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LEXICAL RETRIEVAL DISTURBANCES
IN A CONDUCTION APHASIC

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY
IN LINGUISTICS
DECEMBER 1986

By
Eileen Cain

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Many people have helped me in the process of bringing this dissertation into being. I wish first to express my gratitude to the members of my committee—Ann Peters, chair, and George Grace, Patricia Lee, Frank McPherson, and Richard Schmidt. I appreciate their insightful suggestions and comments, their time, and their willingness to help.

Of course, the central person in this study, to whom I am very grateful, is the subject, C.G. Her willingness to cooperate and persevere greatly facilitated my field work. Her family was also cordial and helpful.

A grant from the Linguistic Society of America made it possible for me to attend the Summer Linguistic Institute at the University of Maryland in 1983. Without that learning experience, this study would not have been possible. The Linguistics Department at the University of Hawaii offered financial support throughout the course of my studies, and aid was also supplied by the Center for Asian and Pacific Studies, the Seth Project, my family, and the Honolulu Friends Meeting, and I am grateful to all.
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Lastly, I also wish to thank Terak 1 and Terak 2 for being there.
ABSTRACT

This dissertation is a case study of a conduction aphasic, C.G. Chapter 1 presents the clinical features of conduction aphasia. This is followed by a discussion of many of the linguistic impairments manifested in this syndrome: an impairment affecting the use of various word classes (including noun facilitation), anomia, and lexical substitution errors, which include verbal paraphasias (replacement of a target word by a word similar to it in meaning and/or form in speech) and paralexias (lexical substitutions in reading). Lexical substitution errors can affect both the open and the closed class vocabularies. It will be my position in this dissertation that all of these errors involve lexical retrieval disturbances.

Chapter 2 discusses accounts of conduction aphasia in the literature: the classical disconnection model of Wernicke (1874/1969), Goldstein's (1948) central aphasia, the encoding deficit approach, studies attributing the repetition deficit in conduction aphasia to a defect of audio-verbal short-term memory, and several phonological approaches. These accounts are described and evaluated.

Chapter 3 describes the subject in this study and the methodology used for data-gathering. The corpus includes
samples of spontaneous speech, repetition, naming, reading, and writing, as well as metalinguistic tasks where the subject was asked to judge sentences as to their grammaticality and to correct them if possible.

The fourth chapter presents the results of the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan 1972) and the Token Test (De Renzi and Vignolo 1962).

Chapter 5 discusses the results of the tests which I designed in order to provide a more complete picture of C.G.'s language abilities and impairments than can be obtained from the Boston Diagnostic Aphasia Examination or the Token Test. Results from the Wug Test (Berko 1958) are also included in Chapter 5. The data includes instances of lexical omissions and substitutions in repetition, reading, and spontaneous speech.

Chapter 6 presents accounts of the linguistic impairments described in the previous chapters in terms of lexical selection errors, relying on models by Merrill Garrett (1980, 1981, 1982) and Katz and Fodor (1963), as well as network models of the lexicon.
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SYMBOLS AND ABBREVIATIONS

Symbols Used in Transcriptions

% stands for schwa.
@ stands for [æ].
i stands for [I].
? stands for glottal stop.
th stands for theta.
! before a syllable indicates primary stress.
    before a syllable indicates secondary stress.
(?) follows items in transcriptions where I am not entirely sure what the subject said—the item before this symbol is my best guess.
xx in transcribed speech indicates that what the subject said was unintelligible.
CG: is the label for utterances by the subject in this study, C.G., in transcribed speech.
EC: is the label for utterances by the researcher in this study, in transcribed speech.

Abbreviations Used to Designate Tests

RI1—The first repetition test focusing on inflectional morphemes
RI2—The second repetition test focusing on inflection morphemes
R3—The third repetition test
JI1--The first grammaticality judgment test focusing on inflectional morphemes

JI2--The second grammaticality judgment test focusing on inflectional morphemes

JI3--The third grammaticality judgment test focusing on inflectional morphemes

RPro--A repetition test focusing on pronouns and pronominal determiners

JPro--A grammaticality judgment test focusing on pronouns and pronominal determiners

JPrep--A grammaticality judgment test focusing on prepositions

ActPrepl--A test focusing on prepositions in which the subject was asked to act out certain commands

ActPrep2--A test in which the subject was asked to make up commands for the examiner to act out

JAux1--The first grammaticality judgment test focusing on auxiliaries and copulas

JAux2--The second grammaticality judgment test focusing on auxiliaries and copulas

JAux3--The third grammaticality judgment test focusing on auxiliaries and copulas

JS--A semantic acceptability judgment test
The study of aphasia by linguists has been increasing in recent years and has led to growth in our knowledge of the relation between language and the brain. Neuro­linguists and psycholinguists are interested in what language pathology can tell us about normal language production, whether the study of language deficits can form part of the body of evidence that bears on levels and kinds of representations, as well as the processes involved in language production. Fruitful hypotheses and models of language production have been based on data from normal speech errors, such as the model proposed by Merrill Garrett (1980, 1981, 1982), which is discussed in the last chapter of this dissertation. Aphasic errors that are similar in kind to normal speech errors may also inform our models, as Garrett (1981) has tried to show. The purpose of this dissertation is to add a piece to the puzzle of the relation between normal and aphasic language production, using data from a conduction aphasic.

Linguistic analyses of aphasia are still in the early stages of development. There is still much that is not known about patterns of impairments and spared abilities in language pathology. There is an awareness among
researchers of the complexity of linguistic impairments and patterns of dissociations of language functions in aphasia. Classic descriptions of syndromes are being called into question (Goodglass and Menn 1985; Badecker and Caramazza 1985). Such statements about aphasics' language as "the closed class is impaired" are now being seen as oversimplified. This puts neurolinguistics in a period of uncertainty that is exciting because it shows a willingness to re-evaluate old assumptions by taking a fresh look at the data.

Like the other aphasias, there is much that is not understood about conduction aphasia. Existing descriptions are intriguing but unsatisfying to one interested in linguistics. Some studies focus on comprehension ability while others investigate naming or repetition. While it is necessary and valuable to focus on one aspect of language performance, such an approach is also unsatisfying in that it leaves one wondering about the other aspects of the subject's language abilities and how the pieces fit together. It is difficult to get a view of a syndrome or a type of linguistic impairment by looking at one study that tests comprehension and another that tests naming and a third that tests reading. Such investigations give part of the picture, but they need to be supplemented by research
that tests language abilities in a variety of modalities with individual aphasics. The approach taken in this study was to design a group of activities that would thoroughly test my subject's ability to comprehend language, to express her own thoughts, and to repeat and read.

One interesting phenomenon is the lexical substitution errors that were made by my subject in spontaneous speech, repetition, and reading. These substitutions can affect open class vocabulary (content words) (e.g., reading argument as remark), and the term semantic paraphasia tends to be used in the literature to refer to such substitution errors with the open class. But substitution errors with the closed class (grammatical morphemes) are also produced by some aphasics, including my subject (e.g., substituting they in place of you in conversation), and these substitutions have been described as a manifestation of paragrammatism, a label which suggests a grammatical disorder. However, as Lecours and Rouillon (1976) observe, these errors generally result in confusions of meaning without affecting syntax. According to these authors, substitution errors in general reflect a selection disorder, and they note that such errors affecting the closed class are similar in nature to substitution errors affecting the open class. This suggests that such errors
with the closed class should not be viewed as manifestations of a grammatical deficit, but rather as manifestations of difficulties in lexical retrieval. My research has led me to the conclusion that paragrammatism is a misnomer for substitution errors with the closed class vocabulary. The open class-closed class dichotomy is therefore over-simplified, in view of the fact that both classes can be involved in similar kinds of errors.

Substitution errors such as those exemplified above are not the only manifestation of lexical impairments. Other phenomena include failure to produce a word at all (anomia), the use of general words like thing and something in place of specific nouns, and circumlocution. All of these phenomena occur in the language output of conduction aphasics, and my subject also exhibits these language behaviors, which reflect lexical retrieval disturbances (Buckingham 1979).

I will show how these lexical retrieval disturbances can be described in terms of Merrill Garrett's model of lexical access and sentence production. It should be noted, however, that conduction aphasics' lexical deficits cannot be accounted for at any one stage of Garrett's lexical access model. Chapter 6 shows that errors in the
language production of my subject can occur at several stages in the model.

There are also interesting patterns of dissociation of language abilities in the language production of my subject. She exemplifies the usual pattern of fluent speech together with impaired, non-fluent repetition. In addition, she is often unable to retrieve the word she wants, a condition known as anomia. While her ability to produce nouns in spontaneous speech and naming tasks is impaired, and while she can produce a variety of syntactic patterns in spontaneous speech, in writing she only produced nouns.

One of the curious phenomena in this type of aphasia is that repetition is disproportionately difficult compared to spontaneous speech (which is fluent, although not without errors). However, it is not sufficient to say of aphasics that their repetition is good or poor. Neurolinguists need to describe the linguistic categories that are repeated successfully and those that are troublesome. References to the repetition deficit in the literature leave one with several questions. What is it that these aphasics have trouble repeating? When they have trouble repeating, what do they say?, i.e., how does the repetition deficit manifest itself? What, if anything, do
they repeat well? Can any mechanisms can be discerned that could be causing the problem? I have addressed these questions in light of data from the subject in my case study.

Some researchers have tested repetition of digits, letters, or words in isolation, while a few studies have included sentence repetition. Sentence repetition is more useful in a linguistic investigation than repetition of digits or letters or isolated words. In this study I have used sentence repetition tests containing sentences with a variety of constructions. Early in my investigations, I observed that my subject would begin to repeat a sentence, but then she would get stuck, often before the verb. Prepositional phrases were also difficult. These observations led me to the idea that word class may be an important factor influencing success in repetition, and this has been reported by Goldstein (1948) as well as others. My repetition data supports the view that some word classes are easier to repeat than others. Accounts of the repetition deficit in the literature that are based solely on short-term memory limitations could not account for this phenomenon, for while there may be memory impairment, that would not in itself cause some word classes to be easier to repeat than others.
It has been said that the closed class vocabulary is more impaired than the open class in some types of aphasia. But the closed class, as several authors have pointed out, is not a homogeneous category (see Goodglass and Menn 1985 for discussion). There is variation in retention and omission of items in the closed class. Therefore in this study I designed separate activities that focus on prepositions, pronouns, auxiliaries, copulas, and inflections, testing them in a variety of types of activities and language modalities. In addition, categories such as auxiliaries and inflections are not indivisible, and so, for example, in relation to auxiliaries I varied the parameters of tense and number agreement in tag questions, and found tense errors to be more frequent. With this kind of approach, it may be possible to describe and account for some of the variability in performance with the closed class. Using these tests, this study covered the closed class vocabulary in English more systematically and thoroughly than previous studies of aphasia have done. The tests made it possible to obtain a thorough view of my subject's ability to use the closed class vocabulary.

This dissertation presents an in-depth view of various disturbances in the language production of a conduction
aphasic. It is hoped that this will add to the body of
data accumulating on the nature of conduction aphasia and
the relation between aphasia and normal language
production.
CHAPTER I
LINGUISTIC IMPAIRMENTS IN CONDUCTION APHASIA

1.1. Introduction. This chapter will present some of the linguistic phenomena of interest in regard to conduction aphasia. First I will present information regarding clinical features of conduction aphasia, similarities and differences between conduction aphasics and other types of aphasics, and sites of lesion involved. This will be followed by a description of some of the ways in which this disorder manifests itself in the individual's language system, in impairments affecting various word classes, including anomia, substitutions and omissions of function words, and semantic paraphasias and paralexias. These kinds of errors appear in my data, the analysis of which will be given in Chapters 4 and 5. Chapter 6 will present a model of language processing to account for these phenomena.

1.2. Clinical overview. In this section, I will give clinical information on conduction aphasia.

1.2.1. Criterial features. Goodglass and Kaplan (1972) note that conduction aphasia is considered to be a fluent aphasia, since spontaneous speech tends to be
fluent, especially when compared to repetition, although word-finding difficulty is common (Goodglass and Geschwind 1976; Green and Howes 1977) and may give speech a halting quality. Phonemic (literal) paraphasias (substitutions and transpositions of sounds in a word) are common. Attempts at repetition are even more marked by phonemic paraphasias than is spontaneous speech (Goodglass and Kaplan 1972; Goodglass and Geschwind 1976). In the more fluent cases, word-finding difficulty can be severe—the person may speak fluently "until he encounters a substantive or a principal verb, at which point he struggles paraphasically" (Goodglass and Kaplan 1972:68), trying to come closer and closer to the target word. In addition, there are also deficiencies in naming objects and body parts.

The outstanding feature in this syndrome is an impairment in the ability to repeat syllables, words, and sentences (Dubois et al. 1964/1973). Some investigators report that repetition is worse when material to be repeated is presented aurally than when it is presented visually (Kinsbourne, 1972; Caramazza et al. 1981; Warrington and Shallice 1969; Warrington et al. 1971; Luria et al. 1967) though Heilman et al. (1975) did not find this to be the case, and it is not clear whether Warrington's
and Luria's patients are really conduction aphasics (this will be discussed further in Section 2.3, the section on the mnestic hypothesis regarding conduction aphasia). In repetition, phonemic paraphasias are prominent. Common words and expressions used often in conversation are not usually hard for these aphasics to repeat, but long words and low-frequency items are difficult, although these aphasics can often make corrections (Goodglass and Kaplan 1972).

Auditory comprehension is generally judged to be near-normal (Goodglass and Geschwind 1976; Dubois et al. 1964/1973). Benson (1979) observes that while there may be some comprehension impairment, it is not severe—a person with a severe comprehension deficit is not likely to be a conduction aphasic, although performance on the Token Test has indicated some degree of impairment in several studies (Warrington et al. 1971; Caramazza et al. 1981). Furthermore, in a test where comprehension depended on grasping syntactic structure, Heilman and Scholes (1976) report deficient performance among conduction aphasics, as do Caramazza and Zurif (1978).

Attempts to read aloud may be marked by the same kinds of errors as those found in spontaneous speech, though reading comprehension may be good. Writing and spelling
are often severely impaired (Goodglass and Geschwind 1976; Green and Howes 1977; Dubois et al. 1964/1973; Wernicke 1874).

Green and Howes (1977) indicate that the spontaneous speech of conduction aphasics may contain grammatical errors, and that these aphasics typically cannot correct these errors or perform adequately on tests of their ability to use affixes. Though they are not specific about the types of errors found, they may be referring to paragrammatism. Paragrammatism has been defined as a disorder involving the use of wrong function words and inflectional affixes, as well as the juxtaposition of "semantically incongruous sentence components", rendering sentences ungrammatical (Goodglass and Geschwind 1976). In this dissertation, I will be concerned with the first part of this characterization of paragrammatism, the use of wrong function words. This will be discussed further in Section 1.5 and in the last two chapters.

To summarize, Benson et al. (1973) assert that there are three criteria which must be present for a diagnosis of conduction aphasia:

1) fluent, paraphasic spontaneous speech;
2) normal comprehension in conversation;
3) significant impairment in repetition.
Other impairments may be present as well, such as those described above.

1.2.2. Sites of lesion. The locus or loci of lesion(s) that produce conduction aphasia is the subject of some controversy. Benson et al. (1973) survey studies of conduction aphasics, as well as supplying data of their own. They observe that the majority of the studies in which sites of lesion were mentioned report lesions in the posterior superior temporal lobe and the inferior part of the supramarginal gyrus, (see Figure 1) "the major abnormality involving the posterior portion of the perisylvian region both above and below the fissure" (525). Two of their patients had lesions in white matter and in the cortex of the parietal operculum, and other cases like this have been reported. These cases are taken as support for the disconnection model, according to which: "the lesion of the parietal operculum...blocks transmission from the Wernicke to Broca area so that repetition is poor" (525).
Figure 1. Left Cerebral Hemisphere. The cross-hatched area is the perisylvian area.
Another patient, however, had a lesion involving Wernicke's area, and other cases like this one have been reported as well. The authors suggest that conduction aphasia may result from "pathological involvement of either of two, neighboring but different anatomical sites" (525). There may be two forms of conduction aphasia: those who have buccofacial and limb apraxia may have a lesion in the parietal operculum, while those with lesions in Wernicke's area would not have apraxia. Green and Howes' (1977:126) survey of conduction aphasics found "a consistent pattern of damage to the temporoparietal region of the dominant cerebral cortex"; these findings agreed with those of Benson et al. Dubois et al. (1964/1973) note that almost all cases published have lesions of the supramarginal and angular gyri. They believe that lesions in the parietal area are necessary to produce conduction aphasia, and that temporal lesions are always present, usually in the posterior part of the first and second temporal gyri, with possible involvement of the transverse gyri.

Mendez and Benson (1985) maintain that damage to the arcuate fasciculus occurs in typical cases of conduction aphasia. There are atypical cases that do not show damage to the arcuate fasciculus, but these, too, can be accounted for by the disconnection model, which holds that conduction
aphasia results from a disconnection between the area of brain responsible for processing the acoustic signal (input) and the area responsible for speech output. The disconnection model will be discussed further in the next chapter (Section 2.2.1.). Brown (1975:38), on the other hand, argues against a disconnection model on the grounds that conduction aphasia does not arise from a lesion in the arcuate fasciculus alone, since some conduction aphasics do not have any lesion in that pathway, and lesions in that pathway are not likely to produce conduction aphasia.

1.2.3. Relation between conduction and other aphasias. Green and Howes (1977) observe that this syndrome affects all aspects of expression (except serial speech, e.g., counting), thus characterizing it as an expressive aphasia. Dubois et al. (1964/1973) also describe it in those terms. Nevertheless, it is different from another expressive disorder, Broca's aphasia. In the latter syndrome, speech is non-fluent and repetition is better than spontaneous speech. Having an immediate auditory model for repetition assists a Broca's aphasic but not a conduction aphasic (Goodglass and Kaplan 1972), for whom repetition is as impaired as or more impaired than spontaneous speech (Dubois et al. 1964/1973). Conduction aphasics, unlike Broca's aphasics, generally have normal
intonation and use a variety of syntactic constructions in their speech (Goodglass and Kaplan 1972). Benson et al. (1973) note that their conduction aphasics had fluent speech which, however, contained many filler (non-substantive) words, unlike that of Broca's aphasics.

Dubois et al. (1973) describe the difference between these two categories of aphasics in terms of Martinet's characterization of language as involving two levels of articulation. The first level of articulation involves the structuring of thought into words and sentences—"programming a word or phrase" (287). The second level involves actually producing utterances, giving them a phonetic realization (Green and Howes 1977). Conduction aphasia involves an impairment of the first level of articulation, not the level of "phonetic programming"; it is the latter level which is affected in Broca's aphasia.

Conduction aphasia also differs from Wernicke's aphasia. Although Wernicke's patients have fluent speech and poor repetition, their comprehension is severely impaired. Conduction aphasics, as it has been noted, generally have good comprehension, are aware of many of their errors, and try to correct them (except perhaps syntactic errors). It has been suggested that conduction aphasia is a just a stage of recovery from Wernicke's
aphasia. Benson et al. (1973) reject this idea, since their conduction aphasics had good comprehension.

Conduction aphasia can also be distinguished from anomic aphasia in that patients with the latter syndrome can usually repeat accurately and do not make phonemic substitutions.

In sum, conduction aphasia is characterized as a fluent, expressive aphasia, marked by impairments in all expressive modalities, with a particularly severe repetition deficit. In calling this an expressive aphasia, it should be noted that the terms expressive and receptive when applied to these aphasias are relative: there are receptive difficulties in this syndrome, but they appear to be minor when compared to the problems in expression. Oral expression is characterized by deficits such as paraphasias, substitutions of function words for one another, and, often, anomia, all of which will be discussed in the following section. Phonemic paraphasias are more common than semantic ones. Jargon (meaningless combinations of sounds) is rare.

1.3. Linguistic impairments. This section will describe some of the ways in which the linguistic system is affected in conduction aphasia, emphasizing lexical
retrieval disturbances in the open and closed class vocabularies. After a discussion of the open and closed classes, I will discuss impairments affecting these two groups of lexical formatives.

1.3.1. Open and closed class vocabulary and aphasia. The term open class vocabulary is used in the psycholinguistic literature mainly to refer to nouns, verbs, and adjectives. The closed class vocabulary consists of what are often called function words or grammatical morphemes, and includes both free and bound morphemes. There are indications that these two categories of lexical formatives behave differently in normal language production.

Garrett (1981) takes the view that the open and closed classes are processed differently, basing this on their involvement in different kinds of speech errors by normal (non-aphasic) speakers. Open class vocabulary is involved in sound and word exchanges and stranding errors, and of these word classes, nouns are the most likely to be involved (Garrett 1980:203). The following examples are from Garrett's (1981) corpus of normal speech errors.
(1) word exchange error: "I have a pinched neck in my nerve".
(2) stranding exchange: "You have to square it facely".
(3) sound exchanges: "spinctly streaking"
(4) word and morpheme shifts: "What do you attribute to your longevity" (target: What do you attribute your longevity to)

Closed class items are not involved in sound exchange errors. Adverbs and other closed class items, except prepositions and pronouns, are rarely involved in exchanges (Garrett 1980:203). Shift errors (incorrect placement of a form, as in example (4) above) usually occur with closed class items whereas word exchange errors usually affect the open class.

According to Garrett (1981) and Butterworth (1983:287), these two classes of vocabulary are distinguished in aphasia as well. Jargon aphasics retain more of the closed class than open class forms, and phrasal organization is retained. Neologisms usually occur in the place of nouns in anomia, according to Buckingham and Kertesz (1974:61). In agrammatism, on the other hand, the closed class is more impaired than the open class (Garrett 1981:17). To Garrett, these differences between aphasic types confirm the idea derived from the study of speech errors that "closed and open class vocabularies play distinct computational roles in the sentence construction process" (18). This will be discussed further in
Chapter 6, where Garrett's model of language production will be described.

Goodglass and Menn (1985:9, 13) support the idea of a "dissociation between the grammatical and lexical components of speech", based on the existence of such phenomena as deep dyslexia (a syndrome in which reading of closed class vocabulary is particularly poor in most cases) and repetition errors of conduction aphasics, who find it more difficult to repeat closed class than open class words. Goodglass and Menn add that members of the open class are not always equally impaired—nouns and verbs can be affected differently in agrammatism. These authors refer to the distinction between content and function words as "a first-pass dichotomy"; the situation is more complex than that dichotomy would suggest.

The function-content distinction is useful in describing agrammatic behaviors, but it is a fuzzy one, reflecting an imperfect confluence of grammatical (linguistic), processing (psycholinguistic), and conceptual (psychological) factors. The conceptual criterion of verbal meaningfulness may well be the most effective property on which to make the so-called content-function distinction (25-6).

Nevertheless it may be helpful to use this "first-pass dichotomy" as a starting point in a discussion of lexical impairments. My own data confirms that members of the open and closed classes are not equally impaired in all
language modalities. This will be discussed further in Chapters 4 and 5.

1.3.2. **Impairments affecting open class vocabulary.** Differences in the treatment of word classes are mentioned in the literature on conduction aphasia. Goldstein (1948:238) notes that it was harder for his patient with central (i.e., conduction) aphasia to repeat adjectives and verbs than nouns, and Goodglass and Kaplan (1972) and Buckingham (1977:176) report that most phonemic paraphasias occur on nouns, verbs, and adjectives. Conduction aphasics avoid strings of content words because of their high information value (Green and Howes 1977:141). In Dubois et al.'s (1973:287-8) model, errors are believed to occur in places in the speech stream where there is a change in information value, such as that which occurs between a noun and a verb phrase (VP) in a sentence. They add:

> the conduction aphasic finds transitions between noun and verb phrase and between the latter and its expansion difficult if not impossible.

In my data, such transitions are clearly difficult in the repetition tests. This will be discussed in Chapter 5.

1.3.2.1. **Differential impairment of members of the open class: noun facilitation.** Noun facilitation (greater availability of nouns than other word classes) has been studied by Marshall, Newcombe and Holmes (1975). They
found that it is significantly easier for many people with acquired dyslexia to read concrete nouns than adjectives or verbs. Tests of normal children and adults support the finding that nouns are easier to read than adjectives, and adjectives in turn are easier to read than verbs. Bisazza (1980) connects this with the work of Nelson (1973:18) who found that some children have a high proportion of adult nouns and pronouns in their first fifty words. (Pronouns will be discussed further in Section 1.3.3 on the closed class vocabulary.) According to Bisazza (1980:31, 44), studies with normal adults and observations of greater usage of nouns than verbs in language development "point to a generally greater processing ease for nouns than verbs as the normal case", that is, it is normally easier to process nouns than verbs. However, he feels that noun facilitation cannot be explained simply by word frequency or by the concreteness, imageability, or operativity of nouns. McCarthy and Warrington (1985:724) report on an agrammatic patient with an impairment in retrieving verbs. This impairment is not an effect of word frequency, since the patient was able to retrieve low frequency nouns (e.g., shuttlecock and mitre) but could not retrieve high frequency verbs (e.g., walking and drinking).
Marshall, Newcombe and Holmes (1975) observe that an entry for a lexical item in the lexicon may need to include features indicating how many and what kind of syntactic and semantic relationships a given lexical item may enter into. This type of lexical organization may lead, in part, to the noun facilitation effect, for the syntactic and semantic relationships specified in lexical entries will often be greater for verbs than for nouns. Retrieval of items with less syntactic/semantic information in the lexical entry is considered to be easier than retrieval of items with a great deal of such information. In their view, lexical complexity is related to how many arguments, or place functions, a lexical item takes: a noun like girl is a single-argument noun (a one-place function), whereas friend is a multiple-argument noun (a two-place function).

Bisazza (1980) characterizes the above model as "the full recall hypothesis" because it predicts that words are retrieved (e.g., when reading a word out of context) with all of their arguments. He proposes an alternative account, "the minimum recall hypothesis", which claims that a lexical item will be recalled from long term memory—in tasks involving little or no syntactic computation—with the minimum number of arguments required to use that item in a grammatical sentence. (vii–viii)
The prediction he makes is that, since multiple-argument nouns can occur in single-argument constructions (e.g., gifts in the sentence: Books make nice gifts), multiple-argument nouns would not necessarily be harder to process than single-argument nouns and verbs, all of which would be easier to process than multiple-argument verbs where the arguments are obligatory (e.g., put). His results with normal subjects and a brain-damaged patient support his hypothesis.

1.3.2.2. Anomia (word-finding difficulty). A person with anomia has difficulty in producing a target word. Anomia is defined by Goodglass and Geschwind (1976:402) as the "selective loss of lexical words--primarily nouns, but verbs, adjectives and adverbs as well". Wepman et al. (1973, cited in Bisazza 1980:28) describe it as a condition in which high-frequency words are retained but low-frequency words are less likely to be available. More low-frequency frequency words are nouns than any other part of speech. Goodglass and Geschwind (1976:404) concur with the idea that the frequency effect is greater for nouns than for other word classes. Word frequency has been found to be an important variable in word retrieval. The higher the frequency level of a word, the sooner it is likely to be available after brain damage, and shorter response
Latencies are found for retrieval of high-frequency words than low-frequency words (Goodglass and Geschwind 1976:402).

Anomia is often a feature of conduction aphasia (Goodglass and Geschwind 1976; Green and Howes 1977), and indeed it is found in nearly all aphasics (Goodglass and Geschwind 1976; Benson 1983). Yamadori and Ikumura (1975) suggest that it might be necessary to consider anomia to be "an essential component" of conduction aphasia. According to Goodglass and Kaplan (1972:68), anomia may be very noticeable in the more fluent cases, for they may produce a fluent stretch of speech and then make paraphasic errors in attempting to say "a substantive or a principal verb".

Buckingham and Kertesz (1974:48, 60) are interested in how conduction aphasics deal with what they call anomia gaps. They observe that such gaps are marked in spontaneous speech by pauses and hesitations, and by the use of indefinite words like thing, something, or stuff, where a content word is needed but the speaker has not retrieved it. McCarthy and Warrington (1985:725) observe that their agrammatic patient had difficulty using verbs and sometimes substituted being, having, or making for a target verb. They call these three verbs superordinates, and note that their usage is similar to the use of thing.
as a superordinate for nouns by some patients. So the indefinite words may be considered to be superordinates, too. The phenomena described by Buckingham as well as the erroneous use of have and make occur in the speech of my subject, C.G.

Buckingham (1977:175) defines a word-finding problem as one in which

the sound symbols [of a word] are not available to the speaker, who may nonetheless have ready access to semantic-syntactic information.

In repetition or naming tasks, Buckingham and Kertesz report that conduction aphasics sometimes supply definitions for the word they are unable to repeat (e.g., when asked to name an eraser, one patient replied "for rubbin' out"). In naming tasks, conduction aphasics are likely to produce a form with the correct number of syllables, but may make phonemic substitutions (Benson 1973).

1.3.2.3. Semantic paraphasia and paralexia. Verbal paraphasias can include word substitutions based on form or meaning. Substitutions of one word (e.g., a noun) for another where the two words are semantically related are generally called semantic paraphasias, and they can occur in spontaneous speech or repetition. An example of such a
paraphasia occurred in the attempt of a patient to repeat the sentence: I saw a bear in the forest. The patient instead said: "I saw a wolf in the forest" (Green and Howes 1977:128). These can be considered to be manifestations of word-finding difficulty. When these kinds of substitutions occur in reading, they are called semantic paralexias.

Rinnert and Whitaker (1973) studied semantic paraphasias reported in the literature as well as paraphasias in their own data. They conclude that such substitutions are not random. Buckingham and Rekart (1979) agree that semantic substitutions are not random. The target word and the paraphasia are related—they are in the same semantic field. But they note that one is not able to predict which related item in the semantic field will be selected in these errors, suggesting that there may be linguistic as well as non-linguistic factors involved. They also note that these semantic errors seem to be qualitatively similar to errors for normal speakers (Buckingham 1980:200; Fromkin 1971:46).

In relation to word substitutions based on meaning, Garrett (1980:208) observes that in normal speech errors, sometimes the meaning relation between target and error is clear, but sometimes it is not. He adds that it would be difficult to make a case for any particular description of
meaning relations among items in the lexicon on the basis of his speech error corpus. My sample of meaning-based substitutions among open class items is rather small and does not lend itself to grand claims about meaning relations in general. I will nevertheless attempt to account for the meaning relations that hold between such target and error verbal substitutions as occur in my data.

Buckingham and Rekart (1979) give examples of semantic paraphasias produced by a Wernicke's aphasic. Some errors occur where an antonym is produced; others include confusions of words for body parts, actions, words expressing spatial or temporal information, etc. Following Rinnert and Whitaker, they classify the relations between target and error as including synonyms, members of the same semantic category, superordinates and hyponyms, spatially contiguous items, and an object and its description (e.g., water $\rightarrow$ wet, or window $\rightarrow$ glass, from Rinnert and Whitaker 1973:68).²

Buckingham (1979:273) presents a catalogue of manifestations of lexical retrieval disturbances: definitional responses, pauses, semantic field errors, word substitutions that are not semantically related to the target, indefinite words (e.g., thing), and neologisms. He distinguishes between semantic field and lexical set. Words
in a semantic field are hierarchically arranged, whereas words in a lexical set, which are semantically related, (e.g., chair and sofa) are not. Possible relations between words in a lexical set include synonymy, antonymy, and similarity (as in the last example). According to Buckingham, lexical paraphasias involve substitutions of items which are all members of a single lexical set. Other kinds of semantic confusions may involve other members of the semantic field, such as object-description confusions (e.g., when a patient is asked to name an oven but instead says hot).

There are also definitional responses, where aphasics may define a word they cannot retrieve (e.g., when unable to say banana, the patient said: "It's a type of fruit to eat"). This type of response involves substituting a superordinate in place of a hyponym. In Buckingham's view, such a response is "significantly different in nature" from a lexical set error, because definitional responses are not truly errors—they should instead be seen as incomplete attempts at lexical retrieval "based on the intact hierarchical semantic relations" available to the aphasic (275). Lexical set substitutions, on the other hand, are
truly "selectional errors". Both definitional responses and lexical set errors reflect word-finding difficulty (277).

The term semantic paraphasia has been used to refer mainly to substitutions among members of the open class (Goodglass and Geschwind 1976:410). Substitution of one functor for another has been considered to be a grammatical error (Goodglass and Geschwind 1976:407; Goodglass 1976:237-8; Menn et al. 1982:11). However, I believe that substitutions among substantives and function words involve similar processes in lexical retrieval. Goodglass (1976:238) does note that the substitutions among function morphemes are "totally consistent with the paraphasic character of the patients' [i.e., Wernicke's aphasics] speech", which reinforces the idea that the paraphasias and substitutions of function words for each other are related phenomena. This issue will be discussed further in Section 1.3.3.1.

Semantic paralexias are likely to be produced in reading by patients with word-finding difficulty and patients with posterior lesions (Marshall and Newcombe 1977). Goldstein (1948) lists paralexia as one of the manifestations of central (i.e., conduction) aphasia.
An example of this kind of error occurred when Marshall and Newcombe (1973) asked a patient (type of aphasia not specified) to read the word *speak*, but the patient read it as *talk*. In one patient's responses, Marshall and Newcombe (1966:172) found that semantic errors were most likely to be made when attempting to read nouns. My patient, C.G., sometimes made this kind of substitution, as when she read *ocean* as *water*.

In his paper on semantic paralexias in deep dyslexia, Coltheart (1980b) notes two types of error: superordinate (e.g., *cattle* --> *animals*) and coordinate (which include synonyms, e.g., *little* --> *small*). These are paradigmatic errors. (Syntagmatic errors also occur in his corpus, e.g., *wrist* --> *watch*.) He relates his data to Jakobson's (1956/1971) typology of aphasias, which classifies them into similarity and contiguity disorders. In this scheme, paradigmatic substitutions are similarity errors.

Jakobson (1964/1971) mentions two operations which are involved in producing language: selection and combination. He relates this dichotomy to the two basic types of aphasia mentioned above. In a similarity disorder, the ability to combine linguistic units is relatively well preserved (Jakobson 1956:245), but the main problem is in selection. This is seen in Wernicke's aphasia. Patients with a
similarity disorder make lexical substitution errors based on contiguity. According to Jakobson (1956:250), contiguity errors are metonymical in nature: "a sign (e.g., fork) which usually occurs together with another sign (e.g., knife) may be used instead of this sign". He gives the following examples:

\[
\begin{align*}
\text{knife} & \rightarrow \text{fork} \\
\text{lamp} & \rightarrow \text{table} \\
\text{pipe} & \rightarrow \text{smoke}
\end{align*}
\]

On the other hand, in a contiguity disorder, such as Broca's aphasia, the patient is impaired in combining linguistic units into more complex units. Syntax is disturbed. Such a patient may produce paradigmatic lexical substitutions, such as:

\[
\begin{align*}
\text{microscope} & \rightarrow \text{spyglass} \\
\text{gaslight} & \rightarrow \text{fire}
\end{align*}
\]

However, Coltheart notes that a given patient may make both paradigmatic and syntagmatic errors, and paradigmatic ones are far more frequent than syntagmatic ones. Buckingham and Rekart's Wernicke's aphasic made many paradigmatic semantic substitutions, and Wernicke's aphasia is not classified as a contiguity disorder. My patient, C.G., makes this kind of error, but she does not have a contiguity disorder in spontaneous speech, though she does in writing, and perhaps reading and repetition. It may be
better to classify aphasic errors, not syndromes, on the basis of similarity and contiguity.

