A STUDY OF PREPOSITIONS IN APHASIA:
EXPERIMENTAL RESULTS AND
THEIR THEORETICAL IMPLICATIONS

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ABSTRACT

This thesis proposes to lay some of the groundwork for an investigation of the prepositional deficit in aphasia. We observe that (i) the status of the category PREPOSITION is problematic for linguistic theory and (ii) patterns of loss in aphasia do not affect prepositions uniformly. In accordance with the view that such sets of theoretical and aphasiological observations can and must be related, an overview of the structural (linguistic) properties of prepositions, an examination of a compatible sentence processing (psycholinguistic) model, and an exhaustive review of the literature on prepositions and aphasia were undertaken. A set of refined predictive hypotheses was then extracted. Preliminary results from a case study suggest that the theoretical argument/adjunct distinction is indeed valid on a processing level. Furthermore, they suggest it might be useful to re-frame the issue of how prepositional structures are compromised in pathology by considering how verb retrieval problems can affect the processing of those structures.
SOMMAIRE

L'objet de ce mémoire est de présenter les matériaux de base qui permettront d'étudier le problème que pose l'utilisation des prépositions dans l'aphasie. Nous constatons que (i) le statut de la catégorie PREPOSITION pose un problème en linguistique théorique et (ii) lors d'un manque de prépositions en aphasie, celles-ci ne sont pas atteintes uniformément. Partant du principe que ces constatations théoriques et empiriques non seulement peuvent mais même doivent être reliées, nous avons entrepris ce qui suit : une présentation des caractéristiques structurelles des prépositions (niveau linguistique), l'examen d'un modèle adéquat de processing des phrases (niveau psycholinguistique), et une revue complète de la littérature traitant des prépositions en rapport avec l'aphasie. Nous en avons tiré un ensemble d'hypothèses précises, afin de pouvoir faire une étude de cas. Les résultats semblent indiquer que la dichotomie structurelle argument/non-argument est de fait valable au niveau du processing. En outre, nos résultats mènent à la conclusion qu'on doit revoir le problème de l'atteinte des prépositions en aphasie à la lumière des recherches concernant l'atteinte à l'accès au verbe, puisque la dernière peut conditionner la première.
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INTRODUCTION

Recent developments in the fields of linguistics, psycholinguistics and neuropsychology have forced us to reflect, in a metatheoretical sense, on the nature of the relationship between "exceptional" language data and linguistic theory. Naturally, the basic assumption here is that there is, or can be, such a relationship. That is, given that theories of Universal Grammar (UG) are theories of the biologically necessary properties of language, they must be brought to bear on acquisition data, aphasic language data, etc. In a fundamental paper on explanation in neurolinguistics, M. L. Kean offers the following statement: "it is not only the case that linguistic research in a variety of areas (e.g. grammatical theory and processing) may make appeal to neurolinguistic data, it is also the case that such research must ultimately engage with those data." Moreover, the analysis of such non-idealized data, over and above the ability to confirm/disconfirm the validity of theoretical linguistic constructs, has the potential of offering insights into how UG is structured. Chomsky acknowledges such potential in a discussion contained in Knowledge of Language: Its Nature, Origin and Use:

In principle, evidence concerning the character of the I-language [system of linguistic knowledge attained] and initial state could come from many different sources apart from judgments concerning form and
meaning of expressions: perceptual experiments, the study of acquisition and deficit or of partially invented languages such as creoles... But we cannot know in advance just how informative various kinds of evidence will prove to be with regard to the language faculty and its manifestations, and we should anticipate that a broader range of evidence and deeper understanding will enable us to identify in just what respects informant judgments are useful or unreliable and why...2

According to this general view, language breakdown can provide the linguist with a rich data base: deviant language data "betrays" underlying systematic regularities. Study of the fractionalized system, then, can provide us with valuable insights regarding the nature (structure and organization) of the intact linguistic system. One may legitimately pose the question: "What can abnormal language data tell us about normal language?" The answer to this question embodies a pretheoretical assumption: that pathological language systems are not qualitatively different from normal language systems, but are quantitatively so. In other words, behavioral data such as those encountered in aphasia are a reflection of the normal system less something.3 In the absence of strong evidence to the contrary, accounts which assume that pathological language system(s) retain much of the normal system are to be favored over those which assume that grammatical loss is total or near total.

Initially at least, the nature of interaction between neurolinguistics/linguistic aphasiology and core linguistics is unidirectional in that the elaboration of testing materials
and analysis of deviant data is guided by a specific theoretical framework. It is relatively easy to see how distinctions made in theoretical models might be used to make predictions about the patterning of lost/retained elements in aphasia, for example. This approach typifies much of the work being carried out in linguistic aphasiology today. What is not so clear at present is how the data so obtained can, in turn, inform further refinement of the theoretical model. However, the potential for such bidirectional feedback is undeniable. One theoretician offers the following example:

If agrammatic deficits reflect domains independently motivated within linguistic theory such as Theta Theory and Trace Theory, not only is the task of the neurolinguist made easier and the hypotheses of the theoretical linguist supported, but also a means is provided to test how language is stored in the brain...

In order for pathological language data to reliably inform linguistic theory, the data base must be both broad (it must include performance on a variety of sentence structural types and must draw from a variety of languages) and consistent (so that successful comparisons can be made across researchers). Linguistic aphasiology is presently striving to meet these objectives.

Let us now consider the problematic status of the category
"preposition": it furnishes us with an example of how research carried out independently in the two domains of linguistic theory and linguistic aphasiology does indeed converge. We observe that the surface class of prepositions is a heterogenous one: prepositions share properties with both major and non-major lexical items. As later discussion will demonstrate, this ambiguous status poses problems for linguistic theory. Now, their ambiguous status in linguistic theory is mirrored in the processing of prepositions in the aphasic syndrome known as agrammatism. According to the canonical view of this disorder, prepositions—by virtue of the fact that they are function words—should not be retained. Yet inspection of the data reveals that this does not hold: in fact, prepositions are differentially impaired. The importance of this finding is not to be underestimated: it is one thing to expect that distinctions made in grammatical theory have direct consequences in the processing of language, and it is quite another thing to find that this is actually the case. Given these observations, we would like to suggest that the obtention and analysis of data regarding prepositional structures will be crucial for any linguistic account of agrammatism.

The main issue to be addressed is, can linguistic theory predict/explain how prepositional structures dissociate in aphasia? On a purely intuitive and pre-theoretical level, prepositions have been described as either "semantic" or
"syntactic", and aphasic data has been claimed to pattern along these lines, as we shall see in the review of previous studies. However, before examining the data and claims reported in the literature regarding the prepositional deficit, we must (a) see how LINGUISTIC THEORY can formalize the intuitive notions of prepositions serving differing semantic and syntactic roles in sentences (Chapter 1) and (b) determine to what extent SENTENCE PRODUCTION MODELS are capable of accommodating the relevant structural differences in processing terms (Chapter 2). We will then be in a better position to evaluate the claims made by the researchers whose work is reported in the aforementioned LITERATURE REVIEW (Chapter 3) and to extract a set of predictive hypotheses which will enable us to interpret the results of the CASE STUDY presented here (Chapter 4).
ENDNOTES


4. See Caplan (1987, Chapters 11-17) for discussion.


A) Basic Properties of Prepositions

In traditional grammar the term "preposition" refers to a member of a fixed set of invariable words which typically relate a constituent of a sentence to another constituent (here it serves a "local" or "concrete" function and usually indicates a spatio-temporal relationship) or to the whole sentence (here it purportedly serves a "grammatical" or "abstract" function). As we will see below, this distinction is not a clear-cut one.

Taken as a class, prepositions (P or PREP) share some properties with the major lexical items such as nouns (N), verbs (V) and adjectives (A). On a syntactic level, Ps can be heads of their own phrases, just as Ns, Vs and As can be. Yet, unlike these categories (and like the minor categories such as Determiner) they do not participate in productive derivational morphology, though in some languages they may be inflected. Furthermore, though they do participate in compounding processes (cf. [[under]p[dog]N]N, [[under]p[ripe]A]A, [[under]p[feed]v]v ) it is not clear to what extent these processes are productive.

Given these very general observations, it is safe to say that the status of the category P with respect to the major/minor lexical category distinction is an ambiguous one.
Furthermore—and this is the crux of the problem when examining the aphasiological data—prepositions are a "motley group", i.e. the class is not a homogenous one. Two alternative approaches can be taken to the problem: one which treats the class of surface prepositions (including particles) as a unique syntactic category despite their distributional differences, and one which considers surface prepositions to constitute neither a natural class nor a category.9

Let us briefly consider a champion of the first view, R. Jackendoff. His 1973 article, "The base rules for prepositional phrases," might more aptly be titled, "In defense of the category PREP" (cf. the opening sentence, "People never seem to have taken prepositions seriously..."). Jackendoff demonstrates that analyses of prepositions which treat them merely as a subclass of verbs or as case markers on nouns are unjustified. He argues that the traditional base rule $P \rightarrow P \, NP$ cannot account for the distributional facts relating to prepositional phrases. In Jackendoff (1977) he claims that the category $P$ is the "fourth major syntactic category...on par with nouns, verbs and adjectives."10 In this connection he is at odds with Chomsky.11 Although for both the category $P$ is distinguished from $N$, $V$ and $A$ in its feature specification $[-N \, -V]$, for Chomsky only $+N$ or $+V$ categories (substantives and predicates: namely, the categories $N$, $V$, $A$) are true lexical categories. In Chomsky's Government-Binding framework, then, $P$ is a category, but not a
lexical category. Thus the ambiguous nature of the surface class is reflected in their categorial status.

As mentioned in the Introduction, it is assumed that the key to how prepositions pattern in aphasic language phenomena lies in the careful consideration of their semantic and syntactic properties, and how these are integrated in the structures in which they occur. We now go on to examine to what extent linguistic theory can capture the intuitive distinction of "semantic" vs. "syntactic" prepositions.
B. Thematic Relations and the Semantics-Syntax Interface

Recent linguistic theories treat the relationship between semantics and syntax in different ways. Crucial to most accounts, however, is the notion of thematic relations, ultimately semantic in nature, but which provide a direct tie-in with syntactic structure. Thematic relations specify how certain lexical items (arguments) in a sentence are related to each other in terms of who performs an action ("agent") on what ("theme"), with what ("instrument"), etc, around a given predicate. They are thus dependent on a particular verb. It follows that as far as prepositions and the verbs with which they co-occur are concerned, the semantic-syntax correlation is most directly reflected in the complement system. We will thus be making reference to such basic notions as subcategorization frames and predicate argument structure (these will be made clear in discussion to follow).

That it is necessary to consider prepositions in the light of the argument structures of verbs was made clear in Chomsky's 1965 model, where he discusses "degrees of cohesion" holding between a verb and an accompanying prepositional phrase. This discussion provided the starting point for many subsequent discussions of the syntactic behavior of prepositions, especially with regard to Reanalysis, as we will see below. The point is that certain aspects of a verb's conceptual structure (stipulated in the
verb's lexical entry) will determine the presence of many kinds of prepositional phrases in sentence structure.

Let us now briefly consider how thematic relations are exploited by various theories of grammar in order to bridge the gap between conceptual/semantic structure and syntactic structure. As alluded to above, the basic notions concerning "who-does-what-to-whom" in a sentence include "agent", "theme", "goal", among others; they are clearly essential to any semantic description of the sentence, and are to be correlated to its syntactic structure. Although J. Gruber's 1965/1976 *Studies in Lexical Relations* laid the groundwork for subsequent work on semantic/thematic roles, and many syntactic theories typically incorporate a formal substantiation of these in the form of theta-roles, these theories differ in how they view the status of thematic relations. Much important research in the area of thematic relations is being done by R. Jackendoff. In a recent paper which provides a "refined integration" of thematic relations into linguistic theory he makes the following observations:

The notions of θ-role and θ-marking, originally based on thematic relations, are now central to Government-Binding Theory--though often with if anything weaker motivation for thematic analyses than provided in Gruber's work and mine--and parallel notions appear in other syntactic theories as well. Given the importance of these notions, it is crucial to find out what they really are, so that they have an independent life of their own. We must be sure we are not invoking them as a thinly disguised wild card to meet the exigencies of syntax...
It is beyond the scope of the discussion here to relate the specifics of Jackendoff's proposal; we will note instead that his organization of the grammar specifies an autonomous semantic/conceptual level in addition to a phonological and a syntactic level. Thematic relations are not a part of the syntax (as they are in Government-Binding models, for instance) but of the semantic/conceptual level. Furthermore, they are not construed as annotations of D-Structure (as in Government-Binding, henceforth GB) or as a mere list of theta roles, or even a set of primitives of semantic theory; they are construed as relational notions which are defined structurally over conceptual structure. Such a rich system is for Jackendoff independently motivated (that is, independent of the syntax) owing to the fact that the determination of unclear cases regarding thematic roles in a sentence ultimately rests on semantic intuitions. 8

Jackendoff thus suggests that treatments of thematic relations other than his own rely heavily on syntactic rather than semantic considerations. This view seems only partially justified: Jackendoff himself notes that the "coarse-grained" (i.e. imprecise) approach to argument structure typical of syntactic accounts which embody theta-roles cannot be avoided, given the fact that a complete theory of conceptual structure is not yet available. We therefore assume that, for the time being, a viable solution to the problem of how to treat thematic relations in the grammar is presented by the GB
One of the hallmarks of this latter framework is its modular approach to the representation of grammar: the representation of a speaker-hearer's implicit knowledge of language is contained in highly articulated and autonomous subsystems, each with its own properties and principles. Ideally, one such subsystem, theta theory, deals with the semantic dependencies holding among lexical items in a sentence, as M. Baker observes:

Ultimately, it is this [theta] theory that divides the possible semantic dependencies into linguistically significant classes-- the theta roles-- and characterizes how each theta role is normally represented in linguistic structure. This is not a developed aspect of the theory, however.

It is interesting to note, in the light of Jackendoff's somewhat negative appraisal of the treatment of thematic relations in GB, that Baker also acknowledges that this aspect of sentence structure is not as well developed as others in the GB framework.10

In order to see how theta theory interacts with the levels in the grammar, we must first present briefly a few basic features of the GB model. In doing so, we will briefly define such notions as subcategorization, argument structure, and theta-role assignment, and introduce two related principles, the Projection Principle11 and the Theta-Criterion12.
The following diagram, adapted from Baker 1988a, illustrates the representational levels in GB theory:

LEXICON ---------------

(lists idiosyncratic properties of lexical items to be inserted in syntactic string: specifies which complements an item permits (subcategorization) and which theta-roles it may assign or be assigned (argument structure)

D - STRUCTURE

(move alpha)

S - STRUCTURE

PHONOLOGICAL FORM
(language/perceptual-motor interface)
stylistic and phonological rules

LOGICAL FORM
(language/conceptual interface)
expression of thematic relationships; predication and quantifier scope

It is easy to see how the lexicon plays an important role in the derivation of a sentence: it contains subcategorization frames that specify the syntactic category of complements that a lexical item permits either obligatorily or optionally (for example, the verb "cut" must be followed by an NP object, which may in turn be followed by a PP expressing
the instrument of the action of cutting, as in the sentence,

(1) John \[\text{VP} \text{CUT}[\text{NP the steak}[\text{PP with a knife}]]\].

In fact, such lexical information (i.e. regarding thematic structure and subcategorization information) must be respected in representations at all subsequent syntactic levels (D- and S-structure, and at the level of Logical Form: LF) as required by the Projection Principle. For example, the move-alpha rule allows us (by Wh-movement) to form the questions "What did John cut t?" or "What did John cut the steak with tj?" but the moved element must leave behind a [phonetically unrealized] trace, so that the movement does not result in the destruction of categorial structure as specified by subcategorization information, including the thematic relationships so determined.

The GB view is, then, that subcategorization entails theta-marking. At LF all lexical items in a thematic relation are assigned theta-roles and assume the status of arguments, and a position in LF to which a theta-role is assigned is a theta-position. The lexical head of a construction assigns a theta-role to each of its arguments, subject to the Theta Criterion:

Every term of LF that requires a theta-role (each argument) is associated with one and only one position to which theta roles are assigned, and each theta role determined by the lexical properties of a head is uniquely associated with one and only one argument.
Furthermore, theta-marking (or the assignment of theta-roles to NP arguments by the N, V, A or P heads of phrases in which they appear) is achieved through government. Government is a relation between two lexical items, itself dependent on the notion of c-command, which formalizes the intuitive relation "higher in the tree than". The definitions reproduced below are from Baker 1988a; how theta-role assignment operates under government in specific types of prepositional phrases will be illustrated in the next section.

**Government:**

A governs B iff A c-commands B and there is no category C such that C is a barrier between A and B

(where "barrier" can roughly be defined as all and only maximal projections--as defined by X-bar theory--except S)

**C-command:**

A c-commands B iff A does not dominate B and for every maximal projection C, if C dominates A then C dominates B

Such relations have important and pervasive consequences for syntactic processes, and could reasonably be expected to bear processing consequences as well. What is problematic is exactly how to test for the "psychological reality" of such essential formal notions, as we shall see.15
C) Overview of Prepositional Sub-Types

1. General Remarks

We have already noted that many surface prepositions appear in the sentence by virtue of the fact that a prepositional phrase is specified in a given verb's complement structure. These prepositional phrases are thus VP-internal and are potential candidates for the status of argument. In addition, there are other prepositional phrases whose presence in a sentence is not verb-dependent; these phrases may be added to virtually any verb. These sentential PPs are considered adjuncts (most typically temporal PPs such as "in the morning" or "at seven o'clock"), and as such do not receive a theta-role in the sense determined by the Theta Criterion. This initial division of prepositional structures into two basic types seems as if it should be straightforward enough, yet much controversy surrounds the issue of exactly which PPs are arguments and which are adjuncts. That the argument PP/adjunct PP distinction is not clear-cut is closely related to the fact that, as Baker puts it, "theta role assigning relationships in PPs remain somewhat murky in current theoretic work". Having made these general observations, we will now go on to examine different types of prepositional phrases, briefly considering certain aspects of their syntactic behavior. Particular attention will be drawn, for reasons made clear above, to their thematic properties.
Although the discussion below will closely follow that of Baker 1988a, references to other works will be made for purposes of comparison/contrast when relevant. To forecast briefly, the exposition of diagnostics which serve to determine the constituency of a prepositional structure will rely heavily on preposing and stranding phenomena.

2. Sentential PPs

In terms of basic syntactic structure, these PPs are sisters of the VP; they are sometimes known as VP modifiers. They can co-occur with virtually any V, are not required by the V (that is, they do not appear in the subcategorization frame or as part of predicate argument structure) and are therefore always optional. Since theta-marking follows from subcategorization, the whole PP is not theta-marked by the V. However, the NP present in the PP (PP--→ P NP) must bear a semantic role. In fact, the P head of PP assigns the relevant theta role to the NP it governs. Though some universal, finite set of theta roles is assumed to exist, it is not clear how many such roles there are, nor exactly what the proper labels should be. These limitations aside, we may temporarily assign labels such as TEMPORAL, DURATION and PURPOSE, to the theta roles corresponding to the NP inside the PP in sentences such as the following:

(2) [S[NpLucia][VPstudies][PPON[Npweekends]]] (TEMP)
and with analogous internal structure "She studies FOR three hours" (DUR); "She studies FOR the fun of it" (PURP).

Theta-role assignment in these adjunct PPs thus takes place as follows:18

Before looking at which syntactic tests (diagnostics) allow us to distinguish this type of prepositional phrase from others, let us first reflect on what our own intuitions tell us about their semantic interpretation. Consider the above sentences, "John washes cars on Saturdays/for hours/for the money". What does it mean to understand the meaning of the verb "wash"? A speaker/hearer knows that a certain animate [+human] entity performs a certain action on a certain other [+/-human] entity; the PP thus furnishes additional information not required by the predicate. For certain types of PPs (temporal, purposive...) the case is clear: for other types (certain locatives) it is not. Semantic intuitions and
syntactic judgments regarding these structures are inconsistent. For example, it is a matter of some debate whether these PPs modify the whole sentence (branch off of S) or modify the VP (branch off of V-double bar in X-bar syntactic terms). Though the relevant discussion is interesting, this issue will not be pursued here. What is crucial is that we be able to distinguish them from PPs which are required by the V, and hence appear either within a simple VP or at the V-single bar level; in other words, the types of PPs we are considering here must occupy a higher position in the syntactic tree than strictly subcategorized PPs.

Now for some relevant diagnostics. The pseudo-cleft test is discussed extensively in Reinhart 1983 but is attributed to J.R. Ross. In this construction, the what-clause can only contain non VP material; this would allow an S PP (as in (3)) but not a VP PP (as in (4)) to appear:

(3) John washes cars on Saturdays
(3') What John did on Saturdays was wash cars.

(4) John puts books on the shelf.
(4') *What John did on the shelf was put books.

We can use the same sentences to illustrate the pro-VP or "do so" criterion, following Jackendoff 1977: the proform must refer back to the whole VP. For this reason, an adjunct phrase, but not an argument phrase, can then follow the proform:
(5) John washes cars on Saturdays and Bill does so on Sundays.
(6) *John puts books on the shelf and Bill does so on the floor.

Stranding constructions (resulting from either Wh-movement or the more restrictive NP-movement rule—the pseudopassive) are sentences in which the P head of a PP is left behind ("stranded") after the movement rule operates on the NP object of a D-structure PP. Preposition stranding phenomena will be discussed more fully below; for the time being it suffices to note that generally speaking, such processes can not strand NPs contained in adjunct PPs. However, the distinction is clearer for stranding via NP movement (the pseudopassive construction) than for stranding via Wh-movement. The examples below illustrate this. In (7) the PP is an argument; in (8) it is an adjunct:

(7) The parents [vpargued[pPfor[Npthe solution]]]
(7') Which solutionj did the parents argue for tj ?
(7") The best solutionj was argued for tj (by the parents)

(8) The parents [vpargued][ppfor[Npthree hours]]
(8') ?How longj did the parents argue for tj ?
(8") *Three hoursj were argued for tj (by the parents)

It should be noted at this point that judgments regarding the grammaticality of sentences containing stranded prepositions vary greatly from speaker to speaker; this is partially due to dialect differences. Another factor, which
clouds judgments generally but is characteristic of judgments concerning preposition stranding in particular, is related to the distinction between prescriptive grammar and descriptive grammar, which linguists distinguish but your average speaker does not. They may state that a given sentence is ungrammatical ("you are not supposed to end a sentence with a preposition") when asked to reflect on the status of a given sentence, yet will spontaneously produce stranding constructions.

We may now return to the seminal comments made by Chomsky concerning "degrees of cohesion" between a preposition and the verb with which it co-occurs (cf. reference supra). Much subsequent work on the syntax of PPs rests on these observations; a case in point being the discussion of stranding in Hornstein and Weinberg 1981. An important example which originated in Chomsky and was taken up by Hornstein and Weinberg will be reproduced here because of its relevance to restrictions on stranding and also because it brings us to our next topic, namely the need to distinguish two types of locative phrases corresponding to two different structural positions.

