Method and materials

In order to elicit prepositions, small toys were used, a girl doll, a boy doll, a tree, a bus, an ambulance, a box and a ladder. These items were placed in specific spatial
situations which would naturally be described by locative and directional prepositions. Examples would be a girl doll placed in a box, or the boy doll climbing up the tree. Because these were 'real' situations all these 'prepositional' situations had to be 'semantic'. The patient was asked to describe each situation after the experimenter presented it. 8 such 'prepositional' situations were shown.

Results

The results of this experiment are given in Table 5.14. In Table 5.14 the situation is described and S.L.'s response is reproduced verbatim. G(overned) and UG (ungoverned) in front of each sentence indicates the structural position of the preposition in an appropriate correct Hebrew sentence.
<table>
<thead>
<tr>
<th>The situation in English</th>
<th>S.L.'s utterance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. G The boy is in the box</td>
<td>Bifnim inside (adverb)</td>
</tr>
<tr>
<td>ha-yeled ba-kufsa.</td>
<td></td>
</tr>
<tr>
<td>2. UG The girl is standing next to the tree.</td>
<td>in writing: al yadey passive by, instead: al yad (by, locative)</td>
</tr>
<tr>
<td>ha-yalda omedet al yad ha-ec.</td>
<td></td>
</tr>
<tr>
<td>3. UG The bus is 'travelling' around the tree.</td>
<td>sivuv ec a turn N tree</td>
</tr>
<tr>
<td>ha-otobus nosea misaviv le-ec.</td>
<td></td>
</tr>
<tr>
<td>4. UG The bus is 'travelling' behind the ambulans</td>
<td>kodem kol ambulans ve axar kox otobus. First of all ambulance, and afterwards autobus.</td>
</tr>
<tr>
<td>ha-otobus nosea axrey ha-ambulans.</td>
<td></td>
</tr>
<tr>
<td>5. G The girl is coming out from a box.</td>
<td>yocet kufsa comes out box</td>
</tr>
<tr>
<td>ha-yalda yocet me- ha-kufsa.</td>
<td>come out from the</td>
</tr>
<tr>
<td>6. G The boy is climbing up the tree.</td>
<td>metapes al ha-ec climbs on the tree</td>
</tr>
<tr>
<td>ha-yeled metapes al ha-ec.</td>
<td></td>
</tr>
</tbody>
</table>
7.6 The boy is climbing down the tree
ha-yeled yored me-ha-ec. le-mata
down (adverb)

8. UGThe boy is walking with the girl
ha-yeled metayel im ha-yolda. yeled holex letayel
yaxad baxura. boy goes to walk
together girl.

Only one preposition in situation (6) was produced
correctly. The preposition in situation (2) was not
produced orally but written by S.L. and it was incorrect.
The rest of the situations were described ungrammatically by
using adverbs.

Discussion

Unfortunately, it was not possible to elicit further
responses. S.L. is quite aware of her difficulties with
prepositions and she was very aware of the experimenter's
intention to elicit prepositions in this task. She refused
to carry on 'playing the game'. The results, however, are
quite telling:

a. The task was clear to the patient and the situations were
unambiguous. All of S.L.'s responses were to the point.
b. The production of prepositions is difficult for S.L. and she prefers to express the meaning of the preposition by using an adverbial instead: e.g. bifnim (inside) kodem kol (at first) axar kax (afterwards), lemata (down) yaxad (together).

c. A point of caution: this task does not demonstrate solely the production deficit for prepositions. In addition to the lack of prepositions, there is also a considerable lack of verbs. S.L. produced only 3 verbs in 8 sentences, and 2 prepositions, one of them incorrect.

d. There is no hint of support for the notion that ungoverned prepositions are better preserved: the only preposition produced together with the verb is a governed preposition (6), and the ungoverned preposition (8) was not produced despite the intactness of the verb itself.

e. This task cannot clarify the putatively different availability of prepositions 'with and without meaning' (Friederici 1982). All the prepositions used here, as in the earlier described comprehension task, were picturable, and therefore, 'with meaning'.
5.8.7 Experiment IX: Sentence completion task

Although the accounts of Friederici, Rizzi and Grodzinsky diverge not only in the terminology they use but also in sorting the prepositions into the preserved or impaired category (see Table 5.4), all of them define the preposition deficit in agrammatism in terms of differences: some types of prepositions are impaired and others are preserved. Nevertheless, the previous experiments reported in this thesis did not show any differences between the various prepositions. There were differences in performance levels in the different tasks, but not between the different preposition types in any one experiment. The present experiment is a final attempt to elicit differences in S.L.'s performance level in relation to different preposition types.

Materials

In this task the patient was given spoken sentences with one missing word. These included various prepositions, the accusative marker (et), genitive marker (Sel), dative marker (le-) and also suffixed prepositions (see Section 5.7.2 for examples).
The following are examples from the experiment with the missing item underlined:

a. missing accusative Case marker:
   Ha- yeled zarak et ha- kadur raxok.  
   the boy      threw acc. the ball    far.

b. missing genitive Case marker:
   Ha- xeder Sel Yosi af paam lo mesudar.  
   the room of Yosi never (no) tidy

c. missing dative Case marker:
   ba- xoref tamid kar le- saba  
   in the winter alway cold to grandfather  
   Grandfather is alway cold in the winter.

d. missing idiosyncratic preposition
   Ani makira oto aval ani lo nizkeret bo- Sem Selo.  
   I know him but I don't recall (in) name his

e. missing semantically motivated governed preposition
   Kvar SaloS Sanim Dani mitkatev im Rina  
   already three years Dani corresponds with Rina

f. missing ungoverned preposition
   Rino holexet lo- kolnoo im ha-xaver Selo  
   Rino is going to the cinema with the friend her

g. missing suffixed (pronominalized) preposition
   Rina bodedo meod, he omeret: af exad lo ohev atif  
   Rina lonely very she says : nobody (no)loves me  
   ve- af exad lo xoSev alay  
   and nobody (no) thinks about me.

The task contained many items (235 sentences) to make sure that the different prepositions in their different roles
(Case assigners and thematic role assigners) and in different configurational positions (governed and ungoverned) would appear a sufficient number of times to permit reliable conclusions. The preposition \le- (to), for example, is used in Hebrew for multiple purposes (shown below) and, therefore, it was important to have in the experiment sufficient items for each function.

The functions \le- (to) fulfills in Hebrew sentences:
Assigns or transmits the following thematic roles:

- **direction**: go to school
- **goal**: give to
- **temporal**: for a year
- **benefactive**: bake a cake for Susan
- **possessive**: the boy has \(\rightarrow\) there is to the boy

Assigns Case:
- **dative**: ozer \le- masbir \le-
  help to explain to

The preposition 'be-' assigns locative

- **temporal**
- **instrumental thematic**
- **idiosyncratic thematic roles**

In addition to ascertaining that the preposition types discussed in Friederici's, Rizzi's and Grodzinsky's theories are well represented in the experiment, it was important to consider the special qualities of Hebrew prepositions in
choosing the sentences, since it is possible that the phonological qualities of the Hebrew prepositions might influence the results.

Some of the most common Hebrew prepositions are very short, for example:

be-  in
le-  to
mi-  from

These prepositions are not free standing morphemes, but appear as prefixes attached to the noun.

David nolad  be-Angliya
David was born in England

Sara nosaat  le-Italiya
Sara 'travels' to Italy
go

Uri ba  mi-Rusiya
Uri comes from Russia.

Be- and le- are less independent than mi-. When the noun headed by the preposition is definite, the definite article ha merges with the preposition and be- becomes ba- and le- becomes la-.

David gar  ba- bayit Sel Sara.
David lives in the house of Sara.

Sara lo  nosaat la- konferens
Sara does not 'travel' to the conference.
go
Ml- behaves differently; no merging takes place, but the definite article follows the preposition which becomes mihoa-

David kibel mixtav me- ha- misrad
David received a letter from the office

In addition, ml- and le- have an alternative free standing form: min and el. Both can only be used when the noun is definite and el is limited to the locative usage of le-.

There are two other very common prepositions: im (with) and al (on). These are free standing prepositions. The other prepositions in the task have more limited usages and are therefore less common. Often these prepositions were in the ungoverned position; they are usually longer items, more 'word' like:

lifney before
axarey after
kemo like
beyn between
al yad next to
al until
neged against
taxat under
biglal because of

The sentences were designed to target specific prepositions. In most cases, the insertion of only one specific preposition was possible. Other cases proved to allow
alternative prepositions but never another class of lexical item.
(See the Hebrew test sentences in Appendix I)

Method

The sentences were typed with empty spaces for the missing prepositions. They were read aloud by the researcher with normal speed and intonation and with a slight pause for the missing preposition. S.L. could also see the printed sentences. The reading was repeated as many times as the patient requested. Repetitions were requested only very infrequently. S.L. was asked to say the missing word, but she was frequently unable to do so and instead wrote her response. When the results are reported, either form of response is considered acceptable.

Results

The number and percentage of correct responses to specific prepositions are given in Table 5.15.
TABLE 5.15
The number of correct responses S.L. gave in the sentence completion task

<table>
<thead>
<tr>
<th>Preposition</th>
<th>numbers correct</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>et (acc.marker)</td>
<td>0/10</td>
<td>0%</td>
</tr>
<tr>
<td>le- (to)</td>
<td>2/49</td>
<td>4%</td>
</tr>
<tr>
<td>Sel (of)</td>
<td>1/11</td>
<td>9%</td>
</tr>
<tr>
<td>al (on)</td>
<td>2/8</td>
<td>25%</td>
</tr>
<tr>
<td>Be- (in, at)</td>
<td>13/34</td>
<td>38%</td>
</tr>
<tr>
<td>mi- (from)</td>
<td>16/31</td>
<td>51%</td>
</tr>
<tr>
<td>al yad(next to)</td>
<td>6/11</td>
<td>54%</td>
</tr>
<tr>
<td>biglal(because of)</td>
<td>4/7</td>
<td>57%</td>
</tr>
<tr>
<td>neged (against)</td>
<td>3/5</td>
<td>60%</td>
</tr>
<tr>
<td>im (with)</td>
<td>11/18</td>
<td>61%</td>
</tr>
<tr>
<td>before/after</td>
<td>11/17</td>
<td>64%</td>
</tr>
<tr>
<td>al yadey (by)</td>
<td>6/9</td>
<td>66%</td>
</tr>
<tr>
<td>beyn (between)</td>
<td>3/4</td>
<td>75%</td>
</tr>
<tr>
<td>taxat (under)</td>
<td>4/5</td>
<td>80%</td>
</tr>
<tr>
<td>kemo (as, like)</td>
<td>4/5</td>
<td>89%</td>
</tr>
<tr>
<td>od (until)</td>
<td>10/11</td>
<td>90%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>96/235</td>
<td>40%</td>
</tr>
</tbody>
</table>

The results organized according to preposition types are presented in Table 5.16. Note that ungoverned prepositions (adjuncts) are always semantically motivated.
### TABLE 5.16

Number of correct responses to categories of prepositions

<table>
<thead>
<tr>
<th>Governed</th>
<th>Ungoverned</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case assigners:</strong></td>
<td><strong>ungoverned prepositions</strong></td>
</tr>
<tr>
<td>et 0/10 0%</td>
<td>are always semantically motivated</td>
</tr>
<tr>
<td>Sel 1/11 9%</td>
<td></td>
</tr>
<tr>
<td>le- 1/28 5%</td>
<td></td>
</tr>
<tr>
<td><strong>Mean:</strong> 4%</td>
<td>be- 9/20 45%</td>
</tr>
<tr>
<td><strong>Idiosyncratic prepositions:</strong></td>
<td></td>
</tr>
<tr>
<td>be- 4/13 30%</td>
<td>al yad 4/7 57%</td>
</tr>
<tr>
<td>mi- 0/3 0%</td>
<td>beyn 2/3 66%</td>
</tr>
<tr>
<td>al 0/3 0%</td>
<td>ad 10/11 90%</td>
</tr>
<tr>
<td><strong>Mean:</strong> 21%</td>
<td>al yadey 6/9 66%</td>
</tr>
<tr>
<td><strong>Semantically motivated/governed prepositions</strong></td>
<td></td>
</tr>
<tr>
<td>be- 0/1 0%</td>
<td>big la 4/7 57%</td>
</tr>
<tr>
<td>mi- 9/15 60%</td>
<td>lifney/</td>
</tr>
<tr>
<td>le- 1/11 4%</td>
<td>axarey 11/17 64%</td>
</tr>
<tr>
<td>im 6/8 75%</td>
<td>neged 2/4 50%</td>
</tr>
<tr>
<td>al 2/3 66%</td>
<td></td>
</tr>
<tr>
<td>al yad 2/4 50%</td>
<td>Mean: 54%</td>
</tr>
<tr>
<td>beyn 1/1 100%</td>
<td></td>
</tr>
<tr>
<td>taxat 1/1 100%</td>
<td></td>
</tr>
<tr>
<td>neged 1/1 100%</td>
<td></td>
</tr>
<tr>
<td><strong>Mean:</strong> 51%</td>
<td></td>
</tr>
</tbody>
</table>

This was a very difficult task for S.L.; she completed it slowly in 10 sessions over a period of one month. She understood the task, she knew that she was required to insert the 'small words' and she knew that they were
difficult for her. At times she gave a content word as a response but there was no indication that she considered this correct. Rather it appeared that she wanted to show her understanding of the sentence by giving a paraphrase of the preposition in the form of a content word.