1.3.3. Impairments affecting closed class vocabulary.

Goodglass and Menn (1985) and Goodglass and Kaplan (1972) mention that grammatical words and content words are differentially impaired in the repetition attempts of conduction aphasics. Caramazza et al. (1981) tested this idea, using nouns and prepositions. It was very difficult for their patient to repeat any function words when they were presented aurally; nouns were easier in that modality. When asked to repeat phrases consisting of function words and nouns, the patient only repeated one functor correctly out of ten—he made substitution and omission errors. The difference between these word classes was greater in the auditory modality than when the stimulus items were presented visually. My own data revealed an effect of word class on repetition, though the visual presentation method was not used.

Goodglass and Menn (1985) present a discussion of the heterogeneity within the closed class vocabulary. In reference to agrammatism, they discuss differences between lexical and grammatical prepositions, retention of the conjunction and by almost all agrammatics, the greater
retention of functors in stressed positions than in unstressed positions in sentences (Goodglass et al. 1972), preservation of -ing, and better retention of WH-question words over articles and copulas (Zurif et al. 1972). In addition, they mention a personal communication from Garrett, according to whom prepositions and pronouns are treated differently than other grammatical morphemes in normal speech errors. Some members of the closed class can be heads of phrases (prepositions and pronouns) whereas others never have that role. Thus, closed class items play a variety of roles in syntactic processing (Butterworth 1980:288).

In Garrett's model, prepositions are a special case. They can participate in word exchange errors, and in this they act like the open class. So one could say that word exchanges affect heads of phrases. But prepositions do not participate in sound exchange errors, and in this they are like other members of the closed class.

Garrett also notes that pronouns are different from other members of the closed class--they can be involved in exchange errors. Although he did not specifically say anything about how they are processed, presumably they would be treated like prepositions and members of the open
class. This will be discussed further in Chapter 6, where Garrett's model will be presented.

Morton and Patterson (1980) report on a deep dyslexic whose ability to read relative pronouns and auxiliary verbs was more impaired than processing of other closed class items. Pronouns were also impaired. In general, function word paralexias occurred often. The patient seemed to comprehend gender in pronouns, prepositions and adverbs referring to space, interrogative words, and pronouns, demonstratives, and conjunctions indicating number. He could not judge whether two words were the same part of speech or had the same case (pronominals). They suggest that their patient appears to understand the semantic content of function words but not the syntactic content. Words specifying gender, space and frequency provide substantive information apart from any role they play in or form they are required to take by their sentential context. It is not clear that the same can be said for variables like case and part-of-speech. (277)

This shows a distinction between semantic information and syntactic information within the closed class itself, and contradicts Caramazza and Berndt's (1978:910, cited in Morton and Patterson, 278) claim that the closed class items do not have a semantic representation. Morton and Patterson conclude that their patient retained lexical/semantic information about functors in spite of his
poor ability to read them aloud. They note that their patient's syntactic ability is impaired, and when he has to make judgments about functors based on their syntactic function, he has difficulties.

Morton and Patterson's views are supported by experiments by Friederici (1985), who accepts a "computational distinction" between the open and closed class. Friederici (1982, 1983) found that agrammatics recognize and produce more lexical prepositions than prepositions that are required by syntactic structure (e.g., for in waiting for). Friederici (1985) notes that agrammatics are not able to utilize syntactic information in the closed class vocabulary, but they are able to retrieve lexical information about the closed class (151). In her word recognition experiment, the agrammatics responded faster to open than to closed class vocabulary (155), whereas normal subjects had the opposite trend (143, 155). Her findings support the view that lexical and obligatory prepositions are processed differently. She interprets this finding as indicating that agrammatics have not "lost" the closed class vocabulary; rather the impairment lies in their "correct functional use" (158).

Goodglass et al. (1970:604-5) report that Broca's aphasics who did not produce prepositions could
nevertheless understand them. In fact, they understood them better than Wernicke's aphasics did, even though the latter use prepositions correctly in speech. They add that stress may be a factor here, in that functors are more likely to be retained after a stressed initial word (Goodglass et al. 1967). Friederici (1983:354-5) also reports that Wernicke's aphasics made more errors with prepositions than did Broca's aphasics, in a word monitoring task.

Butterworth (1983:287) notes that it is controversial whether closed-class vocabulary is separately impaired (Saffran et al. 1980)—i.e., is a separate deficit—or whether the closed class problems are a second-order effect of a syntactic deficit (Cooper and Zurif 1983). There are, then, at least two logical possibilities: 1) aphasics have trouble with the closed class because they have a syntactic deficit; 2) aphasics have a syntactic deficit because they have trouble with the closed class. It is difficult to know how to choose between these two possibilities. However, deep dyslexics have difficulty reading functors out of context (Coltheart et al. 1980). This suggests that their problem with the closed class is not dependent on syntactic processing. It seems that if closed class items are difficult to read in isolation, that would indicate a specific problem with the closed class.
1.3.3.1. **Substitutions and omissions of closed class vocabulary: paragrammatism and agrammatism.** Paragrammatism has been defined as a disorder involving the use of wrong function words and inflectional affixes (Goodglass and Geschwind 1976; Goodglass 1976:237-8) in addition to other errors, and is usually associated with fluent aphasia. Some authors discuss paragrammatism in Wernicke's aphasia (Goodglass 1976; Menn et al. 1982). However, paragrammatism has also been observed in conduction aphasia (Goldstein 1948; Bhatnagar 1980; Gandour et al. 1982; Caramazza et al. 1981).

Lesser (1978) observes that the main issue in regard to paragrammatism is: to what extent are the errors lexical and to what extent are they syntactic? This is an issue in agrammatism, as well. The term paragrammatism implies that what it refers to is a grammatical problem.

One problem in this literature is how one defines paragrammatism, or what aspect is focused on. Menn et al. (1982) claim that paragrammatism cannot be attributed exclusively to errors in lexical selection. Some errors are lexical, such as saying *cookie jars* instead of *cookies*. Other errors are purely syntactic. As I noted earlier, one kind of so-called paragrammatic error involves
substituting an erroneous function word for the one intended. For example, the wrong preposition may be used in place of either the one the aphasic meant to use or the one in the target sentence to be repeated. The same problem can occur with other functors. In errors like these, the substitutions generally occur within the appropriate word class—-the aphasic with paragrammatic speech generally uses a preposition where one is required (unless it is omitted altogether), but may not select the right one. As Lecours and Rouillon (1976:124) note:

In the great majority of...paragrammatic paraphasias, both the replacing and the replaced word belong with the same grammatical inventory.

According to Menn et al. (1982:11), omission and substitution of grammatical morphemes should be regarded as grammatical disruptions "unless there is evidence to the contrary", a view which is based on the "commonsense notion that errors in grammatical morphemes should be considered to be grammatical errors". Such an assumption may not be justified, however. While some of the paragrammatic errors described by these authors may be syntactic (e.g., misplacement of a plural marker or failure to create a slot in a sentence), substitutions of functors for one another seem similar to semantic paraphasias, and may have some underlying mechanism in common with the latter and with
phonemic paraphasias—they all seem to involve errors in selection.

Lecours and Rouillon (1976:104, 106) discuss several manifestations of paragrammatism (which they call dyssyntaxia) in various forms of aphasia. They note that dyssyntaxia occurs in some cases of conduction aphasia. To them, paragrammatic substitutions—which they call paragrammatic paraphasias—involve semantic paraphasias with grammatical morphemes. Such substitutions, the authors note, have been considered to be evidence of a grammatical disorder, even though the substitutions occur within appropriate lexical category, and their effect is to disrupt meaning, rather than syntax (124). After giving examples of substitutions involving prepositions, they assert:

It should of course be realized, if such transformations are to be labeled dyssyntactic, that the term does not indicate a difference in nature between them and other semantic paraphasias, whether bearing on grammatical or lexical words.

In this dissertation, I will be concerned with this aspect of paragrammatism—the substitution of functors for one another. The subject in this study, C.G., made this kind of substitution error (and there was also some evidence of omission of functors). My data supports the view expressed by Lecours and Rouillon that these
substitutions are lexical. This will be discussed again in
Chapter 5, Section 5.3, and in Chapter 6, Section 6.5.

Agrammatism is usually (but not exclusively)
associated with non-fluent (Broca's) aphasia. It is
usually characterized as a condition in which function
words and inflectional affixes tend to be omitted and
syntax is "impoverished", meaning that speech may consist
of only the simplest syntactic forms or simply a string of
juxtaposed nominals.

Goodglass and Menn (1985) discuss the dissociations
that occur in agrammatism. It is possible for agrammatism
to be worse in writing than in oral production. Dubois et
al. (1964/1973) report evidence of agrammatism in the
writing of a conduction aphasic. Instances of omissions of
functors are not common in the speech of my subject, but
her writing is completely agrammatic, consisting only of
strings of nouns.

According to Brown (1977:49, cited in Buckingham
1980), agrammatism is similar to anomia: "Agrammatism is an
anterior disorder comparable to anomia of the posterior
[aphasias]". This suggests that agrammatism and anomia may
involve similar psycholinguistic processes. Perhaps they
could both be characterized in terms of retrieval failures.
Goodglass and Menn (1985:26) propose that although there has been a tendency to consider agrammatism and paragrammatism to be two different phenomena, and to characterize agrammatism as a syntactic impairment and paragrammatism possibly as a semantic one, this is probably not correct. In their view, both fluent and nonfluent aphasics are impaired in their ability to "comprehend morphologically and syntactically encoded relationships among nouns" and this occurs because of "cognitive problems in dealing with decoding the linguistic expression of those relationships".

One difference between agrammatic and paragrammatic speakers is fluency, redefined by Goodglass and Menn (1985:24-5) as "ease of initiating and maintaining a motor speech sequence". In fluent speech, fluency itself is hypothesized to facilitate grammatical production. Fluent aphasics tend to use words that are high in predictability, and grammatical morphemes are usually predictable from context, so they may be carried along in the stream of speech as "high sequential probability 'completions'" (25). Another difference between non-fluents and fluents is that the latter are generally able to begin an utterance with an unstressed functor, but non-fluents have trouble doing this (Goodglass 1968, 1976). Non-fluent aphasics
rely on stressed words to initiate speech, but this is not necessary for fluent aphasics.

There are also similarities between agrammatics and nonagrammatics. Panse and Shimoyama (1973) provide data on a nonfluent agrammatic speaker who also made paragrammatic substitution errors. Goodglass and Mayer (1958, cited in Goodglass 1976) report that both agrammatics and paragrammatics make omission and substitution errors with grammatical morphemes. Goodglass and Menn comment that agrammatics and paragrammatics have similar difficulties, such as problems with pronouns and prepositions. While researchers have generally claimed that agrammatism and paragrammatism have different underlying causes, and the similarities are just at the surface level, Goodglass and Menn prefer the opposite interpretation: if the underlying cause(s) of agrammatism and paragrammatism are the same, that can explain why there are similarities. The differences between these two disorders may come about because of different non-grammatical processing difficulties, such as extent of difficulty in initiating a sentence or strategies used to compensate for impairments.

It should be noted that Badecker and Caramazza (1985) challenge the assumption that clinical categories like agrammatism, Wernicke's aphasia, etc. exist at all, calling
such patient groupings "pretheoretical constructs". Definitions of agrammatism and paragrammatism may overlap. They note that Goodglass' (1976:238) description of paragrammatism is similar to Grodzinsky et al.'s (1985) definition of agrammatism. According to Goodglass, paragrammatism involves:

not so much the reduction of grammatical organization as the juxtaposition of unacceptable sequences: confusions of verb tense, errors in pronoun cases and gender, and incorrect choice of prepositions.

Grodzinsky et al. define agrammatism:

not as a loss of the closed class item vocabulary per se, but rather as a loss of the ability to select properly among inflected forms. On this view, the agrammatic patient retains all the morphological rules...But what is not available to the patient is a means of selecting the properly inflected form.

Badecker and Caramazza point out that there is a great deal of variation in the speech of people who have been lumped together under the label agrammatism. In one type of patient, closed class items are omitted, but not main verbs. Others omit main verbs. These authors note that we do not know what differences in the speech of such people are significant, i.e., what features of aphasic speech would determine who is agrammatic and who is not. We do not have "necessary and sufficient criteria for identifying members of this category [i.e., agrammatism]" (110).
McCarthy and Warrington (1985) refer to Tissot et al.'s (1973) distinction between syntactic agrammatism and morphological agrammatism. In the former, closed class vocabulary is "relatively well preserved" but word order and verb use are impaired. In morphological agrammatism, this pattern is reversed. McCarthy and Warrington report on a patient who has difficulty retrieving verbs in spontaneous speech, whom they label a syntactic agrammatic. Although they call the impairment syntactic, in accordance with Tissot et al.'s definitions, they believe that his syntactic impairment is secondary to a lexical/semantic impairment, and suggest that morphological agrammatism may also be a lexical deficit affecting closed class vocabulary. They add that this patient has a "'partial' agrammatic syndrome", since his articulation is good and he can produce closed class vocabulary.

McCarthy and Warrington (1985) also comment that in the literature, agrammatism has been referred to as representing a rather heterogeneous collection of deficits...As with many other clusters of impairment (such as deep dyslexia, or Wernicke's aphasia) 'agrammatism' is probably only useful as a shorthand classificatory label, without any strong theoretical motivation (726).

Similarly, Goodglass and Menn (1985:26) state:

Agrammatism is a cover term for a complex of impairments in the ability to produce morphological and syntactic devices.
1.4. Issues related to the lexicon and aphasia. There has been much debate in the literature about how the open and closed class vocabulary is represented in the lexicon, and the issue cannot be said to be resolved as yet. Another issue of importance is whether aphasics suffer from a deficiency in lexical retrieval only, or whether the semantic organization of the lexicon is impaired. These issues will be addressed in this section.

1.4.1. Representation of open and closed class vocabulary in the lexicon. Bradley et al. (1980:283) hypothesize that normal speakers have double representation of the closed class vocabulary in their lexicon and that Broca's aphasics, who tend to omit closed class items, have a "failure of the specialized retrieval system for closed-class vocabulary" (Bradley et al. 1980:281). For normal speakers there is an effect of word frequency on lexical decision for open class but not closed class vocabulary (Bradley 1978, cited in Butterworth 1983). Butterworth questions Bradley's interpretation of her results: why would the closed class not be organized by frequency for normals, even if it is listed separately in the lexicon? In support of Butterworth, I find that when C.G.
substitutes one functor for another, it is often the case that the target is of higher frequency.

Gordon and Caramazza (1982) were not able to replicate Bradley et al.'s findings with normal subjects. In a later paper (1983:343), they refute Bradley et al.'s claim. They assert that agrammatism does not result from a disruption of a closed class retrieval system that is insensitive to frequency since they found no evidence of a distinction between agrammatics and non-agrammatics in frequency effects for closed class items.

Friederici (1985:139), following Bradley et al.'s (1980) finding, adopts the hypothesis that there is a special retrieval process for the closed class, in addition to a more general retrieval process for both open and closed classes. Friederici adds that agrammatics are impaired in that they are not able to use the special retrieval system for the closed class (160). She suggests, however, that the distinction between open and closed class may not rest on frequency, as proposed by Bradley et al., but may be affected by other, unspecified factors affecting language performance in tasks other than recognition of isolated words.
1.4.2. **Lexical access or semantic disruption?** As I mentioned above, the question has been raised in the literature as to whether word-finding deficits reflect a problem with the underlying semantic organization of the lexicon or just a problem with access from an intact lexical store. Lesser (1978) suggests that in order to establish whether the semantic system itself is disrupted, we need to know whether word-finding difficulty affects all sensory modalities, and comprehension as well as production.

Some researchers hold the view that the semantic structure of the lexicon is intact, but words are less accessible. Blumstein et al. (1982) tested aphasics of different diagnostic groups and different levels of comprehension ability on a lexical decision task and a semantic relatedness task. On the lexical decision task, the subject was to judge whether the target word presented aurally was a real word or a nonsense word. The target was preceded by another word. In some cases this preceding word was semantically related to the target word; other times it was not. Reaction times were faster for all aphasics when the word presented before the target was semantically related to the target (semantic facilitation effect). This was also found in a similar study testing
Wernicke's aphasics in the visual modality (Milberg and Blumstein 1981). In the semantic relatedness task, which used the same words as the lexical decision task, the subject was to indicate whether two words were related. This was rather easy for most of the subjects and correlated with level of comprehension: those with good comprehension gave more correct responses.

Since semantic facilitation occurred in both the visual and auditory modalities, the semantic system is considered to be relatively intact "at least at the level of semantic relatedness" (314) and functions well if the patient is not asked to manipulate or make judgments about semantic information. They admit that the results do not prove that semantic structure in aphasia is normal, but they thought it likely that it is normal, and that the auditory comprehension problem involves a problem with access. They note that it has been suggested that there may be two ways to access a word: one which is automatic and unconscious, and one where retrieval of a particular word is done consciously (Posner and Snyder 1975; Neely 1977, cited in Blumstein et al. 1982). Blumstein et al. suggest that the automatic route may function normally in aphasia, but conscious access to a desired word may be impaired.
Weigl and Bierwisch (1970) also express the view that aphasia affects access to linguistic knowledge but not the knowledge itself. This is based on Weigl's work in "deblocking" aphasics' responses. For example, a patient who had problems repeating a word was able to repeat it after seeing it and reading it aloud. Deblocking of a word by using an alternative modality only works, however, if the same word or a semantically related word is used in the alternative modality (Weigl 1970, cited in Lesser 1978).

Schuell (1950, cited in Lesser 1978) and Rinnert and Whitaker (1973:80) indicate that there are similarities between naming errors of aphasics and word associations of normal speakers. Schuell looks at naming and reading errors and correlates them with findings of word associations in normals, concluding that the aphasic errors are similar to normal word association responses, and so there is no evidence that the aphasics' word association processes are abnormal. This suggests that the difference between aphasics' errors and normal speakers' problems in finding a word is quantitative, not qualitative (81). However, Wyke (1962, cited in Lesser 1978), after performing a word association test with aphasics in which these subjects gave "unconventional" responses, felt that there may be some alteration in word associations.
Tests of word associations with aphasics have led to varying results, and it seems that whether normal associations are given as a response may depend on the type or severity of aphasia: Howes (1964, cited in Lesser 1978) finds that non-fluent aphasics give normal responses in word association, but fluent aphasics do not. But in a study of comprehension, Pizzamiglio and Appicciafuoco (1971, cited in Lesser 1978) report that comprehension depended on severity, not type, of aphasia. Rinnert and Whitaker (1973:80) summarize by saying that:

> Apparently word association experiments on normal subjects and semantic confusions by aphasic patients follow analogous semantic organizational patterns of the lexicon.

A different view on this issue has been expressed by other researchers. Alajouanine et al. (1964) report that patients who made semantic paraphasic errors in speech (semantic jargon) also made semantic errors on a comprehension test, but since their patients may have had a general comprehension deficit, this study is not conclusive. Gainotti and his fellow researchers (1975, cited in Lesser 1978) tested several kinds of aphasics and found that those with semantic jargon and anomic aphasia made significantly more semantic than phonemic errors in comprehension. Gainotti (1976) suggests that this shows a breakdown at the semantic level. Goodglass and Baker
(1976:371) report that aphasics with good comprehension (Broca's aphasics) retain relatively normal semantic structure, but those with poor comprehension (Wernicke's) may have a disruption in semantic organization.

Zurif et al. (1974) studied this issue by using a task where aphasics were to sort words on the basis of similar meanings. Control subjects sorted on the basis of such features as human vs. non-human, and within the animal group, they sorted words on the basis of species membership (e.g., fish and reptile). Anterior (non-fluent) aphasics' sorting was similar to that of normals for the human items (except that dog was clustered with the human terms). But the animals were grouped together in a way different from the normal species-membership classification. They were grouped into a 'wild, dangerous, and remote' category and an 'edible and harmless category' (178). The authors suggest that "verbal concepts in anterior aphasia appear to be...tied to affective and situational data" (179). They add:

although lexical organization appears to be weakened and even somewhat dislocated by anterior brain damage, the disruption does not appear to be total (179).

The posterior aphasics (four of whom were Wernicke's aphasics and one of whom was not classified as to aphasia type) grouped words very abnormally, and this was taken as
a possible indication that word-finding difficulties can be attributed, in part at least, to "disruption of the underlying lexical organization" (181).

Whitehouse, Caramazza and Zurif (1978) report differences between Broca's and anomic aphasics in naming. They believe that their anomics have difficulty with the organization of concepts underlying word meaning (72), although they concede that some anomic disorders may simply be retrieval failures (73). Blumstein et al. (1982) suggest that the studies by Goodglass and Baker and Zurif et al. reveal deficits that arise when the patient must manipulate or make judgments about semantic information, implying that that type of task is important.

Although Buckingham (1979:273) lists types of lexical retrieval disturbances in aphasia, in a later paper (Buckingham 1980:213), he acknowledges that, in view of Whitehouse et al.'s findings, the problem may involve the "underlying conceptual organization of the lexicon". If this is true, he notes, then calling the aphasic deficit a retrieval problem may only be descriptive but not explanatory. He notes that aphasics:

continue to be constrained by...structural regularities [of their native language]. For instance, we witness that for the most part their lexical fields are still intact, albeit loosened up, because most of the verbal paraphasias produced are still "in field" (1980:215).
The "loosening up" referred to may occur in some aphasics (e.g., anomies) but not others (e.g., Broca's aphasics).

How can these two views be reconciled (or can they)? There are many factors involved: type of aphasia, severity of aphasia, and task. There appear to be differences between anterior and posterior aphasics. Blumstein et al.'s semantic relatedness task, some word association studies, as well as some spontaneous semantic paraphasias and paralexias show normal-like relations between words in the lexicon. And Weigl demonstrates that blocked items can be deblocked in another modality. However, Zurif et al.'s subjects showed abnormal groupings of words, and aphasics are sometimes reported to make abnormal word association responses and definitional responses.

The structure of the lexicon is not completely undermined by brain damage, since many semantic substitutions are not only within field but also of the same word class as the target. In addition, the existence of form-related errors shows that relations between words based on form may still be intact. Where performance is variable, it seems likely that access, not semantic structure, is the problem.
It appears that this issue can best be studied on a patient-by-patient basis. It does not seem possible at this point to make statements about aphasics in general on this issue. We may still be limited to a descriptive characterization of a retrieval deficit.

1.5. **Summary.** Conduction aphasia is a complex syndrome and it is asserted that it is distinct from other aphasic syndromes. The location of lesion or lesions responsible for this type of aphasia is a matter which has not been definitively resolved, but there is usually damage to the left temporo-parietal region. Language behaviors observed in conduction aphasia include relatively intact comprehension, fluent paraphasic speech which is often marred by anomia, and a repetition impairment that is severe compared to spontaneous speech. Some word classes may be less available than others. Closed class vocabulary may be particularly impaired, but there are also deficits involving the open class. A recurring theme in discussions of semantic substitutions is that words that bear a superordinate relation to the target tend to be well preserved. Substitution errors within the closed class resemble semantic paraphasic errors with the open class vocabulary. In sum, there are several manifestations of a
retrieval deficit. These will be discussed further in Chapters 5 and 6.

The next chapter will present a review of attempts to account for the language behaviors of conduction aphasics.
NOTES

1. The term *paraphasia* refers to "the production of unintended phonemes, words, or word sequences during the effort to speak" (Goodglass and Geschwind 1976:404).

2. By convention, the word on the left of the arrow is the target, the one the speaker intended to say or was asked to read. The word on the right of the arrow is the error the aphasic substituted for the target.

3. In a lexical decision task, the subject is asked to decide whether or not a string of letters is a word.
2.1. Introduction. As Caramazza et al. (1981) and Green and Howes (1977) observe, there are many accounts of the deficits in conduction aphasia in the literature. One is the disconnection model, which postulates an interruption of a pathway connecting the centers for language comprehension and production, hence the name conduction aphasia. Goldstein calls this syndrome central aphasia, because of his belief that central language processes are impaired. There are several other views which Caramazza et al. call the encoding deficit and the mnestic hypotheses. The encoding deficit hypothesis, which, as the name suggests, characterizes conduction aphasia as a disorder that affects encoding ability, is proposed by Hecaen and other researchers at the Sainte-Anne Hospital, who, after Green and Howes, I will refer to as the Sainte-Anne group.

The mnestic hypothesis is proposed by Warrington and some of her colleagues (Warrington and Shallice 1969; Shallice and Warrington 1970; Warrington, Logue, and Pratt 1971; Shallice and Warrington 1977; Saffran and Marin...
These researchers and others (Caramazza et al. 1981; Luria et al. 1967; De Renzi and Nichelli 1975) studied patients with impaired repetition. The mnemonic hypothesis proposes that the repetition deficit can be attributed to impaired auditory-verbal short-term memory (STM). I will be referring to this hypothesis throughout the discussion of issues in this chapter.

Strub and Gardner (1974:253) describe the repetition deficit as "an impairment in proceeding from a phonological analysis to the selection and combination of target phonemes". There are also several other phonological accounts in studies of phonemic paraphasias, some of which are compatible with the encoding deficit hypothesis.

There are two major issues which these different accounts address. First, is this really a conduction deficit, involving damage to structures or mechanisms that "conduct" linguistic stimuli from one language center to another, or is it a central language deficit? The name researchers give to this syndrome often reflects their view of what is impaired, though some researchers call it conduction aphasia simply because that is the most frequently used name for it. Second, is it a linguistic problem or simply a memory impairment? While some authors address themselves specifically to the question of what
mechanisms underlie the repetition deficit, which is so striking in this form of aphasia, others study various facets of the speech of these aphasics.

2.2. **Disconnection vs. central language deficit.** The disconnection model is proposed by Wernicke (1874) and is supported by Geschwind (1965), Alajouanine and Lhermitte (1964/1973), and Kinsbourne (1972). After reviewing the literature on the disconnection model, I will discuss some alternative views by researchers who view this form of aphasia as a central language deficit—Goldstein (1948); the Sainte-Anne group (Hecaen 1972; Dubois et al. (1964/1973) and their supporters, Tzortzis and Albert (1973), Yamadori and Ikumura (1975), and Gandour et al. (1982). Following this discussion; several phonological accounts of conduction aphasia will be presented (Friedrich et al. 1984; McCarthy and Warrington 1984; Joanette et al. 1980; Strub and Gardner 1974; Kohn 1984). Kohn suggests that the disconnection and the central language deficit views may be compatible.

2.2.1. **The disconnection model.** Before he had seen an actual case of conduction aphasia, Carl Wernicke (1874) hypothesized that such a condition would exist, based on his model of language and the brain. In this model, there are two language centers, connected by fiber tracts (see
Figure 2). One center, a motor area in the frontal lobe, is believed to contain "representations of movement," including the mechanisms that direct movements involved in speech (Green and Howes 1977:132). The other center, in the "temporal-occipital lobe", is said to contain "memory images of past sense impressions" (Wernicke 1969:36, 47) including the sound images of words:

The first frontal convolution, which is a motor area, is the center of representation of movement; the first temporal convolution, a sensory area, is the center for sound images.

Conduction aphasia would then result from damage to the fiber tracts connecting these two language centers. Wernicke hypothesizes that people with this kind of aphasia would be able to speak and comprehend language but would experience word-finding difficulty and confusion of words (Wernicke 1969:54). According to this model, the individual would produce paraphasic speech because speech could no longer be regulated by the sound images, these having been disconnected from the motor area responsible for speech production. Lichtheim (1885) proposes that conduction aphasics would also have problems with repetition (Green and Howes 1977:133). Wernicke (1908, cited by Geschwind 1965:214) suggests that the arcuate fasciculus may be the crucial bundle of fibers involved in conduction aphasia. Geschwind (1965) agrees with this idea.
However, the discussion on lesion sites in Section 1.2.2 shows that the situation is more complex than that. As Green and Howes (1977) note, the lesions involved usually include more than just fiber tracts.

Benson et al. (1973) and Geschwind (1965) accept the disconnection model of conduction aphasia. Geschwind (1965:215-217) acknowledges that there may be more than one type of conduction aphasia: one where the damage is to the arcuate fasciculus in the left hemisphere, and one where the left Wernicke's area is lesioned. In the latter case, as Kleist (1962) suggests, the right hemisphere may play a role in the repetition deficit. Geschwind notes that Kleist (1962) proposes that in such cases, the right hemisphere temporal speech area can compensate for the lesioned left hemisphere speech area for comprehension. However, Broca's area in the left hemisphere is still needed for speech (output). In repetition, the incoming linguistic material to be repeated would be processed by the right hemisphere temporal speech area, but the output would have to travel through the lesioned left hemisphere temporal area to get to Broca's area. Because of the lesion in the left hemisphere, repetition is rendered difficult.
Figure 2. Wernicke's Model of the Brain. A marks a motor area, Wernicke's "center for the representation of movement". B marks a sensory area, Wernicke's "center for sound images". C marks the fibers connecting A and B (the arcuate fasciculus). In Wernicke's model, conduction aphasia results from damage to these connecting fibers.
In a study by Alajouanine and Lhermitte (1964/1973:326), a delayed auditory feedback task did not affect their patients' speech, though such a task causes expressive problems in normal speakers. They take this as evidence in favor of the disconnection model, because the disruption is assumed to be at the level where auditory input guides articulation. To them, the phonemic paraphasias in repetition are the result of a disconnection:

the phonemic distortions arise from a disturbance of the response dispositions that arise from the sensory components and, in a sense, dynamically guide the articulatory movements.

Kinsbourne (1972) also subscribes to the disconnection hypothesis and argues against describing the repetition deficit as simply a defect of memory span. His patients could repeat one digit relatively well, but when asked to repeat two digits, performance declined, and, significantly, there were longer latencies before responding. He asserts that this shows that the problem is not simply one of short-term memory storage capacity, for such a view would imply that single items are stored normally but multiple items are not. However, the longer latencies show that "when two items are presented, neither is processed normally" (1129). One patient was able to repeat two digits if they were the same, but his repetition
of two different digits was impaired. Moreover, he could remember a list of eight digits in a matching test, a fact which indicates that his short-term memory was functional. Furthermore, according to Kinsbourne, conduction aphasics can understand sentences, and this ability requires a functioning short-term memory, (although Shallice and Warrington (1977:488) would say that comprehension of sentences involves the use of long-term memory). To Kinsbourne, long response latencies in repetition tests are important evidence of an overload of a channel, and for this reason, he adheres to the disconnection model. He agrees, however, that there may be two different kinds of conduction aphasics, as suggested by Geschwind and Kleist. Shallice and Warrington's (1977) response to Kinsbourne will be presented in the section on the mnestic hypothesis (Section 2.3).

To summarize, the disconnection model proposes that conduction aphasics have trouble repeating due to an interruption of a pathway that connects two language centers.

2.2.2. Goldstein's central aphasia. Green and Howes (1977) observe that Freud's (1953) idea of "a unitary
phenomenon as the center of language in which associations take place" influenced Goldstein's views. Goldstein (1948) uses the term *central aphasia* to refer to Wernicke's *conduction aphasia* because, in his view, the syndrome involves an impairment affecting central language mechanisms, not the interruption of a pathway. In his model of language, there is a central, complex cortical apparatus that mediates between external speech (speaking and hearing) and *inner speech* (Green and Howes 1977:137). Inner speech is defined by Goldstein (1948:94) as:

> the totality of processes and experiences which occur when we are going to express our thoughts, etc., in external speech and when we perceive heard sounds as language.

Inner speech and the central cortical area that underlies it are mainly involved in controlling expression, and in central aphasia, the central cortical area and inner speech are affected (Green and Howes 1977:137-8). The impairment of inner speech gives rise to the clinical features of conduction aphasia discussed earlier. Central aphasia is sometimes complicated by the presence of amnesic aphasia and "signs of pure acoustic aphasia" (Goldstein 1948:98, 229-31).

In Goldstein's (1948:103) view, the repetition deficit is due to "destruction of the apparatus 'underlying the concept of words'" which prevents the aphasic from
"matching patterns of inner speech" to the model that is to be repeated (Green and Howes 1977:138). The repetition deficit cannot be presumed to be caused by a disruption of connecting fibers, for repetition can be good even when the association fibers between the frontal and temporal lobe are damaged (Goldstein, 240). To Goldstein, this type of aphasia is not due to a "defect of conduction" but rather results from impairment of "a complex apparatus...in the center of the speech area" (230). Since he believes that the insula and adjacent areas in the temporal and parietal lobe are involved in central aphasia, and that the tractus longitudinalus inferior may be involved in repetition (240, 245), the anatomical basis he assumes is very similar to that of the disconnectionists (Green and Howes, 137).

Indeed, Mendez and Benson (1985:889-90) consider Goldstein's model to be just a variant of Wernicke's, since it involves postulating a single central area that has connections to sites for decoding and encoding speech, the difference being that Goldstein's model emphasizes a central area instead of a pathway. Mendez and Benson prefer the disconnection model. They note that cases of conduction aphasia have been described with lesions in various parts of the left hemisphere and even in the right hemisphere. It would be difficult to locate a single
central language area, given this kind of variability in lesion sites, that could satisfactorily underlie Goldstein's proposed "central" language deficit. To Mendez and Benson, a model with discrete language centers that can be disconnected is more plausible.

2.2.3. The Sainte-Anne group and the encoding deficit model. Green and Howes (1977) discuss the relation between the ideas of Goldstein and the work of the researchers they call the Sainte-Anne Group. This group focuses on the central cortical apparatus, which is not well defined by Goldstein. They identify it in psycholinguistic terms as "the central process for structuring thought into language", which involves such activities as matching, selecting, ordering, and regulating (Green and Howes 1977:139).

Hecaen (1972:628) summarizes this approach to conduction aphasia, which regards it as a form of expressive aphasia in which "the disorder...does not concern the phonemic realization, but rather sentence programming". In this view, conduction aphasia is seen as "an expressive aphasia that affects the emissive system (encoding)" (Dubois et al. 1973:286), i.e., the ability to encode inner speech into a motor output program (Caramazza
et al. 1981:236). This accounts for the observation that conduction aphasics are able to perform well on decoding tasks, such as carrying out commands, comprehending conversations, and recognizing sentences that contain violations of grammatical or semantic constraints.

As I noted in Chapter 1, Section 1.2.3, conduction aphasics are considered by the Sainte-Anne group to have disturbances of the "first articulation" of language, referring to the level of the word, phrase, and sentence (Martinet's (1967) term for the morphemic level (Hecaen and Albert 1978:42)). Errors can occur in combining sounds into words and words into phrases and sentences. Conduction aphasia is distinguished from motor (Broca's) aphasia, in which impairments affect the second articulation of language (Martinet's phonemic level), which is involved with "the motor realization of the phoneme" (Dubois et al. 1973:287). In conduction aphasia, all modalities of expression are affected.