Consideration of the following sentence reveals that it is ambiguous (i.e. it has two possible readings)

(9) John decided on the boat
The two readings correspond roughly to the paraphrases (a) "John chose the boat" (out of a set of objects) and (b) "John made a decision (while he was) on the boat". In the first case, the preposition is, in Chomsky's terms, "in close connection with the verb"; it is therefore VP internal (or located at the level of V single-bar). Indeed, as we shall see below, some accounts claim that the connection is so close as to warrant Reanalysis, a structure-destroying process that would allow the P to become part of a complex V; we will return to this and related issues concerning implications for the Projection Principle and the Theta Criterion in the discussion of preposition stranding below. In the second case, the PP clearly indicates a location and its presence is in no way determined by the V "decide"; Chomsky calls it a "place adverbial". It is either external to the VP and branches directly off of S, or is VP internal, but at the V double-bar level. We will now see how stranding the preposition resolves the ambiguity. In fact, the structures in (10) and (11) are unambiguous; they can only be derived from the structure corresponding to the first reading above (where "decide on" = "choose"):

(10) Which boat_i did John decide on t_i?
(11) The red boat_i was decided on t_i (by John)

To summarize, stranding an adjunct preposition results in an ungrammatical structure: the stranding process once again
serves to distinguish those prepositions which are not closely connected to the verb (i.e. are not "strandable") from those that are.

After Chomsky 1965, this type of "outer" locative is sometimes referred to as "place" in order to distinguish it from a [true] "locative" which is required by the V.21 As alluded to above, the distinction between inner and outer locatives is not a clear-cut one. An illuminating discussion of the issues is given in Reinhart 1983. In her discussion of anaphora and coreference restrictions in different syntactic domains, Reinhart demonstrates how coreference differences correlate with the two basic structural configurations for PPs, namely verb-phrasal and sentential PPs. In addition to the structural diagnostics mentioned above, she outlines semantic and pragmatic differences holding between sentences with outer and inner locatives. The two types differ systematically in terms of quantifier scope, entailments and theme-rheme relations, and these semantic/pragmatic differences correlate with coreference restrictions and with syntactic differences in related PP preposing constructions. The point to be made here is that there are syntactic and semantic grounds to distinguish two classes of locative PPs. Furthermore, Reinhart's work on coreference restrictions provides a perfect example of how certain aspects of the semantic interpretation of a sentence are sensitive to structural relations. Once it is determined that VP PPs and
S PPs have different c-command domains (respectively, the VP node alone vs. all nodes in S); the semantics of these structures (including coreference facts) fall out naturally from this distinction.

Having outlined some important properties of adjunct prepositional phrases, we may now go on to consider different types of PPs that occur within the verb phrase.

3. Verb-Phrasal PPs

a. Introduction: Subcategorization Frames and Predicate-Argument Structure

VP-internal prepositional phrases are distinguishable from sentential PPs by the various criteria outlined above. Their position inside the VP is determined by idiosyncratic lexical properties of the V in question, as required by the subcategorization frame and predicate argument structure projected from the verb's lexical entry into the syntax. A PP argument may be obligatory or optional. It is easy to see how either or both of these kinds of information concerning the conceptual structure of a V (as represented in subcategorization frames and predicate argument structure) can be invoked to determine the complexity of a verb's lexical entry. In the light of our desire to seek convergence in theoretical and empirical sets of observations, the importance of this
seemingly banal assertion cannot be underestimated. We will thus take a useful detour to present some interesting research carried out in a concerted psycholinguistic/theoretical linguistic framework by L. Shapiro, E. Zurif and J. Grimshaw. 22

These researchers have argued that the complexity of a verb's lexical semantic representation is directly correlated to real-time processing complexity, as measured by differential reaction times on a cross-modal lexical decision (dual) task performed by normals. Furthermore, their evidence strongly suggests that processing complexity is more a function of predicate argument structure complexity (number of possible thematic arrangements, not number of arguments within a given arrangement) than of subcategorization frame complexity (number of possible complements). That both kinds of information must be included in a verb's lexical entry is indicated by the fact that the relative representational complexities can diverge within a single class of verbs; for example, alternating vs. non-alternating dative verbs. In what follows, the particular treatment of lexical entries assumed is that of Grimshaw, as presented in the Shapiro et.al. paper. It must be emphasized that treatments of lexical representation differ in terms of exactly how subcategorization restrictions and predicate argument structure are represented. These differences should not be regarded as merely notational; indeed, they may have
consequences for processing theories and the storage and retrieval of lexical items. Although the problem of how argument structures are "mapped" onto syntactic structure is far from being resolved, this aspect is the focus of much recent work.23

In order to illustrate subcategorization frames and predicate argument structures, let us consider the representations Shapiro et al. give for the verb "send":

**SUBCATEGORIZATION FRAME:**

\[
\text{send: } v \left[ \begin{array}{c}
\text{NP} \\
\text{NP} \\
\text{NP} \\
\text{NP}
\end{array} \right]
\]

**PREDICATE ARGUMENT STRUCTURE:**

send: \((x,y)\)

\((x,y,z)\)

The subcategorization frame tells us that the verb "send" allows for three complement structures, as in "Laura sent the package", "Laura sent the package to her mother" and "Laura sent her mother the package". In the predicate argument structure, the variables \(x\), \(y\) and \(z\) are "written over" thematic roles; presumably, some universal
list of thematic roles would allow "x" to correspond to AGENT in a given syntactic configuration; "y" to correspond to THEME or PATIENT; "z" to GOAL, etc. Though Shapiro and colleagues initially shy away from the use of these labels, they suggest in a footnote that the predicate argument structures as illustrated here furnish a "first-pass semantic description" of the sentence when the variables are re-written into thematic roles. Linking rules would allow the argument represented by the variable "x" to be realized syntactically as the NP immediately dominated by the S node, the "y" variable as the NP complement canonically positioned immediately after the V, and the "z" variable as the PP complement of the verb. Though the authors do not mention grammatical functions or relations, a theory of grammatical functions would allow the above positions to be correlated to the notions "subject" and "complement".

We have thus seen how the structure of a sentence is constrained by the lexical conceptual structure of the V which determines it predicate. Accordingly, theta-theory specifies that prepositions which appear in verbal complements do not autonomously assign a theta-role to their NP objects as they do in adjunct PPs. When they do participate in theta-role assignment (and under which conditions they do is a matter of debate) they do so compositionally, i.e. in conjunction with the verb. Chomsky defines compositional theta-role assignment
as follows:

Let's assume that each lexical element $\alpha$ assigns a theta-role to every NP or clause in its complement (if there are any), including NP in PP linked to $\alpha$, in which case the theta-role will be determined compositionally by $\alpha$ and the P head of PP.$^{26}$

More recently, Baker justifies the notion of indirect theta role assignment in terms of the compositional semantic dependencies holding in a subset of verbal complement structures containing prepositional phrases. While the preposition determines a range of roles that its NP object can have, the verb further limits that range of possible interpretations. Hence the $V$ assigns a theta-role to the whole PP and the $P$ assigns a theta-role to its NP object.$^{27}$

Having thus made these introductory remarks concerning verbal complements, we can now make some general observations concerning the different types of prepositional phrases occurring within them, with a view to distinguishing the varying semantic/syntactic functions that their prepositions fulfill.

b. Dative and Benefactive PPs

Let us consider the following sentences:
(12) Mary lent the books to John
(12') Mary lent John the books
(12") *Mary lent the books

(13) Mary sent the books to John
(13') Mary sent John the books
(13") Mary sent the books

(14) Joanna baked a pie for the children
(14') Joanna baked the children a pie
(14") Joanna baked a pie

Taking these examples to be representative of dative and benefactive structures, we can make the following general observations: dative PPs (TO + NP) express a goal or a recipient towards which an action progresses, and they may be obligatory or optional, depending on the verb; benefactive PPs (FOR + NP) also express an action towards an NP whose role is therefore somewhat like goal/recipient; this semantic role is called beneficiary. Benefactive phrases are always optional. Within the PPs, the only prepositions that appear in datives and benefactives and which serve to theta-mark and assign case to their NP complements are TO and FOR, respectively. Although both types of verb classes exhibit the "double-object" or "ditransitive" construction (also called "dative shift" when a movement analysis is implied, or more neutrally, "dative alternation"), not all dative verbs alternate (for example, the verb "donate": *Mrs. Smith donated the school the books), nor do all benefactive constructions allow alternation. The existence of these constructions has posed problems for Case theory; given that Case is assigned
under adjacency, how does the second NP in the double object construction get assigned Case? Two basic approaches to the problem exist: accounts which assume movement, and accounts which do not assume movement and allow the second object to be base generated; we will return briefly to this point below.

Baker 1988a assumes that both dative to-phrases and benefactive for-phrases are arguments of the verb. Although he acknowledges that verbs do not seem to subcategorize for benefactive phrases in the same way as for goal phrases (no verbs seem to require them, and no verbs seem to forbid them) he states that it does not necessarily follow that these phrases are not theta-marked by the verb when they do appear (in essence, we may have "optional" as well as "obligatory" arguments; the obligatory/optional distinction does not map perfectly onto the argument/adjunct distinction). Baker believes that the semantic dependencies holding in these constructions indicate that the "exact interpretation of the benefactive NP is a function of both the verb and the prepositional element". These semantic intuitions, and thus Baker's analysis of these constructions, contrast sharply with those of other researchers.

According to Baker 1988b, theta-role assignment in both dative and benefactive structures is compositional: the verb assigns a theta-role to the relevant PP and the P head of PP assigns a theta-role to the recipient/beneficiary NP, as follows:
As alluded to above, the existence of two types of surface dative/benefactive structures poses at least two central problems for linguistic theory: first, how do we account for the fact that some verbs exhibit the double object construction and some do not, and second, how do we avoid violating the adjacency condition on case assignment?

In answer to the first question, Stowell (1981, 1982) suggests that the relevant distinction is morphological: those verbs which exhibit the double-object construction belong to the "native stem class" (the example of a non-alternating verb given above, "donate", would be [-native] or [+latinate]). Thus the difference may not be so heavily dependent on idiosyncratic lexical properties. This proposal is strengthened by the fact that the distinction between [+/-native] stems operates in other constructions as well,
notably the particle movement construction (V + particle constructions will be discussed below).

With respect to the problems posed by these constructions for case theory, many proposals (among these, Czepluch 1982 and Baker 1988a) have posited the existence of a phonologically null P which governs the goal/receipient/beneficiary NP in the double-object construction and which is allowed to "transmit" (vs. assign) accusative case from the V to the NP. We will not go into the details of these proposals but will note that the exact status of the preposition (theta-role assigner and/or case assigner) in dative/benefactive constructions is not clear.

C. Instrumental PPs

Many researchers have noted that the NP in an instrumental prepositional phrase can fulfill diverse semantic roles. A. Marantz gives two examples of such roles: "intermediary agent" and "facilitatory instrument" as in "Elmer unlocked the porcupine cage WITH A KEY" and "Elmer examined the inscription WITH A MAGNIFYING GLASS", respectively. We can observe that the theme NP is affected by the action in the former case, but not in the latter case, in accordance with lexical properties of the Vs "unlock" and "examine". It thus seems fairly obvious that interpretation of these sentences relies heavily on the semantic/conceptual structure of the verb. What must
be considered is to what extent, if any, the preposition serves to limit the range of roles that the instrumental NP can bear.

Marantz analyzes these structures as VP modifiers (adjuncts) on the grounds that the instrumental PPs are never required by the verb. One would then expect him to claim that the preposition autonomously assigns a theta-role to its NP object, that is, that it does so independently of the verb, as he proposes for benefactive for. But he does not propose a parallel analysis for instrumentals: instead, he claims that the VP (not the V) assigns the theta role INSTRUMENT to the NP in the PP, and allows the preposition to "transmit" this theta-role. This type of approach seems to blur the distinction adjunct/argument and introduces a complication to theta-theory by allowing prepositions to "transmit" a theta-role in addition to assigning a theta role. The approach certainly begs the question "what does it mean for a preposition to "transmit" rather than "assign" a theta-role? We will leave this question unanswered pending the presentation of other analyses. According to Marantz, then, theta-role assignment in instrumental structures would proceed as follows:
Baker's (1985/1988a) analysis of these structures also assumes that the P in the instrumental phrase participates in theta-role assignment, in parallel fashion to benefactive constructions. However, his analysis diverges from Marantz' in that he assumes the PP to be an optional argument of the V, not an adjunct. Using a syntactic test of adjunct/argument asymmetries adopted from J. Huang^34 (long-extraction of an adjunct vs. an argument PP by wh-movement) he demonstrates that benefactives, instrumentals and certain locative PPs do indeed behave as arguments (such movement does not result in questionable or ungrammatical sentences). Only the examples relevant to instrumental structures will be reproduced here (the PP in square brackets [ ] is the putative argument instrumental PP and the PP in the curly brackets ( ) is an adjunct manner PP):
(15) I always forget to open doors [with this key] (by flicking my wrist)
(15') ?With which key do you always forget how to open doors?
(15'') *How do you always forget with which key to open doors?

As we can see, movement of the adjunct phrase is worse than movement of the argument phrase, although it must be emphasized that the difference is a matter of degree; sentence (15') may be more than just "slightly odd", as Baker claims. Thus Baker's claim that the instrumental PP is an argument of the verb is justifiable both in terms of semantic intuitions regarding the conceptual structure of the verb with which it co-occurs and in terms of an independent syntactic test designed to reflect adjunct/argument asymmetries in the grammar.

In a more recent analysis Baker maintains the assumption that instrumental PPs are arguments of the verb but abandons the claim that they participate in theta-role assignment in these constructions. In fact, he claims that an instrumental preposition—when it appears—does so solely for the purpose of assigning case to the NP instrument, while the verb assigns both theta-roles (theme and instrument) to its subcategorized NPs. He notes that this claim coincides with recent discussion concerning instrumental constructions (especially of the type Marantz calls "intermediary agent") in Jackendoff (1987). Let us consider the following sentences from Jackendoff:
Conceptual/semantic interpretation tells us that in (16), by virtue of the car's motion to the tree over an interval of time, the car comes to act on the tree at the termination of its motion/path; in (17) the "instrument" (stick) plays the same role as the "theme" (car) in (16): Sue acts on the stick which in turn acts on Fred at the termination of its motion. What follows from this is that there is no semantic role "instrument": in Jackendoff's words,

...it is the Patient of an action carried out by the Instigator [Sue]. Thus, the role Instrument is not a new primitive role but an intermediary between Actor and Patient in the decomposition of an action...37

The semantic facts therefore justify the claim that instrumental prepositions do not appear as theta-role assigners. Baker also suggests that the preposition would not appear at D-structure, but may be inserted in the syntax as a dummy case marker (analogous to genitive "of" constructions). On this view, its role in instrumental constructions would be purely syntactic. However, Baker does not commit himself totally to the dummy "with" proposal. We will reproduce here the schematic diagram he gives at the beginning of his 1988b discussion, in which the preposition is present at D-
structure—leaving aside the question of how—but does not participate in theta-role assignment:

![Diagram of syntax tree]

d. Locative PPs

We have already discussed certain aspects of these constructions in the context of the discussion of adjunct PPs above; we may recall the need to distinguish inner and outer locatives (with corresponding theta-roles \textsc{loc}(ative) and \textsc{place}, respectively). As mentioned above, stranding constructions allow us to make this distinction. Let us consider the following examples (once again taken from Hornstein and Weinberg 1981):

(18) John [vpslept[ppin the bed]]
(18') Which bed$_i$ did John sleep in t$_i$?
(18'') This bed$_j$ was slept in t$_j$

(19) John [vpslept[ppin New York]]
(19') Which city$_i$ did John sleep in t$_i$?
(19'') *New York$_j$ was slept in t$_j$ [by John]
In terms of conceptual differences, it often seems to be the case that inner locatives express spatial relations of minor extension when compared to outer locatives, (in *the bed* vs. in *New York*) and the verb is kept constant (as in the examples above). 38

Locative PPs are considered to be either obligatory or optional. However, we may ask ourselves just how many verbs actually require that a locative phrase be present; the canonical example is the verb "put"; another similar example is "place", perhaps certain verbs like "go" (cf. ?Harry went); we are hard pressed to come up with numerous examples. Perhaps this class of verbs is indeed quite small. In any case, it is clear that locative PPs can occur as obligatory arguments, as optional arguments, and as adjuncts, though most would probably fall into the last two categories. An important property of these constructions can be illustrated by the following examples:

(20) The cat is sitting ON/UNDER/NEAR/BY... the chair
(21) The boys are running TO/INTO/FROM... the school

Thus more than one locative or directional preposition can occur within a given syntactic frame; this is what is sometimes referred to in the aphasiological literature as "substitutability". Such paradigms indicate that semantic interpretation of the sentence can hinge on understanding the meaning of the preposition. It should follow that they
participate in theta-role assignment, and this is what most accounts assume, including Baker 1988a. Before considering an alternative analysis of the theta-assigning properties of these constructions, another general observation regarding the status of these constructions in aphasiology can be made. It is easy to see why locative constructions are taken by researchers to be the canonical case of "semantic" prepositions. Theoretically speaking, their contribution to sentence meaning is unquestionable; practically speaking, they lend themselves well to testing situations due to their picturability.

A more recent proposal by Baker (class notes) states that locative constructions are essentially of two different types: those associated with posture verbs (such as "sit" or "lie") and those associated with movement verbs ("run"; certain uses of "put"). With respect to the theta-assignment properties of these structures, the first type of [posture] locative is purported to be analogous to instrumentals and the second type, [path] locatives, to dative/benefactive structures. Verbs such as "sit" would then mark the NP as LOC, without participation on the part of the preposition, and movement verbs would assign the theta-role PATH to the NP compositionally, i.e. with the preposition. There are several issues to be addressed here. The division of locative constructions into two classes based on conceptual structure of the verb has intuitive appeal, for all the
reasons a lexical semanticist like Jackendoff would give regarding explanatory adequacy. However, it seems counter-intuitive to cancel out the semantic contribution of the preposition by disallowing it from participating in theta-role assignment. More specifically, if we consider Baker's analysis of dummy "with" for instrumentals we are immediately faced with a problem if such an analysis is to be extended to locative constructions. We could postulate a rule of "with" insertion fairly easily, given that it is always the same preposition that surfaces in these constructions, but that is obviously not the case for locative constructions, in which any one of a number of prepositions could appear. How would the right one surface? Given these reservations, we will for the time being assume a unitary analysis for locative and path constructions, one in which theta-role assignment is compositional, as follows:

```
        S
       /\
      /  \  
     NP  VP
     / \  /  
     N  V  θ  PP
      /  \  /  
     P  θ  LOC  NP
      /    /    |
    Jane  runs  into the school
      /      /     |
    Fido    lies  under the sofa
```
e. Idiosyncratic Verb + Preposition Constructions

Aside from the PP types discussed in (b) through (d) above, we will briefly discuss another class of PP phrases that appear in verb complement structure, for reasons that will become clearer in the context of the literature review.

One of the thorniest problems concerning the syntax of prepositional phrases is presented by idiosyncratic verb + preposition combinations of the following type: NP₁ looks at NP₂, NP₁ waits for NP₂, NP₁ thinks/worries/dreams about NP₂, NP₁ counts/relied on NP₂, etc. We may recall that this structural type has already found its way into our discussion, in example (7) and in the first reading of (9) above, where it served to contrast with adjunct PPs.

On a purely intuitive level, we may make the following observations: the semantics of these V + preposition combinations is in no way compositional; furthermore, the distribution of the various prepositions which appear in these combinations seems to be quite random (many prepositions can occur in these constructions: ON, AT, FOR, ABOUT, TO...). In other words, there does not seem to be any reliable method of determining which preposition will co-occur with a given verb.

Given these properties, it is easy to see why many studies of pathological language data have labelled this class of prepositional structures "obligatory" prepositions and have tested them against locative structures. We will return to
this point presently. We may now ask, as a consequence to the observations made above, what function the preposition does serve in sentences of this type. Bresnan 1978 offers the following explanation:

The prepositions on and at in [rely on] and [one reading of arrive at] function as transitivizers of their verbs. This is a well-developed semantic process in English... If it should seem odd to associate a semantic unit (the logically transitive relation) with elements that do not form a structural unit, notice that we do this anyway for discontinuous verbs like bring...to...where "bring someone to" means "to revive someone"...However, in some cases the transitivizing process may result in the structural incorporation of the preposition into the verbal category V... 39

Thus the (oblique) object of the preposition is in fact interpretable in some sense as the "object" of a verb that is normally intransitive. This is essentially the logic behind analyses of these constructions and preposition stranding phenomena that propose some sort of Reanalysis rule40 which "reanalyzes" certain V-PP structures as a sequence V'-NP, thereby cancelling the PP node. We may represent this schematically below, following Stowell41:

(22) [\bar{v}V - [ppP - NP]] \rightarrow \text{REANALYSIS} \rightarrow \bar{v}[v,V - P] - NP

The former oblique object NP now becomes the object of the complex V' and is therefore licensed to move, causing the reanalyzed P to appear "stranded". A preposition in a PP
outside of the VP would not be a candidate for reanalysis, as we see in the labelled bracketing in (22) which specifies that the PP must be at the V single-bar level, or the level which represents argument structure. Reanalysis is thus the grammatical "device" which allows stranding to occur.

The existence of preposition stranding constructions raises several problems of an explanatory nature. These may be outlined as follows. The first problems concerns the status of stranding phenomena as a marked (language-specific) property. The second concerns the asymmetry observed between stranding via wh-movement and stranding via NP-movement (the "pseudopassive" construction), which is not as free. The third concerns the status of Reanalysis-type rules and their consequences for the grammar; insofar as they are structure-destroying, they may violate the Projection Principle.

Cross linguistic evidence shows that stranding is a marked phenomenon, i.e. that it is a language-specific property of a subset of Germanic languages that the object of a preposition may be moved.42 Generally speaking, then, we should view the problem more as how to disallow stranding than how to allow it. In other words, analyses should capture the generalization that in the normal case, extraction out of a prepositional phrase is not permissible (i.e. PPs are "islands" for movement).

Hornstein and Weinberg (1981), who assume that prepositions assign oblique case, rule out stranding constructions by
positing the existence of a surface filter which would rule out a trace with oblique case. Other accounts, among them Stowell 1982, rule out stranding constructions in the normal (unmarked) case by appealing to the Empty Category Principle (ECP) which requires that all traces must be properly governed. Both types of accounts then force reanalysis in order to allow stranding to occur.

We will not go into the rather complicated issue of whether or not reanalysis is needed to account for stranding via both types of movement. Instead, we will briefly discuss a semantic condition which may be invoked in the explanation of the pseudopassive construction in particular.