It can be seen that there are very large discrepancies between the prepositions S.L. found difficult and those that are less so. Table 5.15 presents the results according to prepositions as lexical items irrespective to the function or the position they occupy in the test sentences. Table 5.16 presents the results categorized according to preposition types. It can be seen that many prepositions, like le-, taxot, be-, al yad, appear under different categories depending on their role in the sentence.

Discussion

These results will be considered in relation to the three theories discussed in Section 5.8.1.

Rizzi (1985) claimed that prepositions that do not assign thematic role, i.e. prepositions which only assign Case, are impaired and all the rest are preserved. It cannot be
denied that Case assigning prepositions are seriously impaired in agrammatism. A comparison between the mean percentage of the Case assigning prepositions (4%) and the rest (21% - 54%) supports Rizzi's theory. Nevertheless, his theory cannot be taken seriously as a viable characterization of the preposition deficit in agrammatism because so many other prepositions are impaired in addition to the Case assigners (Grodzinsky 1990 p.60).

Friederici claimed that 'semantic' prepositions are preserved and 'syntactic' prepositions are impaired. For Friederici, 'syntactic' prepositions are the idiosyncratic prepositions. Although she did not discuss the Case assigning prepositions, it is unquestionable that they would be considered by her as 'syntactic' prepositions, i.e. impaired. Thus, Friederici's impaired prepositions constitute a bigger group than Rizzi's: Case assigning prepositions plus idiosyncratic prepositions.

Grodzinsky claims that governed prepositions are impaired and ungoverned prepositions are preserved. The Case assigning prepositions are governed, as are the idiosyncratic prepositions. In relation to these prepositions, there is agreement between Grodzinsky and Friederici, albeit for different reasons. There is,
however, one group of prepositions that are semantically motivated but governed. According to Friederici (and indeed Rizzi) these should be preserved because they are semantically motivated. However, according to Grodzinsky, they are impaired because they are governed. Grodzinsky's group of impaired prepositions is larger than Friederici's: all governed prepositions, even when they are semantically motivated. Below the data is organized to help to evaluate the predictions of Friederici and Grodzinsky:

Percentage of prepositions produced by S.L., organized with respect to the three theories:

Semantically motivated governed prepositions : 23/45 51%

Ungoverned prepositions : 67/122 54%

Case assigning and idiosyncratic prepositions : 6/68 8%

This set of results reveals that the scores for the semantically motivated governed prepositions and for the ungoverned prepositions are not different from each other. They are both significantly better than the scores for the Case assigning and idiosyncratic prepositions. The conclusion therefore must be that the present data provides support for Friederici's theory while it does not provide
support for Grodzinsky's theory. Government - in this task and for this patient - does not determine whether a preposition will or will not be produced. Meaningfulness of a preposition helps S.L. to produce the required preposition.

To sum up, Rizzi's theory was rejected because, according to him, only Case assigning prepositions are impaired and empirically this is not correct. The preposition problem is more widespread than Case assigners only. In Experiment IX, Friederici's theory is supported against Grodzinsky's, because the crucial difference in performance is between semantically motivated prepositions versus 'not semantically motivated prepositions (Case assigners and idiosyncratic prepositions) rather than between governed versus ungoverned prepositions.

It must be pointed out, however, that this is limited support only. In the case of S.L. it cannot be argued that semantically motivated prepositions are preserved and other prepositions are impaired. S.L. does not use prepositions at all in any connected spoken form. Thus the results of Experiment IX indicate only that 'meaningfulness' is a facilitating factor in a sentence completion task.
5.9 General discussion of S.L.'s abilities

The aim of this series of experiments, in addition to testing theories of the preposition deficit in agrammatism, was to learn more about the deficit itself. Why are prepositions such a difficult category? Section 5.8.6 explored in detail the semantically motivated/not semantically motivated polarity and arrived at the conclusion that meaningfulness facilitated the availability of a preposition in the sentence completion task. The meaningfulness of a preposition, however, did not help in spontaneous speech.

5.9.1 S.L.'s performance on various tasks in the present study

In order to consider S.L.'s overall preposition deficit Table 5.17 gives a summary of the results of Experiments I to IX.
TABLE 5.17

A summary of the results of Experiments I – IX

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Performance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous speech</td>
<td>unavailable</td>
</tr>
<tr>
<td>Single prepositions</td>
<td></td>
</tr>
<tr>
<td>I: Repeating</td>
<td>unimpaired</td>
</tr>
<tr>
<td>II: Reading</td>
<td>50% correct</td>
</tr>
<tr>
<td>III: Writing to dictation</td>
<td>63% correct</td>
</tr>
<tr>
<td>Preposition within sentences</td>
<td></td>
</tr>
<tr>
<td>IV: Repeating</td>
<td>58% correct</td>
</tr>
<tr>
<td>V: Reading</td>
<td>completely impaired</td>
</tr>
<tr>
<td>VI: Comprehension</td>
<td>unimpaired</td>
</tr>
<tr>
<td>VII: Grammaticality judgement</td>
<td></td>
</tr>
<tr>
<td>prepositions mildly impaired</td>
<td></td>
</tr>
<tr>
<td>all others unimpaired</td>
<td></td>
</tr>
<tr>
<td>VIII: Description of 'prepositional' situations</td>
<td>unavailable</td>
</tr>
<tr>
<td>IX: Sentence completion</td>
<td></td>
</tr>
<tr>
<td>Case assigners severely impaired</td>
<td></td>
</tr>
<tr>
<td>idiosyncratic prepositions severely impaired</td>
<td></td>
</tr>
<tr>
<td>semantically motivated governed and ungoverned 50% correct</td>
<td></td>
</tr>
</tbody>
</table>

The table reveals that the main difficulty of S.L. is the production of prepositions within sentences. She is
physically able to produce prepositions, as can be seen from her good performance in repeating single prepositions; her reading and writing single prepositions is partially impaired. Her comprehension and grammaticality judgement of sentences containing prepositions is very good. This contrast between production on the one hand, and input modalities on the other hand is a demonstration that S.L.'s preposition deficit is not parallel.

The explanations of Rizzi and of Grodzinsky were rejected in Section 5.8.7, and it was suggested that 'meaningfulness' (the hypothesis of Friederici) facilitates the production of prepositions in the sentence completion task. Friederici's theory cannot, however, explain the complete unavailability of prepositions in S.L.'s spontaneous speech. The particular features of the Hebrew prepositions and S.L.'s errors in the various tasks will now be considered in a search for explanation.

5.10. S.L.'s performance with special relevance to Hebrew prepositions

5.10.1 S.L.'s use of suffixed (pronominalized) prepositions

Using the suffixed forms of prepositions (pronominalized
prepositions (see Section 5.7.2) is easier for S.L. than using bare prepositions. While prepositions never appear in her spontaneous speech corpus, there are a few examples of suffixed prepositions among the 102 recorded utterances.

Examples of suffixed prepositions (underlined) in S.L.'s spontaneous speech:

Lo meuSeret Rino ho- horim **Selą**
no happy Rino the parents her
**Rina is not happy with her parents**

Sxeno kolonoa Savit mevakeret ani ...... **oti ho-yom**
neighbour cinema Savit visit I me today
**Neighbour who lives next to the Savit cinema visited me today.**

**Hazmini oti xatuna**
invited me wedding
She invited me to (a) wedding.

**Yosi hazmin ota xatuna**
Yosi invited her wedding
Yosi invited her (to his) wedding.

**Ani xoSever oSirim ho- horim **Selą**
I think rich the parents her
**I think her parents are rich.**

**Axotı ho- ceira xatuna ve- ani axareha**
my sister the young wedding and I after her
My young sister married and I (married) after her.

**Ani xov avoda Selı**
I debt work my
I (had) debts at my work place.
In addition to the presence of suffixed prepositions in her spontaneous speech, these forms appear in reading (Experiment II) and writing (Experiment III) single prepositions.

In the task of reading sentences (Experiment V) S.L. omitted all prepositions (9/9 and 2/2 accusative markers) but was able to read correctly 4/6 of the suffixed prepositions.

In the sentence completion task (Experiment IX), in addition to the sentences that required the insertion of prepositions, there were 32 sentences that required the insertion of a suffixed preposition. In 15 of these sentences she managed to produce the correct suffixed preposition appropriately declined for person. For comparison:

Percentage of correct use of prepositions is: 96/235 40%
Percentage of correct use of suffixed prepositions is: 15/32 46%

In order to appreciate this result one needs to remember that the 40% includes the best preserved prepositions, e.g. before/after, until, because of, like. In contrast, the suffixed prepositions included (as the base for suffixation) the most badly affected prepositions (accusative marker, genitive marker and be-). Adding a suffix to a preposition
requires the inclusion of additional information
(person, gender, number) in the item.

Suffixed prepositions thus appear to be privileged in S.L.'s
language in comparison to bare prepositions.

5.10.2 Prepositions in the modality of writing

It is easier for S.L. to write prepositions than to say
them. Her writing to dictation (Experiment III), for
example, is better than her reading of prepositions
(Experiment II).
As reported in the results of Experiment IX, in the sentence
completion task it often happened that, when S.L. could not
produce orally the required preposition, she wrote it
instead. On these occasions she made (as in the writing to
dictation task) a number of errors of pronominalization:
instead of writing the dictated preposition, she wrote its
(longer) pronominalized, suffixed form, e.g. al yadenu (next
to us) instead of the preposition al yad (next to); selo
(his) instead of Sel (of).
5.10.3 The phonology of Hebrew prepositions

Pronominalization creates two changes in a preposition:

a. it saturates it with additional meaning
b. it makes it longer

The possibility that it may be the length of the pronominalized form which makes it easier to deal with is borne out by the observation that the shortest prepositions, *le-* and *mi-* were the most difficult for S.L. to produce in the sentence completion task. These are not only very short but also are not independent free standing words; they are joined as prefixes to the following noun (see Section 5.8.7). They do not appear (or sound) as words; the Hebrew language does not allow words to end with open syllables. The prepositions *lm* (with), *al* (on), *ad* (until), *el* (to) are no longer but they do constitute independent words and are wordlike closed syllables, that end with a consonant. The very short pre-fixed prepositions proved to be very difficult in the sentence completion task. The correct responses were often not produced orally, but written by the patient. There was also a tendency to lengthen the prepositions by adding lexical material: instead of *be-* (in), S.L. produced *be-tox* (inside), or *be-Sao* (at the hour); instead of *mi-* (from), *mi-tox* (from
inside), me-osser (than), 'meet' (a longer form of from).

These responses, although they contained in addition to the required preposition a content word too, were often correct and were scored as such.

The very low scores on the short pre-fixed prepositions, the tendency to lengthen these prepositions, either by pronominalization or by adding extra lexical material, indicate that 'shortness', or, 'non-wordlikeness' contribute to the inavailability of prepositions. But this cannot be the whole story. Not all very short prepositions (e.g. mi-) obtained such low scores:

<table>
<thead>
<tr>
<th>Preposition</th>
<th>Score</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>le- (to)</td>
<td>2/49</td>
<td>.04</td>
</tr>
<tr>
<td>be- (in)</td>
<td>13/41</td>
<td>.38</td>
</tr>
<tr>
<td>mi- (from)</td>
<td>16/31</td>
<td>.51</td>
</tr>
</tbody>
</table>

The results on mi- are high in comparison and approach the scores of the better preserved prepositions. Be- is in between, and le- is very low indeed. Mi- is different in two respects from be- and le- (See Section 5.8.7). It is a little more 'wordlike' than the others and cannot incorporate the definite article, as be- and le- can. Another difference, also concerned with 'wordlikeness', is that Hebrew words can end with an 'ee' sound, like mi-, but not with 'schwa' (as in be- and le-). Moreover, there is in
Hebrew a homophone of 'mi-', meaning 'who'. This is written slightly differently, with a letter 'yod', a consonant at the end, specifically to allow it to surface as a freestanding word. On a number of occasions S.L. wrote the preposition with the spelling of the WH word. It is possible that the existence of a homophone helped S.L. to recall the preposition.