Dubois et al. (1973:287-8) offer an account of this form of aphasia which attributes it to "a disorganized execution of the encoding program". They note that errors in speaking are most likely to occur at points where the information load increases. For example, transitions between noun phrases and verb phrases are difficult, as are
transitions between the verb phrase and later parts of the sentence. They observe:

in encoding it has become impossible for conduction aphasics to set up the program which would allow for the realization of the form they have in memory.
(Dubois et al. 1964:13; translation mine)

High-frequency words are easier for conduction aphasics to produce than low-frequency words, and the more information there is to be communicated, the more difficulty the individual has:

The less common the desired word, that is, the longer the program that it requires, the more the performance breaks down.
(Dubois et al. 1973:288)

"Programming" in this model refers to putting items in their correct order (Tzortzis and Albert 1974:364).

Repetition is more difficult if items to be repeated have high information load/low predictability. According to this account, a high-frequency phrase or sentence is easier to repeat than a low-frequency word with the same number of syllables as the phrase or sentence. Repetition of sentences is harder than spontaneous production of the same kinds of sentences as those in the repetition tests, because in spontaneous speech the patient chooses what to say, but in repetition tasks the target items to be repeated are not chosen by the aphasic and so are not predictable. Conduction aphasia can also entail "a delay of
self-regulation through auditory feedback", especially in the early stages (290-1). This deficit is different from word-deafness where reception of the message is impaired. Conduction aphasics' problem, then, is with encoding.

Tzortzis and Albert (1974) offer support for the findings of Dubois et al. (1964/1973). Their study involved a series of experiments with three conduction aphasics, two other aphasics, and normal controls. They found that conduction aphasics' memory for sequences was impaired regardless of modality of input (auditory vs. visual), method of response (oral vs. pointing, the latter being more impaired than the former) and type of material (verbal vs. nonverbal). The conduction aphasics were often able to reproduce the test items but not in the correct order (363).

Tzortzis and Albert concur with Dubois et al.'s description of the problems as being a matter of programming. They conclude that their conduction aphasics have a "relatively intact" auditory-verbal short-term memory. Their deficit lies in remembering and producing the order of items. They add, however, that their study does not necessarily contradict the findings of those who propose the mnestic hypothesis, who argue that conduction aphasics have a defect of auditory-verbal short-term
memory. Rather, the latter researchers are describing a different defect affecting repetition.

Yamadori and Ikumura (1975) also concur with Dubois et al.'s model. Their Japanese patient's performance deteriorated as the number of syllables in target words increased in different kinds of tasks: repetition, visual confrontation naming, oral reading (*kana* was easier to read than *kanji*), and writing to dictation (*kanji* was easier to write than *kana*).

Yamadori and Ikumura note that their subject performed well with monosyllables but not with polysyllabic words, and there were significant patterns in her errors with the latter: the first syllable was usually correct (in both speech and writing), the number of syllables in the target was usually preserved, and many of the syllables in written words were correct. Referring to Saussure's description of the two aspects of a word—the conceptual and acoustic images—they hypothesize that it is the acoustic, rather than the semantic, aspect of the word that is impaired:

An acoustic form of a target word as a basis for graphic and verbal output is present but seems to be unstable. Thus, when syllables involved are less than two, the patient was able to manage them fairly well. But as the number of syllables involved increased, it became more and more difficult to establish a secure syllabic sequence, and the product became just an approximate form of the target. (80)
The authors conclude that in this form of aphasia the problem probably occurs at the earliest stage of the "motor encoding process" and involves impaired ability to produce the acoustic image of a target word (80).

In a study of a Thai conduction aphasic, Gandour et al. (1982:356) characterize this form of aphasia as a syndrome affecting a language center, rather than as a disconnection syndrome, agreeing with Goldstein and the Sainte-Anne group that there is a "disruption of the central encoding mechanism". Their assertion that an impairment in the structuring of thought into verbal form should be manifested in all language modalities, and should lead to similar kinds of errors in all modalities seems reasonable. This was generally the case for their patient. The authors claim that patterns of errors of their subject partially support the predictions of Dubois et al. (1964/1973), who hold that errors are more likely to occur at places where the information value changes, e.g., between subject and predicate, and at the beginnings of sentences. For example, this patient did make syntactic errors with predicates in complex sentences. However, he did not make syntactic errors at the beginnings of sentences.
This patient's lack of syntactic errors is interpreted by Gandour et al. as "lack of confirmation" of Dubois et al.'s "probabilistic, information-load model of processing". But Dubois et al. did not say what kinds of errors would be expected to occur at the beginning of sentences, and they were talking about repetition, not spontaneous speech—they noted that repetition of sentences is harder than spontaneous production. So Gandour et al. seem to have misinterpreted the predictions. In fact, their patient was not able to repeat any sentences from the Thai version of the Boston Diagnostic Aphasia Examination, and his single word repetition was also impaired, especially for words of two or more syllables. My patient often could not get started repeating a sentence, either. Failure to repeat a sentence may nevertheless be consistent with Dubois et al.'s predictions. Gandour et al. do accept the idea that conduction aphasia is a "language center syndrome".

2.2.4. The disconnection and encoding models: a suggested synthesis. Kohn (1984) attempts to relate the encoding model to the disconnection model. Her study focuses on the phonological deficit which she believes underlies conduction aphasia, using a naming task (which
differs from reading and repetition in that no phonological information is given to the aphasic in a naming task). The six conduction aphasics in this study produced more "phonologically-oriented sequences" than did the seven Broca's or five Wernicke's aphasics in their naming attempts (i.e., sequences in which their utterances had a phonological resemblance to the word being elicited). The conduction aphasics tried to correct their errors, but were not very successful, no more so than the other aphasics. Kohn observes that conduction aphasics, like other aphasics, seem to have difficulty accessing phonological representations. The conduction aphasics, however, seem to have a harder time than the others in "translating these [phonological] representations into articulable forms" (105), and are especially likely to produce word fragments (partial attempts at producing words). They also generally produce all of the sounds of the target word somewhere in their phonologically-oriented sequences, and so it may be that they are usually able to "access the entire phonological representation from the Lexicon" (107). These phonological sequences also show that conduction aphasics are able to monitor their output.

A model for single word production is proposed by Kohn to account for the phonologically-oriented sequences, in
which phonological representations are accessed from the lexicon and held in working memory. Kohn (1984:108) observes that "most phonologically-oriented sequences display remarkable stability, often over a long series of attempts". Thus, Kohn argues that the long series of attempts to get closer to the target shows that working memory is functioning, contradicting the mnestic hypothesis:

the phonologically-oriented sequences of the conduction aphasics reflect the preservation of considerable verbal short-term memory capacity. (108)

While digit-span tasks may show an impairment in STM, such an impairment cannot account for phonological errors. Kohn infers from her data that the phonological representation may be intact (105, 107, 108), contrary to the view of Friedrich et al. (1984), to be discussed in the next section.

In Kohn's model, after retrieval of the phonological form from the lexicon, the aphasic may make many attempts to "set up the proper articulatory program". If the program "fails", the mechanism may return multiple times to the information being held in working memory (107). In this manner, Working Memory has the capacity to operate as a verbal short-term memory buffer. Kohn also observes that although some of the conduction aphasics' output shows a
difficulty in accessing information in the lexicon, this is not peculiar to them— all aphasics have word-finding difficulty. In her model, the phonological problems of conduction aphasics are postulated to occur at the level of Pre-Articulatory Programming, which is where phonemes are selected and put into the proper sequence for output.

Kohn's view of conduction aphasia is in agreement with that of the Sainte-Anne group and Yamadori and Ikumura (1975). Kohn (1984:111) characterizes her results as implicating the level of the first articulation, involving a "difficulty in constructing multisyllabic programs". The phonemic paraphasias indicate a "breakdown at an early stage of sound encoding". This view may be compatible with the disconnection hypothesis, according to Kohn. Both her model and the disconnection hypothesis "point to a general phonological disruption of speech output" (112). However, Kohn calls for more research to determine whether it is true that this phonological disorder results from an impairment affecting "integration of acoustic and motor information" (113). One source of support may come from studies showing abnormal responses to delayed auditory feedback in conduction aphasics. Boller and Marcie (1978) report that conduction aphasics experience less disruption of their speech in delayed auditory feedback than normals
Abnormal reactions to delayed auditory feedback may show that conduction aphasics are not able to integrate acoustic and motor information normally.

2.2.5. The deficient phonological representation approach. Friedrich et al. (1984:289) suggest that their conduction aphasic demonstrated "an inability to generate and manipulate phonological representations".

In their model, repetition can be mediated through one of two possible routes: a lexical route, which involves lexical access, or a direct auditory-articulatory route. The latter route is "independent of the lexical or semantic processing of speech" (270). The notion that these two routes exist is based on studies of aphasics and normals. The direct auditory-articulatory route makes it possible to repeat verbatim and to repeat nonsense words, and is hypothesized to be the route used in echolalia, where repetition is intact (272). Conduction aphasics, on the other hand, for whom repetition is impaired, may make semantic errors, and this suggests that the semantic processing of speech remains intact while a separate function governing repetition is impaired. (271)

Friedrich et al. cite evidence supporting the proposal that the two routes just described may in fact be available
for normal speakers. In a study where normal adults were asked to perform two tasks at once (e.g., a visual letter-matching task and an oral language task) neither task interfered with the other if the oral task was verbatim repetition of speech. If the subjects instead were required to process and respond to the meaning of what they heard, this created interference with the letter-matching task (McLeod and Posner 1984, cited in Friedrich et al. 1984). Friedrich et al. interpret the lack of interference from verbatim repetition as evidence of a direct link between "the auditory percept of a word and its motor representation" (271). This sounds very much like Wernicke's original model of language and the brain (see Figure 2).

The conduction aphasic in their study is not able to use the direct auditory input-articulatory output route—her performance on the dual task experiment showed interference with her letter-matching task, even in verbatim repetition. This is interpreted as showing that she was using "mechanisms or pathways that are shared by the two tasks" (275) and this route presumably uses the lexical system. The authors hypothesize that she used the lexical route in repetition. However, it is possible that her performance was due to generalized effects of brain
damage, which would adversely affect one's ability to perform any two tasks simultaneously. Her repetition of nonsense syllables is impaired, and this confirms that the direct auditory-articulatory route is impaired, since that would be the only route one could use to repeat nonsense words. (A lexical access route would not work, since nonsense words are not in the patient's lexicon).

Additional evidence of an impairment in "identifying and manipulating phonological information" (281) is revealed by her impaired ability to categorize phonemes, distinguish between sounds that differed by only a few features, and analyze nonsense words into their component phonemes. Memory testing reveals that although visually presented verbal material is easier than that presented aurally, both visual and auditory span are below normal, suggesting that the phonological code used in processing both visual and auditory information is impaired. (The patient's nonverbal short-term memory is good.) The patient's performance is taken as evidence of "a disruption of phonological coding", and it is pointed out that the inability to generate a phonological code would lead to a short-term memory impairment, since it appears that short-term memory is mainly based on a phonological code (288). This is similar to the position taken by Heilman et al.
(1976), to be discussed in the section on the mnestic hypothesis (Section 2.3).

According to Friedrich et al., this interpretation of the repetition disorder is consistent with but different from the mnestic hypothesis. In Friedrich's account, the memory deficit results from impairment in "generating or maintaining the phonological code" (288), which is "an abstract speech-based code that is directly accessible to production mechanisms" (268). It is further suggested that this disruption of the phonological code underlies deficits in oral reading and spelling and in comprehension of complex syntactic constructions. The patient's inability to recite the alphabet or common nursery rhymes reveals her "inability to generate a phonological representation that was independent of auditory input" (288). She is considered to be impaired in "developing and maintaining phonological codes from auditorily [sic] presented stimuli" (281).

2.2.6. A two-route model for speech production is described by McCarthy and Warrington (1984). They note that the disconnection model as outlined by Geschwind is "incomplete" because it does not account for well-preserved spontaneous speech. They prefer Lichtheim's (1885) model. According to this model, if the route between sound images
and motor images is damaged, repetition will be impaired, but spontaneous speech should still be good because there is another route linking concepts with motor images of words. McCarthy and Warrington administered several repetition and reading tasks and found effects of word frequency, and, to some extent, word length in the repetition of the two conduction aphasics, with low-frequency polysyllabic words triggering the largest number of errors. But when a repetition task requires the patients to attend to meaning, repetition improves (475). Their deficits are not due to impaired perception or comprehension or auditory-verbal short-term memory (479-80). Although both conduction aphasics had impaired auditory-verbal STM (reduced digit span), their performance improved in tasks that required greater STM capacity, so a memory disorder cannot account for McCarthy and Warrington's findings. They attribute the aphasics' problems to deficits in "the transcoding of information between input and output systems" and added that "speech production deficits were specific to particular task demands" (480).

A model with at least two independent routes is needed to account for their results. An auditory/phonological route links verbal input to articulatory output and does
not involve semantic information. If this route is damaged, the result is conduction aphasia—impaired repetition with well-preserved spontaneous speech. The other route, for semantic/phonological processing, makes use of the semantic system. Presumably, this second route is intact in conduction aphasia. If it is damaged, the result is transcortical motor aphasia, in which repetition is intact but spontaneous speech is impaired. McCarthy and Warrington (1984:482) hypothesize that the nonsemantic route may be part of a "rehearsal loop" in models of STM. They note that Wernicke and Lichtheim suggest that the nonsemantic route is needed "as a feedback loop in error monitoring and word selection" (482).

2.2.7. The strength of phonological representation hypothesis. Joanette et al. (1980) studied attempts by conduction aphasics and other aphasics to correct their phonemic paraphasias (such attempts were called "sequences of phonemic approximations"). Since conduction aphasics often persist in trying to correct these errors, it is suggested that they have a clear phonemic target in mind that they are aiming for, i.e., the "internal representation of the phonological target" is available (32, 36). In the sequences of phonemic approximations, conduction aphasics' production gets closer to the target.
They are more successful at approximating their target in spontaneous speech, oral reading, and automatized speech than in repetition of meaningful items. Repetition of nonsense words is even more impaired. Joanette et al. suggest that conduction aphasics have "relatively intact auditory feedback"—i.e., they can compare their own output to the target and make corrections. According to this account, conduction aphasics have "some awareness of how a planned utterance is to be executed, in other words, an internal phonological representation" (41) which can be impaired differently in different tasks. It is particularly weak, however, in repetition, where the input is fleeting, not having been generated internally. In spontaneous speech, the aphasic can avoid language items which do not have a strong internal representation. The concept of "strength of the internal representation of the phonological target" is rather vague, but the authors feel that this intuitive notion best accounts for their results. In addition to this strength-of-representation hypothesis, it is also proposed that some type of internal speech monitor is functioning which allows one to get
feedback, compare output with one's intended utterance, and make corrections, and the authors add:

If it is the phonological form of their utterances that causes [speakers] to make the correction, we must suppose that they have some internal phonological representation which they can refer to during the monitoring process (41).

Joanette et al. (1980:41) acknowledge that there may be an impairment of the "planning and/or execution of the phonological aspect of an utterance" as proposed by Alajouanine et al. (1964), Blumstein (1973), and Luria (1970), which causes phonemic paraphasias. Such an impairment is reflected in anticipation and perseveration errors. But Joanette et al. propose that it is additionally possible that "the internal phonological representation of a planned utterance and/or the monitoring system used to detect errors in execution" (41) can be affected. They suggest that it is possible for a person to have a double impairment: the phonological representation may not be strong enough or may decay over time, (which suggests a memory component), and the monitoring system may not be functioning well enough to detect errors. (This "double impairment" could simply be a consequence of generalized brain damage.)

In sum, it is suggested that phonemic paraphasias can result from impairment of a "phonological production
mechanism" or from the input to such a mechanism, "the internal representation of the phonological target" (42). These authors view conduction aphasia as a central impairment, like Goldstein's view, noting that disruption of a fiber pathway would be expected to produce complete failure to repeat, rather than erroneous repetition. However, they add that the disconnection view is still possible if some alternative route is invoked to account for the impaired repetition.

2.2.8. The phonological processing account. Strub and Gardner (1974) propose an alternative to the mnestic account of conduction aphasia (see below). In their account, the repetition difficulties are considered to be due to "an impairment in proceeding from a phonological analysis to the selection and combination of target phonemes" (253). Their hypothesis involves an analysis of the steps entailed in repetition. They propose that the conduction aphasic perceives a sound, recognizes it as language, performs a phonological analysis of it, and retains a trace for further processing, as normal speakers do. These aphasics, then, are considered to be able to process input. At the next stage, the normal adult processes the input for meaning (syntactic and semantic
analysis) and also processes it phonologically into "motor patterns necessary for articulation" (242). If the latter stage of phonological processing is impaired, the individual will not be able to repeat language input, although comprehension would be intact. Thus they propose that the stage of phonological processing for output may be where the difficulty lies in conduction aphasia.

Strub and Gardner's patient performed in ways that they claim are not consistent with an account based purely on memory. Their patient, L.S., (and Warrington's patient, K.F.) performed better when the intervals between stimuli to be repeated were increased. He also consistently remembered the first item in a group of items to be repeated (primacy effect). According to Strub and Gardner, under the mnestic hypothesis, one would expect performance to deteriorate with increasing interstimulus intervals (and that did happen for one of Luria et al.'s (1967) patients). These results are consistent with the idea that "the time required to process each phonological unit has been increased" (248). If stimuli are presented too rapidly, the patient does not have time to rehearse them, and rehearsal is important in repetition.

Other results also point to a phonological processing deficit in perception: phoneme discrimination and
performance on the Token Test were poor (250). The patient's superior repetition of high-frequency words compared to low-frequency and nonsense words suggests that he has "a severe difficulty in producing specified phonemes" (249) unless the form to be repeated is familiar and meaningful. An important point is that when the patient was unable to repeat a target word correctly, the erroneous response generally bore some phonological or semantic resemblance to the target. Forty-five percent of the errors made when repeating high-frequency words were paraphasic, as were 90% of the errors on low-frequency words. The number of semantic paraphasias was somewhat greater than the number of phonemic paraphasias. Strub and Gardner observe that it is very likely that:

the patient's difficulty in repetition derives from a difficulty in producing with precision the target word rather than from a failure to recall it. That is, efforts to articulate the target are hampered by a difficulty in the selection and ordering of phonemes and by competition from words of similar meaning or high association value (249).

Additional support comes from an interesting recall procedure which tries to separate production from memory. The patient was given words to repeat. If an error was made, the patient was then presented with three words and asked to identify the one he had gotten wrong (multiple choice). The alternate choices were words with "acoustic
and semantic similarities" to the target. The patient was able to identify the word he had made an error on in repetition (249) in most cases, so he must have remembered it. In a matching test, the patient was asked to judge sets of words as same or different. Even with a five-second delay in which he was asked to count before responding, to prevent rehearsal, he performed well.

One interesting finding of Strub and Gardner's is that the patient repeated three-word and four-word sentences better than two-word sentences. This cannot be attributed to a memory deficit. No examples are given, but one wonders whether the shorter sentences were conceptually or syntactically more complex than the longer ones or whether the longer ones were formulaic, or whether they contained words with a greater number of syllables than the words in the longer sentences.

Strub and Gardner note that their findings do not definitively decide the issue of whether there is a memory deficit involved in the repetition deficit in conduction aphasia, but there are findings, discussed above, that the mnestic hypothesis cannot account for: improved performance with longer interstimulus intervals, the matching test results, and the paraphasias (251). As for digit span, they observe that aphasics are generally impaired on digit
span, even when they do well on other tests of memory, and performance on tests using numbers may be different from performance when other kinds of linguistic materials are used (252).

They hypothesize that competition between semantic analysis on the one hand and selection and sequencing of phonemes on the other may account for their findings. When focusing on meaning, a patient might make ordering errors with phonemes. Phonological analysis of a word in a list might not be possible if the words are presented too fast—slow presentation may give the patient time to process the input phonologically. If the words (and therefore the combination of phonemes making up the words) are unfamiliar, the patient cannot rely on the semantic system for help, and so "any fragility in phoneme selection and combination will be exacerbated" (253). When unfamiliar words are presented, either the person will get only a (partial) semantic trace and produce a semantic paraphasia, or the combining of phonemes will be faulty, yielding phonemic paraphasia.

These authors note in conclusion that it may be difficult to tease out the effects of linguistic and mnestic mechanisms and that both may be affected in conduction aphasia. However, they are not prepared to
accept an account of impairments in their patient that relies solely on non-linguistic mechanisms.

2.3. **The mnestic hypothesis and relevant memory studies.** An important issue in the literature is whether the repetition deficit in conduction aphasia is due to an impairment in auditory-verbal short-term memory, or whether the underlying problem is linguistic, or both. Several studies attribute the repetition problem to a memory deficit, including research by Warrington and some of her colleagues, Saffran and Marin (1975), Caramazza et al. (1981), Luria et al. (1967), and De Renzi and Nichelli (1975). These will be reviewed next.

2.3.1. **The mnestic hypothesis.** Warrington and her colleagues have done extensive testing of patients with impaired repetition (Warrington and Shallice 1969; Shallice and Warrington 1970; Warrington, Logue, and Pratt 1971; Shallice and Warrington 1977). They propose that most of these patients have impaired audio-verbal short-term memory (STM), and that this accounts for the fact that repetition is difficult for them. These studies will be discussed here in chronological order.

In their first study, Warrington and Shallice (1969) show that their patient's (K.F.) performance on their tests
"strongly suggests" that his repetition defect could not be attributed to faulty perception or to articulatory difficulties. The ability of the patient to learn and recall a list of ten words is attributed to his intact long-term memory (LTM). They claim that LTM plays a greater role when verbal material that is more meaningful than digits and letters is used in repetition tasks. LTM is also invoked to account for the fact that repetition improved with slower rate of presentation of stimuli: it is the LTM that is sensitive to rate of presentation, not STM. K.F.'s LTM is said to be intact and only his STM is impaired. The authors thus propose that there is a dissociation between LTM and STM. Amnesic patients have impaired LTM and intact STM, whereas people with a repetition deficit have a functioning LTM and an impaired STM. This study provides negative evidence in favor of the mnestic hypothesis, supporting the hypothesis that the repetition defect is not due to factors other than STM.

Shallice and Warrington (1970) next performed experiments to give positive evidence of a defect of STM. For example, the same patient, K.F., was given a free recall test (auditory presentation, oral response). In the results of such a test, one would expect to find a recency effect (superior ability to recall the most recently heard
stimuli) together with a primacy effect (ability to recall the first items in a series). K.F. had a recency effect limited to the very last item in the list of ten words (instead of five or six items, which would be expected for normal subjects) and a primacy effect limited to the first item in the list (instead of the normal three or four items) (264). Shallice and Warrington claim that the reduced recency effect supports the mnestic hypothesis. Saffran and Marin (1975:429) also note that reduced STM capacity should be reflected in a reduced recency effect. Their patient, I.L., had no recency effect at all in serial recall (i.e., where items have to be recalled in the order in which they were presented), when material is presented aurally.

Additional evidence for the mnestic hypothesis comes from Shallice and Warrington's (1970) use of the Peterson procedure, in which verbal material is presented in the auditory modality and the subject is asked to count before repeating it (to prevent rehearsal of the material to be recalled). With longer intervals filled with counting, the patient's performance declined, supporting the conclusion from the first experiment, that his STM is impaired. In a retrieval test (a probe test), the patient had to decide whether he had heard a given letter in a list of five
letters, both immediately and after a twenty-second delay. The patient did well when the target letter was the fourth item in the list (the fifth position was not tested). They also show that performance declined regardless of which retrieval method they used, and conclude that the problem is due to impaired storage capacity of STM, not a retrieval deficit. However, as Green and Howes (1977:145) note, the patient did well under the condition where the probe letter was presented after a twenty-second interval, so he must have some capacity to retain material in short-term memory. (This may be related to the phenomenon of reminiscence, found in normal psychology, where the ability to repeat may improve after a delay. This will be discussed in Section 2.3.2 in relation to Luria's work.)

Further support for the mnestic hypothesis is offered by Saffran and Marin (1975) who tested a patient, I.L., on repetition of nonsense syllables. Such items could not possibly be retrieved from LTM—nonsense words are not stored in LTM. Therefore, if the patient cannot recall them, STM must not be functioning normally and, in fact, his repetition of nonsense words was very poor. This patient was also given a sentence repetition test. It has been suggested that in sentence processing, STM briefly retains surface structure, while LTM preserves the meaning
of the sentence. However, the authors admit that there is no evidence that normal speakers necessarily retain surface structure until meaning has been extracted. It was predicted that if STM was impaired, the patient would grasp the meaning of the sentence (using LTM) but not the surface structure, and so he would produce a paraphrase of the target sentence.

On this task, the patient showed a primacy effect, repeating at least the first two words in most sentences. The longer the sentence, the poorer was the patient's ability to repeat it verbatim—he made omission and substitution errors. Most of the time, when asked to repeat long sentences, he responded with a paraphrase. Paraphrasing demonstrates comprehension, as well as ability to express the meaning of the simple target sentences. In this case, the patient's paraphrases of complex sentences, such as passives and reversible sentences, were less accurate than those of simpler SVO sentences. In his paraphrases, more familiar words were often substituted for less familiar words. Saffran and Marin interpret their patient's performance on these tasks as indicative of impaired STM.

Shallice and Warrington (1977) argue for their position in opposition to Kinsbourne (1972), Tzortzis and
Albert (1974), and Strub and Gardner (1974). They argue that their mnestic hypothesis could in fact accommodate Kinsbourne's data since the longer latencies in repetition which he found may have been due to the fact that the patient was retrieving from LTM (long-term memory) rather than STM. Kinsbourne reports that one of his patients could repeat two digits if they were the same but had trouble repeating two different digits, and he does not think these results can be explained by the mnestic hypothesis. But Shallice and Warrington cite Waugh and Norman's (1968) finding that repetition of a pair of digits may use the same amount of STM capacity as repetition of a single digit. One of Kinsbourne's patients was much better at making same/different judgments about two strings of digits (matching) than he was at recalling a string of digits, and on the basis of this he argues against the mnestic hypothesis. However, Shallice and Warrington claim that the greater ease of matching two strings compared to the difficulty of recalling a single string does not necessarily mean that there is no STM deficit. Recognition may be better than recall for normal speakers, too—conduction aphasics should be compared to normal controls to resolve this. The mnestic hypothesis may be able to explain Kinsbourne's results better than the disconnection
hypothesis, according to Shallice and Warrington, but no definite conclusion can be reached until the patient's STM capacity has been tested directly.

They claim that they can reconcile their findings with those of Tzortzis and Albert, asserting that there is no need to posit a separate memory for sequences, since auditory-verbal short-term memory is order-based. The mnestic hypothesis is said to be adequate because an STM impairment would lead to both item and order errors.

In opposition to Strub and Gardner, Shallice and Warrington (1977:488) argue in favor of an approach relying much more on memory mechanisms. They claim that Strub and Gardner's use of words and objects in tests may have introduced a long-term memory (LTM) component into their patient's performance, such material being "highly meaningful", and so the effects of STM alone were not adequately tested. They note that the idea that there may be interference between semantic and phonological analyses would be difficult to falsify. A weakness in Shallice and Warrington's argument is that it does not address the occurrence of paraphasias in conduction aphasia, which need to be accounted for.

Shallice and Warrington (1977) also observe that the word repetition has been used in the literature to refer to
different kinds of activities, and so one of their goals is to clarify terminology. They argue that those who have been labelled conduction aphasics represent a heterogeneous group, and that there are at least two different disorders included under this label: one involving a repetition deficit and the other involving a reproduction deficit. Repetition was defined by these authors as imitation of "a number of unconnected short familiar words" (479). Reproduction is concerned with speech production, and refers to the ability to imitate "a single relatively infrequent multisyllabic word" (479) (and presumably, phrases and sentences). Repetition and reproduction are believed by these authors to involve different psychological processes: reproduction involves the ability to produce speech, while repetition involves the ability to retain verbal material. Shallice and Warrington maintain that "there is a STM component contributing to the deficits on repetition tasks of all experimentally studied conduction aphasics" (489), with the exception of one of Kinsbourne's patients, who had a good short-term memory. Imitation of a phrase involves both repetition and reproduction, and many conduction aphasics have both a reproduction and a repetition deficit.
Shallice and Warrington (1977:490) propose that the term conduction aphasia should be restricted to disorders of reproduction. Such patients would also be expected to have deficits in expressive speech, such as those described in Chapter 1 (Section 1.2.1): phonemic paraphasias, and errors in object naming and oral reading, etc. Those who have a pure repetition deficit with no expressive problems would no longer be termed conduction aphasics. Instead, they would be said to have impaired auditory-verbal short-term memory.

Heilman et al. (1976:205) suggest an explanation for their patients' performance that is the opposite of that of the mnestic hypothesis, namely that impaired ability to repeat causes performance on memory tasks to be deficient. Rehearsal is important for immediate memory, and such rehearsal, which involves recirculation of information, is usually verbal. It has been found that people who rehearse have better recall than those who do not (Flavell 1970, cited in Heilman et al. 1976:205). The implication is that if one cannot rehearse, memory will be affected. The conduction and Broca's aphasics in this study did not differ in memory span for digits. There was a correlation between digit span and sentence comprehension (206). Although memory correlated with comprehension, the authors
note that no causal relations have been established here—
memory and comprehension deficits may both reflect an
underlying linguistic deficit.

Caramazza et al. (1981) concur with the Shallice and
Warrington's opinion that conduction aphasics are not a
homogeneous group, but that there are two subgroups. Their
patient, M.C., is of the type which has a "relatively pure
repetition disorder" due to "a disruption of the memory
trace that serves as a model for repetition" (254) in STM.

First, tests of memory were conducted. In a
repetition test, their patient's digit span was very
limited. A probe task (which tests recognition) was used
to test STM in such a way that the patient did not have to
repeat or retain a list of words in memory. Performance
here was similar to that of Warrington and Shallice's
patient, K.F. M.C. did not show a normal recency effect.
These results show that there is an STM deficit.

The patient's ability to repeat high-frequency nouns,
low-frequency nouns, and function words was also tested.
Recall of high-frequency nouns was better than recall of
low-frequency nouns on visual presentation. In general,
repetition was better with visual presentation than
auditory presentation. Word-frequency had a stronger effect
in the visual than in the auditory mode. The patient had severe difficulties in recalling function words presented aurally, but with visual presentation his recall of function words was as good as his recall of nouns. Caramazza et al. note that although the STM hypothesis can account for superior performance with visual input, it has trouble accounting for the fact that there was more of a frequency effect in the visual mode than in the auditory mode.

Having studied the patient's repetition, these authors then undertook a series of tests of other aspects of his language performance—oral reading, speech, sentence comprehension, and sentence construction. In oral reading, he did well with isolated words (including functors) and sentences. Tests of sentence comprehension showed that he made syntactic errors, lending support to the idea that conduction aphasics may have "asymptomatic comprehension" (Caramazza et al. 1981:261; Caramazza and Zurif 1976), which results from "an inability to process or to represent syntactic information adequately" (260). This aphasic had little evidence of agrammatism in sentence production—he performed well on a sentence anagram test, using functors appropriately. His comprehension of aural and written verbal material was somewhat impaired.
On the basis of their findings, Caramazza et al. present arguments in favor of the mnestic hypothesis and against the other hypotheses. They claim that neither the disconnection model nor the encoding model can account for the probe test results, because both models assume that there is no problem with receiving input and that "a normal internal representation of the input string" is constructed by conduction aphasics (244). Nor can these two models account for the different effects of auditory vs. visual mode on performance, repetition that is affected by word class, or asyntactic comprehension in the face of normal sentence production (267). However, the authors did acknowledge that those who proposed these two hypotheses may have been working with a different subgroup of conduction aphasics than their own patient.

According to Caramazza et al., the results of the probe test are consistent with both the mnestic and Strub and Gardner's hypotheses, since neither would predict that the input would be processed normally (244). The results of the language tests are consistent with elaborated versions of Strub and Gardner's hypothesis and with the mnestic hypothesis. The former would hold that the conduction aphasic constructs phonological and/or graphemic representations of language from the input but is impaired
in "carrying out further lexical analysis bearing on the syntactic and semantic properties of the word" (263).

Only the mnemonic and Strub and Gardner's hypotheses can account for two of the four important results obtained by Caramazza et al.: (1) memory of a list of four items was poor (probe task) and (2) repetition was affected by rate of presentation of stimuli and prevention of rehearsal, which affect the internal representation constructed from input. However, Strub and Gardner's hypothesis has difficulty in accounting for the different effects of visual vs. auditory mode of presentation of stimuli and the asyntactic comprehension of sentences in the visual mode. Caramazza et al. therefore abandoned Strub and Gardner's model as a possibility.

Caramazza et al. support the auditory-verbal short-term memory hypothesis of Warrington and her colleagues, which can account for the fact that repetition is better with visual than with auditory presentation through the assumption that it is only the auditory-verbal store that is affected; the visual short-term store is not affected, nor is LTM. The mnemonic hypothesis can account for most of the aspects of their patient's repetition and language processing. The fact that the patient had difficulty repeating functors is not a problem for this hypothesis if
it is assumed that function words are not processed in the same way as other words. In accounting for asyntactic comprehension, it is assumed that the conduction aphasic is more impaired in processing functors than other words, based on an approach to language that assigns to grammatical morphemes primarily or exclusively a syntactic description...Thus the representation of function words in the lexicon would be strictly in terms of syntactic description. (264)

The conduction aphasic's internal representation of a sentence would be "more richly specified semantically" than syntactically. The authors suggest that the representation of function words is particularly affected in the case of disordered memory representation because these words have little semantic information to supplement the short-term representation that is presumably coded phonologically (255).

It is assumed by these authors that functors are "represented only phonologically in short-term store" and so their use is impaired if auditory-verbal short-term memory is impaired (268).

A number of other relevant studies of memory impairments in aphasia have been conducted. Some of these will be discussed below as they relate to conduction aphasia.
2.3.2. **Luria's acoustico-mnestic aphasia.** Luria (1966, cited in Tsvetkova 1976) describes a syndrome called acoustico-mnestic aphasia. Tsvetkova (1976) equates acoustico-mnestic aphasia with classical conduction aphasia. Luria and Hutton (1977:141) called acoustico-mnestic aphasia a form of amnestic aphasia. It is not entirely clear whether all of the patients discussed in this section on memory have the same syndrome. In any event, the cases that Luria reports on are relevant to the issue of memory impairment and conduction aphasia.