VanRiemsdijk and Williams (1986) call their version of such a condition the "natural predicate condition":

...it appears that the NP that undergoes movement in a passive structure must originate immediately to the right of what has been called a natural predicate. Thus, argue for [in "this solution was argued for by many linguists"] can be regarded as a natural predicate, since it could easily be replaced by a single word like "advocate"...unfortunately, although in many cases it is intuitively straightforward to determine what is and what is not a natural predicate, so far no one has been able to make this notion precise.

In order to account for the idiosyncracies of the pseudopassive construction, Stowell also appeals to the semantics of verb and the prepositional object:
it seems that Reanalysis is also subject to various conditions associated with the thematic properties of the governing head (i.e. the V). Thus, a number of logically possible pseudopassive constructions are apparently ruled out because the object of the preposition is not "affected" by the action of the verb...even for wh-movement constructions, the possibility of stranding adverbial prepositions seems to be linked directly to the perceived "closeness" of the adverbial PP to the thematic structure of the governing verb.46

Once again, careful consideration of the conceptual structure of a verb is essential to understanding the syntactic behavior of prepositional constructions.

To summarize, it seems reasonable to assume that whatever the exact form of the additional apparatus needed to account for preposition stranding, the grammar must make some such device available. We have also observed that the semantics of these constructions are clearly non-compositional, and it is logical to assume that the prepositions in these constructions do not participate in assignment of a theta-role to the NP.

Let us now consider some of the implications of the above observations for the study of prepositions in agrammatism. Travis (1983) following Grodzinsky (1983), proposes that prepositions which do not participate in theta-assignment do not surface in agrammatism. If the prepositions are not present to assign case to the object NPs, these NPs will be ruled out by the Case Filter. This would entail that the presence of certain major lexical class items (NPs) is compromised, a prediction which goes against the facts. One
solution to this problem lies in the allowance for empty prepositional nodes which are present for the purposes of case-marking only. That the class of verb + idiosyncratic prepositions is particularly suited to this analysis was noted by Chomsky 1981 in a footnote, citing an analysis of prepositions that does not consider them to be a "natural class":

...those prepositional particles that are transparent to selectional features of verbs (i.e., the verb selects the object of the particle) are Case-markers, not prepositions in the X-bar system...47

Of course, this type of analysis leaves the problem of how the right preposition would surface (in normal speech) unresolved. Assuming that the approach is in essence correct, in these structures: the prepositions do not participate in theta-role assignment; the V theta-marks the NP in a PP with an empty P node; and the empty P then assigns case to the object NP. When stranding does occur, reanalysis of the preposition into a complex V' cancels the PP node (the P loses its status as head of the PP). It is important to note that this results in a structure which directly reflects the "degree of cohesion" holding between the verb and the preposition. Problems for the Projection Principle raised by this structure-destroying rule may be at least partially resolved by proposing some sort of "structure-preserving" condition, along lines presented by Stowell.48
g. Verb + Particle Constructions

Traditional grammars treated particles (as in the sentences "Harry looked UP the address") as a separate (minor) category and allowed for their occurrence in the expansion rule for VP. The particle was generated adjacent to the V and in the case of V + particle combinations such as "look up" "put on" "throw away" which must be followed by an NP object (vs. "fly away" which can not), their presence after the NP was accounted for by the "Particle Movement" transformation. More recent analyses consider these constructions to arise from a Word Formation Rule in the lexicon rather than a transformation in the syntax. Stowell accounts for the intervening presence of an NP by suggesting that it incorporates or "cliticizes" inside the structure of a complex V, in parallel analysis to dative alternation structures. While such a solution may seem at first ad hoc, assuming that the construction arises in the lexicon is definitely more in line with the well-known idiosyncratic nature of these constructions: their semantics are non-compositional, at least in most cases. Stowell notes that languages that exhibit such constructions also allow preposition stranding constructions, and suggests that this is not coincidental. On this view, the grammar should treat verb + particle constructions and verb + preposition constructions
in a similar fashion. Note that both rules are needed, a morphological rule of word formation and a syntactic rule of reanalysis, in order to account for the differences in the way these two types pattern with respect to processes such as nominalization: only the V + particle constructions are candidates for this process (cf. "John's calling-up of his friend" vs. "*Bill's accounting for of the facts"). The particle thus appears with the verb in a lexical entry and gets inserted into D-structure along with the V; the resultant complex verb is then responsible for determining the thematic role of the object NP. We may note as we did for the dative alternation phenomena that the Word Formation Rule producing verb + particle constructions is sensitive to the stem-class distinction [+/-native] while the reanalysis rule is not.

g. Passive "by"

Let us consider the following sentences:

(23) The chocolate cake was eaten by the chef.
(24) The lion was killed by the tiger.

Most GB accounts derive such passive sentences as follows. Taking (23) above, the NP "the chocolate cake" would be generated by the base in a position adjacent to the verb "was eaten" which exhibits passive morphology. At
D-structure "the chocolate cake" would then be assigned the appropriate "theme" theta-role by the verb, but it does not receive case from the verb because one of the characteristics of passive verb morphology is that it "absorbs" case. Thus this NP is forced to move to subject position in order to receive case, which it does from the INFL node. When a "by" phrase appears (we may simply say, "the chocolate cake was eaten" or "the lion was killed") it is the preposition BY which assigns the theta-role (typically "agent") to the adjacent NP, as Chomsky states:

...if an agent phrase (e.g. "by everyone") is added, than a θ-role is assigned to its NP by the preposition "by", and this theta-role is similar to (perhaps identical with) the theta-role assigned to the agent by the VP in the corresponding sentence...50

However, Not all GB accounts assume that the preposition BY has such autonomous theta-assigning properties. According to Baker (1988a), the theta-assigning properties of BY are dependent on the passive construction, and he proposes an analysis whereby the by-phrase "doubles" the theta-role of the passive morpheme in a passive structure; its ability to do so is not language- or preposition-specific, but due to an idiosyncratic lexical property of an individual passive morpheme. Such a passive morpheme "transmits" rather than assigns its thematic role to a doubling by-phrase.51 On this view, the thematic role assigning properties of the
preposition BY in passive constructions is reduced.

This concludes our discussion of the treatment of prepositional structures in representative modular theories of grammar. We now go on to examine if, and to what extent, a psycholinguistic theory of sentence processing can capture the structural distinctions which are made explicit by grammatical theory.
ENDNOTES


2. In Italian, for example, "articulated" prepositions are marked for gender and number in agreement with the adjacent NP: SU ("on") vs. "SUL libro" ("on the book", masculine singular) vs. "SUI libri" ("on the books", masculine plural), etc.

3. Jackendoff (1973) and (1977, pp.79-80) presents arguments for a unified analysis of particles and prepositions; this approach views their homophony as non-accidental. In this framework, both P (Prep) and PRT (Particle) are specified as [-subj] but since only the former have [+obj] complement structure, they are marked [+comp] and the latter are marked [-comp].


6. Chomsky (1965) pp.100-102


10. See also van Riemsdijk and Williams (1986) pp.254-255 for a similar observation.


15. Breakthroughs have been made: see for example D. Caplan and N. Hildebrandt's *Disorders of Syntactic Comprehension* (Cambridge, MIT Press, 1988) for evidence that formal elements proposed in Trace theory (inter alia) bear processing consequences.


18. Tree structure is simplified for illustrative purposes (the Infl node will not be included); similarly, assignment of the external theta-role to the NP subject position will not be shown.

19. See for example Jackendoff (1972) pp.94-95 for arguments that these PPs must be base generated under VP. Unlike "true" sentence adverbs of the type "in my opinion" which can occur in various sentential positions, these only occur in base-generated final position or sentence-initial position by virtue of a rule which preposes them from the VP.

20. A thorough discussion is to be found in Hornstein and Weinberg (1981).

21. We may recall that the class of Vs strictly subcategorizing a locative PP may not be that large; the canonical case (ubiquitous in the literature) is represented by the verb "put" (*John put the book).

22. Shapiro et.al. (1987)

23. Current thematic or predicate "linking" approaches have gained favor: see for example J. Carrier-Duncan, "Linking of thematic roles in derivational word formation," Linguistic Inquiry 16 (1985) pp.1-34.


30. In the article cited in note 29 above, Jackendoff analyzes benefactive phrases as adjuncts, not optional arguments (vs. dative verbs, where the goal/recipient PP is always implied by the verb, even if it is not present).

32. Various mechanisms have been proposed in order to solve the problem of case assignment in double object constructions. For example, Stowell (1981) argues strongly for an analysis in which this construction arises from the incorporation of the goal NP into a complex verb; the shifted construction would then arise as a result of a "to" insertion rule, with the preposition "to" functioning as a "dummy" case marker only.


34. J. Huang, Logical Relations in Chinese and the Theory of Grammar, Doctoral dissertation, MIT, 1982, p.524. We note that on p.543 he explains the logic behind the restricted movement of adjunct phrases as compared to argument phrases: "since the dependency between a verb and an adjunct is looser than that between a verb and its argument, it is natural to assume that, in order for the looser dependency to be established, the two terms of the dependency must be sufficiently close to each other in distance, more so than the two terms of a closer type of dependency..."

38. The same PP (e.g. Reinhart's 1983 example: "in Ben's picture" in "Rosa is riding a horse in Ben's picture" vs. "Rosa found a scratch in Ben's picture") can be either sentential or verb-phrasal, depending on the verb it occurs with.

42. See van Riemsdijk, A Case Study in Syntactic Markedness: The Binding Nature of Prepositional Phrases, Dordrecht, Foris, 1978, for discussion.

44. ECP accounts (e.g. Stowell 1982) depend on the [independently motivated] assumption that prepositions are not proper governors. Huang (see note 34 above) proposes a condition ("Condition on Extraction Domain", p.505) which is similar to the ECP in its effects; however, this condition rules out stranding of an adjunct PP without assuming that Ps are not proper governors.


CHAPTER 2: THE PSYCHOLINGUISTIC FRAMEWORK

A) M. Garrett's Sentence Production Model

While linguistic theory is concerned with models of competence, that is, with idealized models of knowledge and how that linguistic knowledge is structured in a grammar, psycholinguistic processing models necessarily move away from idealizations and attempt to answer the question, "What might be the structure of mental processes which determine language use in real time?" M. Garrett's sentence production model (Garrett and Kean 1980, Garrett 1982, 1984) represents one attempt to answer that question. In their 1980 paper, Garrett and M.L. Kean seem to require that type-transparency exist between a theory of sentence production and a theory of grammar: "a common, and, we think, correct constraint placed on theories of sentence processing is that the levels of representation computed by the processor(s) include at least the set of levels of representation generated by the grammar". Whether or not this constraint is indeed viable, in either a strong or a weak version, is for the authors an empirical question. In a more recent paper, however, Garrett (1984) addresses the issue differently:

I stress that [the model's] features are based on real-time language-processing data, not on a priori assumptions about the relation between formal grammar and processing structure. The obvious correspondences between the organization of the processing model and
contemporary proposals for that of grammars, is, therefore, a consequence of the phenomena examined, not of the observer's theoretical predilections...²

Here, type-transparency is not stated as a requirement, or constraint, but simply as a consequence of the fact that speech error data and data from formal linguistic theories converged. The reader may justifiably question what caused this shift in theoretical stance. In any case, for the time being, type-transparency seems the simplest and most logical route to follow, given the high degree of compatibility between recent highly articulated and modular theories of grammar and Garrett’s model.

In developing his model of language production processes, Garrett used data from speech errors made by normals (both spontaneously occurring and experimentally induced spoonerisms and hesitation phenomena) and referred as well to data from language pathology. Careful observation of the speech error data revealed that errors were not random, and that word exchanges, sound exchanges, and stranding errors obeyed certain constraints and affected the two classes of content words and functional morphemes differentially. Content words only (N, V, Adj) were involved in word exchanges (e.g. "but a BEACH on the BIKINI is all right"), which were always within category and occurred across phrasal boundaries. Content words also exhibited sound exchanges (e.g. "Bill SNovels SHow"), which were cross category and phrase internal. In
stranding errors (e.g. "you have to SQUARE it FACEly"), content words move and their affixes are left in their original positions. These observations led Garrett to propose that sentence planning initially involves selection of content words (semantic determination) and then selection and positioning of sentential elements, phrase by phrase, around fixed functional elements (syntactic determination). Thus, the elaboration of the different levels in sentence planning/production rests on the assumption that lexical items are retrievable by meaning OR by form, with each kind of retrieval serving as the input to a distinct, independent processing level. As we will see in Chapter 3, many experimental studies have attempted to test the claim for independent processing levels by showing that semantic sentence planning processes (=lexical selection) and syntactic sentence planning processes (=phrasal construction) can be dissociated in language pathology. Before presenting Garrett's model in schematic form, we will consider how prepositions behave in speech errors, noting that the relevant generalizations are derived from the consideration of "relatively few cases" such as these: 3

(1) ...send for tickets AT two FOR the box office
(2) ...which was parallel, TO a certain sense, IN an experience...

Clearly, prepositions, usually considered to be function
words, can be involved in word exchange errors, just as content words are. Like nouns, verbs, and adjectives, they are heads of their own phrases. But, unlike the major lexical categories, they only exchange with each other. Furthermore, like functional elements, they cannot bear stress, and they do not contribute sound elements to exchanges. Garrett uses these observations to argue for the correct representation of the Positional Level as phonological, both in his 1980 paper co-authored by Kean and in his 1982 paper, which presents a more complete presentation and discussion of his model. His argument runs as follows:

...At the functional level, prepositions are lexical, and at the positional level they are not. But the "demotion" of prepositions to closed class estate as a consequence of that level shift is quite ad hoc if one construes both planning levels solely in syntactic terms. However, if one were to construe the shift from functional level to positional level as a shift from a specifically syntactic and/or logical level to the (systematic phonemic) phonological level, the prepositional shift in status would be required, for, phonologically, most prepositions behave with the minor classes.4

In the earlier paper, the findings regarding prepositions and speech error data were seen to converge with Kean's data and analysis of the behavior of prepositions in aphasia: their status with regard to the major/minor category distinction is problematic, yet at the phonological level, they can be captured as a class of elements. Such a
convergence, state Garrett and Kean, presents further evidence for the claim that the positional level is phonological. In the later (1982) paper, the importance of this convergence is further emphasized: the "two related sets of observations" from speech error and the analysis of agrammatism, are offered as an illustration of "what sort of argument would support the identification of formal levels of linguistic analysis and ...processing levels." Clearly, analysis of the prepositional data was crucial to the elaboration of Garrett's model.

A few weaknesses in the arguments presented by Garrett and Kean should be noted; the speech error data involving prepositions was (admittedly) meager, and the "phonological deficit" account of agrammatism, used as collaborative evidence for the claim that the positional level is phonological, has since been disputed. Furthermore, given that the speech error data relating to prepositions was so important for the elaboration of the model, we can ask ourselves why no explicit discussion of the sub-types of prepositions involved in exchanges is included. The several weaknesses noted above notwithstanding, it seems fair to say that the empirical evidence to date has confirmed the overall utility of this particular sentence model even though its underspecification leaves many issues unresolved. Future empirical evidence may prove that the basic reasoning underlying the original arguments is sound, though researchers
may consider the question of the precise nature of representations at the various levels to be an open one. Garrett himself refers to his model as a "working model".

Having made these general observations on how the model was developed, we can now turn to careful examination of the model itself. It is presented on the following page in schematic form, the schema being based on the "summary sketch" of the working model.
Conceptual and Inferential Processes

MESSAGE LEVEL REPRESENTATION

Logical and Syntactic Processes:

meaning-based lexical retrieval sensitive to major category labels [including LEXICAL PREPS]

creation of verb-based "functional structures" (predicate argument structure) and assignment of lexical items to [argument] roles

surface order of arguments is not reflected but representation is "syntactic" and multi-phrase

FUNCTIONAL LEVEL REPRESENTATION

Syntactic and Phonological Processes:

form-based lexical retrieval

planning frames supplied ready-made with grammatical morphemes [including NON-LEXICAL PREPS]

assignment of lexical items to phrasal sites, and of phrasal elements to terminal string

surface order of elements is directly reflected; representation in "phonological" and phrase-by-phrase

POSITIONAL LEVEL REPRESENTATION

Regular Phonological Processes

PHONETIC LEVEL REPRESENTATION

Motor Coding Processes

ARTICULATORY REPRESENTATION
General conceptual processes thus occur at the message level, sentence processes at the functional, positional, and phonetic levels, and motor control processes at the articulatory level. We will now follow the model from the message level through to the positional level, paying particular attention to the processes of lexical selection and phrasal integration as they may relate to prepositions.

(1) The real-time conceptual construct which will later determine sentence-level processes is built at the MESSAGE LEVEL. This level is not to be equated with a formal semantic component; in addition, concepts are built compositionally using simple surface vocabulary (i.e. the vocabulary of language is also the vocabulary of semantic processes, following a meaning postulates approach). This hypothesis has important consequences:

it permits whatever degree of lexical dependence may be required for sentence construction processes, specifically for syntactic processes; such may be effected at the earliest stages of the sentence production process. This assumption thus suggests early rather than late lexical specification.8

Such a view seems to render the model particularly compatible with recent formal models of grammar, especially with respect to the Projection Principle and enriched lexical entries containing much syntactic information.9 Let us now recall that the speaker's real-world knowledge and perceptive and
affective states are all relevant to the conceptual construct built at the message level. Presumably, his/her particular perspective regarding a particular event to be communicated is relevant to processes at this level. Given the choice between expressing the same event as an active, a passive or a cleft sentence (The dog bit the cat vs. The cat was bitten by the dog vs. It was the cat the dog bit, etc.) in which the order of constituents differs, we may ask the question, at what point in the production of the sentence does a passive become a passive? In the Garrett model, no look-back mechanism is provided: processes at the positional level, where surface order of constituents is determined, have no access to message level representations, but only to functional level representations. Garrett's model thus encounters problems in accounting for the fact that part of a speaker's intentions may be to express an event in a marked word order.10

(2) At the FUNCTIONAL LEVEL, lexical items are retrieved according to the concepts established at the message level; this retrieval is of the lexical semantic representation of the word and not of its phonological form. (one kind of proof that the two kinds of retrieval are distinct lies in the existence of paraphasias, or word substitutions, in which the target word can be replaced by another, similar either in meaning OR in form). The lexical semantic representation for each major class item includes information regarding the
item's thematic structure. Note that such a functional structure does not specify whether a sentence will be produced as, for example, "the girl gave flowers to the teacher" or "the girl gave the teacher flowers". Surface order is not established, but the presence of all arguments is assured; their thematic roles are specified, and information regarding how each role is to be realized syntactically (as an NP or a PP) is available. This level is therefore necessarily multiphrase.

It must now be seen how the model can be accommodated to the GB framework. Since this level directly reflects the thematic dependencies holding among the elements of a sentence, it follows that theta-role assigners and theta-role assignees, as determined by the theta theory module, become available at this level, including those prepositions which assign theta-roles (such as BEN or GOAL) compositionally with a verb to an NP argument, as discussed in Chapter 1. So much is fairly clear. On the other hand, the status of adjunct PPs (in which the preposition autonomously assigns a theta role such as MANNER, TEMP, PURPOSE to its NP object) with respect to the model is not clear. Functional Structure is predicate-based, and as we have seen, these PPs may combine with virtually any predicate. Adjunct PPs must be available at this level (presumably, the conceptual construct determined at the message level would provide for such information to expressed) though as the model stands now, we cannot determine which
principles/procedures would make them available. As we shall see below, a more recent proposal which draws heavily from the work of Garrett begins to address this issue.

(3) At the POSITIONAL LEVEL the syntactic form of the sentence is produced and the phonological form of words is specified; these phonological forms are inserted into their correct syntactic positions. "Planning frames" specify one phrase at a time and appear "ready-made" with function words and inflections' morphemes. While it is clear that the "mapping" of predicate argument structures onto syntactic structures occurs at this level, it is not clear HOW this mapping proceeds. This is the model's weakest point; the entire discussion begs the question, "what principles guide (a) the insertion of phonological items onto syntactic structure and (b) the creation of 'planning frames'?" In other words, it is not clear precisely how the different subtypes of prepositions fit into the model. This is an area which has not been developed in discussions of the model over the years; in fact, the discussion of prepositions is repeated verbatim in the 1980, 1982 and 1984 papers. What exactly does it mean to say that they behave as major category items at the functional level and as minor category items at the positional level? Several researchers (notably Friederici, as we shall see below) considering the property of substitutability, have extrapolated that some prepositions are retrievable by
meaning and by form (as in: "the cat sits ON/UNDER/etc. the chair"). Where the P is head of a PP and more than one preposition is possible in a given syntactic frame, subject to semantic constraints) and others (those uniquely specified in predicate argument structures, as in "the girl waits FOR the bus"). Where the no substitution is possible, and by reanalysis accounts, where the preposition would lose its status as head of a phrase) solely by phonological form. Once again, exactly which prepositions will appear already fixed in their positions by virtue of the planning frames and which are actually inserted into the syntactic string has not yet been clearly established. However, it seems reasonable to assume that, minimally, "dummy" prepositions identified by grammatical theory would be candidates for those appearing fixed in planning frames.

Careful consideration of the arguments presented by Garrett leads us to the conclusion that his processing model seems to favor theoretical accounts which include a linguistic analysis of prepositions that relates the structures in which they occur to their ability to carry semantic information; this follows from the fact that functional representations are directly sensitive to semantic roles. We are claiming, tentatively, that proposals which explicitly consider the thematic properties of prepositions in their different configurations are particularly compatible with Garrett's processing model. We would like to state however, that such
compatibility exists only to the extent that the theory of thematic relations in question directly relates to the semantics of prepositions. This may seem obvious, but it is not so, and it is for this reason that Baker's account of theta theory was followed more closely than others in the GB framework, where theta-theory is based more on structural than semantic concerns. It was shown in the theoretical discussion contained in the first part of this chapter that, ideally, theta-theory represents a formal instantiation of semantic/thematic dependencies that hold among the elements in a sentence (for example, between a verb, a preposition and an NP object). On this view, proposals distinguishing prepositional structures in purely structural terms would be less compatible with the Garrett model.