5.10.4 The functional roles of prepositions

There is a further difference between mi- and the other two short prepositions. It concerns the functions the various prepositions fulfill in a sentence. It seems that those prepositions that assign only one or two well ascribed thematic roles have more chance to be retrieved in the sentence completion task than those prepositions that are used to fulfill a larger number of functions.

The preposition mi- (from) is used to head a Source NP. This can be a physical source (from the cupboard) or an abstract Source (afraid of dogs) or (received a letter from). In addition, mi- is used for comparing two things (bigger than) and this can also be conceptualized as a Source. Thus all PPs headed by mi- share a common meaning. This is the same for all the other prepositions that
obtained higher scores. In contrast, *le-* and *be-* performs many functions (see Section 5.8.7 introduction). Another point is that *be-* (and the free standing *al*) are the only prepositions that are used with verbs that require idiosyncratic prepositions and idiosyncratic prepositions obtained very low scores in the sentence completion task. *le-* (*to*) and *be-* (*in*) both fulfill a number of roles within the sentence. Among the prepositions they have the least 'wordlike' qualities: they are short, they cannot stand on their own and they are required to express a number of functions within the sentence. The question remains, why did *be-* prove to be easier? The answer was found on the answer sheet. S.L.'s scores are higher for *be*-than for *le-* only because, at times, instead of producing only the preposition *be-* she produced the preposition together with a content word *be-Saa, (at the hour), be-tox (inside)* and since this was correct within the sentences, was scored so.

5.11 Summary and conclusions

S.L., an agrammatic patient who does not use prepositions in her spontaneous speech, was subjected to a battery of experiments to discover the source of those difficulties. She had no problems either in comprehending sentences with prepositions or in judging the grammaticality of a wide
range of sentences containing prepositions. It appears that the preposition problem is confined to the output modality, and is especially severe in spontaneous speech.

S.L. presents a wide range of problems in output. It is not the case that prepositions are completely unavailable to her; she was able to repeat and to read individual prepositions. Her writing to dictation was even better than her reading. But it is not the case that the preposition problem is manifest only in the context of sentences. The reading of individual prepositions was not errorless. She tended to lengthen the preposition by pronominalizing it. It is a separate question why writing is better than reading.

It appears that S.L.'s preposition deficit is multiply determined. In the sentence completion task, meaning, length and function influenced the availability of specific prepositions.

No supporting evidence was found for Grodzinsky's dichotomy of governed and ungoverned prepositions. This dichotomy overlaps to a great extent the dichotomy suggested by Friederici between 'syntactic' and 'semantic' prepositions. The 'syntactic' and 'semantic' prepositions of Friederici
were renamed here as 'idiosyncratic' and 'semantically motivated prepositions'. The particular point of interest are those sentences that are treated differently by Friederici and Grodzinsky: semantically motivated governed prepositions. According to Grodzinsky's hypothesis, these should be impaired and, according to Friederici's hypothesis, they should be retained. It was found that the semantically motivated prepositions (in governed and in ungoverned contexts) obtained scores in the upper range of the scores and, therefore, they offer more support to Friederici's hypothesis.

The present study distrusts dichotomies, and suggests that there are a number of factors that contribute to the availability (or otherwise) of prepositions. The results reported here do not support an account based on clear-cut differences. Prepositions that assign only Case come the closest to an overall impairment. But even these results are only manifest in the output modality and are not paralleled in input (in sentence Judgement, for example). S.L.'s deficit is a production deficit. But that does not mean that it is a superficial deficit.
CHAPTER SIX

THE USE OF VERBS BY AN AGRAMMATIC PATIENT

6.1 Introduction

In the previous chapter the preposition deficit of S.L. was investigated in some detail. S.L.'s problems in relation to verbs are less serious than her total omission of prepositions. Nevertheless, her performance with verbs is characteristic of agrammatism and therefore promises to be instructive.

Verbs are crucial to sentence structure in that they assign Case and Theta role to noun phrases (See Chapter 2 Sections 2.5.3 and 2.5.4). Furthermore, verbs are necessarily a complex lexical category because retrieving a verb involves the retrieval of its arguments too (see Chapter 2, Section 2.4.1). In general, verbs are known to be a difficult category for agrammatic patients. They are often omitted in connected speech, despite the fact that according to a narrow definition of agrammatism, this should not be the case. Verbs are a major lexical category rather than belonging to the category of grammatical morphemes which are impaired in agrammatism. A related problem is the reduced performance level for verbs in comparison to nouns in naming tasks (Miceli, Silveri, Villa and Caramazza 1984; McCarthy and
Warrington 1985; Zingeser & Berndt 1990). The theoretical question to ask in this context is whether the 'verb impairment' is functionally related to or independent of the grammatical morpheme deficit.

The omission of verbs might be seen as somewhat unexpected, but the erroneous use of verb inflections is part of the normal pattern of agrammatism. Verb inflections, together with other grammatical morphemes, are omitted, or substituted. An earlier position - the heritage of the economy of effort hypothesis - claimed that inflections are omitted. Today, however, there are good arguments in favour of not distinguishing between the omission and substitution of inflections. Agrammatics either omit or substitute inflections. Grodzinsky (1984a) drew attention to the fact that in Hebrew the uninflected verb is unpronouncable, because the verb stem contains only consonants. If agrammatics were to omit grammatical morphemes the Hebrew speaking patient could not use verbs at all. But Hebrew speaking agrammatic patients do use verbs in their speech and inflect them incorrectly.

What remains unclear, however, is whether these errors of inflection are confined to the production modality, or are also found in input processing. Are inflections lost from the sentence representation of the agrammatic (Grodzinsky since 1984, in various papers) or are they only unavailable for correct use in speech (and writing).
That the answer is not readily available is not accidental; it is difficult to design a comprehension or judgement task that reliably tests the comprehension of inflections.

It has been suggested that agrammatic patients have lost the ability to use verbs predicatively. Instead they nominalize the verb, as if naming the action (Goodglass and Geschwind 1976 and Saffran et al 1980). English speaking patients often nominalize verbs by using the gerund (the -ing form), like reading, writing, eating instead of read, write, eat. This form, in English, is ambiguous between a verbal and a nominal reading and, therefore, it is difficult to tell which was the intention of the patient. If a patient describes a picture, boy ..........reading .......... book., the listener is uncertain whether he or she describes the picture correctly as a boy is reading a book, or rather using nouns, recounting the persons (boy and girl) and the action (reading) seen in the picture. Lapointe (1985) convincingly argued against interpreting this kind of error as 'nominalization'.

Nominalization of verbs is a derivational error; a change in the morphological form of a lexical item that signifies a change of grammatical category. If it were true that verbs are nominalized by agrammatics this would constitute a counterexample to the claim that agrammatic patients do not make derivational errors. Furthermore, in Hebrew, other forms of derivational errors on verbs are possible. If these errors do occur in agrammatic
output, the assumption that agrammatics do not make derivational errors must be re-examined. The outcome of this controversy has implications for the lexicon of the agrammatic.

Despite the fact that verbs are such a complex category and that there are many ways in which patients can make errors in their use of verbs, there is no systematic documentation of the verb impairment in agrammatism in the literature; there are only sporadic observations on the subject. This is in spite of the linguistic importance of verbs in determining the structure of sentences which are essential for semantic interpretation.

The present chapter will provide some data and arguments that contribute to the central controversies on aspects of verb impairment in agrammatism, and is organized around three forms of problems with verbs:

(a) the presence (or omission) of verbs in connected speech and in picture naming.

(b) derivational errors in verbs: nominalization and other forms.

(c) errors of inflection

The following data were collected and experiments carried out:
1. Spontaneous speech

2. Experiment I: Naming objects and actions
   a. Boston naming task
   b. Action naming task

4. Experiment II: Reading single verbs (in present tense masc. form)

5. Experiment III: Reading richly inflected single verbs

Before introducing the experiments and the data, a short descriptive grammar of the Hebrew verb system is required to help to understand the material and the arguments.

6.2 Short descriptive grammar of the Hebrew verb system

6.2.1 Inflections in Hebrew

Verbs in Hebrew are inflected for tense, person number and gender. There are three tenses: past, present and future; two genders: masculine and feminine; and singular and plural numbers. Gender and person is not marked in all cases. In the present tense, person is not marked at all, and therefore, in the present tense, the verb appears only in four forms: masculine, feminine singulars and masculine feminine plurals. In both past and future tense, the first person, I and we are unmarked for gender. Furthermore, in modern Hebrew, in past and future plurals feminine gender distinctions are only used in marked contexts.
The inflections of present and past tense are suffixes; the inflections of the future tense are a combination of prefixes and suffixes.

In Hebrew, the auxiliary verb to be has no present tense form. Sentences such as John is a doctor, in Hebrew, are verbless. Consequently many more present tense sentences are grammatical in Hebrew than their English translation would be.

6.2.2 Verb paradigms

The Hebrew verb system contains seven declension patterns, 5 active and 2 passive patterns. Each paradigm, or declension pattern, is composed of a consonantal root of three (or four) letters with a particular array of affixes. The seven declension paradigms, binyanim, are above all an indication of a morphological pattern. A verb appearing in any particular binyan has a certain morphological pattern. Only secondarily do the binyanim have semantic significance. This is to say that while the morphological paradigms are invariable, there is, beside the regularity and productivity, much semantic variation.

A Hebrew root - three consonants - can in principle be declined in all the seven binyanim, but there are many gaps in the system, and some declensions are not lexical verbs in the language. Some roots are very productive and appear in all or almost all the binyanim; others
roots only appear in one or two. The root consonants are present in all the paradigms (unless there are irregular weak letters in the root) and therefore, the connections among the binyanim are transparent.

The binyanim

In the examples the root letters are written in capitals and all the examples are in present tense, masc. sing. form.

I. There are two paradigms of simple active verbs, both sometimes transitive and sometimes intransitive:

The binyan 1. PAAL 2. PIEL

Example: KoTeV write meDaBeR speak

Example: HoLeX walk meSaXeK play

Example: DoReS demand meLaMeD teach

II. There is a paradigm of mainly transitive verbs that are often, but not always causatives:

The binyan 3. HIFIL

Example: moZMiN invite

Example: moCXiK make laugh

Example: moRGiS feel
III. There are two paradigms that are always intransitive, one is often reflexive, reciprocal or inchoative:

The binyan 4. HITPAEL

E mitLaBeS dress oneself
X A mitKaTeV correspond
M P mitBaReR become clear

and one is sometimes, but not always, the passive of the first paradigm, of PAAL:

The binyan 5. NIFAL

E niXNaS enter
X A niLxOM fight
M P niSGaR being closed

In addition to the above five active paradigms, there are two passive ones: the passive of the second and the third paradigms.

The passive of the PIEP is

The binyan 6. PUAL

E meGuHaC ironed
X A meSuDoR tidy
M P meSuGo crazy

The binyan 7. HUFAL

E muZmaN invited
X A muRGaS felt
M P muCLaX successful

The NIFAL (5), when it has a passive meaning, is a verbal passive; PUAL (6) and HUFAL (7) are also verbal passives in past and future tenses, but in the present tense they are ambiguous between a verbal and an adjectival passive meaning.
In addition to the above seven binyanim, the PAUL form must be mentioned. The PAUL is the adjectival passive form of the PAAL (1). Being an adjectival passive, it is not part of the verbal system.

**PAUL**

E  SaGuR *closed*

X  KoTuV *written*

M  YaDuA *known*

Below the root letters K T B are rendered in the present tense masculine singular form in all the binyanim. In certain constellations the first letter of the root changed from K into X. Ø indicates that the Hebrew form is not a lexical verb.

<table>
<thead>
<tr>
<th>PAAL</th>
<th>PIEL</th>
<th>HIFIL</th>
<th>HITPAEL</th>
<th>NIFAL</th>
<th>PUAL</th>
<th>HUFAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>KoTeV</td>
<td>meKaTeV</td>
<td>maXTiV</td>
<td>mitKaTeV</td>
<td>n1XTaV</td>
<td>meKuTaV</td>
<td>muXTaV</td>
</tr>
</tbody>
</table>

These examples show the relationships among the binyanim. When a root moves from one binyan to another, in addition to the morphological change, there is often change in the number and the type of the arguments associated with the verb. This is true for the roots that behave in a predictable manner, but there are many roots that do not
participate in this orderly semantic relationship among the binyanim.