Luria et al. (1967) did a study of memory in two patients with acoustico-mnestic aphasia, who had left temporo-parietal lesions. They used verbal and non-verbal stimuli, which were presented aurally, visually, and kinesthetically. They found that only aurally-presented material caused problems in reproducing the target elements. Both patients were able to repeat phonemes and words in isolation, but their repetition of sequences of phonemes and words was impaired. Also, they were unable to learn a series of three to five phonemes or words even after ten trials. Both patients showed normal primacy and recency effects (normal pro-active and retro-active inhibition) on memory tests when the material was presented.
visually. However, when the material to be reproduced was presented aurally, both patients were impaired, but their impairments were manifested differently. One showed only a recency effect (like Shallice and Warrington's K.F.), and said that he could not remember the earlier elements in the series. This was taken to show a "pathological increase in retro-active inhibition" (7) which only occurs when the material is presented aurally and the patient has to respond orally. If instead the stimulus is presented aurally and the response is in writing, or if the material is presented in the visual modality, there is no recency effect. The authors (1967:7) note:

A change of the modality of the decoding or encoding of traces resulted in a change in the neurodynamics of the retention and reproduction of the traces, and the predominance of the pathological retro-active inhibition of traces was observed only when the whole process of decoding and encoding remained in the verbo-acoustic sphere.

Thus, the problem here is not simply one of a memory deficit. In fact, the authors assert that it is the interaction of decoding and encoding with sensory modality that is implicated.

This patient did not make semantic paraphasic responses on recall tests, but the other patient did, and the longer the series of items to be repeated, the more
paraphasic errors he made. Luria et al. state that paraphasia shows a "loss of selectivity of [memory] traces" (8).

The authors also observed differences in reminiscence with these two patients. Reminiscence refers to the improvement in ability to repeat after a pause of thirty seconds to one minute or perhaps more. This phenomenon is observed in normal psychology, and it suggests that memory traces which have been inhibited become available again after the nerves involved have rested. The patient with increased retro-active inhibition had good reminiscence. At first he was able to reproduce only one item in a series, but after a pause of one or two minutes, he was able to reproduce two items. This was interpreted to mean that the memory traces were not weak; they had just been temporarily inhibited. The opposite occurred for other patient--his performance deteriorated after such a pause.

These two patients clearly have different impairments. Luria et al. hypothesize that two neurodynamic mechanisms are involved here, both of which affect these two patients only in the "auditory-verbal sphere": pathological accumulation of inhibitory influences which block the traces" is reflected in the pro-active and retro-active inhibition. Both types of inhibition "resulted in a
blocking of the connection between elements [which made it difficult to repeat items in a series] and a temporary blocking of memory traces" (9). "Pathological equalization of excitations" causes memory traces to become equal in strength, resulting in paraphasia.

Luria et al.'s study shows that not all memory impairments are the same, that there can be a range of variation. Some patients described in the literature fail to respond, while others give paraphasic responses, and perhaps there are others, like my subject, who have can have either reaction in repetition tasks. Perhaps the difference between no response and a paraphasic response is a matter of degree. One could suppose that in paraphasia, the response is less "blocked" than when the patient cannot give any response. Luria et al. speak of "loss of selectivity" in paraphasia, but perhaps it is better to say that paraphasic responses reflect impaired selectivity. Complete lack of a response may reflect total blocking, an inability to select--a true loss of selectivity.

Luria and Hutton (1977:148-9) disagree with Wernicke's description of conduction aphasia as a disconnection between the area of brain responsible for receiving the speech signal (containing the "sensory word image") and the area responsible for speech production (containing the
They do not accept the idea of "special paths between sensory images and motor images" (148). They observe that though a deficit is most noticeable in repetition, there are also errors in spontaneous speech and object naming. They emphasize the differences between repetition and spontaneous speech, as does Goldstein. The repetition deficit is:

caused by the fact that the repetition of the word has an entirely different psychological structure than spontaneous speech. The attention of the subject is directed here at the auditory analysis of the essential structure of the word (precisely this is impeded in such patients).

To Luria and Hutton, regarding conduction aphasia as a "weakened" form of sensory aphasia (i.e., Wernicke's aphasia, with fluent speech and poor comprehension) seems sensible, but they admit that there may be other explanations and note that we do not yet have a good description of the symptoms of conduction aphasia and not enough is known about it to determine the mechanisms that cause it.

2.3.3. Memory and brain damage. De Renzi and Nichelli (1975) conducted a study of memory impairment with a large brain-damaged population. They report that McFie (1969) and Newcombe (1969) found that digit span is affected by left-hemisphere damage, regardless of locus of lesion. Their study shows that shortened verbal memory span is
correlated with presence of aphasia, since non-aphasics with left-hemisphere or right-hemisphere damage were not impaired on verbal memory tasks--the non-aphasics performed like the normal controls. The aphasics' impairment was evident regardless of modality of expression (oral vs. pointing) and did not reflect a comprehension deficit. However, they add, it is not enough to say that verbal STM impairment is just a symptom correlated with aphasia, because there were two patients (one conduction aphasic and one anomic) whose memory impairment was worse than their language impairment.

2.4. Discussion. Several accounts of conduction aphasia have been presented and debated in the literature. Possible reasons for these disagreements will be suggested and the relations between the various positions and their strengths and weaknesses will be discussed below.

2.4.1. Patient variation. There may be several main reasons for the differences of opinion in the literature. One obvious problem is the differences among patients studied. A recurring theme in this literature is that people labelled "conduction aphasics" are probably not a homogeneous group. There are age differences, and some patients may be at a more advanced stage of recovery than
others (I suspect that this was the case with Warrington and Shallice's patient, K.F., who suffered brain-damage at the age of seventeen and whose aphasic symptoms have improved considerably). In addition, there is variation in how patients react to a task. In Luria et al.'s (1967) study, one patient made paraphasic errors, but the other did not.

2.4.2. Methodology. Another problem is differences in methodology or in the aspects of impairment studied. Some researchers have focused on the repetition deficit. The type of material to be repeated is important. Kinsbourne (1972:1130) notes that one cannot make generalizations about the nature of the repetition deficit solely on the basis of repetition of digits—since digit repetition is "not typical of these patients' verbal behavior". In addition, Dubois et al. (1973:291) are right in saying that we must study many aspects of this syndrome, not just isolated aspects of it.

Brown (1975:51) makes several points in his paper on repetition. He states that "repetition is not a special function of language but is only a way of testing patients". He claims that repetition is generally affected in aphasia, and the impairments in repetition reflect the particular language problems exhibited in the particular
form of aphasia being studied. He goes on to observe that

In a given patient repetition may show anomic errors, errors related to phrase length (possibly to verbal memory), verbal or semantic paraphasia, literal or phonemic paraphasia, dysarthria and echolalia. These are also the major types of impairments in aphasic speech in general (51).

Gardner and Winner (1978) undertook an in-depth study of repetition in forty-four aphasics of eight diagnostic groups, including twelve conduction aphasics. Their results suggest that

repetition—at least for isolated elements—may be a single, quantifiable capacity, reflecting the same factors independently of the variety of aphasia (176).

They report, however, that anterior aphasics made a greater number of sound errors, while conduction aphasics made more meaning errors than the other groups. Although these are quantitative differences, it seems likely that there are different mechanisms causing one diagnostic group to make the most phonemic paraphasias and another to make the most semantic paraphasias.

According to Brown (1975:51):

It is not repetition per se that requires an explanation but rather the many different forms of language pathology which have been described, tested under conditions of repetition.

This is not entirely accurate. Conduction aphasics do have a difficulty in repeating that is disproportionate to their spontaneous speech impairments. But, in my data,
there were similar kinds of errors in repetition as in spontaneous speech and reading. Different tasks may provoke different degrees of impairment.

2.4.3. **The different models.** It is difficult to accept the idea that conduction aphasia is just a manifestation of a disconnection between Broca's and Wernicke's areas. It seems difficult to account for paraphasias, paralexias and differential impairments of different word classes by invoking an interruption of a nerve pathway. Goodglass and Blumstein (1973:319) also comment on this: under the disconnection hypothesis, why do people produce paraphasias instead of failing to say anything? Differential impairments of different word classes make the disconnection hypothesis implausible as an account of conduction aphasia. The location of the responsible lesion is not clear. A strict localization approach is undermined by the finding of Benson et al. (1973:525) that lesions in two different sites can cause this syndrome. And as Goldstein observes, repetition can be good even when the association fibers between the frontal and temporal lobes are damaged. It is possible that there is a disruption of a pathway between Broca's and Wernicke's areas. It is also possible that there is a partial disconnection, in which case performance would be
impaired or distorted. But even if this is so, the disconnection model by itself is inadequate. A psycholinguistic model for the patterns of errors and intact performance is needed.

As for the mnestic hypothesis, Brown (1975:43) argues against it on the grounds that some conduction aphasics do not have an STM deficit. Also, self-correction attempts in repetition and naming are often successful, and this implies that the memory trace for the material to be repeated is still available, although Brown does acknowledge that a reduced memory span can limit the length of phrases that can be tested in repetition. As Strub and Gardner note, it is difficult to separate out a linguistic impairment from a memory impairment. However, the production of paraphasias and paralexias and the differential impairments of different word classes make me unwilling to accept the idea that the repetition defect is due solely to an STM deficit.

Caramazza et al. (1981:242) state that the encoding model and the model of Strub and Gardner are both variants of Goldstein's views which differ as to where the impairment is said to occur in language processing. To the encoders, the impairment involves "encoding the phonological targets for output". Strub and Gardner
identify the impairment as one that occurs in "proceeding from a phonological analysis to the selection and combination of target phonemes". According to Mendez and Benson (1985:890), Strub and Gardner's model, which locates the repetition deficit "several steps after phonologic processing but before phonemic encoding" is consistent with their disconnection approach. It fits in with the idea that the message to be repeated is decoded correctly but that transmission from the comprehension area to the output area is interrupted.

Dubois et al.'s encoding model may also be compatible with the disconnection model, according to Shallice and Warrington (1977:481) in that the encoding model may refer to "a deficit in a system which receives input from the conduction pathway or pathways that Kinsbourne argues are damaged". And Mendez and Benson (1985:890) observe that the encoding model can account for the ability of conduction aphasics to monitor their speech and make corrections and for the presence of paraphasias. As I mentioned earlier, Kohn (1984:112) also suggests that the encoding and disconnection models may be compatible in that they both "point to a general phonological disruption of speech output", though she noted that more research is
needed on this point. Kinsbourne (1972:1132) makes a good point when he observes that

it is not possible at present to distinguish by behavioral methods the failure to program a message from the failure to transmit it.

Differential impairment of different word classes may be difficult to account for in any of the approaches discussed in this chapter. However, Dubois et al. (1964/1973) claim that conduction aphasics have problems at points at which there are variations in the amount of information a word conveys. The difficulty with different word classes may be partly related to the amount of information conveyed by members of these word classes. Bisazza's (1980) approach may account for noun facilitation. Gordon and Caramazza (1983:344) note that the open and closed class vocabularies are represented or processed differently and can be differentially impaired.

While Green and Howes (1977) consider the Sainte-Anne group's analysis of conduction aphasia to be the best so far, they caution against believing that the encoding impairment is the only defect. It does not account for everything. For instance, they note, these aphasics produce grammatical errors and find it difficult to correct such errors on tests, and there may be comprehension deficits, which would suggest some difficulty in decoding
an incoming message. It seems that a repetition deficit could involve a problem in decoding or encoding or both, and could result in any of: a failure to respond, partial repetition, or paraphasia. It seems that while encoding is almost certainly a problem, a decoding impairment cannot be ruled out.

Caramazza et al. (1981) are right to wonder whether a unitary account of conduction aphasia is possible, even in a single patient. From the preceding discussion, it can be seen that there could be several factors involved: a memory component and a decoding impairment as well as an encoding impairment. In my view, a memory defect cannot account for all of the manifestations of conduction aphasia. The linguistic deficits--anomia, semantic paraphasia, substitutions and omissions of closed class vocabulary and differences in abilities to use different word classes--cannot be attributed to a memory defect. Rather, they appear to reflect problems with lexical selection and retrieval.

The rest of this dissertation focuses on a patient whose language production exhibits the linguistic impairments just mentioned and described more fully in Chapter 1. In the next chapter, I will outline the
methodology used in this study and give background information on the patient, C.G.
CHAPTER III
METHODOLOGY

3.1. Introduction. This dissertation presents a case study of a conduction aphasic, C.G. The first two chapters have addressed issues in the study of aphasia, especially conduction aphasia. It has been shown that these aphasics have impairments affecting both the open class and closed class vocabularies, and that, at least in some cases, the deficits cannot be attributed simply to a memory disorder. C.G.'s language production contains instances of the linguistic deficits discussed in Chapter 1, Sections 1.2.1 and 1.3. Her language abilities and disabilities will be described in Chapters 4 and 5. Here I will give background information about C.G. and will describe the materials used in testing.

Several approaches to the study of aphasia have been used in the neuropsychological literature, including group studies and case studies. In the group research method, patients are grouped on the basis of some criterion such as locus of damage or syndrome type. As Caramazza and Martin (1983) observe, the basic problem with this method is that of ensuring that the group being studied is homogeneous.
with respect to impairments. Within-group variation in performance on a task cannot be assumed to be due to random noise in a study. We have seen in Chapter 2 that patients labelled conduction aphasics are not a homogeneous group.

One way around this problem is to use the case study method. Shallice (1979:183, cited in Caramazza and Martin) calls this method the most promising neuropsychological technique for providing information on the functional organization of cognitive systems. According to Caramazza and Martin (1983:18), this method allows extensive analysis of clear syndrome cases without the contaminating factor of heterogeneous variation. This property of the case study method is sufficiently important to warrant its more extensive use in neuropsychological research.

They add that the case-study method is useful for testing within-syndrome variation. There are two practical advantages of this method: it may be easier to be sure of one's criteria for classifying patients, and case studies can achieve greater depth and detail than group research. It is the purpose of the present study to obtain an in-depth view of language abilities and disabilities in a conduction aphasic, adding data to the existing pool of information presented in Chapters 1 and 2.
3.2. **Subject.** C.G., a Caucasian woman, was 69 years old when she first agreed to participate in this study in February, 1984. C.G. is from the eastern seaboard of the United States. She was raised as a monolingual English speaker, and studied Spanish, French, and German in college. She worked for twenty to twenty-five years as a secretary in the English Department of a major midwestern university.

Eight years before this study, at the age of 61, having had a history of hypertension, she suffered a cerebrovascular accident (stroke) caused by a left frontotemporal cortical infarction, causing a branch occlusion of the left middle cerebral artery. The EEG was abnormal, indicating a left temperofrontal structural alteration, according to her medical report, which I obtained from her family. The parietal area was not mentioned in the medical report. The speech pathology report indicates that one week after her stroke, C.G. had a "severe dysphasia crossing all language modalities" with oral and laryngeal apraxia as well as non-verbal apraxia, and severe dyslexia and dysgraphia. Auditory comprehension was said to be mildly impaired.

At the time of her evaluation one year after beginning speech therapy, her speech was described as: "fairly usable
but often lacks completely in terms of syntacs (sic) and grammar". Her utterances showed evidence of word retrieval difficulties, paraphasias, semantic confusions, and a mild "verbal sequential dyspraxia". Her responses were said to be delayed because of a need to "retrieve and organize". Auditory comprehension was mildly impaired; she had trouble understanding material that was too long, too complex, or spoken too fast. Her dyslexia was described as mild. She had a moderate dysgraphia, meaning that writing ability was functional at the single word level.

3.3. Materials. In this section, a discussion of the tests used in this research and the rationale behind them will be presented. The method of gathering data has an effect on what facts one has to account for. Spontaneous speech data may not contain all of the types of structures that the patient can produce or understand. On the other hand, structured tasks may cause subjects to fail or to perform in other ways that differ from their free conversation. In a structured task, the subject may be able to monitor her output, and in that case, responses would reflect what the person can do optimally, but may be very different from spontaneous speech. For these reasons, both elicited and spontaneous language have been included in this study. In addition to a standardized aphasia
battery (Section 3.3.1), the Token Test (Section 3.3.2), and the Wug Test (Section 3.3.3.4), I used several supplementary tasks which I devised to probe sentence repetition, sentence completion, carrying out instructions, reading, and metalinguistic judgment tasks with ungrammatical sentences (Section 3.3.3). It has been the aim of this research to use a variety of data-gathering techniques in order to provide a detailed picture of the C.G.'s language abilities.

3.3.1. **Boston Diagnostic Aphasia Examination.** This is a standardized aphasia battery developed by Goodglass and Kaplan (1972) who indicate that it was designed for three main purposes: (1) to determine what kind of aphasia an individual has, which may indicate the localization of damage; (2) to measure the aphasic's level of performance on tasks that range from easy to very difficult in a way that would allow the examiner to see whether performance was changing over time; and (3) to assist a therapist in designing a therapy program by providing a comprehensive picture of the strengths and problems the aphasic exhibits.

The first of these purposes is achieved by tapping the aspects of language ability that are known to be important in diagnosing aphasias, e.g., serial speech, body parts,
etc. Secondly, the measurement of performance is made possible by using items that vary in degree of difficulty, using subtests that are considered to be long enough to be reliable, and providing standardized scores to show degrees of severity of impairment. Thirdly, the aphasics' strengths and weaknesses are revealed by testing language in all modalities: speech, comprehension, reading, and writing.

The first part of the battery taps ability to carry on a conversation. Auditory comprehension of individual words is tested in the second part, which also includes commands of increasing difficulty and short paragraphs.

The third section focuses on oral expression. Automatized speech is tapped through recitation by the subject of days of the week, months of the year, letters of the alphabet, and numbers. The subject is asked to recite, sing, and respond to rhythms tapped out by the examiner. Words, phrases and sentences of increasing difficulty are presented for repetition. Ability to read aloud is assessed by asking the subject to read the words that she demonstrated comprehension of in Part 2. There are several naming tasks. The Responsive Naming subtest taps knowledge of the names of common objects, using questions such as "What do we tell time with?". Visual Confrontation Naming
involves naming of items pictured—the same items that are in the comprehension subtest in Part II. The subject is also asked to name as many animals as possible in a minute, and to name body parts when the examiner points to them. The subject is then asked to read some of the phrases and sentences which she had been asked to repeat earlier.

The fourth section of this battery taps recognition of letters and words that are spelled aloud and written in different kinds of scripts, matching written words to pictures (the same words used in Parts II and III), and reading sentences and paragraphs in a multiple-choice, sentence-completion task.

In the last section, writing ability is assessed—copying, writing the alphabet, numbers, and writing to dictation (letters, numbers, words, and sentences). The subject is also asked to spell, to write the names of items pictured, and to write a narrative description of a picture.

This is a very comprehensive test. Why supplement it with other tests? C.G.'s performance on this exam showed instances of anomia, paraphasia, paralexia, omissions and substitutions involving the closed class, and difficulties in repetition and writing. I needed a way to probe these behaviors in greater depth, and the other tests described
in this chapter were chosen for this reason. The closed class vocabulary is not tested in a very systematic way or in sufficient depth and detail in the Boston Exam for the purposes of my study. I also wanted to probe her repetition difficulties more thoroughly. Therefore, I found it necessary to devise a variety of activities that focus on the use of different word classes and probe them in a variety of ways.

3.3.2. The Token Test. The Boston Exam does include a section that involves giving commands which the subject must act out in order to demonstrate comprehension. The Token Test,² developed by De Renzi and Vignolo (1962), supplements this part of the Boston Exam by probing subtle comprehension deficits. De Renzi and Vignolo specify several criteria for a test of mild comprehension problems: (1) it should consist of short commands that a normal adult could remember; (2) it should not involve intelligence testing as well, since the results would be difficult to interpret—there would be no way to separate out the effects of specifically linguistic problems from conceptual ones; (3) it should contain "considerable difficulties on a linguistic level". This does not mean using infrequent vocabulary or rare syntactic forms. What is needed rather is a language test which
contains no redundancy so that the listener must comprehend each word of each utterance and cannot rely on extralinguistic cues.

This test consists of a series of commands which require the subject to manipulate tokens in order to demonstrate comprehension. Tokens consist of circles and squares, and come in five colors and two sizes. The form of the Token Test which I used has five parts. Part I contains fairly simple commands (e.g., Touch the red circle), and succeeding sections become progressively more difficult. Part 5 involves more than just the ability to identify the tokens themselves—it also contains commands that require the subject to demonstrate comprehension of prepositions, several verbs that were not in the preceding sections, conjunctions, adverbs, and a few subordinate clauses. De Renzi and Vignolo note that in their small population (19 aphasics), there was a somewhat higher level of errors involving closed class items and adverbs than adjectives (referring to color and size) and the nouns circle and square. They caution, however, that the test was not designed to determine whether these linguistic elements are harder to comprehend than the adjectives and nouns. The Token Test will be discussed further in Section
3.3.4.2, in regard to tests of comprehension of prepositions.

3.3.3. Description of new tests. As I noted earlier, the tests I devised were designed to elicit information on both open and closed class vocabulary. Open and closed class vocabulary items appear in repetition, reading, and, of course, conversation. Several tasks also elicit information about the closed class. They will be described in this section, and a copy of each test appears in the appendix. They are referred to in the text by abbreviations which indicate their format and focus (these abbreviations are also summarized in the list of symbols and abbreviations). The format of the tests is indicated by a prefix: R, J, or Act. R designates a repetition test (only grammatical sentences are used in repetition tests). J indicates a test where C.G. was asked to make grammaticality judgments. One type of judgment task is made up of sentences, some of which contain substitution errors, as in the following example:

*Paul drove home with we

The purpose in using this format is to see if the subject can recognize and correct such errors. The other type of judgment task presents two possible items to choose from
in order to complete a sentence: 3

The pen is (on, at) the table.

Act designates a task where C.G.'s task is either to act out commands, or to formulate commands for me to act out.

These prefixes are followed by a symbol for the linguistic forms being studied: I for inflections, Pro for pronouns and pronominal determiners, S for semantics, Prep for prepositions, and Aux for auxiliaries and copulas. For example, RPro refers to a repetition test that focuses on pronominals. In JPro, C.G. is asked to make grammaticality judgments about sentences, some of which were ungrammatical because of a pronominal, as in the example given above. Where more than one test focuses on a particular kind of linguistic form, numbers are used. For example, there are three grammaticality judgment tasks focusing on inflections, as Table 3.1 shows.

3.3.3.1. Pronouns and pronominal determiners appear in both the repetition and the judgment format. JPro consists of twenty-two sentences, some of which are grammatical, while others contain an error:

*The boy is looking for him book.

In the repetition test, RPro, the sentences used are the
grammatical counterparts of the ungrammatical sentences in JPro:

The boy is looking for his book.

Table 3.1
Tests Devised in this Study

<table>
<thead>
<tr>
<th>Repetition</th>
<th>Judgment</th>
<th>Act</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI1</td>
<td>*JI1</td>
<td>ActPrepl</td>
</tr>
<tr>
<td>RI2</td>
<td>*JI2</td>
<td>ActPrep2</td>
</tr>
<tr>
<td>R3</td>
<td>JI3</td>
<td></td>
</tr>
<tr>
<td>RPro</td>
<td>JPro</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*JPrep</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JAux1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JAux2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JAux3</td>
<td></td>
</tr>
</tbody>
</table>

Note: An asterisk designates a test that C.G. read herself. I read the repetition tests and the other judgment tests to her.

3.3.3.2. Prepositions. In JPrep, C.G.'s task is to read sentences containing two prepositions to choose from. ActPrepl requires the subject to carry out instructions by placing common objects in various positions:

Put the pencil on the box.
Move the pen toward me.
This supplements Part V of the Token Test, which includes such instructions as:

Put the red circle on top of the green square.
Put the white circle in front of the blue square.

These commands really test two things at once:
(1) comprehension of commands referring to tokens, and
(2) ability to demonstrate knowledge of the linguistic symbols for spatial relations (i.e., prepositions). But if the subject cannot reliably act out commands like "Touch the red circle and the green square", which do not contain prepositions, then it would be difficult for her to use the tokens to demonstrate her knowledge of the meaning of prepositions. For this reason, ActPrepl was similar to Part V of the Token Test, except that everyday items were used instead of circles and squares.

ActPrep2 taps the subject's ability to produce original sentences with prepositions by taking on the role of the one who formulates commands for the examiner to act out.

3.3.3.3. Auxiliaries and copulas. Judgment tasks containing grammatical and ungrammatical sentences tap ability to understand and use auxiliaries and copulas. I experimented with this by using tag questions. In sentences containing tag questions, the auxiliary in the tag must agree with the main verb in three ways, and in
these exercises, there are three kinds of possible errors in the ungrammatical sentences, i.e., the auxiliary in the tag can be wrong in one of the following ways:

1) tense--the tense of the main verb is not copied in the tag: Mary is at home, wasn't she?

2) number--the main verb agrees in number with a plural subject, but the auxiliary in the tag does not agree: They were early, wasn't they?

3) wrong auxiliary--the auxiliary in the tag agrees in tense and number with the main verb, but is simply the wrong lexical item: I can eat now, don't I?

Using tag questions may be a useful way to see which of these factors is the most difficult and may shed light on factors conditioning substitution errors with auxiliaries and copulas.

In JAux1, the main verb was affirmative and the tag negative, as in the examples above. In JAux2, this was reversed--the main verb was negative, and the tag was affirmative:

Bob isn't busy, was he?

Lastly, JAux3 was the mirror image of JAux1--the sentences that were ungrammatical in JAux1 were grammatical in JAux3 and vice versa.

3.3.3.4. Inflections. Nominal and verbal inflections are sampled in a variety of ways. One method is to use the Wug Test developed by Jean Berko (1958) for the purpose of assessing children's acquisition of English
morphology using nonsense words and a few real words in a sentence completion format. For example:

This is a wug. Now there is another one.
There are two of them.
There are two _____________.

By using nonsense words, one avoids the possibility of word frequency or word-finding difficulty interfering with performance. This approach makes it possible to assess the ability to use inflectional affixes productively.

Two repetition tests, RI1 and RI2, are made up of sentences that include the various allomorphs of the present, plural, possessive, and past inflections. (They were administered in several sessions since they are so long.) The sentences in RI1 and RI2 are relatively short, single clause sentences, ranging from three words/five morphemes to seven words/eleven morphemes.

In administering these two repetition tests, I found that C.G. was often able to repeat the first part of a sentence, but then seemed to get stuck. It appeared that she found NP's easier to repeat than VP's. However, an alternative explanation would be that she was only able to repeat the first part of a sentence, or a certain number of syllables, before getting stuck. Since all of the sentences in these two tests started with the subject NP,
it was impossible to choose between these two alternatives. In R3, the type of item at the beginning of the sentence varies, so that it is not always an NP. PP's and participial phrases are also used:

In the morning I brush my teeth.
Having finished, the boss left.

A wide variety of NP's also appear in initial position in R3, including:

- compound nouns
- ADJ ending in -ing plus N
- ART ADJ PRO
- Relative clause

The washing machine is broken.
The waving policeman blew his whistle.
The red one is mine.
The people watching the show laughed.

It was hoped that this design would show whether C.G. found it easier to repeat the first part of a sentence regardless of word class or whether it was easier to repeat NP's than other kinds of phrases.

Grammaticality judgment tasks supplement R11 and R12, using the same morphemes as in these two repetition tests. In J11, some sentences are ungrammatical because an inflectional morpheme has been omitted:

*My mother feel good today.

J12 is a variation on J11. The same sentences are used in both tests, but in J12 the format is different--in each sentence, two forms of a word are given--one with the
correct inflection and one without an inflection, and the subject is to choose the correct form:

My mother (feel, feels) good today.

It was thought that a multiple-choice format would be easier than JI1 and would give a more accurate picture of the C.G.'s ability with inflections. The order of the two items is varied so that the subject could not get a correct score simply by choosing the first item. However, there is the possibility that reading impairments could interfere with her performance. Another task in this series, JI3, contains the sentences from RI1 and RI2, adapted to a judgment format. The format is like that in JI1--some sentences were grammatical, whereas in other sentences, the inflectional morpheme is omitted. In administering JI3, I read the sentences to her to avoid interference from her reading deficit.

3.4. Testing. Sessions with C.G. were usually held in her home, although the first two sessions were held at the university. In the beginning, we met two times per week, but later we began meeting once per week. Our sessions lasted one half-hour. Data was recorded on a cassette recorder, and scoresheets were used for the Boston Exam, the Token Test, and for my tests. Transcriptions were made of samples of conversation, reading and
repetition from the Boston Exam. In addition, the Token and Wug tests were transcribed in full, as were the repetition tests I designed, another reading task (JPrep), and additional samples of conversation.

3.5. Summary. All of the methods described in the preceding sections of this chapter supplement each other in providing a picture of C.G.'s language abilities and disabilities. The analysis of the results of the Boston Exam and the Token Test is presented in Chapter 4. Chapter 5 presents the analysis of C.G.'s performance on the tests that I devised.
NOTES

1. In the auditory comprehension test, the subject is presented with cards depicting common objects, drawings of people performing various actions, letters, colors, geometric shapes, and numbers. The subject is asked to point to the correct item in response to the instruction: "Show me the ____". The same items are used in the Visual Confrontation Naming task, where, instead of pointing, the subject's task is to produce the names of the items on the cards presented.

2. The form of the Token Test that I used is based on the versions devised by De Renzi and Vignolo (1962) and Boller and Vignolo (1966).

3. This format was inspired by Gardner et al. (1975).
CHAPTER IV
THE BOSTON DIAGNOSTIC APHASIA EXAMINATION AND
THE TOKEN TEST--ANALYSIS OF RESULTS

4.1. Introduction. The Boston Diagnostic Aphasia Examination was administered to C.G. in four sessions at the beginning of my field work with her. This was followed by administration of the Token Test in three sessions. The results of these two tests will be the focus of this chapter.

4.2. The Boston Diagnostic Aphasia Examination. Although on admission to the hospital, C.G. was described as having "expressive aphasia" and "mixed aphasia", her scores on the Boston Diagnostic Aphasia Examination indicate that she is best classified as a conduction aphasic.

In describing the scoring of the exam, Goodglass and Kaplan (1972:69) note that in what they call unambiguous cases of conduction aphasia, the severity rating ranges from two to four on their scale. On the basis of C.G.'s scores, I have assigned her a severity rating of two, which is characterized in the following terms: "Conversation about familiar subjects is possible with help from the
listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner" (test booklet, 6). C.G.'s scores are quite similar to the scores on the profile for conduction aphasics given by the authors.

Figure 3 shows what C.G.'s performance was like in regard to word-finding difficulty (WFD), semantic paraphasia (SP), phrase length (PL) (a measure of fluency reflecting the largest number of words produced without pause in a stream of speech), intonation (I), and auditory comprehension (AC). The scale ranges from severely impaired to normal, at the two extremes.

![Figure 3](image_url)

Figure 3. C.G.'s Profile from the Boston Diagnostic Aphasia Examination. As this figure shows, C.G.'s intonation was near-normal. Auditory comprehension and phrase length were somewhat less normal than intonation. Word-finding difficulty occurred more frequently than semantic paraphasias.

Results on this exam will be presented below. The different semantic categories tested in various language modalities will also be discussed (i.e., objects, colors,
numbers, body parts, letters, actions (-ing forms), and geometric forms).

4.2.1. **Subparts of the Boston Exam.** This exam is divided into five main parts which test aphasics' abilities in conversation, comprehension, oral expression other than conversation, reading, and writing. The subparts of this exam were described in Section 3.3.1.

4.2.1.1. **Conversation.** C.G.'s spontaneous speech is fluent but marred by word-finding difficulty that sometimes makes her sound disfluent. On the Profile of Speech Characteristics it can be seen that her intonational contour is normal and phrase length (i.e., length of stretches of speech between pauses) is frequently about six words. Her anomia can make conversation difficult at times, with the interlocutor sometimes having to guess at what she means. Her speech contains a variety of grammatical forms, including embedded clauses. She uses auxiliary verbs and inflections spontaneously. There are semantic and phonemic paraphasias and substitutions of closed class items for one another in running speech. She sometimes produces semantically aberrant utterances but no jargon.

The remark below illustrates several of the types of problems described here. When I asked if there was any
paralysis on her right side, she showed the right-left confusion that is common to aphasics, as well as body-part naming problems. Touching her right leg, she called it her left arm, and said (verbal paraphasias are capitalized):

CG: I find most of the
I can't find
I just can't feel this [smk]
numb
numbness.

Here, find had been used instead of feel, and there is a phonemic paraphasia in her first attempt at saying numbness.

4.2.1.2. Auditory comprehension was quite good. C.G. was able to point to pictures and figures very promptly on instruction in all of the semantic categories tested. This contrasted later with her difficulties in naming some of these items (to be discussed in the next section).

Comprehension of short paragraphs was also quite good.

4.2.1.3. Oral expression. The third, and longest, section of the Boston Diagnostic Aphasia Examination deals with many aspects of oral expression, including automatized speech, repetition, naming, and reading aloud.

Automatized speech (e.g., days of the week, letters of the alphabet) was well-preserved and recited without paraphasia. (By contrast, writing of the letters was not
Recitation of nursery rhymes and other over-learned material (e.g., the Lord's Prayer) was very difficult, and C.G. usually gave up mid-way, in spite of prompting.

Repetition of individual words out of context was good, though C.G. made a few paraphasic errors, which she was able to correct. However, her repetition of phrases and sentences was very poor. The phrases and sentences are rated by Goodglass and Kaplan as "high probability" and "low probability", referring to the fact that some sentences are expected to be easier than others. Even some of the "high probability" items were hard for C.G. (e.g., Go ahead and do it if possible).

One striking pattern in C.G.'s repetition is that in several sentences, she was able to repeat the initial noun and its preceding modifiers, if any, but then hesitated before the verb, and sometimes was not able to repeat the VP at all, even with prompting. Underlined items in the "low probability" sentences below were repeated easily on the first try, but then C.G. paused before the verb:

- The spy fled to Greece.
- The phantom soared across the foggy heath.
- The Chinese fan had a rare emerald.
- The barn swallow captured a plump worm.
In the first of these sentences, C.G. repeated:

CG: the [s] spy?
   the spy?
   I just can't get that word, that
   the spy?

After I modelled the sentence again, she was able to repeat all of it, and then commented on her problem with the verb:

CG: It's-- it's the word
EC: 'Fled'?
CG: [fl%d]
   [flayd]
   I just couldn't get that word.

There were two sentences in the list which began with verbs: *Pry the tin lid off* and *Go ahead and do it if possible*. C.G. was not able to repeat them. In the second of these sentences, she was not able to repeat the first verb, but she did repeat *do*. This may have happened because when the sentence was modelled for her, the primary stress was on *do*. Altogether, in seven of the fourteen sentences for repetition, there were problems involving the verb. C.G. was also unable to repeat a phrase consisting of two PP's: *Near the table in the dining room*, which may also be harder to repeat than NP's.

Other attempts at repetition on this subtest triggered phonemic paraphasias, which she corrected. There were also two substitution errors with closed class items. When asked to repeat the sentence: *I stopped at his front door and rang the bell*, C.G. changed the *I* to *He* and *his* to *the*. 
It is not clear how the dimension of high vs. low probability actually affected her performance. She did have to make more attempts to repeat the low probability items, but she only received credit for three of the high probability and three of the low probability items (i.e., the same number for each type).