Having made these observations regarding the Garrett model and its compatibility with the general grammatical framework presented in Chapter 1, we may now consider a more recent discussion of certain aspects of sentence processing which relies on the Garrett model but which develops other arguments relevant to the processing of prepositional structures in aphasia.
B) Processing consequences of the argument/adjunct distinction: the Byng and Black model

In their 1988 paper, the authors provide a descriptive framework for the analysis of one particular aspect of sentence production, namely, the syntactic realization of predicate-argument structures ("mapping" from conceptual to syntactic structure). They claim that the specific output analyses yielded from such detailed fragments of an overall sentence production model constitute the necessary first step in the assessment and treatment of sentence production deficits. Although they provide the broad outlines for a production model and make reference to various components (conceptual-semantic/syntactic/phonological) they focus on the two types of processes which relate the semantic level specifying predicate argument structures to the syntactic level: **lexical** (item-specific) information and procedures, and **general** principles or procedures. The first set of procedures would ensure that, given the intention to communicate an event whereby John gives a prize to Tim, and once either of the two predicates represented by the verbs "give" and "present" is selected, then specification of the argument structure for each would rule out occurrences such as *John gives Tim with the prize (vs. John presents Tim with the prize) and likewise *John presents Tim the prize (vs. John gives Tim the prize). Until this point, the discussion is substantially that of Garrett regarding his functional level.
But Byng and Black go on to state that the rest of the mapping can be done by general principles that apply to all items; for example, the relative order of noun phrases and prepositional phrases that realize arguments of a predicate can be stated once and for all, independently of the particular lexical item. For example, prepositional phrases generally follow noun phrases. We might also have a general principle specifying that Agent arguments are realized as noun phrases in subject position preceding the verb. At this point we may ask ourselves how such general principles could be overridden in the case of sentences with marked word orders.

In any case, the most interesting comments made regard the distinction between arguments and adjuncts, which, as we know, is a crucial theoretical distinction. A natural question is, does this theoretical distinction bear processing consequences? In other words, given the communicative intent to specify information regarding (inter alia) where, when, in what manner or for what purpose an event takes place, is such information mapped onto syntactic structure via the same or different principles than those that guide the mapping of predicate argument structures? The authors assume the latter case, and note that the syntactic realization of non-arguments, contrary to that of arguments, is not lexically-dependent. Let us follow their line of reasoning more closely:
Conceptual elements that are not arguments are realized by certain syntactic categories and in particular positions in the sentence, irrespective of the particular predicate they combine with...similarly, syntactic principles that determine the linear order of phrases in a sentence do not apply equally to arguments and non-arguments: different sets of principles are involved. These linguistic differences may be reflected in the psychological separateness of the procedures that construct particular aspects of conceptual (semantic) and syntactic representations, or translate between these two levels of representation.13

The hypothesis that is born of this view is the following: patients may exist who can describe an event in terms of the relevant predicate argument structure without being able to describe where, when or how; and conversely, they may be able to express that an event took place at a given place/time (in a given manner, etc) without being able to describe the precise nature of the event. Either of the two situations is possible in principle. Certainly, the hypothesis regarding the existence of such a double dissociation of argument/adjunct processing awaits empirical verification, but the arguments presented here are convincing.

The second part of the Byng and Black paper presents a report of a preliminary study of elicited narratives from 6 aphasics (3 agrammatic and 3 non-fluent, non-agrammatic) in which utterances were analyzed with respect to the predicate argument structures and adjunct structures they contained. It was hoped that output analyses would support the tentative predictions outlined above. The study produced interesting
results. Semantic/syntactic properties of phrases seem to be more important than the number of phrases to be produced. Argument/non-argument status made a difference: even when certain patients could not express a state, process or event by means of a complete predicate argument structure, they could often realize a phrase expressing time, duration, or manner, that is, a restrictive modifier (non-argument) of that incompletely realized predicate argument structure. These results are certainly highly suggestive; the authors conclude that they provide evidence for incorporating the argument/non-argument distinction in output analyses, and some preliminary evidence that arguments and non-arguments might be realized by means of different psycholinguistic mechanisms. Further research which follows these formal linguistic parameters may, in the words of the authors, "produce patterns that in turn inform the theory." For example, it may speak to the issue of where different types of locative phrases occur in syntactic trees, once a substantial amount of consistent data is available. We would thus have a concrete example of how the bidirectional model of theory-data relations works: initially, the theory tells us to focus our analysis on structures containing arguments and non-arguments and a processing model would be compatible in allowing for a corresponding computational distinction, perhaps exploiting the notions of lexical and general principles; then the data acquired could substantiate the validity of the argument/non-
argument distinction and ultimately, refine it.

To summarize, we have taken a close look at a particular sentence production model with a view to: assess its overall compatibility with formal accounts of grammar in the GB framework and determine what assumptions it makes regarding the processing of prepositional structures. While it has been seen that the Garrett model engages well, overall, with recent highly articulated, modular theories of grammar, we have also established that it is underspecified in many areas, including the area which interests us most--the processing of particular sub-types of prepositions. It was suggested that the sentence production model could be "married" to the linguistic model by exploiting such theoretical notions as thematic role assignment. A more recent proposal by Byng and Black was then examined, and it was seen to complement the Garrett model; the emphasis here was on a distinction which is also applicable to prepositional structures, that of argument vs. adjunct, a distinction which overlaps that of theta-marking vs. non-theta-marking prepositions (as discussed in Chapter 1, prepositions in adjunct phrases do theta-mark their NP objects but are not, of course, arguments).

Having established which notions/distinctions enable us to differentiate among prepositional structures from both a theoretical and a processing point of view, we may now go on to examine the relevant aphasiological literature.
15. It is interesting to note how this ties in directly with independent theoretical work carried out by T. Reinhart (1983, last chapter)
CHAPTER 3: REVIEW OF THE LITERATURE

A. Introduction

In the following critical review of the literature surrounding what we may call the "prepositional deficit" in aphasia, the studies of several researchers will be considered in turn. Although these studies have much in common, they also differ substantially with respect to the kinds of tasks used and the kinds of claims they make, and as well with respect to the emphasis they place on linguistic structure, processing mechanisms, recourse to extra-linguistic strategies to account for performance, etc. Comparison/contrast of the studies is contained in the summaries themselves. In the development of the discussion, the following points were kept in mind:

(1) what prepositional sub-types were tested? Were differential results obtained? How did the prepositional data pattern with respect to lost/retained elements and error types (omissions/substitutions)?

(2) was a specific theoretical linguistic model assumed, and if so, were explanations of performance patterns based on structural notions?

(3) were processing issues discussed? If so, was a particular psycholinguistic sentence processing model assumed, and could data speak to the question of processing levels?

(4) were methodological points concerning task-specificity and the role of possible extra-linguistic strategies in the interpretation of the data addressed?

(5) what kind of claims were made as to the nature of the
deficit observed? What are the unresolved issues regarding the deficit, and how can future work address those issues?

The chapter is organized as follows. First, a brief description of the syndrome of agrammatism (Section B) will be given. The actual review of studies is divided into two sections according to the orientation of the reported research. In Section C, neuropsychologically-oriented studies emphasizing the data base will be presented. In Section D, linguistic analyses emphasizing theoretical issues will be evaluated. Order of presentation is chronological; greater emphasis will be placed on recent research and on unpublished studies. A brief concluding summary will end the chapter.
B. The Syndrome of Agrammatism

"Agrammatism" is the term referring to a syndrome which arises in Broca's (non-fluent) aphasia. The basic traits of agrammatic speech are halting, dysposodic utterances and the omission of function words and bound morphemes (such as inflectional affixes). The observation that the Broca's aphasic has great difficulty speaking, coupled with the observation that his speech has a "telegraphic" character (i.e. the small, purportedly non-essential words are omitted) led early researchers such as Pick and Iserlin to propose the "economy of effort" hypothesis, which emphasizes articulatory complexity and concomitant motor problems and which views agrammatism in terms of an inability to express intact knowledge. Agrammatism would therefore represent a peripheral (or performance) deficit. Although this characterization of the syndrome has recently regained favor, this approach will not be pursued here.

The studies of R. Jakobson and A.R. Luria, emphasizing instead linguistic complexity, stressed the importance of those "small" words in supplying structural information. Since then a major research current has viewed agrammatism in terms of the loss of grammatical knowledge or the inability to exploit certain linguistic processing strategies. Agrammatism would therefore constitute a central (or competence) deficit.

Descriptions of agrammatism have primarily been concerned
with a characterization of loss and retention patterns of linguistic elements; in order to do so, they have relied heavily on the open-class/closed-class vocabulary distinction. Broadly speaking—i.e. as a first approximation—it is the closed-class vocabulary items that seem to be lost in agrammatism. Although this distinction is useful in an initial confrontation with the data, it remains a pretheoretical notion; no precise definition has been provided by linguistic theory. The main problem with the purported dichotomy lies in an unpredicted "gray" area: we recall from the introduction to the status of prepositions in linguistic theory that certain properties of this particular sub-class of function words prove the dividing line is not a clear-cut one.

Despite this problem, in the past many researchers concluded that the distinction between closed and open class items was computationally valid. Recently, however, some researchers have chosen to define agrammatism without making explicit reference to the closed/open class vocabulary distinction. For example, L. Menn and L.K. Obler state that agrammatism "is defined clinically by short phrase length, slowed speech, and simplified grammar." How the notion of "simplified grammar" relates to the closed/open class vocabulary distinction is not transparent. The basic assumption we are making here is that the study of how prepositions pattern in language pathology can help resolve
some of the issues surrounding the validity of the closed/open class vocabulary distinction in the study of language breakdown.

We may now go on to consider published and unpublished studies of the language deficit affecting prepositional structures, paying particular attention to how data was obtained and to what kind of claims were made concerning the locus of the deficit.
1. Early Work

Early descriptions of aphasic language in general and agrammatism in particular were based almost exclusively on qualitative observations of speech output (production) along several dimensions (length of utterance, presence/absence of paraphasias, etc.) in a variety of situations (free conversation, repetition, etc.), while comprehension was considered to be a "unitary" phenomenon.

An example of a study which took good comprehension in agrammatism for granted is the exhaustive study of agrammatic speech production in 19 French-speaking agrammatics done by Tissot, Mounin and Lhermitte (1973). This study included a wide variety of production tasks (story recital, sentence completion, metalinguistic tasks on morphological/semantic opposites, etc.). An in-depth analysis of the data was carried out in order to see whether the canonical agrammatic traits (such as omission of function words and inflections) apparent at a superficial and subjective level were actually defining traits of the syndrome. The authors observed that the loss of function words, including prepositions, was neither total nor consistent. Although their consideration of the patterning of prepositions stops at a qualitative level, their observations are of fundamental importance in that they
contain two premises which are common to all subsequent work:
(1) some prepositions are lost while some are retained and
(2) a partition of the data may be drawn along the lines of a syntactic/semantic dichotomy:

ces manques portent généralement sur des prépositions jouant le rôle de fonctionnel inter-syntaxique. La question reste ouverte de savoir si et quand leur contenu sémantique joue un rôle dans les erreurs..."

While the Tissot et al. study did not treat comprehension at all, the 1970's did witness the proliferation of studies on aphasic comprehension. In one of the first of such studies, Goodglass, Gleason and Hyde (1970) tapped several different aspects of auditory comprehension in aphasia in various clinical aphasic groups and normal children in order to show that comprehension is indeed multidimensional rather than unitary, and that differential levels of performance can characterize different clinical aphasic subgroups. Among the four sub-tests were two tests on prepositions: a sentence-picture matching (comprehension) task using locative and directional prepositions, and a "preposition preference" (judgment) task using mostly subcategorized prepositions. It is interesting to note that the authors made such a distinction in preposition type, yet did not explore the implications of that distinction in interpreting their results.

These results showed that the Broca group did very well on
the first test and poorly on the second; nevertheless, the authors state that even the Broca's aphasics who could produce no prepositions at all appeared to understand them very well: "one need not attribute the loss of prepositions in Broca's speech to a loss of knowledge about how to use them." They cite evidence from a previous study (Goodglass, Fodor and Schulhoff, 1967) where, in a repetition task, unstressed initial function words were dropped by Broca's aphasics, who could then produce them after an initial stressed word. For Goodglass et.al. these facts point to the greater importance of stress patterns (or prosodic factors) over the grammar of prepositions in determining their loss/retention patterns in agrammatic speech. This conclusion, which is representative of Goodglass' major concern throughout his work on agrammatism, is undermined for two reasons. Firstly, in the 1967 study, there was no systematic investigation of prepositions as initial functors; virtually all sentences initiated with unstressed modal/auxiliary verbs such as "Can birds fly?" or "Don't birds fly?". The authors must assume from the start that prepositions will behave exactly as the other function words used in the study would; despite the fact that prepositions rarely occur in initial position, the point to be made is unaffected: it is not at all clear that the results obtained in the 1967 study can be generalized to prepositions as well.

Secondly, Goodglass' central notion of "saliency" (as it is
developed in later work), which depends heavily on a stress component, cannot—in a principled way—distinguish between classes of lost and retained elements. Goodglass himself seems to be aware of this:

What constitutes 'saliency' for the purposes of this model? There is no basis at present for anything but a first-order intuitive definition of saliency as the resultant of informational load, affective tone, and increased amplitude and intonational stress... 9

Although Goodglass' notion of "saliency" is vague and pre-theoretical, his work has shown that factors such as stress and position of the function word in the sentence may play some role in determining patterns of loss. Goodglass et. al. also recognized that prepositions could signal the direction of reversible [thematic] relations, as in "the lion was killed BY the tiger". Subsequent studies of aphasic language have included this sentence type in order to determine use of semantic and syntactic interpretive strategies in sentence comprehension.

The early work of Zurif, Caramazza and colleagues was concerned primarily with aphasic performance on comprehension and metalinguistic judgment tasks. In an important study (Zurif, Caramazza and Myerson 1972) they used a word-relatedness judgment paradigm of triadic comparisons on a group of Broca's aphasics and on normal controls, asking patients which words "went best together" in sentences
presented to them in written form. While the control group's word clusters mapped *grosomodo* onto theoretical constituent trees (e.g. they respected NP node structure by grouping articles and other determiners with the following N), the aphasics grouped content words together and coupled the function words randomly (e.g. clustering two function words together or a determiner with a main verb). Given this finding, namely, that the Broca's aphasics could not correctly assign the same function words (determiners and copula especially in this first study) that were missing in their spontaneous speech and that posed problems in auditory comprehension tasks, Zurif et al. concluded that there are parallel deficits in all modalities in agrammatism and hence agrammatism represents a deficit in language knowledge as well as language use. More specifically, agrammatism cannot be viewed as "the outcome of an economizing effort to circumvent articulatory problems".10 They also conclude that this deficit can be described in terms of a disruption in full syntactic processing. Most importantly, they observe that agrammatism does not apply equally to all functors—an expected observation, given the structural and semantic heterogeneity of the "closed" vocabulary class.

Given this last observation (that functors differ among themselves as to the kind of meaning they convey) and the success of the word-relatedness judgment paradigm, Zurif, Green, Caramazza and Goodenough (1975, 1976, also reported in
Zurif and Caramazza (1976) decided to use the same paradigm a second time, with two major differences in experimental design: firstly, they devised sentences containing functors which varied systematically in terms of their contribution to meaning; and secondly, they included a third group in addition to the normal controls and the Broca's aphasics. The "mixed anterior aphasics" were to be distinguished from the Broca's aphasics "proper" in terms of comprehension level (good for the latter, moderate for the former). Their results can be summarized as follows:

(1) For the normals and the Broca's aphasics (but not for the mixed anterior aphasics) there was differential (i.e. greater sensitivity) to the sub-class of prepositions over other functors. The prepositions TO and BY were strongly linked to their following Ns or NPs, as in the sentences "gifts were given TO John" and "gifts were given BY John".

(2) Apparently, the Broca's aphasics were sensitive only to the informational value, or semantic content of a preposition, since they grouped the preposition TO in a random manner when it functioned as an infinitival complementizer (i.e. where its function is mainly syntactic) as in "she likes TO eat candy".

Unfortunately, the induced phrase-markers (graphic representations) were given by the authors just in the case of the Broca's aphasics; Zurif et al. don't describe what the normal controls did with the infinitival complementizer TO.

On the basis of these findings, Zurif et al. once again conclude that in Broca's aphasia, control of functors is no better in metalinguistic judgment than it is in spontaneous speech. The differential patterning holding between
prepositions and determiners, pronouns, etc. on the one hand and between the dative preposition TO and the infinitive marker TO on the other is determined more by the "semantic force" of a functor than by syntactic factors. Does this imply a hierarchy of functors on the basis of "semantic force"? Zurif et al. don't elaborate on this point. In any case, they never clearly define the notion of "semantic force": therefore it could not be used as a metric for determining the loss/retention of elements in agrammatism. In this sense, Zurif and Caramazza's informal notion of "semantic force" is analogous to Goodglass' notion of "saliency", and is subject to the same kind of criticisms. Let us now consider the comments of a theoretical linguist, L. Rizzi, on such notions:

Reference to such vague notions as "different semantic load" would beg the question: what does "semantic load" exactly refer to in this context? The point is not that such notions are necessarily wrong or useless: they might very well be on the right track in giving an intuitive characterization of the phenomenon; but they can acquire a real explanatory value and predictive capacity only if they are well defined and grounded within a coherent theory of language. The natural thing to do is then to look for a precise theoretical equivalent of the informal notion.11

Although Rizzi's arguments are very convincing and valid generally, it is worthwhile to note that Zurif and Caramazza did go further into grammatical theory, and found that the prepositions that were retained were just those that in a
Fillmorean case grammar "serve to index the semantic role of the noun phrase"\textsuperscript{12}: as we shall see below, the recognition of the importance of semantic roles is precisely Rizzi's own starting point.

2. Friederici and Colleagues


In her early work on aphasic deficits, this researcher focussed almost exclusively on the processing of prepositions. Initially (Friederici 1981 and Friederici et al. 1982, which appeared later but which reports on an earlier stage of research reported on in the 1981 study) she included only locative and directional prepositions in her production and comprehension tasks; in a later, more significant study (Friederici 1982) she expanded the repertoire of prepositions to include those that appear in a variety of syntactic structures. Throughout her work Friederici emphasizes the importance of analogous (i.e. directly comparable) production and comprehension tasks. These are needed in order to settle the issue of the presence or absence of parallel production and comprehension deficits in agrammatism and as well to be able to "tease out" the effects of task-specific demands.

Friederici draws to a considerable extent on the work of Zurif and his colleagues. Two of their findings, in fact,
constitute basic premises for Friederici in her work on preposition processing. Firstly, it is specifically syntactic constraints on interpretation of sentences that are lost in agrammatism, while lexically based inferential capacity is preserved.13 Secondly, prepositions behave differently with respect to other function words in agrammatism: on the whole, they are preserved better than other function words in metalinguistic judgment tasks and in comprehension tasks.

Friederici cites several reasons why the category of prepositions is worthy of special consideration, and she discusses the ambiguous status of the category preposition in linguistic theory:

Given these sorts of reasons to distinguish the role of prepositions from that of other "function words" and the observation of their contrasting performance levels for production and comprehension, it is possible to imagine an account of the latter in terms of the former. Specifically, one may suppose that superior comprehension performance arises only in circumstances which permit decision solely on interpretive grounds.14

Friederici thus provides, in embryonic form, a link between the peculiar theoretical status of prepositions and their patterning in agrammatism.

In the first set of experiments, Friederici et.al. (1982) tested processing of locative and directional prepositions in Broca's and Wernicke's aphasics in a free production task (sentence completion) and two visual input comprehension tasks (preposition multiple choice and sentence multiple choice).
With respect to the last task, distractor sentences (one containing an incorrect preposition, one containing a noun and one "syntactic" distractor in which all the correct words appeared, but in the wrong order) were constructed so as to yield information about the kinds of strategies the aphasics used in comprehension.

As expected, the Broca group did poorly on the production task but did well in choosing the correct preposition when 4 prepositions were given. This would seem to suggest that once the correct syntactic category is supplied, the Broca's aphasic can use semantic strategies to choose among prepositions of this type, which typically have semantic import. The Broca group did poorly on the sentence-choice test. Moreover, their most frequent error was the choice of the "syntactic" distractor sentence. The authors claim that correct performance in this last task—as opposed to the first two—is contingent upon knowledge of sentence form (syntactic strategies). Friederici et al. interpret these results as supporting the view of a general incapacity in agrammatics to use knowledge of sentence structure both in production and comprehension; that is to say, the deficits are parallel. They attribute the difference in levels of performance on the two comprehension tasks as a reflection of the "qualitative difference of the information sources to be used for correct processing," namely semantic vs. syntactic strategies, as above. They then go on to surmise that this difference may be
connected to the contrast in computational roles of these items in sentence processing. Such an account would require that the representation of meaning for lexical category items be distinguished from that for nonlexical category members. Although this final suggestion is quite interesting in that it has implications for linguistic theory, there are two major problems with it: the authors neither expound on the idea nor make it clear how it follows in any direct way from their results.

In a continuation of the previous study, Friederici (1981) used the same materials, the same locative and directional prepositions and the same kind of tasks on Broca's and Wernicke's aphasics, but varied the presentation conditions. In order to account for the discrepancy in levels of performance for preposition processing in production (observed to be poor) and comprehension (observed to be fair to moderate), Friederici looked to task-specific demands and assumed different processing strategies to be a function of the type of task at hand, as follows: the PRODUCTION of prepositions heightens temporal constraints and is thus based primarily on syntactic strategies, while COMPREHENSION and JUDGMENT of prepositions would be based primarily on semantic strategies. Error analysis yielded results which "fit" the new dichotomy perfectly. For the Broca group the most frequent error type was omission of prepositions, and the occasional substitution was random and could cross lexical
categories. This suggested that the Broca group was insensitive to syntactic structure. On the other hand, Wernicke's aphasics would substitute one preposition for another, exhibiting only within-category substitutions; this suggested that they were sensitive to syntactic structure.

Friederici labels the Wernicke's disorder a "selection disorder" (after Jakobson (1956/1975)), but does not use the Jakobsonian term "contiguity disorder" to refer to Broca's aphasia.

To summarize briefly, Friederici's conclusions are twofold: the dissociation in production/comprehension performance in agrammatism is due to task-specific demands, and there is a general inability to exploit the syntactic knowledge source in agrammatism. Moreover, when a preposition is accessed, it is semantic information (if this applies) and not its syntactic structure which is accessed.

In her third set of experiments done with Broca's and Wernicke's aphasics, Friederici (1982) used tasks similar to those in her previous studies, but there were also important differences: her data was gleaned from German-speaking aphasics; the contexts given for the sentences were no longer pictorial, but linguistic. Most importantly, different kinds of prepositions were used:

(1) freely-insertable prepositions that bear semantic content = *lexical prepositions*
(2) prepositions which are "lexically dependent" on a preceding verb (i.e. the verb subcategorizes a specific preposition) = obligatory prepositions

Her distinction between the two sub-classes of prepositions is drawn along the dimension of differential "functional roles". It becomes clear at this point that if indeed it turns out to be the case that agrammatism exhibits a lexical preposition/obligatory preposition dissociation, then the validity of the open class/closed class model of description is undermined for agrammatism:

...we propose to base the distinction upon the functional role of a given item; we claim that whenever an item mainly serves for structural assignment it appears to be computationally distinct from an item which is predominantly semantic.16

Thus the syntactic/semantic strategy dissociation, while still held to be correlated to task type, is also correlated with preposition type (i.e. "functional role"). Important results are reported as follows: Broca's aphasic performance was better on the judgment task than on the production task; in production the functional role of the preposition had a significant effect on performance; in comprehension the functional role of the preposition had no significant effect (though Friederici appeals to her previous findings in order to minimize the importance of the failure to achieve significance in this particular study).
In summary, Friederici concludes that Broca's aphasia reflects a general inability to assign syntactic structure within a given time frame, and she suggests that the availability of a certain item in agrammatism is a function of its class membership (open vs. closed) plus its functional role (semantic or syntactic).