For example, when a predictable root moves from PAAL (1) to HIFIL (3) an argument is added.

\[
\begin{align*}
\text{PAAL (1)} & \quad \longrightarrow \quad \text{HIFIL (3)} \\
\text{coxek (laugh)} & \quad \text{macxik (make laugh)} \\
\text{AGENT} & \quad \text{AGENT THEME}
\end{align*}
\]

when moving to HITPAEL, an argument is taken away:

\[
\begin{align*}
\text{PAAL (1)} & \quad \longrightarrow \quad \text{HITPAEL (4)} \\
\text{loveS (wear clothes)} & \quad \text{mitlabes (get dressed)} \\
\text{AGENT THEME} & \quad \text{AGENT}
\end{align*}
\]

or:

\[
\begin{align*}
\text{PIEL (2)} & \quad \longrightarrow \quad \text{HITPAEL (4)} \\
\text{mefocecc (blow up something)} & \quad \text{mitpacecc (blown up)} \\
\text{AGENT THEME} & \quad \text{THEME} \\
\text{this is not passive as no 'by' phrase can be added}
\end{align*}
\]

when moving to NIFAL (5), (when passive) the order of the arguments is changed:

\[
\begin{align*}
\text{PAAL (1)} & \quad \longrightarrow \quad \text{NIFAL (5)} \\
\text{kotev (write)} & \quad \text{nixtav (being written)} \\
\text{AGENT THEME} & \quad \text{THEME AGENT}
\end{align*}
\]

In addition to these regular changes in the binyanim, there are also idiosyncratic changes. These are often
expressed by adding specific (arbitrary) prepositions to the verb. For example:

<table>
<thead>
<tr>
<th>PAAL</th>
<th>PAAL</th>
<th>PIEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>xozar le-</td>
<td>xozar al</td>
<td>mexazer on xorey</td>
</tr>
<tr>
<td>return to</td>
<td>return on</td>
<td>court somebody</td>
</tr>
<tr>
<td>xozar mi-</td>
<td>revise</td>
<td>after</td>
</tr>
<tr>
<td>return from</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In other cases, there are no obvious semantic relationships between the verbs in the different binyanim despite the fact that they share the same root. There are also roots that appear in one binyan only.

Thus the relationships between the groups of verbs is a mixture of regular and idiosyncratic processes. It seems, therefore, that the movement from one binyan to another cannot occur in the syntax but must occur in the lexicon. It is possible, however, that within the lexicon 'syntactic like' processes take place with somewhat limited applicability.

6.2.3 Nominal forms in Hebrew

The system of roots is characteristic not only of the verb system but permeates the whole lexicon. For example, the root K T V (write) in addition to the five verb forms shown above, forms the basis of many other lexical items. The following list is not exhaustive:
The construction of nouns and adjectives from the roots is much less predictable than the construction of verbs. It is unquestionably a process that must occur in the lexicon, as it does in English (Chomsky 1970).

Each verb form has a particular nominal form associated with it. This nominal form is usually, but not always, the verbal noun which designates the name of the action:
<table>
<thead>
<tr>
<th>VERB</th>
<th>NOMINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PAAL</td>
<td>KoTeV</td>
</tr>
<tr>
<td></td>
<td>write</td>
</tr>
<tr>
<td></td>
<td>YoSeV</td>
</tr>
<tr>
<td></td>
<td>sit</td>
</tr>
<tr>
<td></td>
<td>a meeting</td>
</tr>
<tr>
<td>2. PIEL</td>
<td>meTaKeN</td>
</tr>
<tr>
<td></td>
<td>mend</td>
</tr>
<tr>
<td></td>
<td>meSoPeR</td>
</tr>
<tr>
<td></td>
<td>tell a story</td>
</tr>
<tr>
<td>3. HIFIL</td>
<td>maRGiS</td>
</tr>
<tr>
<td></td>
<td>feel</td>
</tr>
<tr>
<td></td>
<td>a feeling</td>
</tr>
<tr>
<td>4. HITPAEL</td>
<td>mitKoDeM</td>
</tr>
<tr>
<td></td>
<td>progress</td>
</tr>
<tr>
<td></td>
<td>a progress</td>
</tr>
</tbody>
</table>

The NIFAL does not have a frequently used nominal form.

To sum up, the above nominal forms are the Hebrew equivalents of the English gerund, the -ing form. The gerund reading is always a possible meaning for these forms but, sometimes, other readings of derived nouns or of referring nouns are found and the meaning becomes ambiguous between these possibilities.

6.3 Previous studies on verb omission in agrammatism

There are a number of studies (McCarthy and Warrington 1985; Zingeser and Berndt 1990, Miceli et al 1985) that deal with the particular problem of verb omission by
agrammatic patients, or 'verb finding' difficulties in naming tasks. These studies ask one or more of the following questions:

1. Are 'verb omission' and 'grammatical morphemes omission' related or independent impairments?  
2. Are verbs more likely to be omitted than nouns because verbs are a more 'complex' category?  
3. Is verb omission a semantic, a syntactic or a lexical deficit?

The studies of Zingeser and Berndt (1990) and Miceli et al compare the performance of agrammatics with the performance of anomic patients. The major deficit of anomics is in naming objects and in omitting nouns in spontaneous speech. In relation to verb omission, anomia is seen as a deficit complementary to agrammatism. The anomic patient is relatively good at producing verbs (and grammatical morphemes) and weak at producing nouns; the agrammatic patient is good in producing nouns and weak in producing verbs. The fact that there are anomic patients with a noun deficit but no verb deficit is used by Zingeser and Berndt (1990) as an argument against the theory that verbs are omitted because they are more complex than nouns. The verb problem of the agrammatics cannot be explained by reference to the complexity of verbs in the same way as anomia cannot be explained by reference to the complexity of nouns.

McCarthy and Warrington (1985) describe an agrammatic patient, ROX, who had a striking problem with verb
naming. In a naming task in which he was shown pictures and asked to produce the name or the verb, he could retrieve nouns such as shuttlecock, pagoda and mitre, but could not name common actions such as give, walk and drink.

In a recognition task, the patient, upon hearing a word (a verb or a noun) had to choose between two pictures. ROX was able to discriminate between all the noun pictures (seal/walrus) and between verb pictures when they represented semantically distant items. But when the action pictures were relatively close semantically (eat/drink) his performance was much poorer. His performance fell to chance when he had to distinguish between two perspectives of the same action, such as between buying/selling.

The patient's problems in retrieving verbs were reflected in his spontaneous speech which often lacked verbs. Although the verbless utterances appear to be lacking in structure, the authors claim that the source of the problem is not an impaired syntactic processor but what they call a 'category specific lexical-semantic impairment' (p 726). Presumably, this means that verbs in the lexicon of this patient are underspecified in relation to semantic features. This would explain his hesitation in distinguishing between eat and drink or buy and sell. This kind of deficit is, perhaps, unusual in an agrammatic patient and therefore may not be the only reason for verb impairment in the agrammatic population.
in general. ROX - if he is indeed agrammatic - might have an additional deficit specifically related to the semantics of verbs.

Zingeser and Berndt (1990) tested five Broca's aphasics and five anomic patients on various naming tasks. The Broca's aphasics showed some symptoms of agrammatism, such as 'restricted' use of grammatical morphemes, 'restricted' sentence length and/or structural syntactic problems (p 19). The authors found that "when frequency and length are controlled, agrammatic patients find it more difficult to name actions than objects" (p 25).

The authors suggested a number of possible explanations. One possibility is that:

Models of lexical representation typically include form class information as a basic component of each entry's listing; it may be that such representational distinctions within the lexicon are honoured by the neural architecture (p 27).

This seems to imply that verbs and nouns are stored differently or at different locales in the lexicon and thus can be selectively impaired. According to this interpretation, verbs as lexical item are impaired in agrammatism, and nouns in anoma.

Another possibility is that

the processes required to gain access to nouns and verbs in the lexicon may differ in principled ways. For example, the important role of the verb in sentence formulation and interpretation might require that some syntactic properties of verbs are retrieved whenever the lexical form of the verb is retrieved. Deficits that involve those syntactic properties in
some way could selectively undermine verb retrieval. (p 26)

According to this possibility the verb naming deficit in agrammatism is the consequence of a syntactic deficit. Verbs are difficult to retrieve because their retrieval, even in a naming task, constitutes a syntactic process: retrieving not only the verb but, implicitly, its arguments too.

A third possibility is a selective difficulty in producing labels for the semantic categories for actions and objects (p 27).

The dissociation between noun and verb production found in anoma and agrammatism respectively reflect a semantic category deficit.

The study did not distinguish between these three interpretations and the issue was left open for further research.

Miceli, Silveri, Villa and Caramazza (1984) deal with the same question. In order to decide the source of the verb problem and its relatedness to other deficits in agrammatism, they compared the ability of five agrammatic and five anomic patients to name objects and actions.

This study also found a verb deficit in agrammatic patients. The interpretation of this finding, however, is not easy. The verb naming task attempts to isolate verbs as lexical items, to study the verb deficit in isolation from sentences, away from the need to construct
syntactic structures. However, this is not possible if a verb, even in isolation, inherently contains its arguments and thus constitutes a syntactic construction in itself. This is why it is difficult to decide whether the verb deficit is a syntactic or a lexical deficit.

Miceli et al suggest that the agrammatic's performance in oral reading of verbs and other lexical categories might help to decide between the two possibilities, as the reading of single verbs does not require syntactic processing. The difficulties of deep dyslexic patients (often, but not always agrammatics) in reading verbs are well documented (Coltheart, Patterson and Marshall 1980). Miceli et al, on the basis of the data in Coltheart et al, concluded that the verb naming deficit must be a lexical, not a syntactic impairment. Why Miceli et al should believe that verb structure is not retrieved when reading verbs in unclear.

They also claimed that the fact that patients at times (8.4%) responded with a nominalized form of the verb, the English gerund (sleeping, selling, playing etc.) suggested that the verb naming deficit is not a semantic deficit.

".... Agrammatic patients are able to construct the correct semantic representation corresponding to the depicted action but are unable to retrieve the proper lexical forms - a verb ...." (p 217).

This contrasts with McCarthy and Warrington's conclusion (above) that ROX's deficit is 'lexical-semantic'.

Miceli et al also consider the question of the relationship between the verb processing deficit and other features of agrammatism. They deny that the verb impairment is related to the grammatical morpheme deficit (as proposed by Saffron et al 1980) and instead suggest that the two deficits sometimes co-occur only because of the neural proximity of the responsible processing components. The claim is empirical, as T.F., a patient described in Miceli, Mazzucchi, Menn and Goodglass (1983), exhibits a severe deficit in producing grammatical markers in the presence of spared ability to produce main verbs.

Miceli et al (1984) also deny that there is any simple relationship between verb omission and phrase length. The omission of verbs is not the only reason for reduced phrase length in agrammatism. Deficits in processing grammatical markers and disorders of working memory may also contribute.