In sum, repetition is difficult for C.G., and her attempts to repeat are marked by long pauses, omissions, phonemic paraphasias and successive attempts to correct them, substitution errors with closed class vocabulary, noun facilitation with an impairment in repeating verbs, and a great deal of frustration and puzzlement for C.G. Repetition will be discussed in greater detail in Chapter 5.

In the naming subtests, the subject is asked (orally and in writing) the same items tested in the auditory comprehension section (objects, letters, geometric forms, etc.), with animals being added. The Visual Confrontation Naming task triggered some errors. In particular, naming of geometric forms and numbers was not very successful. Body Part Naming also triggered paraphasias, mainly phonemic ones, although C.G. was usually able to give the correct answer. Animal naming was quite poor—only 6 animals were mentioned in one minute and
a half. Responsive naming produced a few semantic paraphasias, though it was generally good. In sum, C.G. was able to get the names of most of the items, but naming often produced paraphasias.

When describing the Cookie Theft Picture, C.G. was able to name most of the items, though she did have some word-finding difficulty. Sometimes this was due to the fact that her lexical retrieval was slow. Other times she simply said "thing" or "things", so that it was not clear what she was referring to. Or she would give up, saying "just can't think of it"--a phrase she uses frequently in conversation. She also produced one circumlocution: "Here's this--for flowers", referring to the window box, and called the stool in the picture a ladder. The word-finding difficulty was so severe that she was not able to produce many complete sentences.

4.2.1.4. Reading. C.G.'s reading of words out of context was generally good on this test. She had a tendency to omit the -ing on so-called action words (e.g., dripping) when she first read them, though she could usually correct herself. The sentence reading subtest, the sentences presented were ten of the ones used earlier in that session in the phrase and sentence repetition test. She read six of the ten without error. She made one
omission error, omitting the in The spy fled to Greece. She also produced a semantic paralexia, reading argument as remark.

Comprehension of oral spelling was fair. She performed well on matching pictures with printed words. In reading sentences and paragraphs, where the subject fills in a blank by choosing one of four words presented, she did not give paralexic responses on the items she was able to answer.

4.2.1.5. Writing. This is the last of the main sections of this examination. In writing, C.G. was able to use normal movements. She copied without any problem. When asked to write the letters of the alphabet, she omitted three of them, although she had recited them in the test of automatized speech. Writing to dictation was good with letters, small numbers, and some simple words. She was able to spell orally some of the words she could not write to dictation. Written Confrontation Naming was fairly good, though as in the oral test, she failed with the word square, and also could not write circle—two crucial words in the Token Test.

In this exam, the subject is asked to write a narrative description of the Cookie Theft Picture. When asked to write about what she saw going on in the picture,
C.G. commented:

CG: Oh, gosh, there's so much to do xx xx xx--just like I can't write, I just don't know how to spell, how to write somehow-- (31 sec) I know how to write--I don't know how to write these xx (all?) I can just put the--put the right--the things that they do.

She proceeded to write some nouns, naming the items in the picture: **boy cookies jar girl mother dish towel water flowers**. She did not produce any phrases or sentences. After finishing, she said:

CG: See, I just--I can't--can't put everything down the xx (thing?) I can--I can [payt]--I can put them--I just can't put them in--order, like, uh, "The--" like: "The--The boy has something, something in there". I just can't xx xx (do that?).

It seems that she wanted to write sentences but was unable to. Her dysgraphia is quite severe, and it shows the relative preservation of nouns as compared to other word classes.

Writing sentences to dictation was also beyond her ability. When the sentence **The boy is stealing cookies** was given in dictation, she wrote only: **boy steal**. Her responses on both of these tasks give the impression of agrammatism in writing. There is no predication in the description of the Cookie Theft picture, and simple predication is all there is in the dictated sentence.
4.2.2. Semantic categories. The Boston Exam is made up of subtests which tap the individual's knowledge in the following categories: objects, letters, numbers, geometric forms, actions, colors, and body parts. Knowledge of these items is tested through the various tasks described above (naming, reading, etc.). C.G.'s performance on these items is summarized in Table 4.1.

As the table shows, objects and colors were the best preserved categories for C.G., being well retained in all modalities. Whereas comprehension of words referring to geometric forms was good, naming them was more difficult. In particular, she failed to produce the word square orally or in writing and was unable to write circle in the written naming task. It is not clear what implication, if any, this has for her performance on the Token Test. Letters of the alphabet were handled well in all tasks except Visual Confrontation Naming, Repetition, and Recall of Written Symbols: in naming and repetition, there were a few paraphasias with letters, and in writing, some letters were omitted. Numbers, especially long ones, were problematic, and also caused problems in spontaneous speech. Actions were usually understood and identified, but the -ing was sometimes omitted in reading, naming, and word-picture matching, though C.G. was usually able to correct these
Table 4.1  
Semantic Categories on Subtests of the Boston Diagnostic Aphasia Examination

<table>
<thead>
<tr>
<th>Spontaneous Speech</th>
<th>Auditory Comprehension</th>
<th>Automatized Speech</th>
<th>Repetition of Words</th>
<th>Word Reading</th>
<th>Visual Confrontation Naming</th>
<th>Word-Picture Matching</th>
<th>Comprehension oral spelling</th>
<th>Serial Writing</th>
<th>Written Confrontation Naming</th>
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<tr>
<td>Letters</td>
<td>12/12</td>
<td>11/12</td>
<td>11/12</td>
<td>2/2</td>
<td>2/2</td>
<td>2/2</td>
<td>2/2</td>
<td>2/2</td>
<td>2/2</td>
</tr>
<tr>
<td>Nos.</td>
<td>92%</td>
<td>92%</td>
<td>92%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Actions</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Parts</td>
<td>poor</td>
<td>poor</td>
<td>poor</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note: The raw scores in this table show the number of points C.G. received out of the total number of possible points for that activity. For example, 12/12 means that she scored 12 points out of a total of 12 possible points. An item is counted as correct if C.G. made a paraphasic error but then corrected herself.
errors. **Body parts** were easy on the auditory comprehension test, and while C.G. was able to name them in Visual Confrontation Naming, they triggered paraphasic errors. She also made errors in referring to body parts in spontaneous speech.

4.2.3. **Summary.** The Boston Diagnostic Aphasia Examination reveals that C.G. has good auditory comprehension. She can converse about a variety of topics and is often fluent, but runs into word-finding difficulty which hinders conversation. She uses a variety of syntactic forms, but her spontaneous utterances are not always well-formed semantically. Writing, reading, naming, and repetition are difficult challenges for her. Attempts to read sometimes result in semantic paralexias. Substitution errors occur in repetition. Phonemic paraphasias are common. In short, C.G. has linguistic difficulties typical of a conduction aphasic.

4.3. **The Token Test.** On the version of the Token Test which I administered (Section 3.3.2), the maximum possible score using pass/fail scoring (no partial credit) is 57. C.G.'s score was 21 (37% correct). Zaidel (1977) proposes a weighted scoring system where partial credit is given if part of a response is correct. I used a weighted
system similar to his, except that I scored all of C.G.'s attempted responses, not just the first, and I counted serial order errors as wrong. Using this system, C.G. received a score of 64% correct. These scores are summarized in Table 4.2. The weighted score reflects C.G.'s ability to perform on this test better than the pass/fail scoring system because the weighted system shows that C.G. understood parts of commands even though she did not always understand the whole command. Her comprehension was not all-or-nothing. While the pass/fail score indicates that she only understood 37% of the test items, in fact she performed accurately in response to 64% of the items, and this is reflected in the weighted scoring.

Table 4.2
C.G.'s Scores on the Token Test

<table>
<thead>
<tr>
<th></th>
<th>Pass/Fail</th>
<th>Weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part I</td>
<td>10/10 (100%)</td>
<td>20/20 (100%)</td>
</tr>
<tr>
<td>Part II</td>
<td>6/10 (60%)</td>
<td>28/34 (82%)</td>
</tr>
<tr>
<td>Part III</td>
<td>0/10 (0)</td>
<td>23/48 (48%)</td>
</tr>
<tr>
<td>Part IV</td>
<td>3/10 (30%)</td>
<td>50/60 (83%)</td>
</tr>
<tr>
<td>Part V</td>
<td>2/17 (12%)</td>
<td>69/134 (51%)</td>
</tr>
<tr>
<td>Total</td>
<td>21/57 (37%)</td>
<td>190/296 (64%)</td>
</tr>
</tbody>
</table>
The next table shows C.G.'s errors in the various linguistic categories in the test (in order of the percentage wrong): prepositions, color words, verbs, circle vs. square, and size (big vs. little).

Table 4.3

<table>
<thead>
<tr>
<th></th>
<th>Prepositions (n=15)</th>
<th>Color (n=105)</th>
<th>Shape (n=108)</th>
<th>Verb (n=24)</th>
<th>Size (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>correct</td>
<td>4 (26%)</td>
<td>62 (59%)</td>
<td>69 (64%)</td>
<td>15 (62%)</td>
<td>30 (97%)</td>
</tr>
<tr>
<td>wrong</td>
<td>11 (74%)</td>
<td>43 (41%)</td>
<td>39 (36%)</td>
<td>9 (38%)</td>
<td>1 (3%)</td>
</tr>
</tbody>
</table>

With commands that included prepositions (e.g., *Put the white square underneath the yellow circle*), C.G. made errors 74% of the time. As for the three categories which denote attributes of the tokens themselves, the largest number of errors involved the choice of a token of the wrong color. On 41% of the items she made errors with color words. As for shape, 36% of her responses were wrong (e.g., she pointed to a circle instead of a square). Thus, the latter category appears to be better preserved than color words. She sometimes performed a wrong action, not responding correctly to the verb. Only once did she make an error involving a word denoting size. Comprehension of such words was tested in only two of the five subparts of
this test, so the size words were used less often than the color and shape words. Still, C.G. demonstrated her comprehension of size words thirty times out of thirty-one. Clearly, her performance with size words was better than with color words and circle and square.

There are three results from this test with C.G. that need to be accounted for, since they appear to conflict with results from other tests. First, her performance in regard to color and shape will be discussed, followed by comments on problems with prepositions.

4.3.1. Color and shape. C.G.'s performance with color and shape words may seem puzzling. Before beginning the test, she named the colors of the tokens without hesitation. When the examiner pointed to the circles and asked: "What are these?", C.G. replied: "Round?" I told her that they are circles and also identified the squares for her.

This test shows that she comprehends the individual lexical items used to refer to color. Furthermore, on the Boston Diagnostic Aphasia Examination, C.G. performed well on all tasks involving colors, as Table 4.3 shows. The colors used in the two tests were not all the same—only blue and red were used in both. But the Boston did require good color discrimination, to distinguish red from pink,
and blue from purple and gray. C.G. did not make mistakes with red or blue on the Boston nor before the Token Test started, but she did in some parts of the Token Test.

C.G. demonstrated comprehension of the words circle and square on the Boston Exam, but she did not perform well when it came to naming the circle and square. It is not clear what bearing, if any, this may have had on her ability to perform on the Token Test. Several times when she repeated commands to herself she repeated them wrong, and then chose the wrong token. In those cases, her repetition and naming disabilities may have affected her performance. This will be discussed further in Section 4.3.4.

C.G. had a perfect score when asked to follow such instructions as Touch the red square, (Part I), where there were only two variables (color and shape). Therefore, if she has a comprehension deficit, it is not severe. Longer, more complex commands, such as Touch the white square and the red square, led to a decline in performance, even though she had been able to carry out each of these commands separately. When the words pertaining to size were added (Parts III and IV), as in Touch the little yellow circle, her performance declined, but not because of a specific problem in comprehending the words big and little,
since she only made one mistake in the size category during the test. Rather, when the size words were added, C.G. made mistakes in identifying color and shape. What caused her errors in regard to color and shape in the more complex commands? Why would adding the word little to a command such as Touch the yellow circle trigger erroneous choices in the domain of color or shape? The added item does increase the complexity of the sentence syntactically, adding a new slot. And it seems likely that adding new items creates greater processing demands. Other factors that could be involved will be discussed below.

4.3.2. Prepositions. It was mentioned earlier that C.G. had a difficult time with commands that contained a preposition. A prior consideration, however, is how could a person demonstrate knowledge of spatial relations using tokens when she cannot reliably identify circles and squares in those commands which do not require knowledge of spatial relations vocabulary? I therefore designed a test that is similar to this part of the Token Test, except that I used common objects, which C.G. was asked to manipulate (e.g., Put the pen between the card and the box). Both the Token Test and my test, ActPrepl, were scored in two ways, indicating whether her response was correct on the first try, and whether she was able to correct mistakes made on
the first try by trying again until she got it right. Table 4.4 summarizes the results.

Table 4.4

<table>
<thead>
<tr>
<th></th>
<th>Token Test</th>
<th>ActPrepl</th>
</tr>
</thead>
<tbody>
<tr>
<td>correct--1st try</td>
<td>3 (20%)</td>
<td>9 (60%)</td>
</tr>
<tr>
<td>correct--1st or any try</td>
<td>4 (26%)</td>
<td>14 (93%)</td>
</tr>
<tr>
<td>wrong</td>
<td>11 (74%)</td>
<td>1 (7%)</td>
</tr>
</tbody>
</table>

On the Token Test commands containing prepositions, C.G. gave the right answer only three times on the first try. Giving her a second or third chance on failed items raised her score to four correct. On the other hand, in ActPrepl, she gave nine correct answers out of fifteen on the first try (60%), and when given a second or third chance, she got five more right, for a total of fourteen correct out of fifteen (93%). Thus, giving her an extra chance (by repeating commands) did aid her comprehension or performance. Scoring only on the first try (as recommended on the Token Test) would have given a less complete picture of her abilities. I wanted to know what the limits of her comprehension ability are. If she failed on an item on the first try, that did not mean that she was completely
incapable of understanding it. I wanted to know if she was able to comprehend those commands at all. For this reason, I gave her extra tries—to find out what her best performance would be.

C.G. performed very well on this test—better than on the Token Test. Her performance was also better than her spontaneous speech would lead one to expect. She makes mistakes with prepositions in spontaneous speech, and this fact seems to be better reflected in the results of the Token Test than in the test I designed. Thus, the Token Test seems to be a more sensitive test than mine in this area. A good test of comprehension, as De Renzi and Vignolo (1962) have pointed out, is one which requires her to process the linguistic information in the command and does not allow extralinguistic factors to facilitate performance. My test may have allowed her to rely more on context and extralinguistic information, instead of relying solely on the linguistic signal presented.

4.3.3. Interference errors. Several kinds of errors recurred that deserve special mention, errors in which a lexical item in a command interfered with the correct response on another item. There were three types of interference: horizontal, vertical, and combined horizontal and vertical.
4.3.3.1. Horizontal interference. This refers to situations where the error is triggered by an item or items within the same command (not by an item in another command). There are three kinds of horizontal interference: anticipatory, horizontal perseveration, and exchange errors. Examples of each are given:

(1) anticipatory:

Target: Touch the yellow circle and the red square.

C.G.'s response: touched red circle and red square.

Here, the word red in the second half of the command is anticipated in the first half, and replaces yellow.

(2) horizontal perseveration:

Target: Touch the white square and the red square.

C.G.'s response: touched the white circle and white square.

In this instance, white in the first half of the command replaces red in the second half.

(3) exchange:

Target: Touch the little blue square and the little green circle.

C.G.'s response: touched the little blue circle and the little green square.

In this example, circle and square have exchanged places.

4.3.3.2. Vertical interference. There are two types of vertical interference: vertical perseveration and delayed reaction.
(1) **vertical perseveration:** C.G. responded to one command, and then gave the same response to the next command, where it was inappropriate.

Target: Touch the green square and the blue circle.

C.G.'s response: touched the green circle and the blue square. (exchange error)

Target: Touch the red circle and the yellow square.

C.G.'s response: same as above

(2) **delayed reaction errors:** C.G. did not respond appropriately to a given command, but then the response to that command was given on the next command:

Target: Touch the **white circle** and the blue circle.

C.G.'s response: touched the blue circle and blue square; did not touch the white circle.

Target: Touch the blue square and the **white square**.

C.G.'s response: touched the white square and the **white circle**.

4.3.3.3. **Combined horizontal and vertical interference.** Some errors appear to have resulted from both horizontal and vertical interference (i.e., interference both from a previous command and from other words within the current command). The above example of a delayed reaction is also classified as a combined interference error, since the word **white** appears in the second command, too.
4.3.4. Discussion of the Token Test results. C.G.'s errors on this test stemmed from a variety of different causes. Her comments during testing shed some light on what her problems were. She admitted to forgetting and commented that the complexity of some items made them difficult. In addition, her attempts to repeat commands misled her, due to her repetition deficit, and, as I mentioned in the preceding section, there were several sources of interference. She sometimes showed a failure to comprehend.

There are several possibilities to be considered in accounting for the pattern of erroneous responses:
(1) guessing; (2) prominence of a given item in the command due to position and/or stress; (3) failure to comprehend commands, a failure that is not triggered by the individual lexical items, but by their being combined in a sentence; (4) a memory deficit; (5) a psycholinguistic processing problem (which could also be involved in repetition errors), where the input goes in and is understood, but the information gets "sidetracked", leading to performance errors only, having no bearing on ability to comprehend and possibly leading to the interference errors described in the previous section.
(1) **Guessing.** C.G. was often unsure of her responses. And when she expressed doubts about her responses, they were wrong. As De Renzi and Vignolo (1962) note, if a person simply guesses on this test, she would have a fifty-fifty chance of guessing correctly when choosing a circle vs. a square or a big token vs. a little one, but only a 20% chance of guessing the right color, since there are five colors. C.G.'s performance in all three of these categories was better than chance, as Table 4.5 shows. But even if she did do a great deal of guessing, that would not explain much, for the next question would be: why would she have had to guess when she had already demonstrated comprehension of the color and shape words in isolation? Apparently she did not comprehend the command as a whole.

(2) **Prominence due to position and/or stress.** C.G. had no problem with commands such as **Touch the red circle.** However, as I noted earlier, when a size word was added, she made mistakes with color and shape. The question arose as to whether stress and/or position in the phrase might be factors conditioning performance. Position in the phrase can refer to whether a given item is in the first or second half of a complex command in Parts III and IV (e.g., **Touch the yellow circle and the red square**). This did not affect C.G.'s scores, as Table 4.5 shows.
Table 4.5

Position in the Phrase, Parts III and IV

<table>
<thead>
<tr>
<th></th>
<th>Errors in first half</th>
<th>Errors in second half</th>
</tr>
</thead>
<tbody>
<tr>
<td>color</td>
<td>8/20 (40%)</td>
<td>7/20 (35%)</td>
</tr>
<tr>
<td>shape</td>
<td>6/20 (30%)</td>
<td>5/20 (25%)</td>
</tr>
<tr>
<td>size</td>
<td>0/10 (0)</td>
<td>1/10 (10%)</td>
</tr>
<tr>
<td>Total</td>
<td>14/50 (28%)</td>
<td>13/50 (26%)</td>
</tr>
</tbody>
</table>

To determine whether stress might have affected performance, the transcript of this test was coded for primary and secondary stress in the examiner's speech. The difference between words with primary stress involved in errors (31%) and those with secondary stress (35%) is very small. However, shape words were more likely to have primary stress (59%) than color words (43%), probably due to their position as the final word in the NP, and that may have had a facilitating effect on her performance. This is summarized in Table 4.6. The fact that there are more colors than shapes to choose from adds an element of complexity. In sum, stress, position in the NP, and number of items to choose from may all have made it easier to choose the correct shape than to choose the correct color.
Table 4.6
Correct Scores and their Relation to Stress on the Token Test

<table>
<thead>
<tr>
<th></th>
<th>Primary stress</th>
<th>Secondary stress</th>
<th>Unstressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>color</td>
<td>26/45 (58%)</td>
<td>35/59 (59%)</td>
<td>1/1 (100%)</td>
</tr>
<tr>
<td>shape</td>
<td>49/64 (77%)</td>
<td>20/40 (50%)</td>
<td>---</td>
</tr>
<tr>
<td>size</td>
<td>1/1 (100%)</td>
<td>28/29 (97%)</td>
<td>1/1 (100%)</td>
</tr>
</tbody>
</table>

(3) Comprehension deficit. De Renzi and Vignolo (1962:667, 669) refer to the Token Test as "a sensitive test to detect receptive disturbances in aphasics" which was designed so that it would not be possible for the listener to figure out the meaning of any word she did not grasp by relying on the meanings of other words in the command. The question here is: does the Token Test detect failures to comprehend (competence), failure to demonstrate comprehension (performance) or both?

Was C.G. truly unable to comprehend most of these commands? It cannot be the case that she simply fails to understand whenever comprehension depends on "the semantic value of every single word" in an utterance (i.e., where there is no redundancy--De Renzi and Vignolo 1962:667)--this could only have occurred in the more complex utterances, since she did understand all of the syntactically simpler commands in Part I. The contrast between her performance on Part I and on the other parts of
the test indicates that her ability to comprehend or perform decreases as the material becomes longer and more complex. Sixteen of her twenty-one correct responses occurred in Parts I and II. The object noun phrase becomes increasingly more complex in Parts II, III, and IV, with the addition of an adjective preceding the color word in Part II, and the addition of conjoined NP's in Parts III and IV. The adding of information seems to be related to a decline in performance. She sometimes seemed not to comprehend the instruction, as the following example suggests:

   Target: Pick up the blue circle or the red square.

   C.G.: What?
   What?

   Ability to discriminate among similar items seems to be a factor in comprehension deficits. Butterworth (1983:284) discusses an experiment (Butterworth et al. 1982) in which aphasics who had impaired comprehension also had impaired naming ability. Such patients were able point to an orange in an array consisting of miscellaneous objects, but not in an array consisting of different types of fruit. This showed that they partially understood the word orange:

   they were able to derive some meaning from the target word but not sufficient to discriminate it from other words of similar meanings.
This shows partial but incomplete semantic processing. The Token Test is like the array of fruits whereas my preposition test (ActPrepl) is like the array of miscellaneous objects (pen, box, book). The more similar the items in the array, the more difficult it seems to be to match the incoming linguistic signal to the appropriate item. In one instance I gave her the following command:

Target: Touch the yellow circle and the red square.

C.G.: (after several pauses) Something else—something wrong with that. Was it the blue square? No, no, it's red square.

This was the first test item in that session, so she could not have been confused by a previous command when she asked about the blue square. In sum, if C.G. does have a comprehension deficit, it is not clear what is causing it, but partial semantic processing may be involved.

(4) Memory. Several times C.G. asked me to repeat a command. Sometimes she seems to have forgotten what I said, as in the following example:

Target: Touch the little green circle.

C.G.: That green or—what was it?

In most instances it is impossible to tell whether she asked me to repeat because she forgot the command or failed to comprehend it. Words denoting colors and geometric
shapes are somewhat abstract, and perhaps difficult to hold in memory.

Delayed reaction responses may be related to a memory impairment. When a delayed reaction occurs, perhaps her short-term memory has not cleared yet, so the preceding command is still there, interfering with her ability to process new input in the next command. The new input may mix with the information already in memory, creating interference.

(5) Psycholinguistic processing. Zaidel (1977:12) reports on administering the Token Test to patients who have had a cerebral commissurotomy ("split brains"). He notes the similarity between the performance of the right hemispheres of the commissurotomy patients and many aphasics on the Token Test and suggests that the right hemisphere "can and may support certain language functions" for some aphasics. He goes on to hypothesize that

some seemingly receptive difficulties of aphasics are a result of impaired speech production including subvocalization such that the auditory linguistic message cannot be stored long enough to permit proper decoding.

Presumably he means that the individual cannot rehearse the command subvocally and so it is not retained long enough in short-term memory for comprehension to be possible. In that case, the memory problem would be a
second-order effect of a primary linguistic deficit. This is similar to the view of Heilman et al. (1976), mentioned in Chapter 2, Section 2.3.1, who suggest that memory and comprehension deficits may both reflect an underlying linguistic deficit.

This is an interesting possibility, and it receives some support from my data. When C.G. attempted to repeat a command, she would often "repeat" it wrong and then make a mistake, touching the token she said instead of the one in the command given. Some of these can be called telescoping errors. For example, when asked to Touch the blue square and the white circle, she said to herself: "blue circle", retaining the color of the first half of the command and the shape in the second half. Then she touched the blue circle. There were several other errors of this type. This does not seem to indicate a comprehension deficit but may be due to a psycholinguistic processing problem. Her repetition impairment may have something in common psychologically/psycholinguistically with the impairment that led to her interference errors.

Errors involving serial order are also of interest. Exchange errors were described in Section 4.3.3.1. Aside from exchanges, on two items, she made a different kind of error in regard to order. For instance, in response to
command 25: Touch the white circle and the blue circle, she touched the blue circle first. And later, when asked to Put the blue circle under the white square, she instead put another token on top of the blue circle. These behaviors suggest some kind of problem with regard to processing involving serial order. She seems to have problems with serial order in sentence repetition, too—this will be discussed further in Chapter 5. If Warrington and her colleagues are right in claiming that auditory-verbal short-term memory is an order-based store, then a serial order problem could be related to a memory deficit, but it is still not clear whether the memory deficit in turn is caused by a linguistic impairment of the kind described by Zaidel.

4.3.5. Summary. In attempting to account for the pattern of errors involving words referring to color and shape, it appears that previous linguistic stimuli, linguistic (i.e., syntactic) complexity, primary vs. secondary stress, position in the phrase, number of tokens, memory, and serial order are all involved. Comprehension may be a complex task in which the listener draws on many different cues in order to interpret the incoming linguistic signal.
In the next chapter, I will present an analysis of data obtained from administering the Wug Test and the tests that I devised, which were described in Section 3.3.3.
NOTES

1. The Token Test, Part V, also includes a few instances of adverbs and conjunctions, a pronoun, and a negative. Since there were so few of these items, they are not included in Table 4.3.
CHAPTER V

ANALYSIS OF IMPAIRMENTS AFFECTING OPEN AND CLOSED CLASS VOCABULARY

5.1. Introduction. The data analysis in this section is based on material from several conversations, five sentence repetition tests, reading activities, and tasks requiring judgments of grammaticality. These materials include tests that I devised, as well as the Wug Test by Berko (1958) and parts of the Boston Exam. I will show that on the basis of this data, it can be said that different word classes are differentially impaired in C.G.'s language. Results of the tests will be presented and described in terms of word class and activity. The error types of primary interest are verbal paraphasias and paralexias, together with substitutions and omissions of closed class vocabulary. Her performance with open class vocabulary will be described first. This will be followed by a description of her use of the closed class vocabulary.

5.2. Open class vocabulary. Members of the open class are differentially impaired for C.G in different activities. These impairments will be described in this section in terms of word class and language modality: comprehension, speech, reading and writing.
5.2.1. **Nouns.** An interesting observation about C.G.'s language has to do with the relatively greater preservation of nouns compared to other open class vocabulary in some tasks. Although she has anomia in spontaneous speech, her comprehension of nouns appears to be quite good, and she has a somewhat easier time repeating nouns than verbs. In addition, nouns are the only kinds of words that she was able to write spontaneously. I will describe her ability to use nouns in the various kinds of tasks she performed.

5.2.1.1. **Aural comprehension.** It may be remembered from the description of the Boston Exam that C.G.'s comprehension rating was good for all categories of nouns tested. Comprehension was poorer on the Token Test. In ActPrepl (where C.G. acted out instructions that I gave her, using common objects, such as a pen and a pencil), C.G. did not seem to have any problem understanding the nouns (n=11) used.

5.2.1.2. **Spontaneous speech.** In conversation, C.G. has a moderate word-finding difficulty. Her speech is interrupted by pauses as she searches for words. She often has to abandon the search, giving up with a groan or the well-used, fluent phrase: "Just can't think of it". Other times she inserts a relatively empty word such as thing,
something, this, or there. For example, when I asked her whether she had had surgery in the hospital, she said that she did not have surgery,

CG: but they did all sort of things...One-- uh-- Tsk! Hm! (5 sec) Like this here, and something this one...

She does make some semantic paraphasic errors, though these are not common. Most often, they involve confusions such as right-left discrimination, names of body parts, and words in a series such as day-week-year, and numbers. These seem to be lexical set errors (Buckingham 1979). Occasionally she is able to correct these errors.

5.2.1.3. Confrontation naming and oral narration.
This was discussed in the preceding chapter in the section on the Boston Diagnostic Aphasia Examination (Section 4.2.1.3). As noted there, C.G. did very well on the naming of objects and colors, but poorly on animals and body parts. In attempting to describe the Cookie Theft Picture, C.G. made some of the same kinds of errors as in spontaneous speech: anomia and use of empty fillers, and she also produced one circumlocution: "Here's this--for flowers", referring to the window box, and called the stool in the picture a ladder.

5.2.1.4. Repetition. The sentence repetition tests included RI1, RI2, R3, RPro, and Section IIIE of the Boston
Diagnostic Aphasia Examination. In scoring these tests, I wanted to know what was easy for my subject to repeat and what was not. For this reason, I distinguished between items she repeated correctly on the first try and items that she had to try several times before she got them right. In addition, some items were omitted. Which of these categories a given morpheme falls into is not always clear, however. In the case of omissions, for example, morphemes may be omitted for different reasons. When asked to repeat the sentence I waited twenty minutes for the bus, on her first try she said:

CG: I waited for the
for the bus

Here, twenty minutes was clearly omitted. However, when attempting to repeat the sentence The librarian reads in her spare time, she struggled with the word librarian, and it was so difficult for her that she did not repeat the rest of the sentence. If I had assigned a score of zero to morphemes that were omitted in cases like this, that would have made it look as though it was the VP that was hard, when in fact it was librarian that caused the problem. When morphemes were omitted at the end of the sentence in situations like this, I excluded them from the tally, rather than assign them a score.
In other cases, where she got stuck, for example, before a verb, it is hard to tell whether the problem was the verb or the whole VP. For example, in attempting to repeat the sentence I saw Mary three weeks ago, she said:

CG: I
  I [s%]
  saw Mary [m] (2 sec)
  [se]
  [se]
  saw Mary. (2 sec)

At that point, I modelled the sentence for her again, and she said:

CG: I
  (sigh) Tsk!
  I can't [s]
  can't send any
  I can't say anything!

  I [he]
  I [s] saw Mary (4 sec) three weeks ago.

The question here is how to score three weeks ago, i.e., whether each of these morphemes should be given the same score. Since she does have problems with numbers, three may have been particularly difficult for her.

The same problem comes up in scoring the sentence

Tony fixes cars:

CG: [tuwniy]
  Tony (8 sec)

I
  I can't
  can't
  I can't [s] say that.
After I modelled the sentence again, she said:

CG: [to]
Tony (2 sec)
Tony [fi]
[ti]
fixes cars.

Both *fixes* and *cars* were omitted on her first attempt at repetition. However, there is no evidence that *cars* itself was difficult to repeat. It appears that once she got the verb, she was able to get the object noun, too. Thus it is difficult to say whether the problem was the verb or the whole VP.

My solution was to score each morpheme separately, based on how many attempts she made to say that particular morpheme before she got it right. If she said something correctly, then made a mistake, then got it right again, the final attempt was scored as correct. Bound morphemes were scored separately from their stems, since they could be impaired separately. If she was struggling with the stem of a word, as in *fixes* above, the bound morpheme was not considered to be omitted. Using this system, the sentence *Tony fixes cars* was scored as follows:

```
   4   5   l   l   l
Tony fixes cars
```

meaning that *Tony* is counted correct on the fourth try. It took her five tries to get *fix*, but once she got the stem, she also produced the inflection and the object noun.
Results of the sentence repetition tests are summarized in Table 5.1.

Table 5.1
Repetition of Open Class Vocabulary

<table>
<thead>
<tr>
<th></th>
<th>Nouns (n=191)</th>
<th>Verbs (n=117)</th>
<th>Adj (n=39)</th>
<th>Adv (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>correct--1st try</td>
<td>105 (55%)</td>
<td>47 (40%)</td>
<td>18 (46%)</td>
<td>7 (39%)</td>
</tr>
<tr>
<td>correct--1st or any try</td>
<td>170 (89%)</td>
<td>102 (87%)</td>
<td>36 (92%)</td>
<td>16 (89%)</td>
</tr>
<tr>
<td>wrong</td>
<td>20 (10%)</td>
<td>15 (13%)</td>
<td>3 (8%)</td>
<td>2 (11%)</td>
</tr>
<tr>
<td>not clear</td>
<td>1 (1%)</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: The second row, "correct--1st or any try" indicates the number of items C.G. was ultimately able to repeat. She was given more than one chance to repeat the targets.

C.G. appears to have some noun facilitation in sentence repetition, in that she repeats nouns somewhat better than verbs. She made the same types of errors on both nouns and verbs: semantic and phonemic paraphasias and omissions of words or just inflections. However, she repeated 55% of the nouns on these tests without error, but only 40% of the verbs (not including the copula) without error. Though this difference is small, it is nevertheless easier for her to repeat nouns than verbs. Pronoun repetition was even better (73% without error; this will be discussed in the section on the closed class vocabulary),
and this confirmed the impression I had when administering the tests that she had much more success repeating NP's than VP's. Often C.G. would successfully repeat the subject NP and then stop, pausing, or unable to proceed to repeat the V or VP. My transcriptions show that she was three times more likely to pause before a V than a N. For example, I asked her to repeat the following sentence:

Target: I filled some cups with tea.

CG: I
I (4 sec)
[☆] (3 sec)
I (2 sec)

I modelled the sentence for her again and she tried again:

CG: I cup
I
Oohh! What's [m] wrong with me. Just can't say it.

The example given above of her repetition of the sentence Tony fixes cars is similar. These examples, as well as the examples in Section 4.2.1.3, support Dubois et al.'s (1964/1973) observation that for conduction aphasics, the transition between the noun and the VP is difficult.

As I mentioned in Chapter 3, since the sentences in RII and RI2 (sentence repetition tests focusing on inflectional morphemes—see Appendix) were basically SVO, and so it was difficult to be sure at first whether she found it easier to repeat nouns and pronouns or whether it
was just easier to repeat the first constituent in a sentence. Therefore, R3 was devised, where the kind of constituent in sentence-initial position was varied: some of the sentences began with an adverb, a PP, a participle or a gerund (e.g., having finished, watching the airplane). C.G. often omitted these kinds of initial constituents and began her attempt at repetition with the subject NP, as the following example illustrates:

Target sentence: Sometimes Paul comes early.

CG: Paul comes early.
   Paul [kri] comes early.

EC: So, the whole sentence is: "Sometimes Paul comes early".

CG: Oh. Paul comes early.

It can be seen, then, that it is not just the case that she repeats the first word or phrase in a sentence. It really is easier for her to start with an NP.

5.2.1.5. Reading. Reading is not easy for C.G. When reading nouns, she makes some paralexic errors, such as those in Table 5.2.

In some of the dyslexia studies in the literature, words are given to a patient in isolation (not in context) on a card or in a list. The first item above, baseball player was presented in isolation, but the other words
were presented in sentences. So semantic substitutions can occur regardless of whether a context is provided.