We may now raise some questions regarding Friederici's claims for task-specific demands. Why should only production, and not comprehension, be based on syntactic processes? Her initial rationale for this claim is based on temporal factors, which also make their way into her revised description of agrammatism; but it is not at all clear how her results support the claim for task-dependent semantic and syntactic strategies.
b. Friederici (1983a), (1983b); (1985); Kolk and Friederici (1985)

In a series of studies which investigated the nature of comprehension disorders in Broca's and Wernicke's aphasia, Friederici focussed on syntactic and semantic on-line processing at the sentential level using a word monitoring (semantic priming) task on six Broca's, six Wernicke's, and twelve controls. She assumed that the comprehension deficit in the two groups differs qualitatively: for Broca's aphasics, the deficit is syntactic in nature while for the Wernicke's aphasics, the deficit can be characterized as lexico-semantic, whether the structure of the lexicon is disrupted or the problem is essentially one of retrieval of semantic information from the lexicon. She expected that an on-line comprehension task such as hers, where subjects were required to act "fast and thereby automatically" on sentence stimuli where open/closed class items and prepositional sub-types were varied, would be particularly revealing. She included lexical and obligatory prepositions as well as verb + particle constructions in her stimuli, but analyzed the results for the first two sub-types only, since the sentence-final position of the last group provided an additional intonational cue and was responsible for extremely low reaction times.

The more important aspects of her results regarding prepositions, which are crucial to her claims regarding the
computational distinction between lexical and structural information, can be summarized as follows:

(1) for the Broca group, reaction times were significantly lower for lexical prepositions than for obligatory prepositions, while the Wernicke group and normals had lower reaction times for obligatory than for lexical prepositions, though the difference was not significant.

(2) the overall error rate for prepositions was significantly higher for the Wernicke than for the Broca group.

With respect to the open-/closed class distinction, the Broca group had lower reaction times for closed-class items than for open-class items (unlike normals) yet exhibited a high level of accuracy for these items; these results led Friederici to claim that although Broca's aphasics can recognize the form of these items, they are impaired in that they cannot retrieve their syntactic function. On the other hand, like normals, the Broca group exhibited a semantic context effect for open-class items, demonstrating intact lexico-semantic processing. These results, Friederici claims, parallel the production results obtained in her previous studies, where Broca's aphasics were claimed to demonstrate an impairment in the retrieval of syntactically necessary prepositions on one hand and the ability to produce lexical prepositions on the other. She concludes that "these patients' deficit may be described as the underlying incapacity in processing closed class items as features of the phrasal frame."17
The semantic facilitation effect for open-class words was also true of the Wernicke group, suggesting that these aphasics are able to process some semantic information during sentence comprehension, and insofar as their performance on closed-class items is superior to that of the Broca group, they seem to be sensitive to syntactic cues as well. Where, then, is their impairment? Overall high reaction times for the Wernicke group (compared to normals) indicate that an impairment is present, though the data here cannot support claims for a deficit at any one particular sentence processing level. Friederici does state that her data are compatible with the hypothesis that the underlying semantic organization of the lexicon is intact in Wernicke's aphasia, but that the ability to access semantic information for interpretation is impaired. Results from other kinds of tasks could shed more light on the nature of the deficit underlying comprehension in Wernicke's aphasia.

In the other paper to appear that same year (1983b), Friederici reports on a series of experiments in which she used the same word-monitoring task on children from the ages of 8 to 11 and then on children from the ages of 5 to 8. These will only be discussed very briefly, in the interest of investigating to what extent language pathology can exhibit features of emerging grammars. Reaction time data and error analysis suggest that the younger children focus on
representation of meaning and only acquire sensitivity to the structural information provided by closed-class items at later developmental stages, with the ability to process purely syntactic information automatically appearing later still. It should be noted that Friederici used prepositions which had the same form across the three categories (e.g. "auf" as a lexical preposition, a subcategorized preposition with the verb "hort", and as a particle with the verb "geht"). Subjects proved to have greater difficulties processing obligatory (subcategorized) preps than lexical prepositions or particles until the age of ten or eleven; for Friederici this pattern directly reflects the fact that obligatory prepositions neither carry meaning by themselves, as do lexical prepositions, nor contribute to the change in meaning from a simple V to a V + particle, as do particles. To the extent that the developmental data obtained by Friederici is valid, it can be noted that performance by children up until the age of 10 or 11 is similar to that of the Broca's aphasics in that they responded faster to lexical than to obligatory prepositions. It would seem that in both cases, developmental and pathological, there is a preference for semantic strategies in sentence comprehension, though Friederici herself never explicitly draws any conclusions regarding this parallelism.

In her (1985) paper for Cognition Friederici again reports
on the data obtained from the Broca group and the normal controls on the word-monitoring task in the 1983 study, and she also reports on an additional large scale study of normals on the same task. She adds a lengthy introduction and a more detailed discussion section, and relates her hypotheses and results explicitly to Garrett's sentence processing model. Her main assumption is that the computational distinction of open-/closed class vocabulary types previously observed in production is operational as well in sentence comprehension. The rationale for the use of a word-monitoring paradigm (as opposed to a simple lexical decision task) is as follows:

recognition differences are, however, not necessarily revealed in experimental tasks that present words in isolation, and where the subject is asked to judge the item's lexical form. In sentential contexts, however, where closed class elements are used in their syntactic function, specialized access procedures may be activated.18

It is important to note here that Friederici assumes such a specialized access routine to be a necessary condition for automatic syntactic processes which are tapped in on-line tasks.

Friederici also explains why she chose to focus on prepositions in so much of her work: they appear in speech errors which are characteristic of both closed and open class items and would therefore be involved in processing at both the Functional and Positional Levels of Garrett's sentence production model. In brief, lexical prepositions are
processed at both levels (semantically at the Functional level and as features of a syntactic-phonological frame at the Positional Level); obligatory prepositions only at the Positional Level; and verb particles primarily at the Functional Level, since they are stored with the verb, contribute to the change of meaning, and are thus relevant to Functional Level processes.

One of the hallmarks of Friederici's recent work is her insistence on task-specificity; she recalls that the difference between production of lexical and obligatory prepositions was not present in a grammaticality judgement task:

...the difference between production and this particular type of comprehension task arose because correct production depends on active syntactic computations to a greater degree than do acceptability judgements. In the latter task the knowledge about the form of some "phonologically specified" elements could be sufficient to judge lexical dependencies between, for example, verb and preposition. Knowledge about an item's syntactic function does not seem to be a necessary requirement for such judgements.¹⁹

Although the importance of assessing effects of task-specific demands on performance is unquestionable, we have already had the occasion to observe that the claim for production being more "syntactic" than comprehension/judgment is questionable. Often an apparent discrepancy in findings across tasks or across researchers can be explained by asking whether differences in performance can be attributed to varying task
demands. In this way, many difficulties impeding otherwise fruitful comparisons of data obtained on different tasks by different researchers can be resolved.

Actual results of the word-monitoring task for the Broca's aphasic group were discussed above. The additional study done on normals showed that the recognition of particles and lexical prepositions was affected by semantic context, but that this was not the case for obligatory prepositions, in accordance with the expectation that the former two categories are processed primarily at the Functional Level and the latter category at the structural, or Positional Level. With respect to the existence of a computational distinction between the lexical and non-lexical properties of words, Friederici interpreted her results as follows:

(1) given that the observed semantic context was not as strong for lexical prepositions as for other (open class) lexical items, lexical prepositions seem to be involved as well at the structural level, where they may be processed according to their syntactic function (i.e. they usually serve as heads of phrases)
(2) obligatory prepositions may be specified as to phonological form in the open class lexicon, but they are not retrievable at the semantic level.

What exactly it means for lexical items "to be involved" at a particular level (semantic and/or structural) needs to be clarified. One of Friederici's most interesting suggestions regards how obligatory prepositions might be represented:
...whether the subcategorization information is directly specified with the verb, but is only retrievable when lexical and syntactic information is available, cannot be decided on the data presented here. The finding that agrammatics are, however, able to judge acceptability of lexical dependencies between verbs and their obligatory prepositions could be interpreted as favoring the former view.20

As will be seen, other researchers (most notably Branchereau and Nespoulous 1988) gathered data which might bear directly on the issue of how subcategorization frames are affected in aphasia; we will have occasion to return to the issue of how much of the information contained in such frames may still be available in disrupted (agrammatic) grammars.

In their 1985 study, Kolk and Friederici sought answers to the following questions: is it true that Broca's aphasics are "without syntax"? If the syntactic disorder underlying comprehension is indeed "all or nothing" is it a property of Broca's aphasia only? The researchers used a sentence-picture matching task on 15 Broca's aphasics and 14 Wernicke's aphasics, half of which were Dutch speaking and half German speaking, to tap comprehension of sentences in which 4 prepositional sub-types, reversibility and standard word order vs. topicalized word order were manipulated. Differential performance on reversible vs. non-reversible sentences would indicate a syntactic impairment, since non-reversible sentences can be understood on the basis of their meaning alone, but not reversible sentences, the comprehension
of which depends, at least in part, on a correct syntactic parse. Topicalized word order (where the PP is preposed, even for obligatory prepositions: "VON dem Madchen traumt der Junge/about the girl dreams the boy) provided a mechanism whereby the use of a non-syntactic heuristic interpretative strategy such as 'assume first NP is agent' could be ruled out. The subject could not choose the correct picture without processing the preposition. The initial tripartite lexical/obligatory/syntactic (=dative, genitive, passive) preposition classification scheme was revised after initial analysis to include the passive as a separate, fourth category since passive sentences patterned differently. Subsequent researchers (most notably Grodzinsky) have also attributed special status to passive constructions.

Subjects were presented with the sentences, one at a time, accompanied by three pictures, the correct one and TWO distractors. For each of the four prepositional sub-types, the reversible sentences in both word order conditions were presented with one syntactic distractor and one semantic distractor. The non-reversible sentences were presented with two semantic distractors, usually resting on pictorial representations which corresponded to an NP not present in the stimulus sentence, except for the category lexical prepositions, where the second semantic distractor presented a different preposition: The boy walks TO the car/ sem. distractor₁ = picture of boy walking to a BUS, sem.
distractor\textsubscript{2} = picture of boy walking AWAY from a car. The Broca group did well on this sentence type, choosing a distractor picture in 3.3\% of the non-topicalized sentences and 5.24\% of the topicalized sentences; whereas the Wernicke group made the wrong choice in 9.79\% of the non-topicalized sentences and 14.29\% of the topicalized sentences. Unfortunately, though the authors provide us with much individual error data across subjects and conditions, they do not provide us with further data concerning which of the two distractors the subjects in each aphasic group tended to choose in the case of lexical non-reversible sentences (Although as would be expected the Broca group made few errors).

Both aphasic groups performed well, with error patterns for both groups similar, thus casting doubts on the validity of the "loss of syntax hypothesis" and leading the researchers to postulate a set of non-syntactic (heuristic) strategies given in Caplan (1983a) which the subjects might have used to choose the correct answer without achieving a correct syntactic parse. Results were still deemed to be "better than expected", and although the authors state that recourse could be made to additional or different strategies (possibly language specific ones), they prefer to postulate that there is no basic loss of syntax in Broca's or Wernicke's aphasia, but that the greater the amount of syntactic analysis required, the higher the error rate, due to processing
overload. Factors such as limited attention and working memory might force the aphasics to adopt a strategy whereby syntactic analysis is confined to the beginning of the sentence only. This hypothesis is claimed to be consistent with the results obtained regarding the sentences in the topicalized vs. non-topicalized conditions. It is important to note that this study focusses more on the effects of extra-linguistic factors on performance than the other studies by Friederici. This is not surprising, since Kolk is one of the current researchers who stresses the effects of non-structural factors and who tends to view the deficit in agrammatism as a peripheral one (cf. supra, section B).

Parting from the assumption that both Broca's and Wernicke's aphasic speech demonstrate syntactic deficits, but that these deficits are qualitatively different, Zurif-Pastouriaux tested the hypothesis that this difference could be captured by locating the deficits at different sentence processing levels, in accordance with M. Garrett's sentence production model. More specifically, she expected results to confirm the hypothesis that Broca's aphasics retain predicate-argument structure, which is instantiated at the Functional Level in Garrett's model, but that they lose the ability to analyze syntactic form, instantiated instead at the Positional Level. The reverse was thought to be true of Wernicke's aphasics. Citing the work of Friederici, Zurif-Pastouriaux realized that stimuli containing prepositional structures could yield crucial data. She conducted two experiments, a sentence completion (production) task on French-speaking Broca's and Wernicke's aphasics, and a sentence anagram (metalinguistic) task on English and French speaking Broca's and Wernicke's aphasics, in order to test her hypothesis. We now turn to a discussion of these two experiments.

In the sentence completion task given to 8 Broca's and 8 Wernicke's aphasics, only 10 stimuli sentences were presented with a picture. In each case, the missing element consisted of either a locative or a directional preposition. No other
propositional subtypes were used. Subjects were requested to choose from six possible answers the word they felt best completed the sentence, and to write it in the blank space. The six choices were structured as follows: 1. the correct response; 2. two locative/directional prepositions, which would "fit" the sentence syntactically but not semantically, i.e., did not correspond to the picture; 3. two "content" words (i.e. words from major lexical categories such as Ns, Vs, As.), which would result in a syntactically aberrant sentence, yet were semantically related (i.e. would "fit" the picture) and finally 4. a function word (always a conjunction), an error category which in fact was never chosen by either aphasic type.

As expected, the two aphasic groups differed significantly with respect to the errors they made: The Broca group tended to choose one of the two content words, purportedly relying on intact semantico-pragmatic competence and lexical inferencing, but producing faulty syntactic structures. When compared to Friederici's results, it is clear that the performance of this Broca group is quite poor; why did they make as many errors as they did on a task which involved only lexical prepositions? Zurif-Pastouriaux explains this apparent discrepancy in terms of semantic load--"le mot plus univoquement 'chargé' lexicalement"21--the presence of semantically related content words is seen to "override"/preclude the choice of a preposition. The Wernicke
group, on the other hand, tended to choose one of the wrong prepositions, demonstrating a sensitivity to syntactic structure though they produced semantically anomalous sentences, either because the preposition chosen did not correspond to the spatial relation depicted, or because the resulting sentence was absurd (cf. "le poisson nage sous l'acquarium").

These results, Zurif-Pastouriaux states, are consistent with the claim that the locus of the deficit for Broca's Aphasia is the Positional Level and for Wernicke's Aphasia, the Functional Level. She notes, however, that with respect to the Broca results, they could also be consistent with the claim that performance in this group results only from semantico-pragmatic competence and that no "supra-lexical" structure is created. Results from the anagram task would show that predicate argument structures are however preserved in Brocas Aphasia. Before passing on to the discussion of the second experiment, it must be noted that it would have been more interesting to include the choice of a non-lexical preposition (e.g. "de"), instead of the conjunction, in order to evaluate the extent of the Wernicke group sensitivity to the category PREP. If indeed their deficit is lexico-semantic, they might be expected to choose randomly between one type of preposition and another. In addition, given the frequency of locative/directional prepositions, and the ease with which relevant sentence stimuli can be constructed (these
sentences are eminently "picturable") it is hard to understand why so few stimuli sentences were given to each subject. Claims made on the basis of such a small number of stimuli should accordingly be accepted with caution.

Following experiments carried out by von Stockert (1972), von Stockert and Bader (1976) and Saffran, Schwartz and Marin (1980), who used the sentence anagram paradigm to investigate aphasic performance regarding word order and predicate argument structure (thematic relations holding between a V and the NPs in a sentence), Zurif-Pastouriaux constructed 66 stimuli sentences where 3 factors were systematically varied. In addition to semantic reversibility (the boy washes the car vs. the boy washes the girl) and the presence/absence of Det in the NPs (the subject would thus have no cue that a given word is an N), verb type was crossed with the other two factors, yielding sentences with and without prepositional structures, as shown below:

(1) NO PREPOSITION: the boy washes the girl
(2) VERBS FOLLOWED BY A NON-THETA ASSIGNING PREP OR PARTICLE: the salesman waits for the clerk/ the man calls up the girl
(3) INTRANSITIVE VERBS FOLLOWED BY THETA-ROLE ASSIGNING PREP: kittens jump over puppies

The inclusion of these prepositional sub-types follows directly from the experimental work of Friederici on the one hand and grammatical theory on the other. For Zurif-
Pastouriaux, the crucial distinction between prepositions in structures (2) and (3) above rests on the notion of "lien/probabilité transitionnelle", which seems to be directly analogous to Chomsky's "degrees of cohesion" between a V and an accompanying PP, (cf. Chapter 1 above) though she does not cite Chomsky. It should be noted that for her the combination V + subcategorized prep represents "un bloc lexical": she also groups such prepositions with V + particle combinations, and goes so far as to say that the transitional probability is greater in the former case, given that the same Vs that take particles can occur without them and furthermore, the particle can be separated from the V, occurring in the post-NP position. It is this emphasis which most clearly distinguishes her work from that of Friederici: for Zurif-Pastouriaux, the syntactic link between a V and a subcategorized preposition is of paramount importance, while Friederici stressed the greater semantic content of those prepositions which express a locative or directional relation between two NPs. Zurif-Pastouriaux notes as well that prepositional verbs such as "listen to", generally regarded as intransitive, share an important property with transitive verbs: they can be passivized. We may recall from Chapter 1 that the pseudo-passive construction is in fact an important diagnostic for internal prepositional structure, and that linguists such as Bresnan regard such prepositions as effective "transitivizers" of the verbs with which they co-
occur. In discussing prepositional structures preferentially and explicitly (albeit briefly) in terms of their syntactic behavior, she is in essence foreshadowing her results—which are at variance with Friederici's—although she states that on an a priori basis, she makes no predictions as to how the structures will pattern in the actual data gleaned from aphasics:

On sait que les agrammatiques sont sensibles à la valeur lexico-sémantique des prépositions, mais qu'ils ne sont pas pour autant capables de les intégrer normalement dans une structure de phrase; les phrases où les prépositions sont porteuses de la relation thématique, ne devraient donc pas a priori être plus faciles à construire pour eux que celles où les prépositions appartiennent au pattern de sub-categorisation du verbe, même dans le cas où ces patients comprendraient la relation thématique en question.  

According to Zurif-Pastouriaux, such syntactically determined transitional probabilities influence normal speech planning. That is to say, they have real correlates in normal speech, which are measurable in terms of acoustic phenomena: pause length between verb and preposition is longer in structures such as (3) than structures such as (2). She cites previous research on pause length and fundamental frequency done by Sorenson and Cooper (1980) and uses a similar paradigm of her own on 10 normal speakers of English, who were required to read aloud 20 sentences where the paired stimuli presented the same surface syntactic structure yet differed crucially as to the transitional probabilities between verbs and
prepositions, viz. the difference between "The woman hurried into the kitchen, sighed and COOKED FOR Teresa a big heap of pancakes" and "That evening, Tim left the office very early and LOOKED FOR Teresa in the cafe around the corner". Although Zurif-Pastouriaux speaks of no transitional probability vs. strong transitional probability, it is not clear whether she is speaking of a dichotomy or degrees on a scale; it would have been interesting had she explored this issue. Her results confirmed the original hypothesis: pause length differed significantly for the two types of prepositions, and she concludes as follows:

If we consider these data in the light of the theoretical discussion (cf. supra pp.42-47), they speak directly to the issue of the validity of Reanalysis rules: shorter pause lengths for verb + idiosyncratic verb combinations may constitute preliminary evidence for the special "link" holding between the verb and the preposition.

Obviously, such a paradigm could not be used to investigate aphasic speech; Zurif-Pastouriaux chose instead to test aphasics on a sentence anagram task, where all elements of the
sentence, given seperately to a subject, must be placed in their correct linear order. Such a task avoids problems of lexical selection, production of incomplete structures and semantic ambiguity, though it is meta-linguistic by nature and as such can tell us little about on-line processing strategies. It is Zurif-Pastouriaux' belief, however, that sequential anomalies produced in such a task can and do indirectly reflect disturbances at a certain processing level. More specifically, she expects that the different transitional probabilities discussed above will find a correlation in aphasic performance on this task, in terms of their ability to correctly place the preposition in each stimulus sentence. We now return to the discussion of her results on the anagram task in English, administered to four agrammatic Broca's aphasics and one Wernicke's aphasic.

The agrammatics tested here, unlike those reported in Saffran et.al., correctly ordered basic \(NP_1 \ V \ NP_2\) sentences, in the case of both reversible and non-reversible sentences. For Zurif-Pastouriaux this showed the existence of "supra-lexical"structure in the patients' grammars, and provided support for the hypothesis that they can correctly establish predicate-argument relations, and that therefore the Functional Level of processing is preserved in agrammatic speech. As far as the placement of prepositions was concerned, they placed them randomly either immediately before or immediately after the verb, which was always placed in the
center of the two NPs positioned as "anchors" at the two extremes of an imaginary line at the beginning of each stimulus trial. While this experiment could not disprove the hypothesis that the agrammatics understood the "lexico-semantic value" of the relevant prepositions, Zurif-Pastouriaux states that this putative knowledge did not help them to treat the preposition "en tant que marquer syntaxique". For her, these results provide direct evidence in favor of the hypothesis that processing at the positional level is disrupted. Furthermore, agrammatics did worse on those sentences containing theta-assigning prepositions (benefactives, locatives and directionals here) than on those containing prepositions specified in the subcategorization frame of the verb, contrary to what one would expect given Friederici's results. For Zurif-Pastouriaux, this difference in results is essentially due to task-specific effects:

She goes on to state that the difficulty with prepositions bearing greater semantic value is due to the absence of transitional probability between the verb and preposition. Thus, aphasic performance, like speech planning in normals, is sensitive to the difference between prepositions linked to
a verb and those in "independent" prepositional phrases. We might ask ourselves at this point to what extent it is valid to assume that a subject might understand the relational meaning of "over" in "kittens jump over puppies" without knowing where to place the preposition in the sentence. To what extent can the syntactic properties of a preposition be separated from its semantic properties in aphasia? Although Zurif-Pastouriaux states that nothing indicates that the subjects do not grasp their lexico-semantic meaning, it seems that an anagram task cannot address such a question. Clearly what is needed are parallel comprehension and production tasks designed to include different prepositional sub-types as distractors, in order to "tease out" the varying effects of semantic/syntactic properties of prepositions. Performance on other kinds of tasks, such as triadic comparisons or simple probe questions might give us more information concerning what aphasics actually know about prepositional meaning.
D. Linguistic Analyses

That which distinguishes the studies reviewed here from those in Section C above is a commitment to a specific linguistic theoretical model either in the preparation of testing materials or in the analysis of data on prepositional structures in aphasia, or both. Some studies (Kean, Lapointe, Rizzi, Grodzinsky (1984)) do not report on original data, but analyze data gathered by other researchers. As we shall see, most characterize the relevant deficit in terms of a systematic level of grammatical representation, or in terms of specific linguistic notions.