According to Miceli et al (1984) then, the verb deficit in agrammatism is a lexical impairment. They conclude "that one dimension along which the lexicon is organized is form class". "......The claim is that verbs constitute a distinct category from nouns" (sic). A further postulation is "a separate subcomponent of the lexicon for grammatical markers in order to account for other features of agrammatism (e.g., omission of grammatical markers)" (p217).
6.4 S.L.'s omission of verbs in spontaneous speech

Main verbs are sometimes omitted in S.L.'s spontaneous speech but auxiliary verbs are always missing. In 102 recorded utterances, 12 sentences were found in which a main verb was omitted in an obligatory context. It needs to be remembered, in order to appreciate these numbers that, in Hebrew, present tense sentences are often acceptable without a verb, mainly because to be has no present tense form. S.L. used 27 different verb roots on 45 occasions, some verb roots she used more than once. In Section 6.4.1 examples of S.L.'s sentences with verbs and in Section 6.4.2 the utterances of S.L. with a missing main verb are listed in the following form:

- line one: the patient's utterance transcribed
- line two: word by word translation
- line three: translated into an English sentence
- line four: corrected Hebrew sentence
- line five: all additions and corrections are translated

6.4.1. Sentences with verbs that S.L. produced

1. Lo, Yosi mitgareš Rina
   no Yosi divorce Rina
   no, (I want) that Yosi will divorce Rina
   Lo, (ani roca) se-Yosi mitgareš mi-Rina
   that will divorce from

2. Asiti gina, HiSketi gina
   I made garden I watered garden
   I worked in the garden, I watered the garden
   avadti ba- gina, hiSketi et ha-gina
   in the acc. the

3. lixlux ve- ze. Asafti lixlux, olim yeveSim
   dirt and this I collected dirt leaves dry
   I collected rubbish and dry leaves.
   Asafti et ha-lixlux ve-et ha-olim ha-yeveSim
   acc the and acc the the
4. Ani ohevet seder
   I like order
   correct

5. Kcat koeset (pr. fem. verb) Yosi, kaved sal
   a little angry
   Yosi heavy basket
   Yosi was angry a little because the basket was heavy
   Yosi kaas (masc. past verb) kecat ki kaved haya ha-sal
   was angry because was the

6.4.2 S.L.'s utterances without verbs

1. Rina ha-bayit 18
   Rina home 18
   Rina left home at 18
   Rina azva et ha-bayit be-gil 18
   left acc. at age

2. Aba lo roSem tov
   father no impression good
   Her father does not make a good impression
   Aba Sela lo ose roSem tov
   her make

3. Etmol axot, pitom axot misrad ha-briut
   yesterday nurse suddenly nurse ministry the health
   All of the sudden yesterday a nurse came from the
   ministry of health
   Etmol pitom axot higia mi-misrad ha-briut
   came from arrived

4. Haftaa, pratim pratim
   surprise details details
   She came unexpected and asked many details
   Hi baa be-haftaa ve-Saala harbe pratim
   She came in and asked many

5. Harbe kesef
   much money
   I lost a lot of money
   Hifsadti harbe kesef
   I lost

6. Paam axot Sana axot ........... ma margiSa
   once year nurse what feel
   Once a year a nurse comes to ask how I feel.
   Paam axot be-Sana axot baa liSol eyx ani margiSa
   in comes to ask how I

7. xuc la-arec, harbe ............ tiyulim
   abroad a lot excursions
   They travel a lot abroad (for pleasure)
   Hem nosim harbe le-tyulim le-xuc la-arec
These examples indicate that main verbs are not a very seriously affected category in SL.'s speech. The situation is very different with auxiliary verbs and prepositions where the omission rate are virtually hundred per cent.

6.4.3 Omission of auxiliary verbs

As explained in Section 6.3.1, in Hebrew, the auxiliary verb to be is required only in the past and future tense:
Another frequent auxiliary construction is the Hebrew equivalent of *to have*. Possession, in Hebrew, is expressed in the dative form:

### Possessives in Hebrew

<table>
<thead>
<tr>
<th>Past tense</th>
<th>Present tense</th>
<th>Future tense</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hu haya rofe</td>
<td>Hu rofe</td>
<td>Hu yiye rofe</td>
</tr>
<tr>
<td>the was a doctor</td>
<td>he (is) doctor</td>
<td>He will be a doctor</td>
</tr>
</tbody>
</table>

The possessive in the past tense and the future tense, the (b) and (c), have agreement features on the verb. Thus the auxiliary verb has masc., fem., and plural forms in agreement with the gender features of the noun which is possessed. No agreement features, however, are required in the present tense.

### Possessives in past tense
Existential and possessive sentences constitute the main obligatory uses of auxiliary verbs in Hebrew. Their omission can be detected as they are obligatory in past and future tense sentences. Other auxiliary verbs, in sentences which include *can* and *must*, are very frequent in Hebrew, therefore if they do not appear in the corpus - although they are never obligatory - is an indication of omission.

S.L. consistently omitted auxiliary verbs in her spontaneous speech. A partial list of utterances with omissions of auxiliary verbs in obligatory contexts is presented below.

**Omission of auxiliary verbs**

1. **Banim Seli ceirim**
   sons mine young
   My sons were young
   ha-banim Seli ceirim hayu.
   were
2. Ben oto davar David kita, xaverim  
son the same class friends  
Her son was in the same class with David, they were friends.  
Ha-ben Sela haya be-ota kita im David, hem hayu xaverim was here  

3. sikuy Sum davor ?  
chance nothing  
There is no chance at all? (for recovery)  
eyn Sum sikuy  
there is no any chance  

4. Ani galuy .......... vila  
I am open vila  
I am open (I don't hide it) I have a vila.  
Ani geluya ...... yeS li vila. fem. there is to me  

5. Ofi mexurban  
character bad  
I have a bad character.  
YeS li ofi mexurban  
there is to me I have  

6. maxSovot acuvot, acuvot  
thoughts sad sad  
I have sad thoughts  
YeS li maxSovot acuvot  
there is to me I have  

7. Tivit, lo odem, nemuxa, Sum davor, nekiya,  
natural no lipstick short nothing clean  
I was natural, without lipstick, short, nothing (special), clean.  
Hayiti tivit, beli odem, nemuxa, Sum davor, nekiya I was without  

8. Naxum nakiy, xulca mexubeset, meguhac, paSut  
Nachum clean shirt washed ironed simple  
Nachum was clean with washed and ironed shirt, simple  
Naxum haya nakiy im xulca mexubeset, meguhacet, paSut was fem.  

Within the corpus of 102 utterances there were many other examples of missing auxiliary verbs in existential and possessive sentences. There were no examples of
sentences that would have required other auxiliary verbs, such as *can* and *have to*.

6.4.4 Conclusions about verb omissions in spontaneous speech

1. S.L. often, but not always, omits main verbs in her spontaneous speech. She omits all auxiliary verbs. The spontaneous speech data suggest that S.L. has a not too serious main verb deficit, but cannot reveal the source of the deficit. Furthermore, on the basis of spontaneous speech, the deficit for verbs and for nouns cannot be directly compared. The omission of verbs (or prepositions) is always more apparent than the omission of nouns because verbs and prepositions are obligatory in more contexts than nouns.

2. If S.L.'s ability to produce main verbs and prepositions in spontaneous speech is compared it is clear that the two are unrelated. Main verbs are used by her often while prepositions are never used. This finding is in agreement with a common view about agrammatism that the grammatical morphemes are affected but major lexical categories, like main verbs are relatively well preserved. The serious problems this patient has with auxiliary verbs is likewise in agreement with this generalization: auxiliary verbs are being grammatical morphemes.
6.5 Experiment I: Object and action naming

In order to evaluate S.L.'s ability to produce verbs in a naming task, she was presented with the Boston naming test for nouns and a verb naming task. This allows a comparison to be made between her ability to produce nouns and verbs.

The research question is whether verbs are more impaired than nouns. Earlier literature suggested that in some patients this might be the case (see Section 6.1).

The following issues were considered:

1. If verbs are more impaired than nouns in a naming task, the source of this selective impairment will have to be investigated for the following possibilities:

   a. the 'verb lexicon' is damaged.
   b. verbs are a more difficult category
   c. producing verbs requires syntactic processing
   d. for any of the above reasons, the accessing of verbs is more complex.

2. If however, verbs are impaired in a similar fashion to nouns, the possibilities above need not be further followed. In that case, it may be concluded that the verb deficit is undistinguishable from a general word finding difficulty. Therefore, attention may be focused on particular problems related to verbs rather than the verb naming deficit per se.
6.5.1 Boston Naming Test  
(BHT; Kaplan, Goodglass & Weintraub 1978)

Materials and Method

There were 60 pictures of objects which had to be named. Examples are: tree, pencil, mushroom, sphynx, iglo and tripod.

Results

Out of 60 pictures S.L. produced 23 correct names. She produced the names of 38% of the items.

The types of errors S.L. made are given in Table 6.1

<table>
<thead>
<tr>
<th>Breakdown of error types:</th>
<th>number of instances</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. difficulty in pronunciation</td>
<td>13</td>
</tr>
<tr>
<td>b. using a semantically close or generic term</td>
<td>10</td>
</tr>
<tr>
<td>c. describing the object</td>
<td>6</td>
</tr>
<tr>
<td>d. no reply</td>
<td>4</td>
</tr>
<tr>
<td>e. wrong reply</td>
<td>2</td>
</tr>
<tr>
<td>f. giving the plural form</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL errors</td>
<td>37/60</td>
</tr>
</tbody>
</table>

These results show that S.L.'s ability to produce nouns which correctly describe pictured objects is substantially impaired.
6.5.2 The naming of actions

Method and Materials

S.L. was presented with 60 individual line drawings that depicted an action. She was asked What is he/she doing? or What is happening here? The pictures included items such as run, drop, yawn, smile, caress, comb, sunbath etc. (A complete list of the verbs in the table and examples of the pictures are in Appendix J).

Results

S.L. responded correctly in 34 instances out of 60. The types of errors she made are given in Table 6.2.

<table>
<thead>
<tr>
<th>Type of error</th>
<th>Number of instances</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. omission of verb</td>
<td>7</td>
</tr>
<tr>
<td>b. difficulty in pronunciation</td>
<td>5</td>
</tr>
<tr>
<td>c. gender error</td>
<td>5</td>
</tr>
<tr>
<td>d. nominalization</td>
<td>4</td>
</tr>
<tr>
<td>e. wrong verb group</td>
<td>2</td>
</tr>
<tr>
<td>f. no reply</td>
<td>1</td>
</tr>
<tr>
<td>Total errors</td>
<td>24/60</td>
</tr>
</tbody>
</table>

Discussion

The above data do not support the claim that verbs are a particularly badly affected category in this agrammatic patient. The ability to produce nouns to describe
objects is no better than the ability to produce verbs to describe actions.

The verb naming task gives results similar to those found in the spontaneous speech of S.L.: some omission of verbs in conjunction with the appropriate use of other verbs. The errors are also similar (and will be discussed in later sections of this chapter). Verbs are occasionally missing from the spontaneous speech of S.L., but a comparison between her noun naming and verb naming shows that her problems with verbs are no worse than her problems with nouns. Prepositions and auxiliary verbs are far more seriously affected than main verbs; prepositions and auxiliary verbs are always missing from her speech.

Therefore, on the basis of the evidence provided by S.L., it must be concluded that the alleged 'main verb problem' - although its existence in some patients cannot be denied - is a separate deficit, unrelated to the agrammatic phenomenon per se.

6.6 Experiment II: Reading single words

The aim of this task was to test whether S.L. could read main verbs of different paradigms and auxiliary verbs indicating that these words exist in her lexicon despite the absence of some of these in her spontaneous speech. Other major lexical categories, like nouns, adjectives and prepositions were included for comparison.
Method and Materials

413 individual words printed on cards were given to the patient to read during a number of sessions. The words included nouns of differing lengths, verbs of different paradigms, adjectives, question words, various morphological markers and prepositions. The words were presented in random order and no more than 30 were given in any single session. The verbs were presented (mixed with other category items) in their present tense, masc. singular form, the simplest and less marked form of a verb. Only passive verbs in PUAL (6) and HUFAL (7) forms were presented in the past tense to achieve an unambiguously verbal reading.

Results

Only the results of the verb reading task will be reported here in detail, but for comparison purposes the results obtained on the other grammatical categories are shown in Table 6.3.
### TABLE 6.3

The number of words S.L. was able to read correctly in the single word reading task

<table>
<thead>
<tr>
<th>LEXICAL CATEGORY</th>
<th>NUMBER OF WORDS</th>
<th>WORDS READ</th>
<th>PERCENTAGE CORRECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nouns</td>
<td>82</td>
<td>70</td>
<td>85%</td>
</tr>
<tr>
<td>Adjectives</td>
<td>47</td>
<td>32</td>
<td>68%</td>
</tr>
<tr>
<td>Question words</td>
<td>13</td>
<td>9</td>
<td>69%</td>
</tr>
<tr>
<td>Grammatical morphemes</td>
<td>90</td>
<td>56</td>
<td>62%</td>
</tr>
<tr>
<td>Prepositions</td>
<td>69</td>
<td>38</td>
<td>55%</td>
</tr>
<tr>
<td>Verbs</td>
<td>102</td>
<td>31</td>
<td>30%</td>
</tr>
<tr>
<td>Infinitivals</td>
<td>9</td>
<td>1</td>
<td>11%</td>
</tr>
</tbody>
</table>

In this task, verbs are most seriously impaired. The percentage of correct responses for verbs is below of the obtained by grammatical morphemes (which included auxiliary verbs) and prepositions. Before commenting on this finding, however, the types of errors made need to be looked at. It is possible that verbs are so badly affected in this task because there are many possible ways one can err on verbs.