Table 5.2
Paralexias with Nouns

<table>
<thead>
<tr>
<th>Target</th>
<th>Error</th>
<th>Relation between Target and Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>baseball</td>
<td>--&gt; baseball</td>
<td>superordinate/</td>
</tr>
<tr>
<td>player</td>
<td>--&gt; catcher</td>
<td>hyponym</td>
</tr>
<tr>
<td>microphone</td>
<td>--&gt; microscope</td>
<td>coordinates</td>
</tr>
<tr>
<td>ocean</td>
<td>--&gt; water</td>
<td>coordinates</td>
</tr>
<tr>
<td>argument</td>
<td>--&gt; remark</td>
<td>coordinates</td>
</tr>
<tr>
<td>opinion</td>
<td>--&gt; principle</td>
<td>coordinates</td>
</tr>
<tr>
<td>intelligent/</td>
<td>--&gt; sense</td>
<td>coordinates</td>
</tr>
<tr>
<td>intelligence</td>
<td>--&gt; sister</td>
<td>kinship</td>
</tr>
</tbody>
</table>

As Table 5.2 shows, these substitutions exemplify some of the relations between target and error mentioned in Section 1.3.2.3: superordinate --> hyponym and coordinates (Coltheart 1980b), i.e., members of the same lexical set, as described by Buckingham (1979): these are words that do not have a hierarchical relation to each other. The substitution of microscope in place of microphone could be a lexical set error and it could also be partly a visual error. The sentence she was reading here was: We are talking (at, into) the microphone, which was true--C.G. and I were talking into a microphone at that moment, though, since our sessions were all recorded using an external
microphone. But that did not seem to facilitate her reading.

5.2.1.6. **Writing.** As I mentioned in Section 4.2.1.5, C.G. was only able to list nouns when asked to write a narrative description of the Cookie Theft Picture. There were no other writing activities because her dysgraphia was so severe, and so writing will not be discussed any further except in reference to numbers (Section 5.3.3.5).

To summarize, C.G. has both anomia and noun facilitation, the latter being evident in her attempts to repeat and write. Her writing can be described as agrammatic, if this is taken to mean that it is lacking in syntactic structure.

5.2.2. **Verbs** are more impaired for C.G. than nouns.

5.2.2.1. **Aural comprehension.** On the Boston Exam, comprehension of verbs was tested using actions in the -ing form (e.g., drinking, running) and C.G. did well with these. But even if she seems to comprehend words out of context, that does not give a complete picture of her comprehension abilities or impairments, as the difference in her performance with color words on the Boston vs. the Token Tests demonstrates. Also, -ing forms are ambiguous as to word class— they can be verbs, participles, or gerunds (i.e., nominalized forms)— and so comprehension of
such forms does not necessarily imply that she comprehends verbs. She was, however, able to carry out the commands given in Section II-C of the Boston Exam (e.g., Make a fist), where the verb is a crucial piece of information. On the Token Test, Part V, she understood the verbs most of the time, and in ActPrepl she also did well with the verbs.

5.2.2.2. Spontaneous speech. Sometimes when C. G. cannot produce a verb, she uses the fillers make or do. This suggests some word-finding difficulty with verbs, analogous to her word-finding difficulty with nouns. She also makes form-based (as opposed to meaning-based) paraphasic errors, as shown in the following table.

<table>
<thead>
<tr>
<th>Target</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>find</td>
<td>feel</td>
</tr>
<tr>
<td>take</td>
<td>talk</td>
</tr>
</tbody>
</table>

5.2.2.3. Naming. Naming of actions (e.g., drinking) on the Boston Exam was good.

5.2.2.4. Repetition. As noted above, performance with verbs was somewhat more impaired than with nouns, though errors were generally of the same types: omissions and paraphasias. The noticeable difference, as was
mentioned above, was that after repeating the subject NP she would sometimes stop and ask me to repeat the VP for her, by saying something like "then what", as in the following examples:

Target: The tall mountain overlooks the valley.
CG: The tall [?n]
tall mountain (7 sec)
The tall mountain xx xx
The tall mountain-- does what?

Target: A bowling ball is heavy.
CG: The [bOling]
bowling
bowling ball-- then what?

This is not simply a matter of a memory impairment, since, as noted earlier, she sometimes skips the first constituent in a phrase and begins with the subject NP. In addition, as I noted, she was three times as likely to pause before a verb as a noun. Clearly, verbs are harder for her than nouns.

5.2.2.5. Reading. C.G. sometimes makes semantic paralexic errors with verbs, as with nouns. Examples are given in Table 5.4. These items, like most of the nouns, were presented in sentences, and they can be classed as lexical set errors.
5.2.3. Adjectives. The use of adjectives in comprehension activities, repetition and spontaneous speech will be described. There is not much data on her reading ability with adjectives in context.

5.2.3.1. Aural comprehension. It has already been observed that in the Token Test, the adjectives denoting size were well preserved, but comprehension of color words used as adjectives was impaired.

5.2.3.2. Spontaneous speech. Generally C.G. does well with adjectives, though she makes occasional form-based verbal paraphasias, such as confusing different with difficult. She sometimes pauses before an adjective, and there may be some relation between her tendency to pause before verbs and these pauses before adjectives. Buckingham (1979:273) mentions pauses in his list of manifestations of lexical retrieval disturbances.

5.2.3.3. Repetition of adjectives is slightly easier than repetition of verbs for C.G. She was able to repeat 46% of the adjectives without error. Her attempts at

| Table 5.4 |
| Paralexias with Verbs |
| **Target** | **Error** |
| talking | --> | writing |
| cools | --> | blows |
repetition are marked by phonemic paraphasias and a few omissions, and an occasional blend. For example, *a large truck* came out as: "a [lajik]".

5.2.3.4. **Reading.** The few adjectives in the Boston Exam's section on phrase and sentence reading were read well.

5.2.4. **Adverbs.** The number of adverbs in the corpus is rather small. There are no adverbs in any aural comprehension test.

5.2.4.1. **Spontaneous speech.** Adverbs were well-preserved in my conversation samples.

5.2.4.2. **Repetition.** C.G. repeated 39% of the eighteen adverbs without error. She would sometimes pause before adverbial phrases, which was similar to her reaction to VP's and PP's. She omitted a few adverbs but was able to repeat 89% of them eventually.

5.2.4.3. **Reading.** She read the few adverbs in the Boston sentence reading task well.

5.2.5. **Summary.** It can be seen from the foregoing sections that C.G.'s ability to use the sub-classes of the open class (N, V, Adj, Adv) is affected by task. Nouns appear to be well-preserved in aural comprehension and writing, and fairly well-preserved but problematic in spontaneous speech, reading, and repetition. Verbs, like
nouns, are understood most of the time, but they, like nouns, may be involved in paraphasias and paraphasias, and they are more impaired than nouns in repetition. There is not as much data on adjectives and adverbs as on nouns and verbs, but they appear to be well-preserved in spontaneous speech and reading. As for error types, paraphasic errors were made with nouns, verbs, and adjectives, and paralexia errors occurred with nouns and verbs. This section shows that C.G. has word-finding difficulty with nouns, verbs, and adjectives. Although similar kinds of errors were made with these three word classes (there is not much data on adverbs), they are not all impaired to the same degree on all tasks.

5.3. **Closed class vocabulary.** This section presents results of activities focusing on C.G.'s ability to use members of the closed class. Most sub-classes within the closed class (with the exception of numbers) were not included in aural comprehension tests, so there is no data on her comprehension of them. The sub-classes of the closed class were not all equally impaired in repetition, as Table 5.5 shows.

5.3.1. **Pronouns.** C.G.'s ability to produce pronouns varies with the activity she is engaged in. She repeats them well, but does make substitution errors.
5.3.1.1. **Spontaneous speech.** C.G. makes substitution errors with pronouns in spontaneous speech, but is sometimes able to correct them. These errors can cause confusion for her interlocutor. For example, once when she was trying to find out when I was coming back to see her, she said *they* instead of *you*, and I did not know who she was talking about at first.

5.3.1.2. **Grammaticality judgments.** In one task (JPro), C.G. was asked to make judgments about sentences, some of which contained an error in the usage of a pronoun or pronominal determiner (i.e., *her*, *his*, etc). C.G. gave correct answers for 82% of the items (eighteen out of twenty-two), (which was better than her performance with auxiliaries, to be discussed in Section 5.3.6). She corrected two of the ungrammatical sentences, but thought that the sentence: *Paul drove home with we* was grammatical. It is possible that she misheard *we* as *me* and so she may have thought it was acceptable. (She was later unable to repeat the PP in the analogous sentence: *Paul drove home with us.*) She was also unable to correct another sentence, which contained an error in person: *He underwent surgery on my heart.* She never attempted to "fix" sentences that were already grammatical, and she
<table>
<thead>
<tr>
<th></th>
<th>Pronouns (n=52)</th>
<th>Det-pron (n=30)</th>
<th>Det-other (n=82)</th>
<th>Prep (n=31)</th>
<th>Copula (n=15)</th>
<th>Aux (n=11)</th>
<th>Quant (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Correct</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st try</td>
<td>38 (73%)</td>
<td>13 (43%)</td>
<td>61 (74%)</td>
<td>11 (35%)</td>
<td>7 (47%)</td>
<td>6 (55%)</td>
<td>8 (47%)</td>
</tr>
<tr>
<td>1st or any try</td>
<td>46 (88%)</td>
<td>18 (60%)</td>
<td>71 (87%)</td>
<td>20 (65%)</td>
<td>10 (67%)</td>
<td>7 (64%)</td>
<td>15 (88%)</td>
</tr>
<tr>
<td><strong>Wrong</strong></td>
<td>6 (12%)</td>
<td>11 (37%)</td>
<td>10 (12%)</td>
<td>11 (35%)</td>
<td>5 (33%)</td>
<td>4 (36%)</td>
<td>2 (12%)</td>
</tr>
<tr>
<td><strong>Not Clear</strong></td>
<td>--</td>
<td>1 (3%)</td>
<td>1 (1%)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: The category "Det-pron" in the table refers to pronominal determiners (e.g., my, our). "Det-other" refers to determiners that are not pronominal (e.g., the).
often laughed at the ungrammatical ones. At the end of the test, though, she commented that the task was hard for her.

5.3.1.3. **Repetition.** C.G.'s repetition of pronouns was better than her repetition of most other word classes. She repeated 73% of the fifty-two pronouns correctly on the first try, and was able to get 88% of them correct on successive attempts. In a few sentences, C.G. made substitution errors with pronouns in repetition.

<table>
<thead>
<tr>
<th>Target</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>they</td>
<td>we</td>
</tr>
<tr>
<td>I</td>
<td>we (self-corrected)</td>
</tr>
<tr>
<td>I</td>
<td>he</td>
</tr>
</tbody>
</table>

5.3.1.4. **Reading.** C.G. is often able to read pronouns, but occasionally omits them or makes paralexic errors.

5.3.1.5. **Discussion.** C.G.'s performance with pronouns on my tests was unexpectedly good, in view of her errors in spontaneous speech. Perhaps I had an exaggerated sense of how bad her pronoun usage was. Or perhaps she is able to monitor her production of pronouns better in structured tasks than in spontaneous speech.
Goodglass (1968:203) reports on an aphasic who could supply the correct pronoun in a task where his attention was focused on pronouns. But when asked to attend to some other aspect of the sentence (e.g., making the sentence negative), he "exhibited much interchange of person, number, and gender of personal pronouns". C.G. may be like this patient. She may be able to monitor her speech better in a structured task than in spontaneous speech.

5.3.2. **Determiners.** Substitution errors with determiners are common in the corpus. Since C.G. is likely to substitute *the* for *her, his, and my*, I have included these words in the category of determiner. Omissions also occur, though less frequently.

5.3.2.1. **Spontaneous speech.** C.G. made some substitution errors with determiners in conversation, though she was sometimes able to correct them.

5.3.2.2. **Repetition.** In repetition activities, determiners often led to substitution errors, which C.G. did not usually correct. Pronominal determiners were her worst category in repetition, with 37% of the thirty determiners in this category not repeated correctly at all, and only 43% correct on the first try. The following table gives some examples of these substitutions involving determiners, along with their word frequency counts in
parentheses, taken from Kucera and Francis (1967).

Usually the error involved substituting a higher frequency
determiner for a lower frequency one.

Table 5.7
Substitution Errors with Pronominal Determiners

<table>
<thead>
<tr>
<th>Target</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>my (1319)</td>
<td>the (69971)</td>
</tr>
<tr>
<td>his (6997)</td>
<td>the (69971)</td>
</tr>
<tr>
<td>her</td>
<td>his (6997)</td>
</tr>
<tr>
<td>its (1858)</td>
<td>his (6997)</td>
</tr>
</tbody>
</table>

Note: In Kucera and Francis' system, the higher
the number assigned to a word, the more frequent
the word is. For example, the, with a frequency
of 69971, has a higher frequency rating than
my, which has a frequency rating of 1319.
The frequency cannot be established for
her as a determiner, since Kucera and Francis
(1967) do not distinguish between the object
pronoun her and the determiner her.

As for the eighty-two non-pronominal determiners, she
repeated 74% of them correctly on the first try, probably
because the was the most frequent one, and is very easy for
her. The was omitted a few times, but substitutions for it
were rare. On the other hand, she frequently substituted
the in place of a, the latter being a lower frequency
determiner.

5.3.2.3. Grammaticality judgments. JPro, as was
already mentioned in the section on pronouns, was made up
of sentences, some of which contained erroneous pronouns and pronominal determiners. Out of a total of twenty-two sentences on the test, C.G. judged only the following three ungrammatical of the fifteen sentences as grammatical:

*He underwent surgery on my heart.
*The policeman wore her badge.
*Paul drove home with we.

5.3.2.4. Reading. C.G. usually read determiners well (n=26), but occasionally made omission or substitution errors.

5.3.3. Quantifiers. Numbers are problematical for C.G. in general.

5.3.3.1. Aural comprehension. C.G. did not have any trouble demonstrating comprehension of numbers on the Boston Exam.

5.3.3.2. Spontaneous speech. C.G. had a great deal of trouble with numbers in conversation. For example, it was difficult for her to tell me how long she was in the hospital after her stroke, or to tell me her address.

5.3.3.3. Repetition. As the table shows, C.G. repeated the seventeen numbers and other quantifiers (e.g., many, some) without error 47% of the time, and was able to get 88% correct on later attempts.

5.3.3.4. Reading. Reading of numerals was tested in the Visual Confrontation Naming section of the Boston Exam.
C.G. was able to read only three out of the six numbers presented. Numbers consisting of three or four digits (i.e., 700, 1936, 7000) were not read correctly.

5.3.3.5. Writing. Although she had difficulty telling me her address orally, she was able to write it. She was able to write the numbers from one to twenty-one and said that doing so it was "pretty hard" but "not too bad". Writing numbers to dictation was also hard. She was not asked to write quantifiers.

5.3.4. Prepositions. The corpus of data on prepositions includes samples of C.G.'s spontaneous speech, the repetition and reading sections of the Boston Diagnostic Aphasia Examination (Sections IIIE and IIIL), Part V of the Token Test, and several of my own tests. As indicated in Chapter 3, the tests I devised to focus on prepositions included: (1) ActPrep1, an aural comprehension test, where C.G. carried out commands similar to those on the Token Test, except that common objects, such as pens and pencils, were used instead of tokens; (2) ActPrep2, where C.G. was called upon to produce prepositions to formulate commands which were then carried out by the examiner; (3) judgment tests (JPrep1 and JSL) where the task was to choose one of two prepositions presented in order to complete the sentence; and (4) several repetition
tasks. Since C.G. is not able to write sentences spontaneously, there are no writing samples bearing on prepositions.

5.3.4.1. Aural comprehension. Results of the two comprehension tests (Token Test Part V and ActPrepl) were summarized in Section 4.3.2. It was noted there that ActPrepl was easier for C.G. than the Token Test, probably because common objects were used, and that may have given some predictability to the tasks—it was not likely that I would ask her to put the box in the pencil, for example—whereas there is no such predictability on the Token Test. So ActPrepl may have made it possible for her to make use of context and extralinguistic information to aid her performance. In addition, there were four consecutive sentences which were the same except for the preposition:

Put the pencil in the box
beside
on
behind

Here, the object to be moved and the location were held constant, in order to see if this would make it easier to comprehend the preposition. (Also, the examiner unwittingly used contrastive stress on the last three prepositions.) C.G. responded correctly to all four of these on the first try.
The prepositions on and under/underneath deserve special mention. In ActPrepl, when I asked C.G. to put the book under the magazine, she instead put it on top, and was pleased and puzzled by how well she thought she had understood the command. Also, on the Token Test, when asked to put the white square underneath the yellow circle, she instead put the white square on the green circle. And when asked to put the red circle on top of the green square, she did the opposite. It is not clear whether or not this is just a preposition error. Saffran et al. (1980:234) make the interesting point that the choice of a spatial preposition has syntactic implications for what can be selected as a subject and vice versa (e.g., the star is above the circle vs. the circle is below the star.) Since these prepositions affect the choice of subject, they are functioning in a way similar to verbs, according to Saffran et al. C.G. made mistakes with under on both tests. Substitution errors with on and under recurred throughout the corpus. In ActPrepl, she also made another such error, confusing near and in, and she had difficulty comprehending between and beside on both tests.

5.3.4.2. Spontaneous speech. Substitution errors also occurred in production. In ActPrep2, C.G. asked me to put the magazine on top of the paper, but in fact she
wanted the magazine to be **under** the paper. In spontaneous speech, she does well with prepositions most of the time, but this kind of error can cause confusion for her interlocutor.

5.3.4.3. **Reading.** On the Boston Exam, in the section on oral sentence reading (IIIL), C.G. read six out of seven prepositions correctly—**all but near**. She recognized some of them as being the same items as in Section IIIE of the Boston's repetition task, which we had done earlier in the same session. It is likely that this fact facilitated her performance.

In **JPrepl**, there were some items that she read well. On other items she made paragrammatic or paralexic errors. The two paragrammatic errors involved the choice of the wrong preposition, which she read accurately. The following example will illustrate: in our sessions, we always sat on her sofa. There were photographs on the wall above us, and on the ceiling there was a row of lights. One of the sentences she was asked to read and complete was:

We are sitting (above, under) the pictures.

One might expect this to be fairly easy, since it referred to our actual location. However, she chose **above** as her answer. On the other hand, a week later,
she made the correct choice when given the sentence:

The lights are (above, under) the sofa.

One difference between the latter sentence and all of the ones on which she made mistakes with above and under, both on my tests and in the Token Test, is that the objects referred to here are stationary. Spatial relations may be easier to identify when stationary objects are involved. People and tokens, whose position in regard to other items in the environment is always relative, might be more difficult.

She also made paralexic errors. In this test, where two prepositions were presented and C.G. was asked to choose the correct one, she usually knew the answer—knew what preposition to use—but often could not tell which preposition was which on the page, i.e., could not match the written symbol with the answer she wanted to give. For example, in the sentence

She wore a flower (in, on) her hair

C.G. wanted to choose in but had to ask me which word was in so that she could underline it.

5.3.4.4. Repetition. As Table 5.5 shows, of the thirty-one prepositions in the repetition tests, C.G. repeated eleven correctly on the first try (35%). This was her poorest score for unbound morphemes. Prepositional
phrases were omitted in some of her attempts at sentence repetition. In most of the sentences in RI1 and RI2 that had a PP, the PP followed the verb. Sometimes C.G. had such a difficult time while trying to repeat a word preceding the PP that she never got to the PP. Sometimes when she failed to repeat a PP, I was not certain, therefore, whether the problem was the PP itself, or whether the sentence was just too long or complex for her to process or repeat. In R3, there were two sentences where the PP was in initial position. In one case, she omitted the PP in her first repetition attempt and started with the subject (errors are capitalized):

Target: In the morning, I brush my teeth.

CG: Uh...

WE
I brush THE
I brush my teeth...EARLY.

Her use of early here may result from both perseveration from the preceding sentence in this exercise (Sometimes Paul comes early) as well as partial preservation of the semantic content of the omitted PP. When I modelled the sentence again, she successfully repeated the PP.

In the second sentence beginning with a PP, she was not able to repeat anything at first. After I modelled the sentence again, she was able to repeat the PP. At first it was impossible for her to get started in repeating this
sentence. Hearing it a second time seemed to help, though that was not always the case for her in repetition tasks. (Note also the form-based verbal paraphasia involving the verb: become instead of begin.)

Target: In a few minutes, the show will begin.

(12 sec pause)
CG: Can't
Can't say that word (laugh)
EC: The first part?
CG: !All of [%m] xx
EC: All of it?
EC: Yeah-
EC: Ok?
CG: Any of them.
I-- it's just getting uh
getting one or two that're
then I get
then I get ok.

EC: (3 sec) Do you want me to say it again?
CG: Yeah, if you will.
EC: Ok? In a few minutes, the show will begin.
CG: In a few minutes the
the SHOWS
the show will [biyk%N]
will become
will be-

Tsk! (2 sec) Hm...(laugh)
EC: "will begin".
CG: will begin.

A few of her attempts at repetition revealed substitution errors with prepositions. For example, when asked to repeat The flying plane went behind the clouds, C.G. said before instead of behind in her first attempt at repeating, and knew that she had said something wrong. (This error is probably partly form-based as well as
meaning-based—behind and before are similar semantically, morphologically, and phonologically). When I modelled the sentence again, she tried to repeat it, but omitted the preposition altogether, then gave up. Sometimes she was not able to repeat a preposition until after several tries or could not repeat it at all.

In sum, the repetition data show that C.G. was able to repeat prepositions sometimes, but other times she omitted them or used the wrong one.

5.3.4.5. Summary and discussion. C.G.'s use of prepositions is impaired in all language modalities. Her comprehension of prepositions is better if she can rely on context than if she cannot. In spontaneous speech, repetition, and reading, she makes some substitution errors. Repetition of prepositions is not easy for her, and reading them is also quite difficult—the transcription of my reading test contains many paralexias.

The most interesting substitutions are those that occur with prepositions that have a polarity relation to each other: reversing on/on top of and under, or before and behind, or before and after. Three of her errors on my tests involved prepositions that denote the vertical dimension of spatial relations: above/on (top of) vs. under. In these three test items, under was the correct
preposition. All together in the corpus she made six errors with on top of vs. under. In all of these, she chose or said on (top of)/above, but never under.

Goodglass, Berko Gleason and Hyde (1970) tested comprehension of locative and directional prepositions in normal children (kindergarten and grades one through three), normal adults and adult aphasics (various diagnostic groups, including conduction aphasics). There was no significant difference in the order of difficulty of these prepositions for the children and aphasics. For both groups, in, on, atop, against, and under were quite easy. Children did not make mistakes with in or on, and rarely with under. The hardest prepositions were over, before, to the right of, above, and to the left of. For children and aphasics, the polarity on--under was easier than some others, such as to the right/left of.

C.G.'s problem with these prepositions is semantic/lexical, not syntactic. I am not aware of her ever using a preposition in the wrong slot in a sentence. These reversals show that C.G. does retain some appreciation (competence) for polarity relations--her substitutions in these cases were not random. What is the difference between above and under, for example? They are close semantically in that they both refer to the
vertical dimension of space, differing only in which aspect of the vertical dimension they refer to. To account for substitution errors, I am hypothesizing that C.G.'s lexical access works well up to the point where she accesses the prepositions in the lexicon, since she uses them in the appropriate slot. In the case of prepositions that have a polarity relation to each other, she does even better than that—she accesses the right pair of prepositions. But at this point the lexical access process may break down, and she seems to be impaired in distinguishing between the two words in the pair. This will be discussed in Chapter 6, in a more general discussion of lexical access.

This problem is not peculiar to prepositions. She once said going when she meant coming in a conversation with me. It is difficult to tell whether this problem is linguistic, conceptual, or both.

On the other hand, some of her substitutions do not involve polarity, as shown in Table 5.8, where prepositions error are listed, along with word frequency counts from Kucera and Francis (1967). The substituted word in such errors with prepositions was almost always a word of higher frequency than the target, according to the Kucera and Francis (1967) word list.
Table 5.8
Substitution Errors with Prepositions

<table>
<thead>
<tr>
<th>Target</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>on (6742)</td>
<td>in (21341)</td>
</tr>
<tr>
<td>on (6742)</td>
<td>to (26149)</td>
</tr>
<tr>
<td>on (6742)</td>
<td>from (4369)</td>
</tr>
<tr>
<td>above (296)</td>
<td>of (36411), on (6742)</td>
</tr>
</tbody>
</table>

In addition to the word frequency effect, there may have been other factors conditioning her performance here. The substitution of *in* instead of *on* may be influenced by the phonological similarity between these two. Semantically they may also be a minimal pair in that *in* refers to interior whereas *on* refers to exterior. Reading *above* as *of* may be phonological, while reading *above* as *on* is a semantic error. Thus it seems that semantic and phonological, and, in the case of reading, visual factors may influence her responses.

It seems that there is a fine line—if there is a line at all—between substitutions of closed class items for one another and semantic paraphasias. The latter term is usually used to refer to substitutions among members of the same lexical category in the open class vocabulary. But perhaps instead of calling these errors *paragrammatisms*, it would be better to call them *paraphasias* also. Calling
this phenomenon paraphrasmism obscures the similarity between this and paraphasias in the open class vocabulary and makes it sound as though the preposition errors are syntactic rather than semantic.

5.3.5. Copula. Instances of the copula occurred in only three activities: spontaneous speech, repetition, and reading. In conversation, she uses the copula appropriately much of the time, but errors with tense are not uncommon. Repetition of the copula was not as successful as repetition of other verbs. Though C.G. repeated more of the copulas correctly on the first try (47%), she only got a total of 67% correct (as compared to 87% of the verbs) on all tries combined.

5.3.6. Auxiliaries. Auxiliaries were tested in a variety of different activities.

5.3.6.1. Spontaneous speech. C.G. uses a wide variety of auxiliaries in conversation, with occasional errors involving tense.

5.3.6.2. Grammaticality judgments. As I mentioned in Section 3.3.3.3, there were three tests (JAux1, JAux2, and JAux3), which used fifty-two sentences with tag questions to test auxiliaries. Twenty-two sentences were grammatical, while thirty contained a violation of number agreement, tense agreement, and/or the wrong auxiliary in
the tag. Altogether, the test sentences contained thirty-three errors (three sentences contained two errors each): thirteen involving tense, eight involving number, and twelve involving the wrong auxiliary. C.G. was to decide if the sentences were ungrammatical, and correct the ungrammatical ones.

Most of the time, she recognized grammatical sentences as correct, with only one error: out of twenty-two grammatical sentences, she only judged one as ungrammatical. Her ability to recognize grammatical sentences, then, is very good.

As Table 5.9 shows, C.G. was able to correct twelve (36%) of the thirty-three agreement errors in the test sentences, and she recognized nine more of them (30%) as being erroneous, but was unable to give the correct form. Responses in this second column are not counted as wrong answers. Only the last two columns of the table show her wrong answers: there were ten errors which she failed to recognize as such, and in several cases, the form she supplied was wrong.

Tense was the most difficult category for C.G. While she was able to correct a tag with the wrong tense three times, she judged ungrammatical sentences as
grammatical seven times. In addition, she supplied erroneous "corrections" three times.

Table 5.9
Auxiliaries

<table>
<thead>
<tr>
<th></th>
<th>recognized error but unable to correct</th>
<th>error not recognized</th>
<th>correction wrong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tense</td>
<td>3</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Wrong aux</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Number</td>
<td>5</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

Note: The second column, "recognized error but unable to correct" indicates those test sentences which C.G. recognized as ungrammatical, but was not able to supply the form that would have made them grammatical. The fourth column, "correction wrong" indicates those items where C.G. tried to correct the sentence but gave a wrong form instead.

C.G. was able to correct four sentences that had the wrong auxiliary in the tag question. However, she made six errors with sentences that contained the wrong auxiliary: either she failed to recognize that the tag had the wrong auxiliary, or in making "corrections", she supplied the wrong auxiliary. For example, I gave her the sentence: *I can eat now, don't I?*. She "corrected" it so that it said: *I can eat now, shall I eat?* (this is also a tense error).
As for number agreement, she was able to correct five sentences that were ungrammatical because of violations of number agreement, and in the other three sentences with number violations, C.G. knew the sentence was wrong but could not correct it. Thus, number agreement appears to have been easier for her than the other two types of agreement.

5.3.6.3. Discussion. Several questions arise in connection with these tests on auxiliaries. First, there is the question of distractability, which was also mentioned in regard to the Token Test. There were two possible (unintentional) distractors in addition to the three variables focused on. The distractors are: (a) the proportion of grammatical to ungrammatical sentences, which was high in JAux1 and JAux2, but low in JAux3, and the latter test was easier, in that she made fewer errors and found it easier to decide on her answer; (b) the placement of the negative, in the main verb vs. the tag. In JAux1 and JAux3, the negative was in the tag, whereas in JAux2, it was in the main VP. And it was in JAux2 where she gave almost all of the responses of the type that showed that she knew the sentence was ungrammatical but was unable to correct it (see Table 5.10).
Table 5.10

Auxiliaries

<table>
<thead>
<tr>
<th></th>
<th>able to correct</th>
<th>recognized error but unable to correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>JAux1 and JAux3</td>
<td>JAux2</td>
</tr>
<tr>
<td>Wrong Aux</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Tense</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Number</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

Why was it harder to supply the correct form on the ones that she knew were wrong in JAux2 than in the other two tests? The main difference between them was the placement of the negative, but there was also a slightly higher proportion of ungrammatical sentences in JAux2 than in JAux1. It is not clear, then, whether the position of the negative made the task itself harder and functioned as a distractor. Also, the tests were administered on different days, and that may have been a factor, if, for example, she was more tired during one session than another.

C.G.'s performance on these metalinguistic tasks provides some support for Green and Howes' (1977:129) observation that conduction aphasics are not usually able to perform grammatical analyses of sentences in tests.
In sum, these tests do show a difference in difficulty involving the factors of tense and number agreement, and meaning (wrong aux).

5.3.6.4. **Repetition.** The repetition tests contained only eleven auxiliaries, six of which (55%) were repeated correctly on the first try. Successive attempts to repeat gave her a score of seven correct (64%)--one of the lowest--only pronominal determiners were lower.

5.3.6.5. **Reading.** There is little data on reading of auxiliaries, but she read the few instances in the corpus correctly.

5.3.7. **Inflections.** C.G.'s use of nominal and verbal inflections is fairly good, though she did have trouble repeating them.

5.3.7.1. **Spontaneous speech.** Inflections usually appear where required; omissions are rare. Errors in tense do occur, as noted earlier, with the copula and auxiliaries.

5.3.7.2. **The Wug Test,** developed by Berko (1958) samples a subject's ability to supply verbal, adjectival, and nominal inflectional morphemes in a sentence-completion format, using nonsense words for the most part, though a few real words are included. C.G. did fairly well, giving
acceptable answers to 63.6% of the items. Several results are noteworthy.

Table 5.11 lists the stimuli in the Wug Test that are designed to elicit nominal inflections, along with C.G.'s responses. Six out of ten (60%) of the plural inflections were supplied accurately. The syllabic form was produced only two times out of five (40%), whereas non-syllabic forms were given correctly four times out of five (80%).

For the possessive, four out of six (67%) of her answers were accurate. The syllabic form was produced correctly on one of the two items that required it, and non-syllabic forms were accurately supplied three times out of four.

Though the sample size is small, it appears that non-syllabic allomorphs are better retained for nominals (seven out of nine = 78%) than syllabic allomorphs (three out of seven = 43%).

In making the error with niz in the possessive singular, C.G. may have used a strategy where she simply repeated the stimulus item in the test sentence (in the first column) as her response. The test sentence for this item says: This is a niz who owns a hat and C.G. called it the "[niz] hat". For her correct answers with the possessive, (except the singular of wug), she could have
used the same strategy, but for these ones it worked, because the plural form in the test sentence and the possessive form required as a response are homophonous.

Table 5.11
Nominal Inflections in the Wug Test

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Target</th>
<th>C.G.'s Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>voiceless</td>
<td>heaf</td>
<td>heafs, [hiys]</td>
</tr>
<tr>
<td></td>
<td>heaves</td>
<td></td>
</tr>
<tr>
<td>voiced</td>
<td>wug</td>
<td>wugs</td>
</tr>
<tr>
<td></td>
<td>tors</td>
<td>wugs</td>
</tr>
<tr>
<td></td>
<td>luns</td>
<td>lugs, luns</td>
</tr>
<tr>
<td></td>
<td>cra</td>
<td>[kra, kr@chiz, krach]</td>
</tr>
<tr>
<td></td>
<td>gutch</td>
<td>gutches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>gutch (rejected correct form)</td>
</tr>
<tr>
<td></td>
<td>kazh</td>
<td>[k@chi, k@ch%z]</td>
</tr>
<tr>
<td></td>
<td>niz</td>
<td>[nigz, nik, niz, niz, [k@chi, k@ch%z], niz, nigziz, nigz, nigz, nigziz, nigziz, nigz, n%gz, niks, niygz]</td>
</tr>
<tr>
<td></td>
<td>tass</td>
<td>[t@, t@s]</td>
</tr>
<tr>
<td></td>
<td>glass</td>
<td>[gl@s%]</td>
</tr>
<tr>
<td></td>
<td>glasses</td>
<td></td>
</tr>
<tr>
<td>Possessive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>voiceless</td>
<td>bik</td>
<td>bigs, big, bik</td>
</tr>
<tr>
<td></td>
<td>biks</td>
<td>biks', bikses'</td>
</tr>
<tr>
<td></td>
<td>wug</td>
<td>wig, wug, wug's</td>
</tr>
<tr>
<td></td>
<td>wugs</td>
<td>wugs', wugses'</td>
</tr>
<tr>
<td></td>
<td>niz</td>
<td>[ni], niz</td>
</tr>
<tr>
<td></td>
<td>nizzes</td>
<td>[n@, niz, nijiZ], nizzes'</td>
</tr>
</tbody>
</table>

Note: C.G.'s responses are given in regular orthography unless there is an error, in which case, phonetic symbols are used.
Table 5.12

Verbal Inflections in the Wug Test

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Target</th>
<th>C.G.'s Response(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pres (n=2) (syllabic)</td>
<td>naz</td>
<td>nazzes</td>
</tr>
<tr>
<td></td>
<td>nazzing</td>
<td>did [baz]</td>
</tr>
<tr>
<td></td>
<td>loodge</td>
<td>(perseveration</td>
</tr>
<tr>
<td></td>
<td>loodging</td>
<td>from previous item)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>does [luwjiy]</td>
</tr>
<tr>
<td>Pres Prog (n=1)</td>
<td>zib</td>
<td>zibbing</td>
</tr>
<tr>
<td>Past (n=9) voiceless</td>
<td>rick</td>
<td>ricked</td>
</tr>
<tr>
<td></td>
<td>ricking</td>
<td>he did, too (2 x);</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[rikig], [rikiy]</td>
</tr>
<tr>
<td>voiced</td>
<td>spow</td>
<td>spowed</td>
</tr>
<tr>
<td></td>
<td>spowing</td>
<td>he's doing now spowing,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[st-, sto', sowing, sto]</td>
</tr>
<tr>
<td>syllabic</td>
<td>mot</td>
<td>motted</td>
</tr>
<tr>
<td></td>
<td>motting</td>
<td>[mey%, ma, mapping,</td>
</tr>
<tr>
<td></td>
<td>bod</td>
<td>bodded</td>
</tr>
<tr>
<td></td>
<td>bodding</td>
<td>motting, did motting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>did some--did bodding,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bodding, did bodding,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>did some bodding</td>
</tr>
<tr>
<td>voiced regular/ irreg</td>
<td>gling</td>
<td>glinged,</td>
</tr>
<tr>
<td></td>
<td>glissing</td>
<td>did glissing</td>
</tr>
<tr>
<td></td>
<td>clang</td>
<td>glinged, did glissing</td>
</tr>
<tr>
<td></td>
<td>bang</td>
<td>binged, did binging</td>
</tr>
<tr>
<td>irreg</td>
<td>ring</td>
<td>rang                          ringing, was also</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ringing, was also</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ringing, was also</td>
</tr>
</tbody>
</table>
|          |        |                       ring
It appears that she tended to use such a strategy where the syllabic form of the plural or possessive was required or optional.