This researcher's "phonological" account of agrammatism is based on the theory of grammar outlined in Chomsky and Halle's 1968 study, The Sound Pattern of English. Kean states that the minimal requirement for an adequate characterization of patterns of loss and retention in agrammatism is "the provision of a principled algorithm which could be applied (at a specific level of grammar) to draw the necessary partition of the data." All subsequent accounts of agrammatism owe much to Kean, in that they respect this minimal requirement. For Kean, the crucial level of representation is the level of R-structure (where Readjustment Rules apply) at the point
where the syntactic and phonological subcomponents of the grammar interact. Only at this level is the needed bifurcation of linguistic elements into the phonological word/phonological clitic classes provided for. This division ultimately rests on the phenomenon of stress which specify word boundaries. Her "algorithm" is therefore word boundary assignment, and it yields the following classes of elements which map roughly onto the distinction between major lexical categories (P-words) and all the other elements in a sentence (P-clitics). The phonological account of agrammatism can now be stated as follows: the P-words of a sentence will be retained, *ceteris paribus*. The fact that Kean (and most subsequent investigators) chooses to characterize agrammatism in terms of what is retained, instead of what is lost, is a direct reflection of the disparity of the class of lost elements, which do not easily lend themselves to a unified analysis.

Let us now turn to Kean's discussion of prepositions. Although she is aware of the diversity in the class of surface prepositions, and provides a taxonomy\textsuperscript{26}, she does not try to correlate sub-classes of prepositions with patterns of loss and retention. What she does instead is partition prepositions on the basis of number of syllables: "prepositions, particularly short ones, tend to be unexploited in the spontaneous language use of agrammatics" (data supporting this claim is not cited) and "as a rule,
monosyllabic prepositions are not phonological words while polysyllabic ones are."\textsuperscript{28} Although she acknowledges in a later paper the importance of "semantic specificity", that is, "the greater the semantic specificity of the preposition, the more likely it is to be a phonological word..."\textsuperscript{29} she sees no point in developing an analysis using such a purely intuitive notion with no systematic grammatical status. But as we have seen, experimental evidence shows that the semantic content of the preposition correlates with patterns of retention. Kean recognizes this, yet she rejects such an approach. Furthermore, she never states which data substantiates her number-of-syllables claim. In any case, her account can provide for the type of division she wants only by introducing a complication into the grammar, i.e. by introducing a special R-rule that would either erase boundaries on some prepositions (in the event that the universal convention of boundary assignment applies to N, V, A, Adv and Prep) or supply boundaries on some prepositions (in the event that boundary assignment applies only to N,V, A and Adv). Such a complication is not a desirable addition to the grammar, and the fact that preposition omission data cannot be explained in terms of stress-determining potential or other phonological phenomena speaks against her "phonological" account.

Kean's rejection of would-be syntactic and morphological accounts of agrammatism also depend crucially on arguments regarding the status of prepositions. Let us first consider
her "syntactic" arguments. Kean states that in her framework all prepositions are lexical prepositions (including "of" in "he took advantage of Martha") except those which are assigned automatically by rule, purely grammatical formatives (such as "of" in "destruction of the city" and possibly infinitival "to" and "for"). Thus, the former would have a phonetic matrix at R-structure, while the latter would be specified only in terms of features. She argues that the category Prep is a major lexical category since prepositions are heads of their own phrases. Having made these claims, the essence of Kean's rejection of a syntactic account is as follows:

Those items which are retained in agrammatism as well as one class of the items which are unexploited belong to a single class, the set of lexical formatives. Not only is it impossible to give a uniform syntactic account of what is retained, it is also impossible to give a systematic account of the set of items which is typically unexploited as that set consists of two types of grammatical formatives as well as a subset of the set of lexical formatives.30

For her, a syntactic account of agrammatism would depend crucially on the headedness of categories. While it is true that purely "grammatical" prepositions (the ones predicted to be lost) do not head PPs, it is also true that the class of monosyllabic prepositions (also supposed to be lost) can head PPs. Given that such a syntactic account would make the wrong predictions, Kean rejects it. Once again, however, Kean does not consider testing a hypothesis of prepositions in different
phrasal structures without imposing the number of syllables criterion, and in that sense, her would-be syntactic account never had a fair chance in the competition.

A morphological account of agrammatism would have to be based on participation in derivational processes, Kean claims. She rejects such an account on general grounds, noting that it would have to make reference to rule sequences, and that such a "vertical cut" goes against her basic assumptions about what a grammatical analysis of the data should do. For her, characterizations of agrammatism that make appeal to levels of representation ("horizontal cuts") are of greater value. However, she goes on to consider such a hypothesis, stating that prepositions would have to be distinguished from the "other" major categories in order for the account to fit the data. She claims that this would not be possible, since prepositions "have in all relevant respects the same properties as the other categories". She attributes internal morphological structure to "beyond" and "yonder" and states that the noun "behind" is derived from the preposition "behind". Kean herself recognizes the fragility of such evidence, yet goes on to conclude that it supports her view.

It should be quite clear that this line of reasoning is not sound for at least two reasons. First, the processes she describes are "fossilized"; and second, to the extent that prepositions did (or do) participate in derivational processes, these are unquestionably non-productive. In fact,
as S. Lapointe observes, the rarity of such derivational processes speaks more to the differences between prepositions and other lexical categories. It seems that the evidence that Kean cites in order to reject a morphological account could count instead as evidence supporting such a view.

2. S. Lapointe (1983)

Lapointe's morphosyntactic account is based on a more recent theoretical framework which specifies a separate morphological component including both inflectional and derivational affixation and enriched lexical representations. Word structure here is no longer taken for granted; words (of major and non-major lexical categories) exhibit this structure in trees which are rule generated. These rules are constrained by universal principles such as X-bar, so that we have three levels of structure ($X=\text{words}; X_s=\text{stems}; X_r=\text{roots}$) and the special level specified by $af$ (affix) which is not hierarchically ordered; boundaries are thus eliminated.

For Lapointe, the crucial level of representation is at the interface between the morphological and syntactic subcomponents of the grammar (the level of Morphological Structure Rules) where lexical information is inserted into syntactic structures. At this level the notion of "minimal stem" (analogous to Kean's "p-word") is defined as the material dominated by the lowest $X_s$ node; this notion now
provides the criterion for bifurcation into those elements contained within minimal stems (retained in agrammatism) and those that appear outside of minimal stems (which are lost). Underlying his distinction between classes of elements is participation in productive derivational processes. Lapointe's description of agrammatism then states that "the relatively retained elements in agrammatism are those stem-level items (minimal stems) of major categories that are inserted into morphosyntactic structures during lexical insertion."34

In order to account for the data specifically relating to prepositions, Lapointe divides them into two sub-classes, once again on the basis of the number of syllables they contain. Polysyllabic prepositions may have internal structure but are disallowed from participating in productive morphology by "universal conventions"35; monosyllabic prepositions are constrained to have no internal morphological structure, though where the constraint operates is not discussed. We may once again ask the question, precisely what evidence motivates the number of syllables claim? Is it totally ad hoc or is it related to the traditional observation that most function words are monosyllabic (and hence polysyllabic function words might enjoy some kind of special status?). If this is the case, neither Kean nor Lapointe says so. Certainly, given that researchers such as Friederici have shown that locative
prepositions, regardless of number of syllables (e.g. "on" vs. "under") are retained, the distinction seems not only unmotivated, but explanatorily inadequate.


Branchereau's M.A. dissertation represents essentially a replication study of Friederici's 1981 and 1982 experiments. Eleven French-speaking aphasics were tested: four agrammatics, three conduction, 2 anomic and 2 Wernicke aphasics, as well as four controls matched for sex, age and level of education to the four agrammatics. Stimuli for the five tasks administered (oral reading and repetition of sentences, sentence completion, sentence-picture matching and grammaticality judgement) were constructed using Kean's 1982 preposition classificatory scheme differentiating lexical from verb-associated from purely syntactic prepositions. (Kean's fourth sub-type, verb + particle constructions, do not exist in French.)

The study failed to confirm Friederici's finding that the greater semantic import of lexical (i.e. locative and directional) prepositions favors their access. Although lexical prepositions were those most frequently substituted (vs. omitted), this tendency did not differentiate aphasic groups as it did for Friederici. Branchereau suggests that this finding supports a recent trend in aphasiology which
calls into question the validity of the agrammatism/paragrammatism distinction. She concludes, also in line with a resurgent view of agrammatism that stresses the role of adaptive strategies (the "economy of effort" explanation in new dress), that an adequate characterization of agrammatism may rest as much on the psycholinguistic, "procedural" level (which also takes into account attentional factors, memory constraints, etc) as on the linguistic, or structural level.

Branchereau and Nespoulous' 1989 paper re-presents a portion of the 1985 data (specifically the results of the sentence production task), from all but two of the original eleven subjects. The data is analyzed here in greater detail and in light of more recent developments in the field. However, no strong claims are made; the authors speak of "tendencies" rather than "significant effects" and make "suggestions" rather than "claims":

Even though no clearcut structural effect is evidenced, lexical prepositions tend to be more involved in substitutions than the other subtype (sic) of prepositions. It thus appears that the distinction between lexical and other types of prepositions can still be maintained, but not necessarily in Friederici et.al.'s terms. In other words, the semantic content of a preposition might not play a determinant role for its preservation and production... The difficulty might very well be due to other structural differences...37

A few observations regarding the stimuli used in Branchereau's
study can now be made, as they involve factors which might have influenced the outcome of her results. Firstly, with respect to her classification of prepositional structures (after Kean 1982), dative and benefactive structures (both labelled "datives") are purported to contain "purely syntactic" prepositions, i.e. prepositions that are present only for the purposes of case assignment, and are expected to pattern along with genitive constructions containing dummy "of". We may recall from the discussion in Chapter 1 that some versions of recent linguistic theory regard dative "to"/"à" and benefactive "for"/"pour" as prepositions which participate in the assignment of the theta-roles beneficiary and goal to the NP that they precede. If this analysis is correct, then these structures might be expected to pattern with those prepositions generally regarded as "primarily semantic" or "lexical", viz. locative and directional prepositions. We may also observe that Branchereau's category of "lexical" prepositions includes temporal adjunct phrases (cf. "Il neige en hiver"; "l'épicier ferme son magasin à sept heures") with true locatives ("le chat dort dans l'armoire") and directionals ("le marin lance une bouée vers le naufragé"). We recall that adjunct PPs may enjoy special status and suggest that it should be included as a separate structural category in testing materials. Since Branchereau does not provide us with information internal to her categories, it is not possible to ascertain how the temporal
structures fared with respect to the true locatives and directionals.

Inspection of the sentence stimuli used for both the oral reading and the repetition task shows that stimuli sentences occasionally varied greatly as to sentence length: to cite three examples, "le bebe veut boire", "dans l'armoire, le chat dort", "le mecanicien repare le retroviseur de la voiture". The obvious question is to what extent these factors might have affected aphasie performance.

To return to Branchereau's sentence completion task, it must be noted that she introduced some changes in methodology with respect to the Friederici studies. These changes were important ones and were incorporated after Branchereau observed that Friederici's "sentence with a hole" version of the sentence completion task could not address the issue of whether or not the aphasics tested exhibited a syntactic parsing difficulty. Half of Branchereau's sentences were syntactically complete (i.e. they did not require a preposition) and each word of every sentence was placed at equal intervals in order to avoid revealing the position of the missing preposition, when one was indeed missing. Such an experimental design, she claims, in effect presents the subject with two tasks:

1. a judgement of grammaticality based upon syntactic parsing— i.e., the ability (a) to distinguish between ill- and well-formed sentences, and (b) to locate the missing elements; and
Although results have already been summarized above, a few observations regarding agrammatic performance should be discussed, as they are of particular interest. Subjects had no difficulty judging a sentence such as "--le--canari--est--la--cage" as ill-formed; two of three always indicated the correct position for a missing prep, the third placing it between the article and the noun, but always within the correct phrase. When substitution errors did occur, they were always within the category of preposition (contrary to Friederici's and Zurif-Pastouriaux's results). Finally, Branchereau and Nespoulous observe that substitution errors were made by agrammatics in the case of obligatory (verb-associated prepositions) as well, though to a lesser degree than substitutions of lexical prepositions. They claim that the underlying disruption does not seem to be of the same order as the one implied by the substitution of lexical prepositions. The substituted prepositions could, in fact, co-occur with the V in question, though NOT in the context of the sentence given: "la fillette apprend DE nager" where DE is incorrectly substituted for A; the prep DE could follow the V "apprendre" in a sentence such as the following: "la fillette apprend DE la voisine que...". Obviously (for the researchers) the agrammatics maintain sensitivity to the
sUbategorization frames of verbs; the fact that they also correct themselves immediately, upon awareness of the context (the pictorial representation of the sentence), leads them to suggest the following explanation:

agrammatic patients might make use of some kind of syntactic information in sentence production (i.e. they are still aware of the link between prepositions and verbs); and that a compensatory strategy of some sort leads them to produce one of the legitimate prepositions associated with the verb.\(^{39}\)

It seems especially unfortunate, given this convergence of findings regarding the "links between prepositions and verbs" in the Zurif-Pastouriaux and Branchereau studies, that the latter researcher was not familiar with the former's work. The kinds of observations Branchereau and Nespoulous make regarding the substitution errors on verb-associated prepositions can speak directly to the issues surrounding the mental representation of verbal structure.

4. L. Rizzi (1985)

In his short but highly suggestive paper on the linguistic interpretation of Broca's aphasia, Rizzi investigates the consequences that the "modular approach" of recent Government-Binding models has on the study of pathological language. The strong echo of his comments have been apparent throughout the present discussion. Rizzi claims that reference to the new
model of grammar can not only improve the interpretation of known material, but that it can guide aphasiological research in the discovery of new data. Instead of classifying data intuitively/pretheoretically, the aphasiologist can determine whether or not such data can be organized into natural classes, as determined by the modular structure of the grammar.

A case in point is offered by the impact of theta theory on the analysis of agrammatic data. Theta theory divides the linguistic items in a sentence into three classes of elements: theta-role assigners, theta-role assignees, and other elements which do not fall within the scope of the module. Given that the properties of theta-role assignment reflect compositional semantics, it follows that the formal notion of theta-role assigner, in the case of prepositions, may converge with the pretheoretical notion of "semantic preposition".

It is easy to see that Rizzi's independently motivated theoretical distinction between prepositions that participate in theta-role assignment and those that do not seems to map well onto Friederici's empirically substantiated lexical/obligatory preposition distinction. Rizzi has thus provided the linguistic aphasiologist with a strong (if not as precise as we would like it to be, cf. Chapter 1) predictive hypothesis that correlates well with, but is also capable of generalizing beyond, existing data.
5. Grodzinsky (1984) and (1988)

In his (1984) syntactic characterization of agrammatism, Grodzinsky challenges the view that closed-class items are omitted across-the-board in agrammatic language. Having studied Hebrew agrammatics and re-examined data from English, Russian and Italian agrammatism for purposes of contrast, he observed that for structural (language-specific) reasons, certain kinds of closed-class items cannot be omitted from agrammatic speech; they are instead mis-selected. His claim is as follows: while free grammatical morphemes (except for "semantically" determined prepositions) are omitted, patterning is more complex in the case of inflectional (bound) morphemes. If a lexical item has a 0-inflected form (i.e. if the stem is a word) then the agrammatic will select that form; if no 0-inflected form exists, he will choose from the (paradigmatic) set of possible inflectional forms, regardless of syntactic constraints. Therefore, while items that are not morphologically well-formed will not be produced, selection of the inflected form might not be appropriate for syntactic structure.

One of the merits of Grodzinsky's approach lies in its view of the agrammatic language system as a "possible grammar" which conforms to the principles and properties of UG. For him, the problem is "to find a condition for grammaticality within the agrammatic system". In this structural account...
he opts for a "conditions on representations" approach. The "natural candidate" for the imposition of such a condition is the level of S-structure: at this level, members of major categories, plus prepositions, are specified lexically while the minor categories are specified by features. This gives us a first approximation in the partition of items. However, Grodzinsky's "agrammatic condition" must be articulated in two parts: a special proviso must be added to it in order to account for prepositions:

Agrammatic Condition:

(1) if a terminal element at S-structure is not lexically specified, then it will be unspecified at this level

(2) every preposition at S-structure will be deleted, unless it is a head of a PP adjoined to S

We can note that in the phrase markers generated, the nodes for non-lexical elements are created but never filled, so that mis-selection patterns can be explained.42

Grodzinsky does not provide the empirical basis for his claim that only prepositions in PPs adjoined to S are retained; no references to studies demonstrating this are given. Furthermore, this claim is at variance with a previous assertion that "'semantically determined' prepositions and particles may be retained in agrammatism, while other types are lacking." We may recall that prepositions other than those contained in adjunct structures are considered to have
semantic content. This is not to say that his configurational account of agrammatic language is not valid, just that greater empirical motivation is needed. It should also be noted that Grodzinsky never explicitly discusses sentence processing models, but deals with the deficit purely in structural terms.

Grodzinsky maintains this structural approach to the deficit in the second (1988) study. In this paper the unique role of data from prepositional processing is assumed and exploited in the context of the investigation of the syntactic deficit occurring in agrammatic aphasia, which is held to be partial rather than total. Previous descriptive generalizations regarding the relevant data base are evaluated and rejected, and it is proposed that the relevant grammatical notion capable of accounting for the partitioning of lost/retained prepositions is a structural one, namely government. He is essentially refining his 1984 Agrammatic Condition by appealing to this notion. Government defines a relation which must hold between the preposition and the verb in a given sentence. After discussing the predictive power of such a hypothesis, a report of an original experiment designed to test the hypothesis is presented, and the findings are claimed to support the author's hypothesis. In brief, ungoverned prepositions are retained, and governed prepositions are lost. This claim is stated in the grammar as a condition on S-structure representation: in agrammatism, governed terminal nodes at S-structure that are dominated by the category P are
deleted. Agrammatics would thus have access to the category label in their representation of tree structure, but not to the actual identity of the preposition. This is necessary in order to account for good performance on grammaticality judgements and within category substitutions.

We would like to observe that there are certain unclear points both in Grodzinsky's discussion of previous accounts of the deficit and in his own theoretical discussion. Grodzinsky recognizes that the linguistic impairment of prepositions in agrammatism is directly related to the fact that their distribution is at times syntactically determined and at times semantically determined, yet he summarily rejects a proposal that attempts to capture that distinction in a formal and precise manner.

His rejection of Rizzi's (1985) proposal that the relevant partition could be drawn along the lines provided by theta-role assignment, is based on claims which can be contested. He states that "the consequence of Rizzi's hypothesis for English is that the only prepositions to be omitted (or substituted) will be of and the infinitival to...the data reviewed so far, however, seem to disconfirm this claim." 44 The prepositional sub-type most crucial to this discussion is the case represented by subcategorized prepositions, which Rizzi never discusses explicitly in his paper on the linguistic interpretation of Broca's aphasia (unfortunately). Grodzinsky automatically assumes that these prepositions do
assign theta-roles to their NPs, and crucially uses Friederici's findings that these prepositions are omitted in agrammatic sentence production to disconfirm the theta-role assignment hypothesis: "that agrammatics omit prepositions such as those in 'Afghanistan applied for economic aid' speaks directly against Rizzi's account, since these prepositions are assigners of thematic roles." However, we may recall that some recent GB accounts (most notably Stowell 1981 and 1982) state that these prepositions are reanalyzed into a complex V' structure and that they do not participate in theta-role assignment, which would depend wholly on the V. Note that intuitively, if theta-role assignment is the notion that captures the semantics of V-prep relations, then this view is valid. If so, the Friederici data speak against Grodzinsky's account.

In addition, Grodzinsky's theory is contradicted by the finding that locative and directional prepositions are retained, unless it is assumed that these constructions are all adjuncts. It is most interesting to note that when Grodzinsky does discuss sentences such as "the cat is lying UNDER the chair" (his sentence #13) he does not provide us with his usual notation in square brackets indicating the hierarchical structure of the PP. If indeed he does assume that all locatives and directionals are adjuncts, which he would have to do to save his configurational claim, then he should state this assumption clearly. He refers the reader to
the relevant discussion in Hornstein and Weinberg (1981) but
does not follow their analysis, in which locative PPs in the
VP are distinguished from sentential "place" PPs. (see
Chapter 1 above for relevant discussion).

Grodzinsky discusses two potential problems for his analysis
pointed out by D. Saddy. His discussion is contained in two
footnotes. Firstly, his claim is inconsistent with data such
as those gathered by Zurif and Caramazza (1976) which show
that agrammatics are sensitive to dative prepositions. The
preposition to in such constructions theta-marks the NP for
GOAL, by many accounts. Grodzinsky explains away this
apparent contradiction by claiming that "various extraction
phenomena suggest that they may be actually ungoverned"
without giving any examples of such phenomena.

Secondly, Saddy suggests that the same partition of the data
could be achieved by stating that heads of subcategorized PPs
are omitted, others retained. We can assume that this
comment might have been made because of the problems with
Grodzinsky's analysis of the configuration of prepositional
structures outlined above. A proposal such as Saddy's would
make no claims as to the theta-marking properties of
prepositions, perhaps because recent linguistic theories have
not satisfactorily dealt with the issues surrounding
prepositions which are subcategorized (or present in the
predicate argument structure of the verb, see relevant
discussion in Chapter 1). Given the results obtained in
studies by Zurif-Pastouriaux and Branchereau, it might even rest on a claim that is empirically false. In any case, as Grodzinsky himself notes, it would not account for the fact that of, which is usually not subcategorized, yet governed, is lost in agrammatism.

The point being made here is that, as Saddy recognized, Grodzinsky's proposal (if indeed it should prove to be empirically true) may not be the only one compatible with the data.

Another important claim is presented in the form of an agentless passive, and is therefore difficult to verify: "it was observed that only sentential adjuncts and particles are unimpaired in this syndrome"; but no reference is given for this observation.