The types of errors found in verbs in the single word reading task:
1. nominalization

2. inflectional errors (fem. pl. imp. forms)

3. verb paradigm errors (wrong binyan)
   a. existing words
   b. non-existing possible words
   c. adjectival form

4. other errors:
   a. difficulty in pronunciation
   b. paraphrasing
   c. no response

A summary of the number of errors of each type is presented in Table 6.4

<table>
<thead>
<tr>
<th></th>
<th>nominalization</th>
<th>paradigm error</th>
<th>infl.</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAAL</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>PIEL</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>HIFIL</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>HITPAEL</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>NIFAL</td>
<td>5</td>
<td>7</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PUAL</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>HUFAL</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>28</strong></td>
<td><strong>15</strong></td>
<td><strong>10</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

Nominalization errors will be discussed in Section 6.7.5, paradigm errors in Section 6.8.2 and inflectional errors in 6.9.

6.7 Verb nominalizations and other derivational errors

In Section 6.2.3 the system of the nominal forms of Hebrew verbs was described. One of the aims of this brief introduction was to show both the regular and the irregular processes that are evident in derivation of nominal forms of verbs.
The irregularity of nominal forms in English led Chomsky to propose the lexicalist hypothesis: nominalization and other word formation processes are idiosyncratic and therefore cannot be dealt with in the transformational component. Until the publication of Chomsky's On Nominalization (1970), derived nominals, like *invitation*, *agreement* etc. were analyzed as the result of a transformation from the appropriate verbal element that was considered more basic.

6.7.1 The nominalization of verbs in agrammatism

It was pointed out in Section 6.1 that English agrammatics frequently use the gerund form of the verb, e.g. *pulling, reading* instead of *pull* and *read*. Because of the nominal qualities of this form it has then been suggested that the patients, instead of using the verb form for predicating, were naming the action (Saffran, Schwartz and Marin 1980). The problem, however, is that in English it is difficult to decide what is the meaning of the *-ing* form. The form is ambiguous between the gerund and the present continuous form. For example, *sitting* can mean that somebody is sitting but can also stand for the verbal noun, the act of sitting. It is thus often difficult to decide what form an aphasic patient intended to say. On the one hand the patient's fragmented and slow speech may give the impression that, instead of predication, naming of actions is taking place; on the other hand, it is equally possible that the
-ing form is used as a verb. This form is very common; it is usually required when patients are asked to describe a picture; it is also a well practiced form; furthermore, it is possible that phonologically this form of the verb is easier for Broca's aphasics to pronounce.

6.7.2 Previous work on the problem of nominalization in agrammatism

Goodglass and Geshwind (1976) discussed errors of nominalization by agrammatics. Usually, in the literature, when nominalization in agrammatism is discussed, the reference is to the -ing form of the verb: sitting, sleeping etc. But Goodglass and Geshwind did not consider the overuse of the -ing form by these patients, but rather their tendency to drop inflections (third person -s, past tense -ed) and auxiliaries used for the future tense. Their question was whether the bare (uninflected) form of the verb is a nominalization or a morphological simplification. Goodglass and Geshwind's argument was that agrammatics do not drop the inflections only to simplify, but rather in order to produce a nominal form. They support their position by pointing out that German speaking agrammatics tend to use the infinitival form of the verb. The German infinitival has an inflectional ending which is not dropped by agrammatic patients. Thus, the infinitival in German is used by the agrammatic not because of its simple morphology but because of its nominal qualities. This indicates that "the agrammatic is not merely dropping the
person and tense markers in English, but rather shifting to a nominalized use of the verb" (p.409).

Saffran, Schwartz and Marin (1980) supported the claim of Goodglass and Geshwind. They suggested that the agrammatic "does not use the verb in a relational sense but rather to 'name' the action" (p.278).

Lapointe (1985), however, argues against this by showing that the German infinitival, like the English -ing form, is ambiguous between a verbal and a nominalized sense. Therefore, the fact that German agrammatics use it cannot decide the controversy. More importantly, gerunds, and other nominals related to verbs, express functional relations among constituents, exactly as do verbs. Using a nominalized form does not simplify, and does not avoid the relational meaning of the verb, as can be seen in the following examples:

Verb : Mary proved the theorem
Gerund : Mary's proving the theorem
Action nominal : Mary's proving of the theorem
Derived nominal: Mary's proof of the theorem
(Lapointe 1985 p.103)

Lapointe distinguished between relation-expressing nouns like the nominals in the above examples and simple referring nouns, like table, apple, boy. The claim that agrammatic patients do not express relations by verbs, but only use them as referring to actions, suggests that verbs appearing in the patients' output have qualities like the simple referring nouns. This is, however, not the case. Agrammatic patients, despite the morphological
poverty of the verbs they use, are able to express propositions and relate functionally the noun phrases in their sentences.

One point needs to be stressed. This is that the theories described above are predicated on the assumption that nominalizations are in some sense 'simpler' than the verb form and that this would explain the tendency to nominalize. According to Goodglass and Geschwind and Saffran et al., nominal forms are used in place of the more complex linguistic act of predication. In contrast to their view, Lapointe argues that the forms used by agrammatics are not nominalized forms at all (in any case nominalized verbs are not 'safe heaven' from predication) rather they are morphologically simplified predicates.

In the following, the use of nominalized verbs by S.L. will be considered. The problem to face will be how to explain errors of nominalization in Hebrew, a language in which the nominalized form is not morphologically simpler than the verbal form; and by a patient whose use of verbs is not too seriously impaired and who often uses verbs accompanied with all its arguments, i.e. predicatively.

1. The claim of morphological simplification cannot hold for Hebrew. In Hebrew the verbal noun is not 'simpler' than the verb; the Hebrew nominal form is quite different from the verbal form. It is not a simple addition of a morpheme and lengthening of the stem; the whole internal organization of the vowels around the fixed order of the
root consonants is changed (see Section 6.2.3). Intuitively, this is not an easily available form of the verb and is not very frequent in everyday speech in Hebrew: it does not have multiple uses (unlike the -ing form in English).

2. S.L. gave every indication that she could use verbs predicatively. It is not obvious how one could prove the point, although her appropriate use of psychological verbs suggests that she is using verbs - even if erroneously - to make propositions. For example:

Ani roca roca giruSim
I want want divorce

or:
Xavera lo mistaderet David xavera.
girlfriend no get on girlfriend
His girlfriend does not get on with David's girlfriend
Ha-xavera Selo does not get on with ha-xavera
Sel David

Such utterances do not support the view that S.L. cannot use verbs to express functional relations among noun phrases. The interesting phenomenon, however, is that nominalizations of verbs do nevertheless occur in S.L.'s spontaneous speech (and in experimental tasks involving verbs).

Thus the two explanations in the literature for nominalization errors in agrammatism are unlikely to explain S.L.'s use of this form.
6.7.3 Examples of verb nominalizations from S.L.'s spontaneous speech include:

1. Ani ovedet ovedet, Sanim, Sanim, xisaxon.  
   I worked, work, years, years, saving  
   I worked and saved for many years  
   Ani avadeti ve-xasaxti harbe Sanim

2. Kol ha-zeman xisaxon  
   all the time, saving  
   I saved all the time.  
   Kol ha-zeman xasaxti.

3. Sum davor dibur dibur  
   nothing, speech, speech  
   I did not speak at all  
   Lo dibarti bixlal

4. dibur kecat  
   speech, a little, a little  
   (Later) I spoke a little  
   (axar kax) dibarti kecat kecat.

5. ani meamecet sevel dibur, kaSe dibur.  
   I make effort, suffering, speech, difficult, speech  
   If I make an effort, my speech suffers, my speech becomes difficult  
   Im ani mitamecet ha-dibur  
   Seli sovel, kaSe li ledaber  
   if I make effort, the speech mine suffer difficult  
   for me to speak

6. David sevel  
   ima lo  
   David suffering, mother, no  
   David suffered, because mother (did not speak).  
   David saval, ki ima lo (dibra)

7. axoti  
   ha-ceira xatuna ve-ani axareha.  
   my sister, the young wedding, and I, after her.  
   My younger sister got married, and I (got married) after her.  
   Axoti ha-ceira hitxatna ve-ani axareha.

These are the seven examples of nominalization from the corpus of 102 utterances. In all the above sentences it is unlikely that a nominal form instead of a verb was intended.
6.7.4 Nominalization of verbs in the action naming task

There are two types of nominalization in a task in which the patient is asked to produce a verb to describe an action (see Section 6.7.2). The first is when a simple referring noun is used when a verb is required; an example is sentence (7) above, when instead of getting married, S.L. uses wedding. This is a simple referring noun, albeit derived from the verb. The second occurs when the verbal noun, or the gerund, is used rather than the required verb. In the verb naming task there were examples of both types.

The first type is less interesting in a picture naming task. The patient, instead of describing what is happening in the picture might prefer to name objects in the picture.

The second type of error is more revealing. As pointed out above, intuitively one would not expect the verbal noun in Hebrew to be easier - morphologically, semantically or otherwise - than the verb itself.

Examples of nominalizations in the verb naming task:

1. a woman is ironing a pair of trousers:
   > So gihuc megahecet mixnasayim
   Woman ironing (N) irons(pr.f.) trousers.
   Self corrected, but at the first instance the verbal noun is available.

2. a couple is dancing
   > rikudim zug
   Dancing(N) couple
Nominalization is rare but its occurrence at all is a curious phenomenon: the nominalized forms are far removed from everyday usage. None of the normal control subjects (3) who gave responses to the pictures used the nominalized forms.

Further examples of nominalization errors were made by S.L. in the single word reading task. This task has been already described in Chapter 5 where particular attention has been paid to reading of single prepositions. Here the attention is focussed on reading of verbs.

6.7.5 Nominalization errors in Experiment II: Reading single words

Nominalizations occurred twenty-eight times in the verb reading task (see Table 6.4 in Section 6.6) The numbers of nominalization errors, distinguishing between simple referring nouns and verbal nouns in each group of verbs, are presented in Table 6.5.
The nominalization errors were divided between the use of referring nouns and of verbal (derived) nouns. While it can be argued that using referring nouns is simpler than using verbs, the same cannot be said about the use of derived nouns. The question is how can S.L.'s use of the nominal form of the verb, (which is not a particularly simple or frequently used form of the verb in Hebrew) be explained? Before an attempt at interpretation is made, another form of errors made by S.L. must be discussed. In Table 6.4 in addition to the nominalization errors, 15 instances of 'paradigm errors' are indicated.

Verb paradigm errors are particular to Hebrew, a language based on consonantal roots that are realized in various forms by the addition of different vowels and affixes. The shared root in different lexical verbs facilitates verb paradigm errors (see Section 6.2.2).
6.8 Derivational errors in agrammatism

It is almost axiomatic in the aphasia literature that agrammatics do not make derivational errors, there is, however, little empirical evidence for the claim. Nominalization - if it occurs - is unquestionably, a derivational error. Verb paradigm errors are, similarly, derivational errors.

6.8.1 Derivational processes in the Hebrew verb system

The most frequent form of derivation (Scalise 1988) is when the morphological change is marking syntactic category change, for example, from verb to noun (develop to development), or from adjective to verb (large, enlarge).

However, change in syntactic category is not the only defining characteristic of derivational change. For example, when man becomes manhood, the noun remains a noun, but the derivational suffix has changed the features added to the category specification of the lexical item. Another example from English is the following: the tree falls; He felled the tree. The two verbal forms (fall and fell) are clearly related by derivation. The difference between the two forms is in their argument structure; the first verb has only one argument (tree-Theme), and the second has two arguments (he-Agent; tree-Theme). In English there are not very
many similar examples, but in the Hebrew verb system such
derivational alterations among verb paradigms designating
changes in argument structure are basic (see Section
6.2.2).

This form of change occurs when a Hebrew root moves from
one binyan (paradigm) to another. When an alteration in
the argument structure of a verb takes place, the change
is derivational, and must be distinguished from
inflectional change. Derivation occurs prior to
inflection and can change in radical ways the information
attached to an item, while inflection can only change a
fixed set of linguistic features such as tense, gender
and number.

Confusing between two different paradigms of one verb
root is a likely error in aphasia, although not in
agrammatism, because paradigm errors are derivational
errors and agrammatic patients are said not to make
derivational errors. Nevertheless, S.L. makes quite a
large proportion of paradigm errors.