Regarding verbal inflection, there is a surprising preponderance of -ing forms in her responses. Although only one of the eleven verb forms on the test required an -ing form (present progressive), C.G. used -ing with ten of them (see Table 5.12).

There are two test sentences in which the third person singular present tense inflection can be used (the syllabic allomorph), but C.G. substituted -ing instead. As for the past, the various allomorphs of the regular past tense inflection can be used seven times in the test, although two of the verbs, bing and gling, can also be treated by a subject as irregular in the past. The verb ring, of course, has an irregular past form. But C.G. did not use these morphemes, choosing instead to respond with the progressive form when a word called for a tense inflection, past or present (with the exception of an item designed to elicit the past form of melt, which she supplied correctly).

The only time C.G. used the regular past tense morpheme was with a real word (melted). She used verb phrases of the form Aux V+-ing (where Aux was does, did, or
was) with all nonsense verbs and the verb ring. These
responses are not wrong (except in one case where she used
the wrong Aux), but they are curious. It appears as though
she was avoiding the regular past tense inflection and the
present tense inflection. The Wug Test contains only a few
instances of each of these morphemes, so the sample is
small. Nevertheless, the pattern of her responses suggests
an avoidance or neutralizing of past and present endings by
using -ing forms. She was usually able to use the
auxiliary to signal tense, instead of using the present or
past suffixes on the verb stem. One wonders whether the Aux
V+-ing construction was easier to produce than these
suffixes. It is known that -ing is well-preserved for
aphasics (De Villiers 1978). It is a frequently occurring
morpheme, and is invariant morphophonemically.

It is possible that C.G. used a strategy here of
combining elements of the test sentence to form her
response in many of the test items, similar to a strategy
she appeared to be using with nominal inflections. For
example:

This is a man who knows how to gling. He is
glinging. He did the same thing yesterday.
What did he do yesterday?

C.G.: Yesterday he did-- glinging.
The words *did* and *glinting* occur in the test sentence, which was presented to her orally. She was also able to see the test sentences. Her answers could have been based on what she heard me say and/or what she read.

C.G. did not supply the comparative *-er* or the superlative *-est* on the only test item that called for them. She instead used *more* plus adjective for the comparative; she did not use any form of the superlative. This use of *more* seems similar to the strategy of using *Aux V+-ing* with verbs. Inflectional suffixes are avoided in both situations, in favor of forms supplied in the test sentences.

It is possible that C.G. adopted this strategy in order to deal with nonsense words and irregular forms. She performed correctly on two of the three real words in the test, giving the plural for *glass*, and the past for *melt*, both of which are regular and take the syllabic allomorph of the morpheme in question.

De Villiers (1978:136) observes in her study of inflections in aphasic speech that aphasics' performance is about the same for syllabic and non-syllabic allomorphs. Goodglass and Berko (1960) report similar results. Goodglass, Quadfasel, and Timberlake (1964) report that fluent aphasics had somewhat more difficulty with syllabic
allomorphs of the plural, past, and present tense, and so did their nonaphasic brain-damaged control subjects and the children studied by Berko (1958). The opposite trend is found for Broca's aphasics. Goodglass (1968:188) hypothesizes that the syllabic allomorph is easier for Broca's aphasics because of its "phonological prominence", but this does not have a facilitating effect for fluent aphasics. De Villiers (1978:135-6) suggests that "overall frequency of use might render some morphemes more resistant to disruption than others" and that in the speech of the aphasics she studied, "the frequency of contexts for syllabic allomorphs was very low". So it is possible that frequency is a factor influencing which allomorphs of inflectional morphemes are better preserved for fluent aphasics.

It is not clear from these results whether C.G.'s word-formation rules are normal, or whether she simply has trouble applying them when presented with nonsense words. Conduction aphasics are said to have particular difficulty with nonsense words (Saffran and Marin 1975; McCarthy and Warrington 1984).

The inflectional morphemes just discussed were tested more thoroughly in repetition and judgment tasks, to be presented next.
5.3.7.3. **Grammaticality judgments.** Two tests of ability to recognize inflections were administered, with different formats (JI1 and JI2). In the first, twenty-five sentences were presented, fifteen of which were ungrammatical because of erroneous use of inflections. C.G. was asked to read them, and correct them if necessary. This task was difficult for her. She did recognize nine of the ten (90%) grammatical sentences as being grammatical, but only recognized seven of the fifteen (47%) ungrammatical sentences as being ungrammatical. She mistakenly marked eight ungrammatical sentences as grammatical, but this fact may not be meaningful, because sometimes she misread a sentence, correcting the error when she read it, and then thought the sentence was correct. For example, when given the sentence: *The old sailors watches the ships,* C.G. read it as

> Those old sailor watches the ships,
> The sailor watches.

and then marked it correct. The results of this test are difficult to interpret because her reading problems may have interfered too much to allow one to gain an accurate view of her knowledge of inflections.

The other test, JI2, may have been better because of the format: she was given a choice between two possible answers: The student (raised, raise) his hand. This focused
her attention on the inflections. Of course, with this format, the subject also has a fifty-fifty chance of guessing the right answer. The same sentences were used on both tests, but the format was different, and they were administered on different days. C.G. got 88% of the items in JI2 right. Thus, she seems to know when inflections are needed in the simpler of the two tests.

JI3 used the same format as JI1, but this time I read the sentences to her. She gave correct answers 81% of the time. In this test, the plural was the easiest inflection, followed by the third person singular present, the possessive, and the regular past. Syllabic and non-syllabic allomorphs were equally difficult.

5.3.7.4. Reading. Inflectional morphemes in the Boston Exam's Phrase and Sentence Reading task were read correctly.

<table>
<thead>
<tr>
<th>Inflections</th>
<th>Number corrected</th>
</tr>
</thead>
<tbody>
<tr>
<td>plural (n=10)</td>
<td>9 (90%)</td>
</tr>
<tr>
<td>present (n=8)</td>
<td>7 (88%)</td>
</tr>
<tr>
<td>possessive (n=9)</td>
<td>6 (67%)</td>
</tr>
<tr>
<td>past (n=11)</td>
<td>6 (55%)</td>
</tr>
</tbody>
</table>
5.3.7.5. Repetition. C.G.'s repetition of inflections is often accurate, but she sometimes omits them or makes substitution errors (e.g., using the wrong tense). She also sometimes adds an inflectional ending to a word other than the inflected word in the target sentence. For instance, when asked to repeat the sentence: Tony's father gave him some candy she said: "Tony's fathers" and when asked to repeat five cats, she said: "fives cats". This pattern of paragrammatism has been also observed by Obler (1983) in the language of dementing patients.

The following table shows the relative preservation of inflectional morphemes in C.G.'s repetition attempts.

<table>
<thead>
<tr>
<th></th>
<th>Plural (n=37)</th>
<th>Poss. (n=8)</th>
<th>-ing (n=7)</th>
<th>Present (n=23)</th>
<th>Past (n=39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>correct-- 1st try</td>
<td>26 (70%)</td>
<td>1 (13%)</td>
<td>5 (71%)</td>
<td>15 (65%)</td>
<td>21 (54%)</td>
</tr>
<tr>
<td>correct-- any try</td>
<td>32 (86%)</td>
<td>4 (50%)</td>
<td>5 (71%)</td>
<td>21 (90%)</td>
<td>30 (77%)</td>
</tr>
<tr>
<td>wrong</td>
<td>5 (14%)</td>
<td>3 (37%)</td>
<td>2 (29%)</td>
<td>1 (5%)</td>
<td>6 (15%)</td>
</tr>
<tr>
<td>not clear --</td>
<td>1 (13%)</td>
<td>--</td>
<td>--</td>
<td>1 (5%)</td>
<td>3 (8%)</td>
</tr>
</tbody>
</table>

If one looks at correct repetition on the first try, then the hierarchy of retention of these morphemes is as
follows (from best to worst):

\[-\text{ing} \quad \text{Plural} \quad \text{Present} \quad \text{Past} \quad \text{Possessive}\]

When subsequent attempts at repetition are taken into account (the row marked "correct, any try"), the hierarchy changes:

\[
\text{Present} \quad \text{Plural} \quad \text{Past} \quad -\text{ing} \quad \text{Possessive}\]

The same kinds of errors occurred on nominal inflections as on verbal inflections.

5.4. Factors affecting repetition. In the literature, various factors have been mentioned that may affect repetition in conduction aphasia, such as a memory impairment, an encoding deficit, word or sentence length, word frequency, and word class. Comprehension (decoding) and word order problems could also be involved. These variables will be discussed in this section. Observations on comprehension, memory, and encoding deficits are anecdotal, based on C.G.'s comments during our sessions. I analyzed the data from the sentence repetition tests in terms of word and sentence length, word frequency, and word class.

5.4.1. Comprehension. It is not clear what the implication of noun facilitation would be for comprehension and repetition. If it is the case that it is easier to repeat what one understands, and if one repeats nouns
better than verbs, then it is possible that it is also easier to understand nouns than verbs. However, it is not clear that C.G.'s problem in repeating verbs is due to a lack of comprehension.

On some occasions, when asked to repeat a sentence, C.G. could not even start. On one such occasion, I asked her to paraphrase the sentence she could not repeat and she was able to do so. This shows that, at least in this instance, her inability to repeat did not stem from lack of comprehension. In view of her performance on the Token Test, a comprehension problem cannot be completely ruled out, though the sentences in the repetition tasks may have been easier to process than those in the Token Test.

5.4.2. Word order and memory. I asked if she had trouble remembering the sentence to be repeated and she said that sometimes she could not remember, but most of the time she had another difficulty which was hard for her to explain. It seemed to have something to do with putting the words together in the right order—she complained that she gets the words "in the wrong place". When I asked her what she meant, she said:

CG: Sometimes I've got 'em black an' back an' black back back and forth, you 'know.
On another occasion, she said: "I get something before the other way". These remarks suggest an ordering problem which could be part of a syntactic deficit, but could also be partly a memory deficit, if, as Warrington and her colleagues claim, short-term memory is an order-based store.

5.4.3. Encoding. C.G. often expressed frustration about repetition tasks. She would remark on the fact that things that were hard for her to repeat should not have been hard, so it seemed that she understood them. She would often say something like: "I try to think of something--I just can't say it". This gives the impression of an encoding problem, such as that suggested by Dubois et al. (1964/1973).

5.4.4. Word or sentence length. This factor alone does not account for C.G.'s repetition deficit. The few words that do have three or four syllables were somewhat difficult for her--she rarely got them right on the first try. But there are not many words of three or more syllables in my corpus. Of the sixteen three-syllable words in the repetition data, she only repeated three on the first try, and she was not able to repeat one-fourth of them at all. She repeated four of the five four-syllable
words. In the Boston Exam's sentence repetition test, the low probability sentences usually have one- or two-syllable words—only one had a three-syllable word (i.e., argument), and she repeated that word on the first try. Yet the low probability sentences were quite difficult for C.G. Since she often made errors with one- and two-syllable words in all of the repetition tests, number of syllables in a word does not account for her repetition difficulty.

Of the one hundred twenty-eight sentences in the repetition tests, C.G. repeated twelve (9%) without error. These sentences are listed in Table 5.15. The numbers above the words are word frequency counts from Kucera and Francis (1967).

It can be seen that these twelve sentences vary along several dimensions. In terms of length, they range from three to seven words, and from three to eight morphemes. The shortest sentence has three words/three morphemes, and the longest has seven words/eight morphemes. As for word frequency, the range is from a frequency of 1 (robs) to 69,971 (the).

The other one-hundred sixteen sentences range in length from three words to nine words, and from three morphemes to eleven morphemes. The shortest is three
Table 5.15

Sentences Repeated without Error

<table>
<thead>
<tr>
<th>Test</th>
<th>Sentence</th>
</tr>
</thead>
</table>
| RI2  | 10595    8 1 37  
      | That thief robs banks. |
|      | 74 43 2619  
      | Nobody believes him. |
|      | 8756 4 3001 686  
      | It rained all day. |
| R3   | 69971 44 103 10099 63  
      | The washing machine is broken. |
|      | 69971 197 3292 10099 59  
      | The red one is mine. |
|      | 69971 660 59 10099 10  
      | The old tree is blooming. |
| RPro | 362 72 6997 60  
      | John broke his nose. |
|      | 2859 20 3037 148  
      | She brushed her hair. |
|      | 69971 242 10099 173 9489 6997 193  
      | The boy is looking for his book. |
| Boston | 3286 683 834  
       | You know how. |
|      | 13 4393 3  
      | Limes are sour. |
|      | 5173 482 547 4369 760  
      | I got home from work. |

Note: Kucera and Francis (1967) do not actually give a frequency rating for *limes*, only for the singular, *lime*, so that is what is given in the table.
words/three morphemes (He drove home), and the longest is nine words/eleven morphemes (There are too many cars in this parking lot). This sentence was unusually long. Most of these sentences had no more than seven words/eight morphemes. The number of words and morphemes is comparable in the twelve sentences listed in Table 5.15 and in the other sentences in the repetition tests. In sum, word and sentence length do not seem to determine success in repetition, although three syllable words may be difficult.

5.4.5. Word frequency. One problem in looking at the effect of word frequency on sentence repetition is determining the frequency of words. For example, in my repetition tests, saw is used as a verb. But when a word like saw is listed in Kucera and Francis (1967), one cannot tell whether it is a noun or a verb—in fact, it is probably both. This is not a satisfactory method of rating word frequency. In addition, words like lowers and lowered have different frequency ratings. C.G. attempted to repeat the word lowered but instead said lowers. It is difficult to know what frequency rating should be assigned—the frequency of the target or of the error? I have used the frequency rating of the target in looking at the effect of word frequency, since that was what she was asked to repeat. C.G. was able to repeat some nouns and verbs of
low frequency, but had difficulty with others. On the other hand, many of the nouns and verbs she did not repeat at all were low frequency words. However, she sometimes omitted closed class items which are very high frequency words (e.g., is and a). So frequency cannot account for all of the variation.

5.4.6. Word class. This appears to be an important factor in repetition. My results support the observations about word class and repetition reported in the literature in Chapter 1 (Goldstein 1948; Goodglass and Kaplan 1972; Caramazza et al. 1981). My patient, like Goldstein's, found it easier to repeat nouns than verbs. And like Caramazza et al.'s patient, C.G. repeated nouns better than function words. Dubois et al. (1964/73:287-8) attribute the conduction aphasic's problem to a change in the information value between the noun and the VP in spontaneous speech:

the conduction aphasic finds transitions between noun and verb phrase...difficult if not impossible.

This problem also seems to occur in repetition, as I noted in Section 5.2.1.4.

5.5. The lexicon and semantic organization. C.G. does spontaneously produce semantically anomalous utterances at times. During one of our sessions, her son-in-law came in
wearing a yellow raincoat. C.G. said to him: "You gonna rain or you gonna sun?". This remark suggests the presence of a semantic deficit as well as a syntactic deficit, since sun is in a slot where a verb is required. On the other hand, since she does produce antonyms, hyponyms, superordinates and coordinate words in her word substitutions, the organization of the lexicon cannot be completely disrupted. The paraphasias, paralexias, and substitutions of closed class items for one another suggest the presence of a disturbance of lexical selection, which I will discuss further in Chapter 6.

5.6. Summary. The data reported in this chapter show that different word classes are differentially impaired in C.G.'s language system, and performance also appears to depend on the task at hand. Structured tasks allow for more "monitoring" than spontaneous speech, and this may have been a factor in the results of some of my tests. In repetition, as I suggested at the end of Chapter 2, there may be several factors operating. A memory impairment may be involved. Encoding the intended message seems to be difficult at times. There is also a linguistic impairment that is reflected in greater difficulty in producing members of some word classes than others.
In the open class vocabulary, nouns are impaired in naming, and while C.G.'s anomia causes her a great deal of frustration, nouns do not seem to be as difficult to repeat as verbs. In the closed class vocabulary, there are more instances of substitution errors than omission errors. Some members of the closed class are better preserved than others. It appears that lexical substitutions with the open class (semantic paraphasias and paralexias) and with the closed class ("paragrammatic" substitutions) are similar and may result from the same underlying mechanism—an impairment in lexical selection and/or retrieval. This will be discussed further in the next chapter.
1. Clark (1974) has studied strategies used by children in a test of comprehension of the prepositions in, on, and under. She found that children use two rules: If one of two items is a container, then the other goes inside it, and if one of two items has a flat surface, the other goes in it. Seron and Deloche (1981), in a study of comprehension found that aphasics do not use the same strategies, and there is no support for a regression hypothesis which would hold that aphasics regress in such a way that their behavior corresponds to the developmental stages of children.

2. C.G. never chose under as her response. This suggests that some members of these antonymic pairs of prepositions may be more marked than others.

3. Twenty-seven of the ungrammatical sentences contained only a single agreement violation. Three others contained compound violations involving both tense and the wrong auxiliary, as in *You are living in Hawaii Kai, didn't you?. Although there are thirty ungrammatical sentences, there are thirty-three errors designed into the tests: thirteen violations involving the wrong tense, eight violations involving the number agreement, and twelve
violations involving the wrong auxiliary. C.G. sometimes made compound errors, where the "corrected" form she supplied was wrong in terms of being both the wrong auxiliary and the wrong tense. For this reason, the number of errors in Table 5.9 is higher than the number of errors designed into the tests.
CHAPTER VI
LEXICAL SELECTION DISORDERS

6.1. Introduction. In this chapter, I intend to show that anomia, semantic paraphasias and paralexias, and substitutions of closed class vocabulary are all the result of a similar disorder: they reflect impaired ability to access lexical items. Lexical substitutions with both the open and the closed class are due to selection errors.

A model which could account for these kinds of problems would need to include a mechanism for how open and closed class vocabulary are accessed. Ideally a model that can account for normal language production and normal speech errors would also be able to account for aphasic errors, at least those that are similar in kind to normal speech errors. It would need to account for failure to retrieve a word (anomia), use of fillers (e.g., thing) in place of substantives, as well as meaning-related substitutions. In order to achieve this it would be necessary to relate aphasic errors to normal speech errors. The purpose of this chapter is to offer an account of these phenomena in terms of a model of lexical retrieval.

which normal speech errors and aphasic errors relate to each other. His approach is to see how aphasic errors can be accommodated to his model of normal language production, which was developed mainly in the course of studying normal speech errors and is based primarily on patterns in these errors. I will first describe Garrett's models for sentence production and lexical retrieval, and then discuss their applications to aphasic errors.

6.2.1. Sentence production. Garrett (1981:11) has developed his model based on the belief that:

If speech error patterns are taken to reflect normal processing structure, the properties of error types and their interactions should tell us what structures are being computed by the system at given points in the elaboration of a sentence.

In his working model, there are three sets of processes: conceptual, linguistic (sentence level), and motor. Garrett (1981:3) defines language production as:

the development, under message level control, of sentence level representations that are sufficient to determine an appropriate control structure for articulation.

The conceptual level is called the message level. The message level is concerned with processes that are based on the speaker's knowledge of the world and affective state. This level may not be linguistic (Garrett 1980:216). According to this model, the vocabulary used in mapping the message level onto the functional level is the surface
vocabulary of the language (Garrett 1982:26), i.e., the system is not based on semantic features.

Sentence production involves the functional, positional, and phonetic levels. The mapping from the message level to the functional level involves logical and syntactic processes and leads to the "first specifically linguistic structures" (Garrett 1981:5). The functional level is said to be a "syntactic and/or logical level" (Garrett 1981:20). Three aspects of sentence planning are carried on at the functional level: lexical identification based on meaning for the open class vocabulary (6), selection of functional structures (i.e., predicate-argument structures (Menn et al. 1982:6)), and the assignment of selected words to functional structures (Garrett 1982:67). These "planning modes" have been postulated on the basis of two kinds of normal speech errors: substitution of one word for another, where the target and the error are related in meaning, and exchanges of words between phrases (Garrett 1981:5):

meaning-based substitution: "He rode his bike to school tomorrow", where the speaker meant to say yesterday.

(This is similar to a semantic paraphasia.)
word exchange error: "I have a pinched neck in my nerve."

Words exchanged in this fashion are those that have a "corresponding grammatical role" in different phrases (Garrett 1981:6) but are usually in the same clause (Garrett 1980:193).

At the functional level, planning involves more than one phrase, as exhibited in the word exchange above. The functional structures are planned in the order that corresponds to the sequence of verbs and their arguments on the surface, and planning proceeds "underlying verb group by underlying verb group" (Garrett 1981:7). On the basis of speech error data, it appears that people may process two verb groups at a time. The functional level representation is syntactic (Garrett 1982:67).

Whereas the functional level is logic-oriented, the positional level is pronunciation-oriented. The positional level involves retrieval of the phonological forms of words, determination of surface structure, assignment of lexical items to their positions, and the assignment of closed class vocabulary. The representation is phonological (Garrett 1982:67). At this level, unlike the functional level, planning is said to involve single phrases, based on the observation that errors here occur within a single phrase. At this level, "the serial order of
words and some aspects of their form are specified" 
(Garrett 1980:190). Several kinds of errors led Garrett to postulate this level:

1. **form-based word substitutions** *(not meaning-based)*
   
   (the intended target is in parentheses):
   
   "a slip which **considered**..."  (consisted)
   
   "people who have never sat
   
   on an **envelope**"  (elephant)

2. **sound exchanges**
   
   "**spictly streaking**"  (strictly speaking)

3. **stranding exchanges** (where stems are exchanged, leaving affixes behind)
   
   "You have to **square it facely**"  (face it squarely)
   
   "It waits to pay"  (pays to wait)

4. **word and morpheme shifts**
   
   "**What do you attribute**
   
   to your longevity"  (your longevity to)

Lexical retrieval at this stage is based on initial sounds, number of syllables, and stress. This claim is based on form-based word substitutions like (1) above.

A phonetic level is postulated in order to account for the fact that erroneous forms produced conform to the phonological constraints of the speaker's language. For example, in the utterance: "**What that add upg to**" (target:
adds up), the suffix changes from [z] in adds to [s], assimilating to the [p] in up. This shows that when shifts and sound exchanges occur at the positional level, "the phonetic character of elements subject to regular phonological processes remains to be specified" (Garrett 1981:11). The phonetic level accounts for such adjustments.

The different levels (i.e., message, functional, positional) are posited in this model because "the constraints on the errors which characterize the processing levels are disjoint" (Garrett 1981:11). Word exchange errors occur between phrases but sound exchanges are within a phrase. Word exchanges do not involve similarity of form between the items exchanged, whereas sound exchanges and most stranding errors do involve similar forms. It is not clear from Garrett's description what kinds of errors occur at the message level, though Menn et al. (1982:8-9) speculate that meaning-based word substitutions could occur in the process of formulating the message or in lexical identification, which is part of the mapping from the message level to the functional level. This will be discussed below in the section on semantic paraphasias.

6.2.2. Lexical access. In the sentence production model outlined above there are two levels at which lexical selection is said to occur (this is the "double retrieval"
hypothesis): at the functional level, where the meaning of open class vocabulary is chosen, and at the positional level, where the phonological forms of the open class are specified and where closed class items are assigned their position. Different kinds of lexical selection processes occur at these two levels, reflecting the different kinds of speech errors, as discussed above. Garrett (1980:200) notes that "specific lexical identity is required at the functional level" and that

features of lexical description which bear upon meaning relations and upon syntactic environments in which a word can appear must be available at the functional level (or some higher level).

Garrett emphasizes the difference between meaning and form in lexical access and sentence construction. The dissociation between meaning and form is reflected in the production model by the fact that the message level connects only to the functional level, not to the positional or any other level. The dissociation between meaning and form is also represented in the model by the fact that the meaning of open class vocabulary is selected at the functional level, but the phonological forms are retrieved at the positional level (Garrett 1980:200; 1981:5, 7, 21). The model is summarized in Figure 4.
Figure 4. Merrill Garrett's Language Production Model

The model for lexical access in speech production (Garrett 1981:21ff) has six steps which, he implies, occur in sequence:

(1) A word is identified on the basis of meaning;
(2) The word is assigned to a functional structure role;
(3) The segmental specification of the word is retrieved by way of a "linking address" which is given in step (1). Words can be accessed on the basis of the first sounds, number of syllables, and stress placement.
This segmental information is assigned to a phrasal frame position;

(5) Phonetic detail is specified, through regular phonological processes;

(6) Motor programming is carried out.

The models described in these two sections will be discussed next in relation to aphasic errors.

6.3. **Aphasic errors and normal speech errors.**

Similarities between normal speech errors and aphasic errors have been described in the literature. Buckingham (1980) attempts to demonstrate that there are many similarities between aphasic errors and normal speech errors, and that data from both populations can give insights into language processing. His discussion of lexical errors is relevant here. In this kind of error in both populations, the substituted forms are nearly always members of the same word class as their targets (200). According to Nooteboom (1969, cited in Buckingham 1980:200), this happens in normal errors because the syntax of the phrase involved restricts lexical selection. This would mean that faulty lexical selection occurs either at the same time as or after the phrasal frame has been specified. Buckingham (1980:205) agrees with Fromkin
(1971:49) and Fay and Cutler (1977:508-9) that a model is needed that includes a level where syntax, semantic features, and intonation are specified before the phonological representations of words are specified, in order to account for the fact that lexical errors are constrained by word class and stress.

According to Garrett (1981:26), the relation between normal and aphasic errors is such that:

The general pattern is for an [aphasic] error mechanism to display itself as a pronounced exacerbation of the normal error mechanism. In aphasia, he observes, one can find higher-than-normal numbers of segment selection errors, anticipation or perseveration errors in words and sounds, lexical selection errors that are meaning-based or form-based, and blends. So there are quantitative differences between normal and aphasic errors, implying that aphasics make more errors per number of words produced than normal speakers do.

To summarize, regarding the relation between normal speech errors and aphasic errors, Buckingham (1980:217-8) notes:

if slips of the tongue data (which demonstrate separate disruptability of function in non-brain-damaged subjects) have relevance for the study of the levels and mechanisms of the mental grammar, and if data from aphasia correlate closely with that of slips, then it follows that the study of aphasia can reveal something about
the units of the mental grammar and how they are readied and executed for normal speakers.

6.4. Errors with the open class in aphasia. This section is concerned with relating the phenomena of anomia (complete failure to retrieve a lexical item) and semantic paraphasias and paralexias (retrieval with substitution errors) with the open class to models of lexical retrieval. Particular aphasic behaviors can be described in terms of particular stages of language processing. An issue that arises in connection with these models is how to characterize the vocabulary in the mental lexicon. While some approaches, such as that of Katz and Fodor (1963), use semantic features, Garrett's model does not. These matters will be discussed below.

6.4.1. Anomia. Garrett claimed that a dissociation between meaning and form can be found in lexical access disturbances in aphasia. In anomic aphasia, sentences are well-formed, but there is an impairment in lexical access: these aphasics know what they want to say, as evidenced by the fact that sometimes they can give definitional responses (e.g., unable to say pen, the anomic may say "'it's for writing'"), and/or use pantomime (Buckingham 1979, cited in Garrett 1981:13). Garrett takes this as evidence that step one (meaning-based access) is intact.
Although they know the meaning, they are unable to access the form of the word they want.

Anomic aphasics in a tip-of-the-tongue state are similar to normal speakers in that they know what word they want to say. However, they differ from the latter in that normals can often give the first sound and number of syllables of a word they cannot produce, but anomies are very impaired in doing this (Goodglass et al. 1976). Garrett (1981:21-2) hypothesizes that anomies have an impairment at step 3 of the lexical access model, i.e., they do not have the "linking address" that connects the meaning of a word to its form.

Turning to conduction aphasics, Garrett notes that the fact that they make repeated attempts to correct their errors shows that they know the word they want to say (14). This shows a dissociation between meaning and form, too. In a tip-of-the-tongue study, conduction aphasics were more like normals than anomies were: the conduction aphasics were able to give the first letter and the number of syllables for one-third of the words they could not produce (Goodglass et al. 1976:151). So it seems that some aspects of meaning and form are preserved for conduction aphasics, yet the form does seem to be harder to access than the meaning. Garrett cites a study (Lecours and
Rouillon 1976:112) where it is reported that when a conduction aphasic struggles to repeat a word, the patient may give up and substitute a synonym, showing that it is easier to access meaning than form.

Garrett (1981:22-23) interprets the tip-of-the-tongue phenomenon in conduction aphasics as showing that the "linking address" is intact and available, but they have difficulty in making use of the information they obtain through the linking address. Such an impairment could involve steps 4, 5, or 6 in his model. Garrett (1981:23) hypothesizes that it is step 5 that is implicated:

The commonly reported failures of conduction aphasia seem best understood as a disorder of the phonological interpretation of the lexically specified positional frames.

He tries to rule out other steps of the model as possible causes of conduction aphasics' difficulties. Although he suggests that "meaning and form based lexical access" (steps 1 and 3) are probably intact, since he believes that conduction aphasics do not produce many meaning- or form-based verbal paraphasias, in fact such errors do occur, as I reported in Chapters 4 and 5. Garrett (1981:22) claims that semantic paraphasias indicate that the person has achieved "correct entry to the form inventory" (presumably at step 1), because if this were not the case, one would expect random substitutions, not meaning-based ones. If
the "linking address" is available, as the tip-of-the-tongue study suggests, the conduction aphasic has "access to a specification of word form" (23) sometimes, at least, but it appears to be incomplete. This is what Friedrich et al. (1984) and Joanette et al. (1980) suggest, too (Sections 2.2.5 and 2.2.7). The repetition problem would then be due to failure of the segmental interpretation stage (step 5) in both production and reception.

Garrett rejects the idea that conduction aphasics have difficulties with motor programming (step 6) on the grounds that they do not produce sequences of sounds that are not legal in their language. In his view, conduction aphasics do not have problems at step 4 in the model, because that is the level at which sound exchange errors would occur, and he is unaware of an abnormal number of sound exchange errors in conduction aphasia. Also, sound exchanges are tied to phrasal structure, in that they occur during the processes that assign words to phrasal structure, but conduction aphasics have trouble repeating words in isolation, not just words in phrases. This matter needs further study--it is not clear whether conduction aphasics make such errors at a higher rate than normal speakers. At any rate, step 4 seems to be a likely place for phonemic
paraphasias to occur. Buckingham (1986:195, 214) describes phonemic paraphasias, using Garrett's model, at the level of "phonological planning", before phonetic forms are specified, which sounds like step 4 in Garrett's model. Indeed, he argues that phonemic paraphasias occur in the mapping from the functional to the positional level, the latter being the level of phonological representation in Garrett's model. The relation between my data and the model will be discussed in Section 6.7.

6.4.2. **Semantic paraphasias and paralexias.** Different approaches have been taken in characterizing the relation between meaning-based lexical substitutions and the target lexical item that the aphasic was trying to produce.

In discussing lexical substitutions, Garrett (1980:213) proposes that

> words are selected from the mental inventory under (partial) descriptions given as values on semantic parameters. Failures of such a system might well be expected to yield substitutions that are very close in meaning.

It is not clear what he means by "partial descriptions given as values on semantic parameters" here, since he has stated (1982:55-56) that semantic features are not used in his model. Meaning-based substitutions probably occur
early in processing, in the mapping from the message level to the functional level (Garrett 1980:212). Buckingham and Rekart (1979:206) observe that in their patient, the semantic substitution is in the right slot in the sentence, and this shows that "the syntactic position must have been determined in the encoding process before the lexical switch took place".

Garrett (1982:25-6) states that in his model, meaning is represented in surface vocabulary, not semantic features (the latter type of model he calls a "definitional framework"). Garrett (1982:55-56) does note that word substitutions involve antonyms and coordinates, but there are other kinds of substitutions that cannot be accommodated by a feature system, such as the following normal speaker's error: "I just put it in the oven at a very low speed" (target: temperature). He notes, however, that there is not clear or compelling reason as yet for accepting one approach (his) over another. Of course, it is possible that both approaches are useful, in explaining different phenomena.

Garrett's ideas on the representation of vocabulary are not incompatible with those of Pick, Goldstein, and
Luria. In describing verbal paraphasias, Pick (1931, cited in Buckingham and Rekart 1979:197) has said:

the word determined by thoughts and by the sentence pattern is inwardly present or at least there is an intention in this direction but this rigid determination is loosened up. The coherence is not firm enough to maintain the normal suppression of words evoked by association from the sphere of meaning.

As Buckingham and Rekart point out, this is similar to Luria's (1972, 1973) ideas about paraphasia and the lexicon. To Luria, words are organized in a "multidimensional matrix". In amnesic aphasia (where anomia is the main symptom), there is a selection disturbance. It is not that the person cannot access a particular word, according to Luria. The problem is that a whole complex of words may be aroused that are similar to the target word phonologically, morphologically, and/or semantically. The aphasic is unable to select the correct word from this complex. To Luria (1970:122), verbal paraphasias occur when unsuccessful attempts to reproduce the original word lead to inhibition of the necessary sound structure and substitution of the trace of another word.

As I noted in Section 2.3.2, Luria et al. (1967:8) attribute semantic paraphasia to a "loss of selectivity" of memory traces. Finally, Goldstein (1948:226) observes semantic confusions in the repetition of a patient and he
interprets this as showing that when a word is spoken to the patient,

the sound complex may be sufficiently precise to awaken a realm of ideas to which the idea belongs, without being precise enough to awaken the individual idea which belongs especially to the presented word.

These views call to mind the experiment by Butterworth et al. (1982, discussed in Butterworth 1983:284), mentioned in Section 4.3.4 in reference to the Token Test. Some of their patients were able to point to an orange in an array consisting of miscellaneous objects, but not in an array consisting of different types of fruit. This showed that they were able to derive some meaning from the word but not sufficient to discriminate it from other words of similar meanings.

All of these authors are referring to a problem of selection, of discriminating among similar meanings and/or inhibiting associated but incorrect words.