In order to test his hypothesis, Grodzinsky assumes an analysis of passive constructions in English according to which the by-phrase in syntactic passives ("the boy is pushed by the girl") is ungoverned, and the PP in lexical passive ("the boy is interested in the girl") is governed. Results of a grammaticality judgment task given to four Broca's and four Wernicke's aphasics and four normal controls (with ungrammatical sentences containing the wrong preposition) confirmed the hypothesis that the agrammatics would perform poorly on the lexical passive and well on the verbal passive, since the by-phrase in the latter is a sentential adjunct. In his interpretation of the results, Grodzinsky concludes
that "it is clear that the ability to use some prepositions is preserved, yet some others are lost, where the best distinction between the two groups is configurational". Given that his own findings relate to a grammaticality judgment task, they can not be used as evidence for/against claims regarding the "use" of prepositions. Grodzinsky himself acknowledges the ungeneralizability of findings across tasks and across researchers and stresses that the properties of stimulus materials, method of presentation and mode of response are all factors which can crucially affect aphasic performance, especially in the case of a deficit which is not total but partial, i.e. where minor differences may have far-reaching consequences in performance. Any claims made must therefore be tempered by an assessment of "the nature of the task coupled with the specific syntactic properties of the sentences presented". This point is well taken; once again, it indicates the need for structured and analogous comprehension, production and metalinguistic judgment tasks.
E. Summary

It is clear from the studies reviewed above that a salient feature of the syntactic deficit in aphasia is the preservation of certain prepositional types and the impairment of others. No clearcut overall tendency can be deduced, however, regarding the direction of the differential impairment (patterns of loss/retention). With regard to the types of errors occasioned by the two main (theory-neutral) classes of prepositions ("lexical" and "obligatory") divergencies are also apparent. For example, Friederici claims that lexical prepositions are substituted and syntactic prepositions omitted (as one would expect intuitively, given their paradigmatic structure). Although Zurif-Pastouriaux' anagram task could not speak directly to the issue of substitutions (only the correct preposition was presented; it had to be correctly positioned), she found that agrammatics fared better on the syntactic prepositions than they did on the lexical prepositions; Branchereau noted that substitution errors were more frequent for lexical prepositions, but she also found that syntactic prepositions could be omitted or substituted. The substitution pattern for syntactic prepositions was not random: the prepositions erroneously supplied could co-occur with the verb in contexts other than the specific context given in the stimulus sentence. Such a result, if confirmed by other researchers, may provide
evidence for the way verbs are encoded/stored in the mental lexicon (i.e. aphasics seem to be sensitive to the fact that more than one preposition can be associated with a given verb, depending on the syntactic structure of the sentence).

What is immediately obvious from even a cursory review of previous studies is the researchers' focus on the "semantic/syntactic trade-off" phenomenon. We recall that in the traditional view, the deficits in Broca's aphasia and Wernicke's aphasia are held to be syntactic and lexico-semantic, respectively. Given the fact that many researchers view prepositions as either primarily semantic OR primarily syntactic, it is easy to see why the data from prepositions in aphasic performance is expected to be so revealing. In actual fact, however, as we have seen, the data do not pattern so neatly. It remains to be seen just how much of the divergence can be satisfactorily attributed to differences in task demands.

The studies also differ with respect to the extent to which they rest on linguistic notions. Some of the researchers (especially the early ones) approach their data from a theory-neutral, or general theoretical point of view. For example, the notion of subcategorization frame is fundamental, and it is appealed to by Friederici to distinguish "obligatory" from "semantic" prepositions, and by Zurif-Pastouriaux to designate those prepositional structures in which there is a strong "transitional probability" between the verb and the prep in
question. Branchereau assumes Kean's (1982) classification of prepositional structures which is in turn based on the notions of subcategorization frames and case theory present in the Extended Standard version of Chomsky's theory of syntax. She introduces a change in the classificatory scheme assumed by the two previous researchers by distinguishing subcategorized preps from those [ostensibly] present only for the purposes of case-marking.

On the other hand, proposals such as Rizzi's or Grodzinsky's rest on a specific linguistic theory, namely the Government Binding Framework (Chomsky 1981). Rizzi appeals to the notion of theta-role assignment in order to formalize the intuitive notion of "semantic preposition". Grodzinsky explicitly discusses theta-theory and ultimately decides that the data can best be accounted for by appealing to the structural notion of Government. Both proposals await empirical verification.

Researchers also differ in the extent to which they relate their work to sentence processing models. Friederici and Zurif-Pastouriaux explicitly claim that their results confirm the validity of Garrett's sentence processing model, and support the hypothesis that Broca's aphasia represents a deficit at the Positonal Level and Wernicke's at the Functional Level. Branchereau makes reference to the Garrett model but is cautious not to make any explicit claims relating her data to Garrett's processing levels. All the researchers
expressed concern over task-specific factors in the interpretation of the data and the explanation of the variability observed both across tasks and across studies. Some interpretations of performance patterns (for example, in Kolk and Friederici and in Branchereau) appealed to non-linguistic factors such as the use of adaptive (e.g. non-syntactic, linear) strategies and to limitations in attention/working memory in order to account for aphasic performance. It can be noted in this regard that an account of aphasic language data which assumes that aphasic grammar conforms to UG, the type of account favored here, does not necessarily rule out the possibility that non-linguistic strategies can be resorted to in order to explain performance. In other words, structural accounts can and must be complemented by explanations which take into account factors such as memory limitations, attention, and the use of adaptive/compensatory strategies by aphasics. Work by J-L. Nespoulous has confirmed the validity of such an approach.51

How can new investigations of the prepositional deficit circumvent some of the problems raised in the discussion of the previous studies? Obviously, given that more questions regarding the deficit have been posed by an analysis of the data obtained than have been answered, research is still at a preliminary stage. What is clear is that the key to understanding how prepositions behave in aphasia, and how they might be encoded/stored, lies in the interaction between their
semantic and syntactic properties, and to the extent that the
two roles, semantic and syntactic, are dissociable. It would
seem that the most fruitful approach to the problem would be
embodied in research that follows these basic guidelines:

1. **as full a spectrum as possible of prepositional structures** should be manipulated in the sentence stimuli, with the classification scheme based not on intuitive, pre-theoretical notions but on precise (hence testable) notions provided by recent linguistic theory.

2. data should be obtained on a **variety of tasks** (production, comprehension, grammaticality judgement) with each task given in minimally different conditions in order to "tease out" task-specific variables. Such **structured tasks** should be designed, as far as possible, to be analogous (use the same sets of stimuli), so that meaningful comparisons/contrasts can be drawn;

3. interpretation of the data obtained should take into account structural factors and processing factors and be open to explanations which seriously consider the role of extra-linguistic factors affecting aphasic performance.

Having made these general observations regarding the direction research into the prepositional deficit should take, we may now present the case study. We begin by stating more formally the specific predictive hypotheses that have arisen in the context of the discussion in Chapters 1-3.
1. For discussion of agrammatism in this perspective, see for example the papers by Heeschen and Kolk in M.L. Kean (1985).


4. This vocabulary distinction is well-known; it has turned up under a variety of names: "little" vs. "big" words (based on length); "function" vs. "content" words (based on semantic content), etc. Chomsky and Halle's The Sound Pattern of English proposes the grammatical/lexical formative distinction. The former have no phonetic matrix but are specified in terms of features. This last distinction probably maps best onto the closed/open class distinction.


7. Tissot et.al. (1973) p.64


13. In another (more general) study of strategies used by Broca's, conduction, and Wernicke's aphasics, Caramazza and Zurif ("Dissociation of algorithmic and heuristic processes in language comprehension," Brain and Language 3 (1976) pp.572-582, the authors paired the syntactic and semantic strategies described here along the lines of algorithmic (specifically linguistic) and heuristic (partially non-linguistic) processes, respectively.


15. Friederici et.al. (1982) p.532
20. Friederici (1985) p.159
27. Kean (1979) p.73
30. Kean (1979) pp.74-75
31. Kean (1979) pp.75-76, footnote 8
32. Lapointe (1983) p.19, footnote 16

34. Lapointe (1983) p.24

35. See Lapointe (1983) p.19 for justification of such a universal condition, which would not (unlike Kean's special R-rule for preposition boundary assignment) represent a complication in the grammar.

36. See Heeschen in Kean (1985) for discussion.


41. See Travis (1983) for a similar but more refined approach.

42. See Travis (1983) for discussion of other merits of this type of approach.


44. Grodzinsky (1988) p.120

45. Grodzinsky (1988) p.120


47. Grodzinsky (1988) p.122, footnote 6


51. See discussion in Nespoulous et.al. (1989)
A) Possible Predictive Hypotheses

We have seen (in Chapter 1) how the modular structure of a highly articulated theory of grammar allows us to define subclasses of prepositional structures in which the semantic and syntactic properties of the prepositions differ, and (in Chapter 2) how a model of sentence production can capture, grossomodo, some of these relevant distinctions by postulating different processing levels. In other words, linguistic and processing theories "draw the lines" for the linguistic aphasiologist who wishes to test refined hypotheses about how prepositional structures dissociate when the language system breaks down. We also saw (Chapter 3) how researchers examining the prepositional deficit in aphasia made use of theoretical and processing distinctions to varying degrees, and how high levels of variability contributed to the fact that many of the claims made concerning the locus of the deficit were contradictory.

Investigation of the prepositional deficit is thus in the early stages. For this reason, we believe that the most fruitful approach to the problem (for the time being) is to examine how a variety of prepositional structures pattern in aphasic performance. The preliminary data thus obtained may then be examined in light of a few competing hypotheses. The
next step would be to reformulate materials specifically
testing one or another hypothesis. Accordingly, we have
identified several specific dimensions along which
dissociations of prepositional structures would be
predictable. These were suggested throughout discussion in
the first three chapters, and are restated more formally
below. It must be noted that the predictive hypotheses
extracted are not mutually exclusive; however, each of the
hypotheses can be considered to "frame" the problem of the
deficit relating to prepositions in a different way.

(1) ADJUNCT vs. ARGUMENT: this distinction relates to the
position of the PP in the syntactic tree as a function of its
dependency on the sentential verb. Adjunct PPs either branch
directly off of S or off of the V-double bar level, in order
to distinguish them from those PPs conceptually linked to the
sentential V, and which are thus present at the VP or V-single
bar level. This structural difference usually entails a
difference in theta-assigning properties of the attending
preposition: in the first case, the preposition autonomously
assigns a theta-role to its NP object; in the second, it
usually does so compositionally with the verb. Temporal PPs
and some types of locative PPs are typically analyzed as
adjuncts. This hypothesis predicts that either adjunct PPs
will be compromised in agrammatism and arguments remain
intact, or the reverse; we would not expect to find a mixture
of argument and adjunct PPs present in the same patient.

(2) GOVERNED vs. UNGOVERNED: this distinction was proposed
by Grodzinsky (1988) in an attempt to reconcile the somewhat
disparate observations of previous researchers. Stating that
the use of prepositions is not preserved or impaired along
thematic lines (although he does not discuss which theory of
thematic role assignment he is assuming), he prefers to couch
his characterization of agrammatism in purely structural
terms: "governed terminal nodes at S-structure that are
dominated by the category P are deleted" (p.121). This
hypothesis then states that adjunct PPs and the passive
by-phrase will be retained, and that all others will be lost.
Except for the specific claims it makes regarding passive by,
it divides the class of prepositional structures in much the
same way as in (1) above, although the claim here is that patterns of loss are unidirectional (i.e. it is always the case that governed prepositions are lost, and that ungoverned Ps are retained, and not vice-versa).

(3) THETA-ROLE ASSIGNER vs. NON-THETA ROLE ASSIGNER: this hypothesis is in the spirit of Rizzi's (1985) discussion of agrammatic data. Its intuitive appeal is unquestionable: theta-theory and thematic relations are at the core of the semantics-syntax interface, and it is reasonable to expect that given a coherent and complete theory of the theta-assigning properties of prepositions, that the predictive hypothesis/es yielded would bear considerable predictive power vis-a-vis the breakdown of these structures in aphasia. Unfortunately, as the discussion in Chapter 1 demonstrated, the effectiveness of such a hypothesis is compromised by the fact that there are various competing and incomplete theories of theta-role assignment in prepositional constructions; for example, there is little agreement as to which PPs occurring with a verb actually participate in theta-role assignment, if at all (a case in point is presented by the varying status of instrumental "with" in analyses by Marantz (1984) Baker (1988a) and Baker (1988b). The type of approach to the dissociability of prepositional structures embodied here contrasts those prepositions which are present because they contribute to the thematic representation of the sentence with those prepositions which appear solely for the purposes of case-marking. As we have seen, though this distinction sounds straightforward, it is not. A theta-role assigning hypothesis of preposition loss/retention patterns would predict that adjunct PPs plus those argument PPs which assist the verb in determining the semantic role of the PP-internal NP would be retained, while those prepositions co-occurring with verbs which autonomously assign a theta-role to the NP inside the PP would be lost. Sensitivity to passive "by", according to most accounts, should be intact. Particulars would depend on the version of theta-theory assumed.

Having set forth these predictive hypotheses, we may now go on to consider the case of an agrammatic aphasic who manifested difficulty processing prepositional structures.
B) General Introduction to the Case Study Approach

Towards the middle of the past decade, several important papers (among them Schwartz 1984, Caramazza and Badecker 1985, Heeschen 1985) appeared in the aphasiological literature which did not report on experimental results. Instead, they raised—in a dramatic way—serious questions about the theoretical and methodological viability of previous studies of aphasia, and suggested new perspectives and procedures which were deemed to be more appropriate for the psycholinguistic and linguistic study of aphasiological language data.

At the very root of the pessimism immediately apparent in these influential papers is the acknowledgment of an inescapable variability in the data base upon which theorizing ultimately rests: this variability of performance occurs not only across researchers and patients but even within the same patient across tasks (cf. Nespoulous et.al. 1989 for an overview of the problem and its metatheoretical import). Obviously, the pervasiveness of this phenomenon has foiled many attempts at making significant cross-task, cross-subject, or cross-study generalizations.

In addition to pointing out the theoretical indefensibility of classical taxonomies based on the agrammatism/paragrammatism distinction and the difficulty of implementing linguistic models in aphasiology, the discussion in these papers was also concerned with the immediate issue at
hand, namely an appraisal of the relative merits of group studies and case studies. The essence of Badecker and Caramazza's (1985) argument for the superiority of an individual case study approach over group studies is that inter-task and inter-subject variability are totally incompatible with the presumed homogeneity of subject groupings. Task-specific performance models (i.e. "procedural models" rather than linguistic models) are to be tested for accuracy on a subject-by-subject basis, as follows:

Any pattern of performance on a task must be considered as evidence for or against the adequacy of the model. Thus, by taking it as our primary research goal to discover which models of language processing are up to the job of explaining individual aphasic deficits, and not to group patients, the questions concerning what is to count as evidence for the legitimacy of patient groupings do not arise.¹

Caplan (1986 and 1987) defends the utility of group studies but also recognizes the value of single case studies. Such studies typically provide evidence for a dissociation of symptoms which purportedly results from the impairment in an isolable linguistic/processing component:

Unlike arguments from associations, arguments from dissociations do not depend upon large series of cases. In the extreme, a single case will do... If one patient, drawn from a "normal population"...manifests a dissociation of two abilities, then we may conclude that, for the normal population as a whole, the processing components related to these two abilities are at least partially separate. In fact, a great deal of contemporary research on
language processing based on studies of aphasia utilizes the dissociation approach.²

Particularly revealing are arguments which arise from cases of "double dissociation", where one subject has lost ability A (whose description is made possible by, and whose dissociability is predicted by, at least one particular linguistic theory and one processing theory) and retains ability B, and a second patient manifests the reverse performance pattern. Single case studies have proven to be the vehicles most suited to providing evidence of double dissociations, the presence of which allows us to claim that separate processing components are involved in two or more tasks.³ It is easy to see how highly articulated models of linguistic theory and processing are especially suited to the investigation of dissociation of deficits. In this regard, the arguments presented in favor of single case studies in Badecker/Caramazza and Caplan diverge in an important and interesting way. Badecker and Caramazza argue for the compatibility of the single case study approach with the use of task-specific, procedural models of performance. Caplan, on the other hand, argues for the suitability of specific linguistic models to the study of individual cases. Certainly, the single case study approach allows for a level of detail/specificity which is unattainable with a large sample of subjects, as Caplan notes:
Single case studies published in recent years show highly specific, quite restricted, impairments of psycholinguistic functioning... these analyses provide direct evidence for the existence of particular components in the language processing system... In large part for practical reasons, due to the great degree of specificity of impairments in individual patients, detailed psycholinguistic studies showing associations of very specific deficits in series of patients have been less forthcoming in recent years than individual case studies documenting a particular deficit in detail.  

For researchers approaching aphasic language data from the theoretical linguistic point of view, such a level of descriptive specificity is more than merely desirable; it is a conditio sine qua non.

Having thus established the validity of the single case study approach, especially from the point of view of the theoretical linguist, we now turn to a presentation of the particular methods and materials used in the investigation of the case at hand.
1. Analysis of Narrative Speech Sample

The spontaneous speech output of aphasics has always been of great interest to clinicians and theoreticians alike. While general impressions of the features of spontaneous aphasic speech have proven valuable in a historical sense, the need for a reliable method of adequately characterizing unconstrained output from both a qualitative and quantitative point of view has only recently been addressed in a systematic manner. The researcher interested in what an aphasic actually produces "on-line" in addition to his/her performance on highly constrained tasks is faced with several problems. Given that conversational speech does not lend itself to systematic analysis--it is difficult to ascertain "target" structures in such a highly unconstrained communicative situation--it has been deemed preferable to exercise some kind of control on the broad lexico-semantic content of the sample. This would reduce to a minimum inferences regarding the subject's target utterances.

One of the most effective procedures being used presently is the elicitation of narratives, where the narrative is usually a familiar fairy tale. This story elicitation procedure yields a body of continuous speech which can be framed within certain contextual boundaries; the constraint of narration also reduces experimenter interference to a minimum. In this
way, the problems associated with conversational speech and output on picture-description tasks (which tends to result in serial "labelling" instead of connected speech⁶) are circumvented.

Saffran et al. (1989) present a detailed procedure for the quantatative assessment of narrative speech, including explicit instructions for elicitation, simultaneous transcription, segmentation, coding, scoring, and statistical analysis of the narrative texts. In particular, they also provide a structural framework for the classification and tabulation of utterance types, and include instructions for how to extract a core narrative from the corpus. They also warn researchers against the methodological pitfalls associated with the attribution of target utterances to the subject, and require them to make only minimal assumptions. In other words, scoring should be based on the structural elements which actually occur in the output of the subject. Their own series of case studies showed that agrammatics differ reliably from other groups (non-fluent non-agrammatics and normal controls) in terms of certain aspects of their speech; most notably:

(1) a significant proportion of the words they produced is not incorporated into NP-VP structures, and
(2) their output is deficient in bound and/or free grammatical morphemes, but not necessarily in both

Byng and Black (1989) present a detailed descriptive
framework for the assessment of predicate argument structures in aphasic speech as measured in the story elicitation task, following the procedures given in Saffran et al. Since their list of possible structural descriptions allows for the presence of argument and adjunct PPs, it was adopted here. The subject is asked to tell a well-known fairy tale to the experimenter; no time limit is given. The experimenter records the session but also simultaneously transcribes the speech of the subject, including pauses, intonational contours and other phenomena which will allow him/her to determine utterance boundaries. The corpus yielded is then reduced to a narrative core (for example, commentary is eliminated; conjunctions such as "and" or "but" are also eliminated except when the conjoined phrases can be treated as separate sentences by virtue of an overt subject NP being present in both).

Once the utterances are segmented, they are classified according to the chart reproduced on the following page: this chart organizes the data into classes which are not meant to be exhaustive but which are relevant to the specific type of analysis to be carried out, dependent upon the researchers initial hypotheses. In the case of the Byng and Black study, and also for the present study, classification of structures along the lines of the argument/adjunct distinction was desired. Categories are set up as follows: 7
<table>
<thead>
<tr>
<th>Structural Description</th>
<th>#</th>
<th>Example(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. NP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Nominalization of V</td>
<td></td>
<td></td>
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<tr>
<td>3. V only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. PP only</td>
<td></td>
<td></td>
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<tr>
<td>5. AP/AdvP only</td>
<td></td>
<td></td>
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<tr>
<td>6. NP₁ V</td>
<td></td>
<td></td>
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<tr>
<td>7. V NP₁</td>
<td></td>
<td></td>
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<tr>
<td>8. V NP₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. NP₂ V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. NP₁ XP (X=N,A,P,Adv)</td>
<td></td>
<td></td>
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<tr>
<td>11. XP NP₁</td>
<td></td>
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<tr>
<td>12. V AP/PP/AdvP</td>
<td></td>
<td></td>
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<tr>
<td>13. NP₁ V NP₂</td>
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<tr>
<td>14. NP₁ NP₂ V</td>
<td></td>
<td></td>
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<tr>
<td>15. NP₂ NP₁ V</td>
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<td></td>
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<tr>
<td>16. NP₂ V NP₁</td>
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<tr>
<td>17. V NP₂ NP₁</td>
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<tr>
<td>18. V NP₁ NP₂</td>
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<tr>
<td>19. NP₁ V PP</td>
<td></td>
<td></td>
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<tr>
<td>20. NP₁ V AP/AdvP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. V NP₂ NP₃/PP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. NP₁ V NP₂ NP₃/PP</td>
<td></td>
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<tr>
<td>23. NP₁ V PP PP</td>
<td></td>
<td></td>
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<tr>
<td>24. NP₁ V PP NP₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. XP non-arg XP*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. NP₁ V non-arg XP*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. NP₁ V XP non-arg XP*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. NP₁ V S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. automatized sequence</td>
<td></td>
<td></td>
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</tbody>
</table>

Total # of utterances analyzed
-Categories 1-5 represent phrases produced in isolation, i.e. they have not been integrated into a predicate-argument structure (we may expect agrammatics to produce more nouns (1 and 2) than verbs (3))

-Categories 6-24 represent predicate-argument structures; 6-12 for one-place arguments, 13-21 for two-place arguments, and 22-24 for three-place arguments (all subcategorized PPs would be included here, reanalyzable prepositions would fall under the category 13 or 19, depending on whether not reanalysis is assumed; verb + particle constructions are treated as regular verbs)

-Categories 25-27 represent the production of non-arguments either with (26 and 27) or without (25) a predicate-argument structure (temporal PPs and some locative PPs would be included here)

-Category 28 represents embedded structures

Different diacritics can be used in conjunction with this descriptive chart to mark error types (omission, substitution, agreement violations, etc.) at the discretion of the researcher(s). It is important to emphasize that the chart is meant to be a descriptive tool:

The chart is purely descriptive: without specific psycholinguistic theories of production and production impairments no predictions can be derived from it. However, as a systematic description of a particular aspect of output, it should provide us with patterned data that can be used to construct and evaluate some psycholinguistic models and theories of particular types of language breakdown, as well as theories of therapeutic intervention and rehabilitation.

This is not to say that the classification scheme used is not more compatible with certain linguistic theories than with others; for example, it does exploit certain aspects of X-bar syntax.