6.8.2 Examples of S.L.'s using the wrong binyan
(paradigm error) in Experiment II: Reading
single words

In Table 6.4, 15 verb paradigm errors are indicated.
Upon presentation of the verb S.L. produced instead of
the verb written on the card, a different binyan or
paradigm of the same root. In Table 6.6 a detailed
account of her errors are presented, indicating the
required verb, the verb produced and comment, if any.
<table>
<thead>
<tr>
<th>TABLE 6.6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S.L.'s paradigm errors in the single word reading task</strong></td>
</tr>
<tr>
<td><strong>THE TARGET VERB</strong></td>
</tr>
<tr>
<td>binyan</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td><strong>1. melamed</strong></td>
</tr>
<tr>
<td>PIEL</td>
</tr>
<tr>
<td><strong>2. mitkalkel</strong></td>
</tr>
<tr>
<td>HITPAEL</td>
</tr>
<tr>
<td><strong>3. megale</strong></td>
</tr>
<tr>
<td>PIEL</td>
</tr>
<tr>
<td><strong>4. mitxapes</strong></td>
</tr>
<tr>
<td>HITPAEL</td>
</tr>
<tr>
<td><strong>5. mitkarer</strong></td>
</tr>
<tr>
<td>HITPAEL</td>
</tr>
</tbody>
</table>
1. nitax  liftaax  NIFAL  PAAL  is being  to open
2. nitax  liftaax  NIFAL  PAAL  opened
3. nlSloax  l1Sloax  NIFAL  PAAL  being  to send
4. nifgaS  megafes  NIFAL  PIEL  meet with  non existent word
5. nimSax  memuSax  NIFAL  PAUL  continued  continuous
6. nizkor  zozer  NIFAL  PAAL  recall  remember
7. nirtav  ratuv  NIFAL  PAUL  becoming  wet
8. nilmad  lomed  NIFAL  PAAL  being  study
9. guraS  garuS  PUAL  PAUL  was  divorced
10. Sulam  Silem  PUAL  PIEL  was paid  he paid
11. tuxnan  metaxnenet  PUAL  PIEL  has  she plans
12. hirgaS  hirgaSfi  HUFAL  HIFIL  was felt  I felt
6.8.3 Examples of S.L.’s using the wrong verb binyan (paradigm errors) in spontaneous speech and in verb naming presented in Table 6.7

**TABLE 6.7**

<table>
<thead>
<tr>
<th>TARGET VERB</th>
<th>VERB USED</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>binyan</em></td>
<td><em>binyan</em></td>
<td></td>
</tr>
</tbody>
</table>

**In spontaneous speech:**

1. lehitgareš Legareš
   HITPAEL PIEL
   to get a divorce to expel or to divorce somebody

2. mitamec Meamec
   HITPAEL PIEL
   make an effort strain something

3. hitkitu Nitketu
   HIFIL NIFAL
   (they) attacked non existent form

4. mistoderet Mesaderet
   HITPAEL PIEL
   manage with, put in order, tidy something

5. sotef Mesatef
   PAAL PIEl
   wash (the dishes) non existent form the form exists, meaning something different

**In action naming task (see Section 6.5.2):**

1. mistorek Mesorek
   HITPAEL PIEL
   comb oneself comb somebody
6.8.4 Impairment of 'syntactic like processes' in the lexicon

Derivational errors within the verb category occur in both speaking and reading aloud. They become more frequent as the verb form becomes more complex. On three occasions in the single word reading task, she gave examples that were appropriate to the target verb and not to the verb she actually used.

These errors could be elicited in Hebrew but not in English, because of the special qualities of the Hebrew verb system. Similarly, the Hebrew language allows a better view of nominalization errors.

This study suggests that both errors of nominalization and verb paradigm errors are derivational errors and, therefore, the myth that derivational errors do not occur in agrammatism needs to be reconsidered. There are a number of reasons for why this 'belief' has been maintained. One of them is that the English language does not facilitate derivational errors (apart from the -
ing form in nominalizations). The second reason is more profound. Agrammatism has been conceptualized as a 'syntactic' deficit, an impairment in which the lexicon is relatively intact. Therefore, it was assumed that word formation (derivation), a process occurring in the lexicon could not be implicated in agrammatism.

Borer (1984) suggested that there can be 'syntactic like' processes within the lexicon. While it is probably true that the transformational component (Move alpha) cannot carry out paradigm changes in Hebrew and nominalizations because these processes are not entirely productive, nevertheless, their partial productivity cannot be overlooked. The process of moving from paradigm to paradigm, or from noun to verb could occur within the lexicon using rules with somewhat limited and continuously checked applicability.

What is being suggested is a dynamic lexicon in which the items represented are not fixed and frozen entities; some of the items, at least, like the Hebrew verbs, may go through substantial changes within the lexicon, according to specifications; at times the specifications are limited to only a few items, at other times they are more general, resembling rules. The suggestion here is that the more the specifications within the lexicon resemble rules, i.e. they have wider applicability, the more they are impaired in agrammatism.
In order to specify how the lexical formation rules might be working, more and detailed studies of the kind presented here needs to be carried out. For example, there are some indications in the present data that certain paradigms are more error prone than others (PIEL, HITPAEL, NIFAL). This is, probably, not accidental, perhaps due to more 'regular processes' involved with these paradigms than with the others, but at the present stage nothing definitive can be said about this.

6.9 Errors of verb inflection

In spontaneous speech and in the verb reading task too, S.L. made inflection errors. It is well known that agrammatics have difficulties with verb inflections. One important issue when considering inflection errors in agrammatism is whether inflections are omitted or substituted.

Studies conducted with English speaking aphasics show that aphasics omit verb inflections. This generalization has been corrected by Grodzinsky, who argued that in some languages it is not possible to produce a real word without some form of inflection. The verb stem in Italian is a non word and in Hebrew it is unpronouncable as it contains only consonants. In Italian and Hebrew patients do not omit verb inflections. Instead, they make substitution errors, i.e. they use a wrong inflection.
According to the general theory of Grodzinsky (see Chapter 3 Section 3.7) inflections are part of the non-lexical items that are deleted from the s-structure representation of agrammatic patients. That an inflection is required is 'known' to the patient as the relevant node of INFL is undamaged, but the identity of that node is not specified in the agrammatic representation of sentences and the patient is reduced to guessing.

In Section 6.2.1 the Hebrew inflections are described. It can be seen that inflection in Hebrew is quite rich and if, as Grodzinsky claimed, guessing guides the agrammatic patient's choice of inflection, a variety of forms, in principle, could be used. This is not the case in S.L., despite the fact that she has a problem with inflections.

In spontaneous speech her problem is not always apparent. Most of the time she is talking about herself and she is usually successful in expressing present tense feminine and first person past.

The following errors of inflection were recorded in her 102 spontaneous utterances, presented in Table 6.8
TABLE 6.8

<table>
<thead>
<tr>
<th>Target</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd person past tense fem.</td>
<td>1st person past</td>
</tr>
<tr>
<td>future tense in obligatory context</td>
<td></td>
</tr>
<tr>
<td>past tense</td>
<td>present tense</td>
</tr>
<tr>
<td>3rd person past feminine</td>
<td>present tense masculine</td>
</tr>
<tr>
<td>past tense</td>
<td>present tense</td>
</tr>
<tr>
<td>past tense</td>
<td>present tense</td>
</tr>
</tbody>
</table>

The small number of errors reflect the fact that in the main she is talking in the present tense about herself. Present tense sentences are often acceptable even when referring (semantically) to the future. Furthermore, in Hebrew, as it has been pointed out already, in the present tense verbless sentences are acceptable.

The kind of errors S.L. makes are described better as simplification of the inflection than guessing. This gives more support to Lapointe's hypothesis than to Grodzinsky's.

6.9.1 Experiment III: Reading single inflected verbs

The aim of this experiment was to find out S.L.'s ability to produce inflected verbs. Prior to this test evidence
about her difficulties with inflections came from her spontaneous speech data and her reading of single verbs. Although in both tasks she made errors of inflection, these tasks give only limited information about the scope of S.L.'s problems with inflections. The reason is that in spontaneous speech she chose the subject of her conversation and most of the time it required the use of present tense feminine and first person past tense. In Experiment II, all the verbs were in present tense masculine form. In the present task, the verbs were inflected for present, past and future tense; for masculine and feminine gender; for singular and plural number and for first, second and third person.

Method and materials

40 verbs of different verb groups in all tenses written on individual cards and given to the patient for oral reading.

Results

Reading inflected verbs was very difficult for S.L. and the verb was never correctly inflected. S.L. often refused to read and responded by saying I don't know. In table 6.9 the target verbs and her responses are presented for those verbs that she attempted to read.
TABLE 6.9

<table>
<thead>
<tr>
<th>TARGET</th>
<th>ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. hifxadto</td>
<td>paxad</td>
</tr>
<tr>
<td>you frigthened somebody</td>
<td>fear</td>
</tr>
<tr>
<td>2. Silmu</td>
<td>Silamt1</td>
</tr>
<tr>
<td>they paid</td>
<td>I paid</td>
</tr>
<tr>
<td></td>
<td>Silem</td>
</tr>
<tr>
<td></td>
<td>he paid</td>
</tr>
<tr>
<td>3. yaxlitu</td>
<td>lixlot</td>
</tr>
<tr>
<td>they will decide</td>
<td>a non existent infinitival</td>
</tr>
<tr>
<td>4. hiskamnu</td>
<td>hiskim</td>
</tr>
<tr>
<td>we agreed</td>
<td>he agreed</td>
</tr>
<tr>
<td></td>
<td>corrected</td>
</tr>
<tr>
<td>5. cexaktem</td>
<td>coxeket</td>
</tr>
<tr>
<td>you laughed pl.</td>
<td>she laughs</td>
</tr>
<tr>
<td></td>
<td>coxakim</td>
</tr>
<tr>
<td></td>
<td>they laugh</td>
</tr>
<tr>
<td>6. darSu</td>
<td>doreS</td>
</tr>
<tr>
<td>they demanded</td>
<td>he demands</td>
</tr>
<tr>
<td>7. yedabru</td>
<td>dibur</td>
</tr>
<tr>
<td>they will speak</td>
<td>speaking N</td>
</tr>
<tr>
<td>8. nevSel</td>
<td>mevaSelet</td>
</tr>
<tr>
<td>we will cook</td>
<td>she cooks</td>
</tr>
<tr>
<td>9. korati</td>
<td>likro</td>
</tr>
<tr>
<td>I read past</td>
<td>to read</td>
</tr>
<tr>
<td></td>
<td>corrected</td>
</tr>
<tr>
<td>10.esa</td>
<td>nasoti</td>
</tr>
<tr>
<td>I'll travel</td>
<td>I travelled</td>
</tr>
<tr>
<td>11.lekaxtem</td>
<td>cannot read</td>
</tr>
<tr>
<td>you took pl</td>
<td></td>
</tr>
<tr>
<td>12.higati</td>
<td>correct</td>
</tr>
<tr>
<td>I arrived</td>
<td></td>
</tr>
<tr>
<td>13.tiknu</td>
<td>tikanti</td>
</tr>
<tr>
<td>they repaired</td>
<td>I repaired</td>
</tr>
<tr>
<td></td>
<td>tikun</td>
</tr>
<tr>
<td></td>
<td>repairing</td>
</tr>
<tr>
<td>14.yisperu</td>
<td>yispor</td>
</tr>
</tbody>
</table>
they will count  he will count

S.L. attempted to read 14 verbs out of the 40; she did not want to read anymore.

Discussion

The root was always recognized and in those verbs where reading was attempted, there was a tendency to simplify the inflection: a tendency towards a present tense form; to the past tense from the required future; to the singular from the plural. The reading of these inflected verbs was difficult and had to be abandoned.

When S.L. made clear that she will not read any more verbs, she was asked by the experimenter what can she tell about the verb: when was that? who did it? how many people?

S.L. was able to give an almost entirely accurate account of the functions of the inflections although she could not actually produce them. She could state the tense, gender and number of the verbs. In Table 6.10 S.L.'s analysis of the verbs is presented.