Although Garrett has reservations about the use of semantic features in models of the lexicon, and although it is probably true that not all semantic substitutions can be described in terms of features, it may be possible to describe some such substitutions in this way, and there are models which do use a feature system. Let us look at some of them.
Coltheart (1980b:156) favors Marshall and Newcombe's (1966:175) proposal to account for semantic reading errors (e.g., *cattle* --> *animal*) (discussed in Chapter 1, Section 1.3.2.3). (Since C.G. did not produce syntagmatic errors like those of Coltheart's patient, I will not discuss them here). Marshall and Newcombe propose that oral reading of a word may involve:

- retrieving the full dictionary entry associated with the visual configuration and encoding this specification into the appropriate phonological form.

Their approach is based on Katz and Fodor's (1963) work. The dictionary entry for a word in Katz and Fodor's system includes the word class, a set of semantic markers and a distinguisher, which gives information on meanings that are specific to the target word. Marshall and Newcombe give a sample entry for the word *bush*:

```
BUSH
noun
(with plant)
(plant)
(affixed to or near the ground)
```

Misreadings result from a "breakdown in the encoding process". That is, when the patient read *bush* as *tree*, he had "encoded the lexical entry as far as the "distinguisher", which is in square brackets (175).

This is a superordinate error, where what is produced is "the stimulus [word] minus its distinguisher" (Coltheart
This model can be extended to account for coordinate substitution errors, according to Coltheart. Some coordinate errors are synonyms—words which have the nearly the same semantic representation—and in deep dyslexia it is hypothesized that the patient only gets semantic (but not phonological) information about the target word. Presumably, not enough grapheme-phoneme information gets through to allow the patient to choose between synonyms like *little* and *small*. Coordinate errors (e.g., *niece* $\rightarrow$ *aunty* or *carnation* $\rightarrow$ *narcissus*) are dealt with in this model by suggesting that the lost distinguisher can leave a trace, and the patient is unable to select the distinguisher that would differentiate, for example, *niece* from *aunty*, although the dyslexic retains the information that the target (*niece*) is a kinship term that refers to a female.

Marshall and Newcombe's approach cannot account for errors where the target and error are not hierarchically related to each other (Coltheart 153). To account for these, Coltheart turns to Weigl and Bierwisch's (1970:13) idea, which is similar to Luria's, that the lexicon includes an "associative network" for a word, and when a word is accessed, the whole network is accessed. Saffran, Schwartz and Marin (1976, cited in Coltheart 1980b) suggest
that deep dyslexics are unable to "restrict verbal output to the appropriate element within the activated field".

However, an approach based on associations cannot account for aphasic substitutions that are not similar to normal speakers' word associations or for definitional responses, e.g.,

Holland --> it's a country, not Europe...no... not Germany...it's small...it was captured...Belgium? That's it, Belgium. (Luria 1970, cited in Coltheart 1980b:155)

The Katz-Fodor model accounts for this, according to Coltheart. What the patient is doing in this example here is "a slow progression down a Katz-Fodor semantic hierarchy" that does not get as far as the distinguisher (156).

To summarize, according to Coltheart (1980b:156), some substitution errors "arise via an associative link between stimulus and response", whereas paradigmatic (or "shared-feature") errors arise because:

some of the semantic features of the stimulus are lost or not used during the process of deriving response from stimulus via semantic representation; moreover, the lower a semantic feature is in the Katz-Fodor hierarchy, the greater the likelihood of its loss.

6.5. Errors with the closed class in aphasia. As I mentioned above, in Garrett's model, the closed class is hypothesized to be accessed differently than the open
class. "Phrasal frames" are selected at the positional level, and closed class vocabulary is assumed to be part of the frame (Menn et al. 1982:7; Garrett 1982:61). The phrasal frames are thus structures with the closed class already in place, with the open class items being inserted into the frames at the positional level (Buckingham 1986:200).

According to Garrett (1982:61-62), if closed class items are "features of positional frames", then it may not make sense to even speak of "retrieval" of the closed class.

Closed class identity is fixed by the (unknown) processes which select phrasal frames under the constraints imposed by functional level representation.

However, as I mentioned in Section 1.3.3, closed class items are not all treated the same in this model. Since prepositions can participate in word exchange errors, they act like the open class. But they do not participate in sound exchange errors, and in this they are like other members of the closed class. The postulated resolution of this is that prepositions are lexical at the functional level but not at the positional level, which is phonological, and "phonologically, most prepositions behave with the minor classes" (Garrett 1981:20). Pronouns,
evidently, also receive special treatment in the model, since they, too, can participate in word exchanges. Presumably, they, too, have a dual representation, though this is not expressly stated by Garrett.

Garrett (1982:62) notes that it is possible that although the (presumably semantic and syntactic) identity of closed class items is fixed as described, "their segmental structure is not [fixed] until a point following the lexical interpretation of the positional strings". The identity of the closed class items, then, would be specified before their segmental structure is spelled out. This suggests that lexical identification and phonological identification occur in two different stages or computations. If so, this would allow for double retrieval of the closed class, as well as the open class. In this way, closed class meaning-based substitutions could occur at a lexical identification stage. If so, meaning-based errors with the closed class would occur in a way quite analogous to such errors with the open class and may even occur at the same level of processing.

Garrett says (1981:5, 12) that "lexical selection on the basis of meaning relations" occurs in the mapping from
the message to the functional level. At the latter level, the properties of sentence form which determine meaning are assumed to be fixed...including the processes of meaning dependent lexical access.

He adds that prepositions are open class items at the functional level and closed class at the positional level.

Friederici (1985:159-60, discussed in Section 1.3.3), expresses the view that lexical prepositions (i.e., prepositions that have semantic content) are processed at two different levels: at the functional level, for meaning, and at the positional level, for syntactic function. Obligatory prepositions (i.e., prepositions required by a grammatical structure, such as of in cup of coffee), on the other hand, are hypothesized to be processed only at the positional level. She suggests that in general words are processed differently for lexical information than for non-lexical information, regardless of word class.

Garrett's model, then, can account in principle for meaning-based substitutions within the closed class as well as the open class. These substitutions within the closed class should then be included under the term semantic paraphasia, not paragrammatism.

How omissions of closed class items would fit into Garrett's model is not clear. In Menn et al.'s (1982:10-11) description, for example, the plural marker is
considered to be created in the mapping from the functional to the positional level, and can be misplaced (i.e., it can appear on the wrong noun). If that is so, then it seems possible that there could be a failure to create a plural marker, too. For unbound closed class items, there could be a failure to create a position or slot for the omitted item, or a slot could be created but not filled. It is not clear how one would distinguish between these two alternatives in sentence production, or even if it is possible to do so. However, if a person is unable to produce a closed class target, this seems like the same kind of phenomenon as anomia, even though anomia generally refers to failure to retrieve open class items. Omission of a closed class form might also be a simple retrieval failure, at least if the item conveys lexical, as well as grammatical information.

6.6. **Selection errors and failures in lexical retrieval.** My data indicate that in a variety of language tasks, C.G. is not able to select the lexical item needed. Of the lexical retrieval disturbances outlined by Buckingham (1979:273, discussed in Section 1.3.2.3), my corpus includes instances of semantic substitutions, anomia, use of fillers like **thing**, and circumlocution.
When these lexical retrieval problems occur, C.G. either fails to select a form or produces a form that differs from the target, as the following list shows.

1. **Failure to select a form.** This includes:
   
   (a) anomia--the failure to retrieve an open class item;

   (b) omissions of closed class items.

2. **Misselections.** When a person fails to retrieve a desired form, another form may be substituted. This may be a filler or pro-form, like *thing*, *make*, or *do*, a circumlocution or definition, or a verbal paraphasia. Misselections can be seen as different ways of dealing with a lexical retrieval difficulty (Buckingham and Kertesz 1974).

   a) **Filler.** The use of a filler is evidence that C.G. at least knows the grammatical category of the word she wants, since she uses *thing* for nouns and *make* or *do* for verbs:

   (1) C.G. (describing the mother in the Cookie Theft Picture, who is drying dishes):

   Uh...she's bringing--she's got all of her *things* here.
(2) Target in the sentence repetition task of the Boston Exam:

The Chinese fan had a rare emerald.

C.G.: The Chinese fan (2 sec)
The xx made a
What is it. I don't-- xx get
the rest of it.

b) Circumlocution or definition. These substitutions are closer to the target than fillers:

C.G.: Here's this-- for flowers. (a windowbox)

c) Semantic paraphasia.

Open class: baseball player --> baseball catcher
(superordinate --> hyponym)

Closed class: behind --> before (antonym)

It should be noted that is not clear whether 1(a) and 1(b) should really be grouped together. As I mentioned in section 1.3.3.1, it has been suggested that agrammatism is similar to anomia (Brown 1977:49, cited in Buckingham 1980). Both of these phenomena involve a failure to produce a form. But when an open class item is not produced, the speaker is usually conscious of the problem and actively searches for the word. On the other hand, when a closed class item is omitted, the speaker may not even be aware of the error. It is possible that anomia and.
omission of closed class items involve similar processes, but this is speculative.

6.7. **Lexical retrieval errors and Garrett's model.**

In this section, I will discuss possible ways of relating the errors listed above to Garrett's lexical access model. Garrett (1981:22-4) states that conduction aphasics and anomic aphasics have different kinds of word-finding difficulty, and he relates these two types of aphasia to different steps of the model. As I noted in section 6.4.1, he suggests that anomic aphasics have an impairment at step 3 of the model—-they have lost the linking address that connects the meaning of a word to its form. But in his view, step 1 is intact for them, in view of the fact that such aphasics can use pantomime or give a definitional response when unable to produce the desired word. He further speculates that conduction aphasics do have this linking address, basing this on the tip-of-the-tongue study by Goodglass et al. (1976). If this is so, then step 3 has been carried out successfully, and he suggests that conduction aphasics are impaired in using the information that the linking address provides.

An approach that involves equating particular types of aphasia with particular steps in the model does not seem very useful. It seems more reasonable to attempt to
relate particular aphasic behaviors to the steps of such a model. Thus, in my view, the goal is to characterize anomia, for example, in any aphasic in terms of an impairment at a given step or steps of a model.

It is not clear whether it is step 3 that is involved in the impairments in my data, as Garrett's work suggests, or whether it is step 1. I will explore the implications of attributing C.G.'s lexical retrieval disturbances to each of these two steps in turn.

If the impairment is at step 3, then when C.G. fails to retrieve a form, it may be that the linking address that should connect meaning with form is not available to her. This would mean that C.G. knows the meaning of the word she wants but is unable to produce its form. The availability of the linking address may not be all-or-nothing. It is possible that an aphasic, such as C.G., may have varying degrees of success in utilizing the linking address. When she is totally unsuccessful, she fails to produce any form; the linking address may be completely unavailable. On the other hand, in the case of circumlocution or paraphasia, the linking address may be available enough to allow retrieval of a word closely related to the target in meaning. Indeed, Garrett (1981:22) suggests that the linking address is available in semantic paraphasia,
because if it were not, random verbal substitutions would be expected. Misselections, then, may result from inadequate access to the linking address.

Garrett's characterization of anomia as implicating step 3 of the model is not the only possibility, however. If, as he suggests, the linking address is normally provided in step 1, and if the linking address is not available to the aphasic, then perhaps the impairment is at step 1. Garrett speculates that step 1 is intact, because anomics know what they want to say. It seems reasonable to say that when definitional or circumlocutory responses are produced, the person knows what she wants to say. But that does not mean that meaning-based lexical identification has taken place. If C.G. knows what meaning she wants to convey, this knowledge could be attributed to the conceptual level of the language production model, and it is possible that she does not know what word to use in order to convey the meaning she has in mind.

By this alternative analysis, failure to select a form could reflect a complete inability to execute step 1— the speaker has not managed to identify the desired word on the basis of meaning. Misselections may also indicate problems with step 1. Meaning-based lexical identification may not be all-or-nothing. There may be varying degrees of success
in executing step 1. The production of fillers, such as *thing*, indicates that lexical identification has not taken place. Circumlocutions and definitional responses show a closer approach to the target word than fillers do. When a definition or circumlocution is produced, meaning-based lexical identification is incomplete. In the case of substitutions like *before* in place of *behind*, it seems that lexical access is proceeding normally at first, but then breaks down at a level of fine distinctions. So C.G. may access the sub-list of prepositions within the list of the closed class items in the lexicon, and may even access the antonymic pair *behind*-before. But here the process breaks down. The lexical access process is almost successful, but she cannot always distinguish, for example, between antonyms, or between superordinate and hyponym.

It is not obvious whether these impairments should be attributed to step 1 or step 3 of the model. In the case of the tip-of-the-tongue state, where an individual may retrieve the initial sound and/or number of syllables in the desired word, it is likely that step 1 has been successfully executed. But it is difficult to see how one could assert with confidence that step 1 has been carried
out in the errors listed above. It appears that meaning-based lexical identification has not been carried out successfully when these errors are produced.

6.8. **Conclusion.** Many of C.G.'s errors can be seen as reflections of the kind of selection disorder outlined above. These errors occur in various language activities, as described in Chapters 4 and 5. They may well reflect an impaired ability to match meaning with form in different kinds of lexical retrieval. C.G.'s errors show different degrees of success in lexical retrieval.

Closed class meaning-based substitution errors are included in the category of semantic paraphasia in this study, reflecting the notion that they are manifestations of a lexical, not a syntactic, deficit, and indicating that similar processes are involved in substitution errors with the open and closed class. The division of vocabulary into two separate classes, open and closed, can be seen to be oversimplified.

Other kinds of selection problems may be related to those in the above list, such as incorrect selection of tokens in the Token Test. In Section 4.3.4, I cited Butterworth et al.'s (1982) study of aphasics with poor comprehension who also made semantic errors in naming, and
related this to C.G.'s errors on the Token Test. Errors in selection of tokens and errors in selection of lexical items in spontaneous speech, reading and repetition may result from a single impairment. It may be remembered that Zaidel (1977) and Heilman et al. (1976) suggest that memory and comprehension deficits may reflect an underlying linguistic deficit. A semantic processing impairment might be one candidate for consideration as the underlying linguistic deficit referred to here.

It is likely that there is some syntactic impairment in both comprehension and production in my subject. In the Token Test, C.G. understood the individual lexical items, but when these lexical items were combined into sentences she made errors. A syntactic deficit may also be partly responsible for her faulty repetition of sentences. It is not clear whether the repetition problem is due to comprehension or just production deficits (or both). C.G. does make serial order errors in repetition, and such errors have been reported by other researchers. Syntactic deficits in conduction aphasia need to be explored further. One way to do this, for example, would be to use sentence anagrams, where words are written on cards and the subject is asked to arrange them in the correct order to produce a sentence. Another procedure would be a Cloze test, where a
sentence or paragraph is presented from which some morphemes are omitted, and the subject is asked to fill in the blanks. Such procedures may help to give a better picture of aphasics' grammatical knowledge.

I suspect that the Sainte-Anne group's encoding deficit model (Section 2.3.3) is on the right track in accounting for many of C.G.'s language production disorders. Encoding includes such processes as matching, selecting, and ordering (Green and Howes 1977:139). Problems in matching meaning and form that appear to be involved in lexical retrieval disturbances may be characterized as part of an encoding deficit.

The phenomena referred to as agrammatism and paragrammatism need further study. The nature of the relation between agrammatism and paragrammatism, and between agrammatism and lexical selection disorders needs to be further clarified. Goodglass and Menn (1985) make the interesting suggestion that agrammatism and paragrammatism may result from the same underlying cause, which would account for the similarities between them, while the differences may be due to different processing problems or the use of different strategies to compensate for impairments. This needs to be pursued further.
Tissot et al.'s (1973, cited in Section 1.3.3.1) idea that there are two different kinds of agrammatism—morphological and syntactic—is interesting. Syntactic agrammatism is a label for the condition in which closed class vocabulary is well-preserved but word order and verb use are impaired. But McCarthy and Warrington (1985) express the view that the deficits of their so-called syntactic agrammatic are secondary to a lexical/semantic impairment. Morphological agrammatism (where word order and verb use are well-preserved but the use of the closed class is impaired) may also reflect a lexical deficit, according to McCarthy and Warrington. The relation between lexical/semantic and syntactic impairments is far from clear at this stage.

A theme that has run throughout this study is that of problems with the classification of patients. Patients differ as to age at onset of aphasia, age at time of testing in a research study, level of education, and individual differences, and these factors may account for some of the variance in the patients reported in the literature. There is also the matter of different stages in the course of recovery. It is possible that some people who have been called conduction aphasics (Section 2.3) are at a more advanced stage of recovery than others and that
that accounts for some of the differences among patients. The relation between agrammatism and paragrammatism may also be important in relation to recovery patterns: I have wondered whether aphasics who tend to omit closed class vocabulary would, in the course of recovery, gradually make fewer omission errors and instead make substitution errors. Longitudinal case studies are needed to address this issue. Such studies would be helpful in diagnosis and treatment, as well as being informative for linguists. Without awareness of the factors responsible for patient variation, we will continue to be uncertain about the validity of diagnostic categories in aphasia. Such categories are meaningful to the linguist if they reflect the fact that language breaks down in systematic ways and that particular impairments cluster together.

As for testing, while the tests that I designed could be used with any aphasic, it would be interesting to try them on other conduction aphasics, for the sake of comparison. The next step ideally would be a group/case study (Caramazza and Martin 1983), in which the same tests would be administered to a series of individual conduction aphasics, and then comparisons would be made. This might make it possible to sort out what linguistic behaviors are common to conduction aphasics and what behaviors are
idiosyncracies of individual aphasics. In addition, using the same tests with aphasics of other diagnostic groups might provide a view of what is unique to conduction aphasics and what problems cut across all types of aphasia. Weighted scoring of tests is preferable to pass/fail scoring, since the former is better able to reveal the individual's abilities, as the results from the Token Test and my sentence repetition tests show.

Using the tests designed in this study, one can obtain an overview of aphasics' abilities to use the closed class vocabulary. My repetition tests focused on closed class vocabulary, which is problematic for many aphasics, in order to allow me to see the patterns of omission, retention, and/or substitution. But since no one activity may tell the whole story, it is useful to supplement repetition tests with grammaticality judgment tasks. Repetition alone does not tell whether the aphasic still has knowledge of the rules of grammar. If a person repeats a sentence correctly, that does not mean that she knows the rules of grammar or even that she understands the sentence. If she repeats a sentence incorrectly, and there are patterns in the errors, then one can get a sense of the aspects of language that are impaired and those that are spared. Grammaticality judgment tasks focus in on and
manipulate a certain aspect of grammar (e.g., agreement or tense). This kind of task can show whether the person is aware of obligatory forms, even if she cannot produce them spontaneously or consistently. If aphasics can correct errors that are similar to the kind that they make spontaneously, then the spontaneous errors may be only performance errors. If they do not recognize the errors, that implies a more general problem affecting knowledge of the rules of grammar, not just the application of those rules. We need to know whether aphasics can correct the types of errors that they make spontaneously.

The construction of language production models is an important part of the linguistic endeavor to describe language and the human capacity to use it. Garrett's model is useful as a starting point in this endeavor. One of the advantages of this model is that it is based on real language production data from normal speakers. It attempts to characterize types of processes that might be involved in language use, based on that data.

Garrett himself refers to his model as a working or preliminary model. Clearly, there are aspects of it that need to be explored further. For example, there is the question of whether linguistic processes are carried on at the message level, or whether this is a prelinguistic
level. The processes that distinguish the message level from the functional level need to be clarified. In addition, as Figure 4 shows, many different processes are collapsed together at the functional level and at the positional level. We may find that these levels need to be divided further. In particular, it may be better to split the functional level into at least two levels: a logic-oriented one that specifies predicate-argument structures and that may account for word exchanges between phrases, and a separate level where lexical identification takes place. We can expect that the refinement of language production models will be an ongoing process.

In order to resolve some of the issues facing neurolinguistics, at least three things are needed. The first is adequate descriptions of patients' language behaviors in all language modalities, leaving aside assumptions about, for example, what agrammatism is or is not. Studies that focus on linguistic categories are important. A good example of this kind of approach is Friederici's (1985) work on the differences between lexical and grammatical prepositions in aphasia. It is linguistic categories such as these that need to be systematically examined. The following kinds of questions could be addressed: can we predict the kinds of linguistic
environments or structures that are likely to trigger substitution and/or omission errors? Are all pronouns or prepositions equally likely to be involved in aphasic errors? Are there certain types of verbs that are harder to repeat than others and if so, are they also harder to retrieve in other language tasks? We need more fine-grained descriptions of language impairments on which explanations and theories can be based.

Secondly, we need to look beyond surface differences in aphasic language behaviors to see if there are unifying, underlying patterns. Tests such as the ones I devised could be administered to people whose language has been described as agrammatic or paragrammatic, for example, to see what the similarities and differences are. As I noted above, Goodglass and Menn (1985) suggest that differences between agrammatics and paragrammatics may be due in part to the ways in which people with these language behaviors attempt to compensate for their impairments, and these compensatory behaviors may obscure similarities. Studies of how aphasics compensate for their impairments may help to shed light on this matter. Also, individual differences could be studied by means of group/case studies which could make similarities in language behavior more apparent.
Thirdly, we need to relate patterns of aphasic behaviors to normal language behaviors. For example, clarification is needed on the question of whether there are differences between normal speakers and aphasics in the mechanisms used in accessing the open vs. closed class vocabulary (Bradley 1978; Gordon and Caramazza 1982). Buckingham (1980; see Section 6.3) has related lexical substitution errors to normal speakers' errors, and has looked at phonemic errors and at constraints (e.g., phonotactic constraints) that are operational in normal and aphasic language. Further studies of constraints on aphasic errors could be illuminating. Patterns of breakdown in the language system that occur in aphasia may make it possible for us to be more explicit about the mechanisms involved at various stages in language production. Also, we need to describe differences between normal and aphasic errors, as well as similarities. Studies such as these would make it possible for neurolinguistics to contribute to our understanding of language production.
APPENDIX

NEW TESTS DEVISED FOR THIS STUDY

RIII. -- The first repetition test focusing on inflectional morphemes: plural, third person singular present, possessive, and past.

1. I saw Mary three weeks ago.
2. His wife's ring is expensive.
3. He agreed with the judge's decision.
4. Tony fixes cars.
5. I filled some cups with tea.
6. I waited twenty minutes for the bus.
8. The girl washed her face.
10. Pat's friend is from New York.
11. There are too many cars in this parking lot.
12. I found the knives and forks.
13. We parked illegally.
14. My niece's friend went to the movies.
15. Marion writes letters every day.
16. He mixes cement at work.
17. Peter washed the dishes.
19. Tony's father gave him some candy.
20. They needed directions.
21. Harry always eats sandwiches for lunch.
22. Jane's car doesn't run.
23a. She planned her vacation.
23b. She planned a holiday
24. The baby hugged her doll.
25. Mary cleans people's houses.
RI2. -- The second repetition test focusing on inflectional morphemes: plural, third person singular present, possessive, and past.

1. The little boy coughed.
2a. The canoe team rowed out to sea.
2b. The team rowed out to sea.
3. Hawaii has many coral reefs.
4. He laughs very loudly.
5. The train arrived late.
6a. The librarian reads in her spare time.
6b. The teacher reads in her spare time.
7. Someone grabbed her purse.
8. That family has five cats.
9. We decided on a new car.
10. The train arrives at nine o'clock.
11. She bought some beautiful lamps.
12a. I borrowed Bob's radio.
12b. Bill borrowed Bob's radio.
12c. Bill took Bob's radio.
13. The witness describes the robber.
14. He lowered his eyes.
15. The baby plays with her toys.
16. Someone robbed a bank.
17. That thief robs banks.
18. I reached for the mango.
19. I dialed a wrong number.
20. I have three nephews.
21. The police stopped a car.
22. Terry buys lots of clothes.
23. He tied his shoelaces.
24. The secretary xeroxes her papers.
25. A cat has nine lives.
26. She received a gift.
27. Eggs are expensive nowadays.
29. The bird flapped its wings.
30. Mary trains horses.
32. It rained all day.
33. They insisted on leaving.
R3. -- The third repetition test. This does not test inflections. Here, the type of linguistic structure at the beginning of the sentence is varied. There are also several different kinds of NP's.

1. Sometimes Paul comes early.
2. In the morning I brush my teeth.
3. Apparently, she is ill.
4. So far, five people have come.
5. In a few minutes, the show will begin.
6. Being scared, the child cried.
7. Getting lost is annoying.
8. Having finished, the boss left.
9. Feeling curious, the baby opened the box.
10. Watching the airplane was fun.
11. The blue house is near the park.
12. A black dog bit the mailman.
13. The washing machine is broken.
14. A large truck parked out front.
15. The people studying need quiet.
16. The heavy book is not interesting.
17. The red one is mine.
18. The old tree is blooming.
19. The waving policeman blew his whistle.
20. The wooden houses have termites.
21. The flying plane went behind the clouds.
22. The tall mountain overlooks the valley.
23. A bowling ball is heavy.
24. Mother watches the children playing.
25a. A heavy one is hers.
25b. The heavy one is hers.
26. The waiting patients read magazines.
27. The noisy child was scolded.
28. The people sailing are having fun.
29. The playing children threw mud.
30. The people watching the show laughed.
JII. -- The first grammaticality judgment test focusing on inflectional morphemes.

1. The student raised his hand.
2. He keeps all of his letters.
3. Bill has some map.
4. He spill some tea yesterday.
5. They danced last night.
6. She sleep for eight hours.
7. I wrote to Mike daughter.
8. All of the roads will be repaired.
9. My mother feel good today.
10. That is a boy bike.
11. My nieces live with my brother.
12. She dreams about her boyfriend.
13. Peter miss his bus the other day.
14. Helen takes two baths every day.
15. He hunt for a wild animals last summer.
16. The boss wallet was stolen.
17. The old sailors watches the ships.
18. The little girl waited for Santa Claus.
19. I need some new pen.
20. Ruth's mother lives in Boston.
21. Oahu has many beautiful beach.
22. Alcohol cause drunkenness.
23. The doctor examined horse's leg.
25. The doctor's coat are white.
JI2. -- The second grammaticality judgment test focusing on inflectional morphemes.

1. The student (raised, raise) his hand.
2. He (keeps, keep) all of his letters.
3. Bill has some (map, maps).
4. He (spill, spilled) some tea yesterday.
5. They (danced, dancing) last night.
6. She (sleeps, sleeping) for eight hours.
7. I wrote to (Mike, Mike's) daughter.
8. All of the roads will be (repair, repaired).
9. My mother (feel, feels) good today.
10. That is a (boy, boy's) bike.
11. My (niece, nieces) live with my brother.
12. She (dream, dreams) about her boyfriend.
13. Peter (miss, missed) his bus the other day.
14. Helen (take, takes) two baths every day.
15. He (hunt, hunted) for a wild (animals, animal) last summer.
16. The (boss, boss's) wallet was stolen.
17. The old sailors (watches, watch) the ships.
18. The little girl (waiting, waited) for Santa Claus.
19. I need some new (pen, pens).
20. (Ruth, Ruth's) mother lives in Boston.
21. Oahu has many beautiful (beach, beaches).
22. Alcohol (cause, causes) drunkenness.
23. The doctor examined (a, an) horse's leg.
25. The doctor's coat (are, is) white.
JI3. -- The third grammaticality judgment test focusing on inflectional morphemes, using the sentences from R11 and R12, from which some morphemes have been omitted.

1. Hawaii has many coral reef.
2. I reached for a mango.
3. I say Mary three weeks ago.
4. Paul speak English and French.
5. I found the knives and forks.
6. My niece friend went to the movies.
7. They insisted on leaving.
8. I have three nephew.
9. A cat has nine live.
10. I wrote to Mike daughter.
11. She received a gift.
12. Harry always eats two sandwich.
13. He laugh all the time.
14. Marion write letters every day.
15. That family has five cat.
16. Terry buy lots of clothes.
17. Karen wear a hat to the beach.
18. I dialed a wrong number.
19. The baby plays with her toes.
20. Mary clean people's houses.
21. She dreams about her boyfriend.
22. Last night the train arrive late.
24. The librarian read in her spare time.
25. The thief always rob banks.
26. Tony fix cars for a living.
27. Yesterday it rain all day.
28. He mixes cement at work.
29. Mary trains horse.
30. His wife ring is expensive.
31. There are too many car in this parking lot.
32. That is a boy bike.
33. The doctor coat is white.
34. The roads will be repaired.
35. I borrowed Bob radio.
36. The boss's wallet was stolen.
37. Bill likes to have many watch.
38. The train arrive at nine o'clock.
39. The little boy coughed.
40. This morning the little girl wash her face.
41. The police stop a car.
42. Yesterday we park illegally.
43. Tony father gave him some candy.
44. My nieces live with my brother.
45. Yesterday he tie his shoelaces.
46. Jane car doesn't run.
47. The canoe team row out to sea.
48. Yesterday I fill a cup with tea.
49. Egg are expensive nowadays.
50. She plan a vacation.
51. Someone grabbed her purse.
52. Ruth's mother lives in Boston.
53. Someone robbed a bank.
54. Last year, Helen want a new house.
55. The bird flapped both wing.
56. Last night they need help.
57. Pat friend is from New York.
58. We decided on a new car.
RPro. — Repetition test focusing on pronouns and pronominal determiners.

1. Mary dropped her lipstick.
2. John broke his nose.
3. She brushed her hair.
4. Helen read her book.
6. He drove home.
7. The boy is looking for his book.
8. They want to go home.
10. My parents visited their grandchild.
11. The queen wore her beautiful gown.
12. The bride wore flowers in her hair.
13. The policeman wore his badge.
14. My nephew got his hair cut.
15. The children should brush their teeth.
16. We ate our lunches at the park.
17. I have to study for my exams.
18. He underwent surgery on his heart.
JPro. -- Judgment test focusing on pronouns and pronominal determiners.

1. Mary dropped his lipstick.
2. John broke their nose.
3. Paul drove home with we.
4. The queen wore his beautiful gown.
5. She brushed her hair.
7. John visited his.
8. The policeman wore her badge.
9. Him drove home.
10. He underwent surgery on my heart.
11. My parents visited them grandchild.
12. We ate my lunches at the park.
13. My nieces are looking for their toys.
14. I have to study for your final exams.
15. The bride wore flowers in his hair.
16. The boy is looking for him book.
17. The children should brush her teeth.
18. My nephew got his hair cut.
19. My mother lost her watch.
20. Them want to go home.
21. Paul and Bill bought his watches at Sears.
22. I got something in my eye.
JPrep. -- Judgment test focusing on prepositions.

1. We are sitting (above, under) the pictures.
2. His shoes are (in, on) his feet.
3. The pen is (on, at) the table.
4. She wore a flower (in, on) her hair.
5. We are talking (at, into) the microphone.
6. The beach is (near, over) the ocean.
7. The Capitol is (above, near) the palace.
8. The airplane flew (over, through) the city.
9. We are sitting (in, at) the table.
10. She wore a ring (in, on) her finger.
ActPrepl. -- A test focusing on prepositions, in which the subject carried out a set of commands.

1. Put the card on top of the book.
2. Put the pen between the card and the book.
3. Put the book under the magazine.
4. Put the pencil in the box.
5. Put the pencil beside the box.
6. Put the pencil on the box.
7. Put the pencil behind the box.
8. Put the paper near the book.
9. Hold the paper above the table.
10. Move the pen toward me.
11. Move the paper away from me.
12. Hold the pen over the taperecorder and then put it on the sofa.
13. Pick up the pencil and write the letter w.
14. Put the book below the table and the pencil beside the magazine.
JAuxl. -- The first grammaticality judgment test focusing on auxiliaries, using tag questions. Ungrammatical sentences contain errors involving tense, number, and an auxiliary different from the one in the main clause. The verb phrase in the main clause is affirmative; the tag is negative.

1. She went home, didn't she?
2. I can eat now, don't I?
3. We are going, weren't we?
4. They eat meat, don't they?
5. Bob and John will come soon, wouldn't they?
6. The Pacific Ocean is deep, aren't it?
7. They are at home, isn't they?
8. We have to go, don't we?
9. Paul should call us, couldn't he?
10. They were early, wasn't they?
11. He was home, didn't he?
12. He goes to school, doesn't he?
13. You are living in Hawaii Kai, didn't you?
14. We could leave early, wouldn't we?
15. They can help, can't they?
16. They work here, doesn't they?
17. Mary is at home, wasn't she?
18. You would help him, shouldn't you?
JAux2. -- The second grammaticality judgment test involving auxiliaries, in tag questions. The verb phrase in the main clause is negative; the tag is affirmative.

1. They couldn't see, could they?
2. You didn't finish, could you?
3. Helen isn't lazy, are she?
4. Bob isn't busy, was he?
5. We aren't late, are we?
6. The boys aren't leaving, were they?
7. Tom and Jerry didn't leave yet, were they?
8. Louise isn't here, was she?
9. They don't know the answer, does they?
10. They can't work today, could they?
11. Bill wasn't driving, were he?
12. You aren't ready, do you?
13. John wouldn't help, will he?
14. Paul doesn't work there, is he?
15. We don't have a stamp, did we?
16. Your friends weren't home, were they?
JAux3. -- The third grammaticality judgment task involving auxiliaries; this is the "mirror image" of JAux1, i.e., the sentences that were grammatical in the latter are ungrammatical here, and vice versa. The verb phrase in the main clause is affirmative; the tag is negative.

1. She went home, don't she?
2. I can eat now, can't I?
3. We are going, aren't we?
4. They eat meat, won't they?
5. Bob and John will come soon, won't it?
6. The Pacific Ocean is deep, isn't it?
7. They are at home, aren't they?
8. We have to go, won't we?
9. Paul should call us, shouldn't he?
10. They were early, weren't they?
11. He was home, wasn't he?
12. He goes to school, don't he?
13. You live in Hawaii Kai, don't you?
14. We could leave early, couldn't we?
15. They can help, couldn't they?
16. They work here, don't they?
17. Mary is at home, isn't she?
18. You would help him, wouldn't you?
JS. -- A judgment test focusing on semantics.

1. George Ariyoshi is our (governor, senator).
2. Bill is Paul's (daughter, son).
3. This candy costs fifteen cents, but I only have a (quarter, dime).
4. The lights are (above, under) the sofa.
5. Because of my toothache, I went to the (doctor, dentist).
6. The noise (erupted, disrupted) the meeting.
7. The governor lives on (Oahu, Maui).
8. The man wore a new (shirt, skirt) to the meeting.
9. The doctor (rejected, injected) the medication into his arm.
10. Louise picked (up, out) a new car.
11. In 1982, Hawaii had a (blizzard, hurricane).
12. I wrote a (book, letter) to my mother.
13. Terry looked (up, out) a new word in the dictionary.
14. The boat arrived at the (airport, harbor).
15. The plane (ran, flew) over the airport.
16. Marie needed a new blouse, so she (bought, sold) one.
17. The boat (swam, sailed) to shore.
18. I need a drivers' (submit, permit).
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