+ indicates correct response;
- when no response is required, when a certain feature is not marked in the inflection, for example, gender in the first person past, which is the same for masc. and fem.
/ or \ when she did not specify
- indicates error
<table>
<thead>
<tr>
<th>THE VERB</th>
<th>INFLECTION ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tense</td>
</tr>
<tr>
<td>1. kotavti</td>
<td>I wrote</td>
</tr>
<tr>
<td>2. hitxodto</td>
<td>you (masc.)</td>
</tr>
<tr>
<td></td>
<td>somebody</td>
</tr>
<tr>
<td>3. Sii©u</td>
<td>they paid</td>
</tr>
<tr>
<td>4. yaxlitu</td>
<td>they will decide</td>
</tr>
<tr>
<td>5. tilbeSi</td>
<td>(you sing. fem. will wear)</td>
</tr>
<tr>
<td>6. caxaktem</td>
<td>(you pl. laughed)</td>
</tr>
<tr>
<td>7. darSu</td>
<td>(they demanded)</td>
</tr>
<tr>
<td>8. yedobru</td>
<td>(they will speak)</td>
</tr>
<tr>
<td>9. nevoSel</td>
<td>(we will cook)</td>
</tr>
<tr>
<td>10. karati</td>
<td>(I read past)</td>
</tr>
<tr>
<td>11. esa</td>
<td>(I will travel)</td>
</tr>
<tr>
<td>12. hiskamnu</td>
<td>(we agreed)</td>
</tr>
<tr>
<td>13. lekaxtem</td>
<td>(you pl. took)</td>
</tr>
<tr>
<td>14. doreS</td>
<td>pr. sing. masc. demand</td>
</tr>
<tr>
<td>15. meSalemet</td>
<td>pr. fem. sing. pay</td>
</tr>
<tr>
<td>16. biSaltem</td>
<td>(you pl cooked)</td>
</tr>
<tr>
<td>17. higati</td>
<td>(I arrived)</td>
</tr>
<tr>
<td>18. modia</td>
<td>(pr. sing. masc. announce)</td>
</tr>
<tr>
<td>19. tiknu</td>
<td>(they repaired)</td>
</tr>
<tr>
<td>20. yesapru</td>
<td>(they will tell)</td>
</tr>
<tr>
<td>21. tekoblu</td>
<td>(you pl. will get)</td>
</tr>
<tr>
<td>22. ticxeki</td>
<td>(you sing. fem. will laugh)</td>
</tr>
<tr>
<td>23. osir</td>
<td>(I'll sing)</td>
</tr>
<tr>
<td>24. gamornu</td>
<td>(we finished)</td>
</tr>
<tr>
<td>25. hirgaSto</td>
<td>(you masc. sing felt)</td>
</tr>
<tr>
<td>26. lekaxtem</td>
<td>(you pl. took)</td>
</tr>
<tr>
<td>27. yaskim</td>
<td>(he will agree)</td>
</tr>
<tr>
<td>28. himSaxti</td>
<td></td>
</tr>
</tbody>
</table>
It seems clear that the deficit in using verb inflections is an output deficit only. While S.L. was unable to read the inflected verbs, she was very sensitive to what they signified. Her comments often used the correct grammatical term for tense, gender and number, and sometimes she employed everyday words, like yesterday, tomorrow, a boy, a girl, many people. She did not often comment on the person of the inflected verb. This is either a less salient feature than tense, gender and number, or she did not know how to convey information about person.

Inflections then are very difficult for S.L. to read (and even to repeat). Guessing, however, is not an appropriate description of what is happening; ‘guessing’ would indicate random responses. ‘Guessing’ would not account for her consistently correct usage when talking about herself; it would provide no way of distinguishing
between 'easier' and more difficult inflections (e.g. between the past and the future tense in the repetition task). In the reading of single inflected verbs, there is a tendency towards using the simpler inflection, although the definition of 'what is simpler' is no simple matter (See Lapointe 1983).

6.10 Conclusion

There are many ways it is possible to make errors on verbs and therefore the exploration of the 'verb deficit' in an agrammatic patient led to the discussion of variable phenomena.

It was claimed that, although verbs are often missing from S.L.'s speech, this is not a more serious impairment than her naming deficit, i.e. the unavailability of nouns. There is a contrast between S.L.'s relatively well preserved main verb vocabulary and the total omission of auxiliary verbs (and prepositions). S.L.'s performance thus confirms that in agrammatism, content words are relatively well preserved, while grammatical morphemes are impaired.

S.L.'s nominalization and paradigm errors suggested a particular conceptualization of the lexicon in which 'syntactic like' processes are carried out. It was claimed that the more 'regular' the process, the more error prone it is for the agrammatic. This may explain S.L.'s serious impairment of inflections.
CONCLUSIONS

One of the objectives of the present thesis was to test Grodzinsky's theory about the comprehension failure in agrammatism. Grodzinsky put forward two accounts as an explanation for the comprehension failure of agrammatics in passives and object relatives.

The first account claimed that the s-structure representation of the agrammatic patient lacks trace and therefore one of the noun phrases is thematically uninterpretable.

In Chapter 4 experiments were reported which tested this theory by exploiting a special feature of the Hebrew language in which it is possible to construct passives both with and without trace. There is no other direct way to test the 'trace theory'. In Hebrew, the two forms of passive have precisely the same meaning, have little difference in grammatical structure and the only difference is in the pragmatic contexts in which they are used. The hypothesis was tested on patients whose performance levels were above chance on actives and at chance on (ordinary) passives. It was argued that if the deletion of trace was the causal factor for the comprehension failure of the agrammatic patient, the traceless passive should not create any difficulties. The results were the same - at chance - for both types of
passives, which suggested that the trace theory explanation of the comprehension failure cannot be correct.

According to the second account of the comprehension deficit in agrammatism of Grodzinsky, traces are not deleted from the sentence representation of the agrammatic. Rather the difficulty lies in the need for coindexation between two distant elements in the sentence. In the case of passives and object relatives, between the trace and the moved noun phrase.

For passives and object relatives the predictions made by the two accounts are not different. In these cases it could still be argued that the presence of the trace is causal for the comprehension problem. Nevertheless, the two accounts are very different and they do have different predictions for sentences that do not contain trace but require coindexation.

The full range of differences between the accounts and the reasons for preferring the 'coindexation' version has never been spelt out by Grodzinsky. It is not clear whether the second account was proposed for conceptual or for empirical reasons. On purely linguistic grounds, trace deletion would result in extremely wide ranging deficits, not just those found in agrammatism. The coindexation hypothesis, on the other hand, posits the comprehension deficit in Binding theory, a less central
module of the grammar that indeed might be implicated in agrammatic comprehension.

A theoretical consequence of this change of mind is that the account for comprehension is no longer related to the account for production (see Chapter 3, Section 3.7). While in the first account, the deletion of the trace was shown to be the same kind of deficit as the deletion of the non-lexical categories typical of the production of agrammatic patients, the coindexation account is unrelated to the grammatical morpheme omission.

The experiments reported in Chapter 4 were able to show that coindexation is indeed difficult for agrammatic patients. The test sentence which demonstrated this had no passive morphology (and no trace!). Nonetheless, the dislocated noun phrase in a non-argument position—a position that is not assigned a theta role—must be coindexed with a pronoun that receives the appropriate theta role from the verb. In English, as for sentences for example, *As for the zebra, the horse is photographing him*, gave results supporting a coindexation account. In Hebrew, object relatives with a resumptive pronoun gave results similar to object relatives with a trace, indicating that the need for coindexation could create comprehension problems.

To show that the coindexation of two distant elements in a sentence is indeed difficult, a sentence appearing on posters in the underground is reproduced below. In this
sentence two verbs, one main and one auxiliary, must be coindexed in order to get the message. The poster advertises a newspaper that supports homeless people. It reads: The paper you cannot ignore that benefits people you usually do. The difficulty that normal readers have with this sentence is not that the paper is moved from its original postverbal position (leaving a trace) but in finding the reference for do, i.e. with the coindexation between do and ignore.

In addition to demonstrating that coindexation is difficult for Broca's aphasics, two other experiments reported in Chapter 4 indicated that the reversibility of the test sentences has diverse effects on the patients' performance. In the first experiment, truncated passive questions and active questions - which are non reversible because no two noun phrases are present in the sentence itself - were used. In the second experiment, existential active and passive sentences were given to the patients. In these sentences, the contrast was not based on reversing thematic roles (as it is in the full reversible passive sentences) but on the transitive and intransitive uses of particular verbs such as eat, walk, fly, drive etc.: consequently, both the sentences and the pictures were non reversible. In both experiments the differences in performance levels between actives and passives did not reach significance. This suggests that non reversible sentences interact with the difficulties
involved with passives differently than reversible sentences do.

It is argued that (a) rejecting the 'trace theory' (b) accepting the hypothesis that coindexation between elements in a sentence is problematic for (some) agrammatics and (c) taking into consideration that reversibility has a special and unaccounted for effect on the comprehension abilities of these patients, could lead towards new ideas in identifying the comprehension impairment in (some) agrammatic patients.

It has been also shown, and not for the first time, that Broca's aphasics vary in their comprehension abilities. In both group studies - the English and the Hebrew - there were patients with relatively well preserved comprehension. The existence of these patients supports arguments against the view that asyntactic production, i.e. agrammatism, must be accompanied by asyntactic comprehension. The assumption of parallelism is gradually crumbling away, although questions remain. Before abandoning the notion of parallelism completely one would like to investigate specifically the idea suggested by Grodzinsky that there is a subtle qualitative difference between the production of those agrammatics who have comprehension deficits and those that do not.
The case study of S.L. provided an opportunity to observe in detail a 'classical' agrammatic patient. This was a patient who has a relatively well preserved content word vocabulary but who omits most grammatical morphemes. S.L. omitted all prepositions and it was almost impossible for her to use verb inflections freely. Nevertheless, because of her unimpaired comprehension, and her own ability to express meanings, one could conduct a conversation with her.

S.L.'s preposition deficit and her difficulties in using the rich inflection system of Hebrew proved to be limited to production. She had excellent comprehension and her grammaticality judgements for prepositions were good. However, tasks that did require the production of prepositions, even reading or writing single prepositions, proved to be difficult for her. What became clear from the 'preposition case study' is that, although none of the prepositions are lost for her, she is severely limited in using them in all production modalities.

The situation is similar in relation to verb inflections. While S.L. was able to read single verbs in the present tense, where the inflection is simplified, she could not read richly inflected verbs. However, when asked to do so she was able to show that she understood the significance of the inflections - tense, gender and number.
Thus this case study showed very clearly that the same elements of language that are very difficult for S.L. in speaking are available for her intact in comprehension.

In most of the tasks, S.L. either could perform well or was impaired. The sentence completion task was the only task in which differences between the availability of different preposition types could be shown. The comparison explained in Experiment 9 in Chapter 5 confirmed Friederici's hypothesis that the 'meaningfulness' of a preposition is the crucial factor in determining production in a task such as sentence completion. Grodzinsky's claim that governed prepositions are impaired and ungoverned prepositions are retained, was rejected.

It is important, however, to emphasize that Friederici's dichotomy between 'meaningful' and 'meaningless' prepositions has only limited value in explaining the preposition impairment of this patient. A detailed error analysis and an analysis of her pattern of omissions in different tasks revealed a number of additional factors that contribute to the availability/omission of some prepositions.

In Chapter 6 it was suggested that agrammatism is a deficit in carrying out regular syntactic-like processes within the lexicon, a deficit in following the rules of word formation including derivations and inflections.
I.e. exploiting the 'rules of grammar'. This form of explanation does not require that the deficit will be parallel or that will be manifested all the time. Words may be available unanalyzed and thus unimpaired. Furthermore, following the rules of grammar is required in producing language but not in comprehension, therefore a dissociation of comprehension and production impairments is a natural outcome of the explanation.

In Chapter 2, however, it has been emphasized that Government and Binding theory conceptualized the grammar as a system of interrelated principles or modules and that there were no 'rules of grammar' (no rules of passive formation or rules of question formation, for example). How to accommodate this view of the grammar with the idea that is expressed above that, in agrammatism, 'rule following' is impaired?

The contradiction is solved if the principles of Universal Grammar and its parametric variations are assumed unimpaired in agrammatism and the deficits are placed in the peripheral features of individual grammars. This possibility is supported in the present study by the failure to demonstrate the importance of trace for the sentence interpretation of agrammatic patients and the failure to show the importance of government for determining which preposition will be produced and which will not be produced. It is further supported by finding that the individual features of Hebrew were important in
facilitating the production of certain prepositions, or of particular errors to occur.

There is little evidence to suggest that principles of Universal Grammar are unavailable for agrammatic patients like S.L. S.L.'s knowledge of language—her comprehension and her intuitions for prepositions and verb inflections that has been demonstrated—is far too good to assume the inavailability of any of the central modules of Universal Grammar. The impairment of any of these modules would result in far reaching deficits that were not seen in her case.

In order to account for S.L.'s agrammatic production it is suggested that features of the Hebrew language—especially those that require 'rule following', and 'processing of regularities' like inflecting verbs, realizing verb roots as different paradigms and the use of prepositions—are impaired while the principles of Universal Grammar are preserved. The deficit of patients like S.L. is thus located in the 'grammar' that has to be learnt and memorized when learning a second language. What is impaired is not the lexical identity of the items contained in this grammar (prepositions, inflections etc.) but the ability to follow the rules of the grammar of a particular language.
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