Once the utterances are rigorously segmented and classified,
and results tabulated in terms of the frequency of occurrence of each category type, proportions of instances of certain categories or groups of categories with respect to others (e.g., noun to verb ratio; argument PP to adjunct PP ratio) can be computed. These can then be compared with frequencies of occurrence and proportions observed in the speech output of normal controls. Thanks to the framework supplied by Saffran et al. and Byng and Black, we can obtain a clearer picture of a particular aspect of the sentence production deficit (for us, the presence of different types of prepositional phrases) as it is manifested in its purest form, i.e. in the spontaneous speech produced by the aphasic subject. Production patterns observed on this task will serve as a basis for comparison with performance on more constrained production tasks.

2. Sentence Completion

This basic task-type has been used extensively by various researchers, as the literature review contained in Chapter 3 reveals. Two variations ("first" and "second" conditions) of the completion task were administered. In both cases, a time limit was imposed; presentation of stimuli (N=56) was in written form; each sentence and corresponding picture were presented simultaneously; stimuli were pseudo-randomly ordered as to prepositional sub-type so that no more than two consecutive stimuli sentences contained prepositions of the
same sub-type (see below); the subject was required to read
the stimuli sentence aloud along with his response, and also
to write the response. Each condition occupied one testing
session; a three-week period elapsed between trials so as to
cancel out a possible practice effect. Sentence stimuli
appeared in large black type on white cards and were each
accompanied by a laminated black-on-white line drawing (8 1/2"
x 11") depicting the semantic content of the sentence. We now
turn to a discussion of the two conditions, which we may
characterize roughly as the "free response" type (first
condition) and of the "multiple-choice" type (second
condition), though for the sake of expository clarity they
will be discussed here in the order opposite the order of
presentation/testing.

Second Condition (following Friederici (1981) and
Zurif Pastouriaux 1984)

Each picture is presented with a single sentence stimulus
printed on a (6" x 8 1/2") card in which the missing
preposition is replaced by a single blank. The subject is
required to choose the correct response from a set of five
vertically arrayed choices, the correct response plus four
distractors. An example will illustrate the logic behind the
choice of distractors:

The carpenter is fixing the table _______ the glue.
It was not always possible to constrain the prepositional distractors in the way described above, due to the individual syntactic characteristics of the different prepositional subcategories, but an attempt was made to do so in the most systematic way possible. Prepositions which can only occur in verb + particle constructions ("away", "off", etc.) and "of", i.e. those that have limited distribution, were most often chosen as the second type of prepositional distractor. In the example given above, we can observe that the choice of the first prepositional distractor would result in the sentence "A carpenter is fixing the table FOR the glue": the preposition FOR can appear in the syntactic frame \([\text{NP}_1 \text{ is fixing NP}_2 \text{ FOR NP}_3]\) where the preposition FOR has a benefactive reading; for this reading to be possible, however, the third NP would have to bear the feature \([+\text{animate}]\). The choice of the second prepositional distractor, on the other hand, would result in the sentence "A carpenter is fixing the table OFF some glue": the preposition OFF can not appear in this syntactic frame.

(endnote: unless we allow for the possibility of a PP..."
internal to the NP, such as "NP₁ is fixing [NP the table off the kitchen] (with the glue)", an unlikely possibility. Previous versions of the multiple choice version of this task did not seek to constrain error choices in this way, as we can recall from the reviews in Chapter 1. Zurif-Pastouriaux (1984) tested only locative/directional constructions and allowed for two syntactically appropriate but contextually wrong prepositions (according to situation depicted in picture), two semantically related content words, and one extra function word (usually the conjunction "mais"). Significantly, not one of her patients chose the latter error type. The decision to provide two prepositional distractors constrained as described above was made in the light of recent suggestions that agrammatick display a certain amount of syntactic sensitivity (see for example Linebarger et al. 1983). The two prepositional distractors were included here in order to investigate the possibility that this purported syntactic sensitivity affects error choice.

The question of syntactic sensitivity brings us to the rationale for the other version of the sentence completion task.

First Condition (Branchereau 1985)

Here the picture is presented along with a sentence stimulus in which a preposition is missing, but in which the position of the missing word is not indicated: blanks occur at the
beginning and end of the sentence and as well between words. This technique was used by Nespoulous et. al. 1984 and by Branchereau 1985 in order to ascertain whether the subject was able to provide a correct syntactic parse for the sentence, under the assumption that this ability would be a prerequisite for the ability to correctly identify the position of the missing sentential element. The subject was thus able to insert any element at any position in the sentence. Typed stimuli were presented on (4" x 11") cards, as follows:

---a---carpenter---is---fixing---the---table---the---glue---

In both conditions, eight instances of seven prepositional sub-types were tested (N=56). The chart below lists these categories and gives an example of each. Sentence stimuli were controlled for length (10-12 syllables); it was not possible to vary the position of the missing preposition due to the fact that the position of many PPs in the sentence is fixed.
<table>
<thead>
<tr>
<th>CATEGORY TYPE AND LABEL</th>
<th>EXAMPLE STIMULUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjunct (ADJ)</td>
<td>The father is driving the kids IN the morning.</td>
</tr>
<tr>
<td>Locative (LOC)</td>
<td>The man is hiding the money UNDER the mattress.</td>
</tr>
<tr>
<td>Dative/Benefactive (DAT/BEN)</td>
<td>The leader is telling stories TO the campers.</td>
</tr>
<tr>
<td>Instrumental (INST)</td>
<td>The butcher is slicing the steaks WITH a knife.</td>
</tr>
<tr>
<td>Other Subcategorized PPs (SUBCAT)</td>
<td>The woman is supplying the nurses WITH the caps.</td>
</tr>
<tr>
<td>Verb + Particle (PRT)</td>
<td>The maids are putting AWAY the clothes.</td>
</tr>
<tr>
<td>Passive (PASS)</td>
<td>The child is being called BY the teacher.</td>
</tr>
</tbody>
</table>

The full list of stimuli sentences, distractors and corresponding pictures can be found in Appendix C.

3. Grammaticality Judgement

In this task, 106 typed sentence stimuli (50 grammatical and 56 ungrammatical) were presented to the subject one at a time on white (4" x 11") cards. The subject was to read each sentence once out loud and judge if the sentence was "bad" or "good". Response was verbal and no time limit was imposed.
Stimuli were not taped due to the fact that it is very difficult to record ungrammatical sentences using normal intonation patterns\(^{10}\) and therefore avoid giving the subject an intonational cue.

Arguments for the administration of this kind of task to agrammatics are given in Linebarger et al. (1983), who assume that performance on this type of task can be interpreted as a direct gauge of the agrammatic's structural (i.e., syntactic) sensitivity. Zurif and Grodzinsky (1983) take issue with this claim, stating that it is methodologically and theoretically unsound to infer agrammatic comprehension ability on the basis of performance on what is essentially a metalinguistic task. This is not to say that grammaticality judgement tasks are not valuable tools for the linguistic aphasiologist. Indeed, when administered not in isolation of other tasks, but in conjunction with production and true comprehension tasks, interpretation of results obtained may prove useful to the aphasiologist in determination of the locus of the deficit in question. Caplan 1987 describes how and why the interpretation of results on tasks of this type is important:

Linebarger and her colleagues (1983) were the first to report the phenomenon of retained grammaticality judgement abilities, in the face of severe disturbances in syntactic comprehension, in agrammatic patients. These findings suggest that parsing operations are partially separable from the process of interpreting the structures created by a parser in normal people.\(^{11}\)
In sum, although grammaticality judgment tasks (more generally, tasks of a metalinguistic nature) can prove to be quite valuable, researchers must not assume that the resources tapped in such tasks are directly indicative of parsing operations which are involved in sentence comprehension.

Let us assume that a subject's performance on the sentence completion task reveals a tendency to either choose or insert content words in the place of the missing preposition. How would this same subject react to complete sentences containing errors of this type, that is, would he judge them as grammatical or ungrammatical? In order to answer this interesting question, sentence stimuli were set up in the following way. For each prepositional sub-type, either 7 or 8 grammatical sentence tokens and 8 ungrammatical sentence tokens were presented for judgment. These were randomly ordered with respect to prepositional category and error category. The 8 ungrammatical sentences were constructed as follows: 3 contained content word intrusions in the place of the preposition, 2 contained erroneous prepositions and 2 contained no preposition. This paradigm may be illustrated as follows, using the sub-type instrumental ("G" stands for grammatical/good and "B" stands for ungrammatical/bad):

G: The man is washing the car WITH a sponge.
B (content word): A waiter is slicing the meat SHARP a knife.
B (wrong P): The clerk is cutting the tape FOR a razor.
B (P omission): The mayor is signing the papers Ø a pen.
The full list of sentence stimuli used in this task is to be found in Appendix D.

In order to arrive at an acceptable quantitative measure of performance on this task, instructions for setting up a 2 x 2 contingency table and the formula for computing the "A' score" or "index of sensitivity" were taken from the Linebarger et al. study, as follows:

Contingency Table:

<table>
<thead>
<tr>
<th></th>
<th>SG = good sentences</th>
<th>SB = bad sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG = response: &quot;good&quot;</td>
<td>HITS</td>
<td>FALSE ALARMS</td>
</tr>
<tr>
<td>RB = response: &quot;bad&quot;</td>
<td>MISSES</td>
<td>CORRECT REJECTIONS</td>
</tr>
</tbody>
</table>

where \( x = \frac{\text{false alarms}}{\text{false alarms} + \text{correct rejections}} \)

and \( y = \frac{\text{hits}}{\text{hits} + \text{misses}} \)

Index of Sensitivity:

\[ A' = 0.5 + \left[ (y-x) \left( 1 + y-x \right)/4y(1-x) \right] \]

where .5 represents Yates correction for continuity

4. Sentence-Picture Matching Task

It was decided to obtain a measure of sentence comprehension
capacity as well as production and metalinguistic judgment capacities. The task used to measure the subject's comprehension of sentences containing prepositional structures was the sentence picture matching paradigm, which has been used frequently to tap comprehension (cf. Kolk and Friederici 1985; Branchereau 1985) of sentential structures where the constraint of picturability does not pose a problem.

A single sentence stimulus was presented on a white (4" x 11") card along with two (8 1/2" x 11") laminated line drawings. Sentence stimuli were randomized with respect to prepositional sub-type; placement of the correct picture was also randomized with respect to left/right orientation. The subject was required to read the sentence out loud and then point to the picture that corresponded to the sentence. Once again, no time limit was imposed and only the first response was scored.

100 trials were initially constructed; however, after testing several controls, 7 problematic trials were eliminated due to ambiguities present in the pictorial representations. Foils were constructed in the following way: all NPs were kept constant from stimulus to foil, but the presence/constituency of the preposition varied. Let us consider the following paradigm:

(1) The woman is wiping Ø the cloth. (category = Ø)
(2) The woman is wiping WITH the cloth. (category = INST)
(3) The woman is wiping UNDER the cloth. (category = LOC)
It is easy to see how these sentences can be pictured and how each of them could be crossed with the other, to yield three possible crosses (1x2, 1x3, 2x3). Trials were divided over two sessions: for a given cross, the pictures remained constant but the sentence varied (directionality). For example, if in the first session the sentence given was "the woman is wiping 0 the cloth" and two pictures, of a woman wiping a table(cloth) with her hand and of a woman wiping a table with a cloth in her hand, respectively, then in the next session the same two pictures were presented with the sentence "the woman is wiping WITH the cloth". The two testing sessions were separated by two weeks in order to diminish a practice effect. As it turned out, (cf. results and discussion, below) performance on the two sessions was equivalent. Not all crosses could be tested in both directions, as the following paradigm shows:

(1) The boy is being frightened BY the snake. (only boy and snake in picture)
(2) The boy is being frightened WITH the snake. (snake as instrument necessitates the presence of an agent in picture as well)

If the sentence given is "the boy is being frightened BY the snake", then the choice of either picture could be interpreted as correct, though one would be better than the other. If the sentence given is "the boy is being frightened WITH the snake", however, then the only correct picture would be the one in which the instrument status of the final NP "snake" is clearly represented.
In order to partially compensate for the fact that the temporal (adjunct) PPs which were used on other tasks could not be exploited here (the NP internal to the PP in these phrases—e.g. "morning" or "weekend"—could not be a constant) another category with possible adjunct status was introduced. **Comitative PPs** ("the boy listens WITH his mother" vs. "the boy listens TO his mother") are always optional and may be preposed. The chart below shows which crosses were tested. A complete list of the sentences and corresponding target pictures and foils are included in Appendix E.

<table>
<thead>
<tr>
<th>Prepositional Type x Foil Type</th>
<th>NULL</th>
<th>LOC</th>
<th>D/B</th>
<th>PASS</th>
<th>COM</th>
<th>INST</th>
<th>SUBC</th>
<th>PRT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NULL</td>
<td>X</td>
<td>5</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>LOC</td>
<td>6</td>
<td>X</td>
<td>2</td>
<td>X</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>D/B</td>
<td>X</td>
<td>2</td>
<td>X</td>
<td>3</td>
<td>3</td>
<td>X</td>
<td>1</td>
<td>X</td>
<td>9</td>
</tr>
<tr>
<td>PASS</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>1</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>COM</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>5</td>
<td>X</td>
<td>10</td>
</tr>
<tr>
<td>INST</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>10</td>
</tr>
<tr>
<td>SUBC</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>X</td>
<td>4</td>
<td>X</td>
<td>17</td>
</tr>
<tr>
<td>PRT</td>
<td>4</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2</td>
<td>X</td>
<td>7</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>16</strong></td>
<td><strong>18</strong></td>
<td><strong>10</strong></td>
<td><strong>8</strong></td>
<td><strong>7</strong></td>
<td><strong>7</strong></td>
<td><strong>21</strong></td>
<td><strong>6</strong></td>
<td><strong>93</strong></td>
</tr>
</tbody>
</table>

NULL=no prep; LOC=locative; D/B=dative/benefactive; PASS=passive; COM=comitative; INST=instrument; SUBC=other preps in verb frame; PRT=particle
D) Results and Discussion

1. Background information on subject

HC, a retired insurance broker with 12 years of formal education, was an outpatient at the Constance Lethbridge Rehabilitation Center in Montreal in May 1988 when testing began. He was 71 years old at the time and was referred by his speech pathologist for the present study because he demonstrated problems with the function word vocabulary; the speech pathologist also felt he would be a good subject because of his preserved comprehension abilities and also because he was alert, active, and cooperative. He was diagnosed as having a mild/moderate non-fluent aphasia and apraxia.

The patient suffered two infarcts, in 1979 and in 1985. No data was available relative to the first infarct, other than that revealed by the CT scan performed in 1985. (A copy of the hospital report is provided in Appendix A). The scan revealed:
(1) a left frontal lesion due to an old infarct and
(2) a left parietal area lesion due to a recent infarct.

At the time HC was discharged from St. Mary's Hospital in April 1985, he was recuperating well although he presented with an expressive aphasia. There were no complications and he was placed on an anti-coagulant drug therapy program and a speech therapy program.

Performance on the Minnesota Test for Differential Diagnosis
of Aphasia in October of 1987 (see Appendix AA) revealed, inter alia, good auditory comprehension for sentences (score=15/15); good reading comprehension for sentences (score=12/12); an ability to complete sentences (score=6/8); but poor performance on sentence repetition (score=2/6). His spontaneous speech demonstrated frequent paraphasias and was limited to simple declaratives and stereotypic utterances. HC's speech therapy program at the Constance Lethbridge was terminated in the fall of 1988; his aphasia was considered to be chronic. Since that time he has been attending two weekly support groups for stroke victims.

2. Analysis of Narrative Speech

One of the most striking characteristics of HC's spontaneous speech output is a paucity of verbs and a preponderance of nouns. This is evident impressionistically from his conversational speech and is verified by the analysis of his narrative speech, where the noun/verb ratio is 3.6 (see Table 1 below). Zingeser and Berndt (1990) report that in a task of story narration, agrammatics as a group displayed a noun/verb ratio of 2.6, while anomic aphasics and normal controls displayed ratios of .9 and 1.0, respectively, on the same task¹²: it is thus obvious that HC's speech output displays a noun/verb dissociation. Before going on to present the details of HC's performance on this task, we must consider what
underlies his apparent verb retrieval problem.

Recognition of the phenomenon of "main verb omission" has important consequences for the theory of agrammatism, a disorder which is viewed essentially as a disorder affecting closed-class items. The co-existence of this symptom in cases of agrammatism was first explicitly discussed by Miceli et al. (1984) and has compromised claims that agrammatism is a unitary deficit. Since the mid-1980s much work has focussed on the nature of the difficulty agrammatical patients may manifest in verb processing relative to spared processing of nouns. Tests are being carried out on the single-word and sentence level, from a variety of naming tasks to picture description and story narration. Although some of the strongest evidence comes from detailed case studies such as McCarthy and Warrington (1985), the noun/verb dissociation may in fact be more widespread than originally thought: for example, the Zingeser and Berndt study cited above was based on a group of English-speaking aphasics; it broadens the relevant data base by replicating the Miceli et al. 1984 results obtained from Italian-speaking aphasics.

The central question concerning difficulty of verb processing is, of course, identification of the locus of the deficit. Is this category-specific deficit essentially semantic or syntactic? Several researchers (McCarthy and Warrington (1985) and Miceli et al. (1988)) suggest that the verb retrieval problem is causally related to the sentence-level structural problems typical of agrammatism. To put it simply, we can ask
ourselves how much structural information is retrieved along with the verb, or, how much of the sentence production processing is "free" once successful retrieval of the verb is established. Discussion of these issues is just beginning to be formulated but the processing consequences are far-ranging, as Zingeser and Berndt convincingly argue:

Another consideration relevant to determining whether noun/verb dissociations represent syntactic or semantic deficits is the relationship of verb retrieval to sentence production. The group effects... suggest a possible causal relationship of verb retrieval and sentence production, which, if supported, would favor a form class basis for verb retrieval problems...

These authors then go on to discuss aspects of Bock's (1987) proposals for sentence production processes which follow directly from recent linguistic theoretical models containing an enriched lexicon and which may present certain advantages over the Garrett (1982, 1984) model:

Following recent trends in linguistic theory that have tended to place more emphasis on the information carried by specific lexical items in the formulation of sentences, Bock (1987) has considered the retrieval of the verb to be one of the primary events that determines how other sentence structural elements will evolve during production... Bock assumes that information about how functional and grammatical relationships map onto one another is part of the information contained in the verb's lexical representation. Once the verb and the sentence subject are retrieved, there are automatic consequences about the structure that the sentence will take... Within this framework, there are a variety of ways that the relative inability to retrieve verbs could affect the production of sentence structures.
Now, two related observations are in order. The first regards the convergence of these empirical findings with independent developments in linguistic theory and psycholinguistic processing models. We may recall that in Chapter 1, the discussion of the argument structure of verbs led us to the discussion of recent work done on normals by Shapiro et al. (1987) on processing consequences related to the lexical representation of verbs, and to postulate that the distinction argument PP/adjunct PP may have processing consequences. It can now be seen that Shapiro et al.'s data from normals converges with the preliminary data from agrammatics displaying a verb retrieval deficit, in that both sets of results are explainable if we assume rich lexical entries for verbs.

We can now state our second observation: the view of verb retrieval and its fundamental role in sentence-building processes described above bears obvious and important consequences for the production of prepositional phrases in a sentence. Insofar as such a view is tenable, we may state the relationship to the prepositional deficit as follows: IF AN AGRAMMATIC APHASIC DEMONSTRATES A VERB RETRIEVAL DEFICIT, IT IS REASONABLE TO ASSUME THAT THE PRESENCE IN THE SENTENCE OF THOSE PREPOSITIONAL PHRASES WHICH ARE SUBCATEGORIZED BY THE VERB IS SUBJECT TO THE SUCCESSFUL RETRIEVAL OF THE VERB. In other words, in the cases of agrammatic aphasia with concomitant verb retrieval problems, the theory predicts that prepositional structures may dissociate along the dimension adjunct
PP/argument PP. To the extent that prepositional phrases occur in the production of these subjects, the tendency would be to produce the former but not the latter.

Having completed this important theoretical digression, we may now go on to present the details of HC's narrative speech, bearing the above tentative hypothesis in mind. HC's verb retrieval problem was not apparent on a pre-test of oral sentence reading but became apparent on a pre-test of sentence repetition. Table 1 (see page 176) presents the number of instances of each utterance category in HC's narrative. A narrative core of 80 words in 29 utterances was extracted from the sample, in which several non-narrative comments were interspersed with the narrative itself (see sections "Coded Transcript" and "Comments on Analysis" in Appendix B).

Roughly half of the total utterances consisted of isolated NPs (category 1 = 14/29 utterances = 48%). There were two clear cases of verb nominalizations (category 2), one produced in isolation ("that holding") and one in the context of a larger utterance ("the dancing until one, till twelve"). There were no instances of isolated Vs, PPs, APs or AdvPs (categories 3-5).

With respect to the 9 predicate argument structures (categories 6-24) produced, we can note the following. There were 4 instances of category 6 (NP1V): "she loved", "wheels working", "the boy came" and "he's". There was one occurrence of category 8 (V NP2): "find her", and one occurrence of an NP1 V AP construction (category 20): "she's poor". Of greater
interest are the remaining 3 instances of predicate argument constructions: "the prince look FOR him", "the girl couldn't think ABOUT them" and "find her ON the steps". In the first two cases we have verb + idiosyncratic preposition constructions; given the strong link between the verb and the preposition (formalized by some as a reanalysis rule) we would expect, on and view of the representation of verbs, that the retrieval of this kind of V would entail the retrieval of the preposition. If we subscribe to the view that these prepositions do not undergo reanalysis and thus remain as heads of a PP, then the PPs here bear the status of argument PPs, and these utterances are classified under category 19. If we accept reanalysis, then they are classifiable under category 13. It is interesting to note that two such utterances are present in a sample of this size, especially given the fact that other argument PPs indicating goal, instrument, benefactive, etc. do not appear at all. The third utterance "find her on the steps" contains an optional argument (locative) PP of the type which, as we recall from the discussion in Chapter 1, may have the status of adjunct. (though it is more plausible conceptually that "find" subcategorizes for a locative PP, since the action of finding implies that the object found was in location X rather than location Y, etc.)

The most telling examples are provided by the two instances of category 25, where an NP is not followed by a verb but is followed by a clearly adjunct PP (temporal phrases in both
Table 1: ELICITED NARRATIVE: Number of instances of each utterance category produced by HC

<table>
<thead>
<tr>
<th>Structural Description</th>
<th>#</th>
<th>Example(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. NP</td>
<td>14</td>
<td>one shoe: the pumpkin</td>
</tr>
<tr>
<td>2. Nominalization of V</td>
<td>1+1a</td>
<td>that holding: the dancing</td>
</tr>
<tr>
<td>3. V only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. PP only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. AP/AdvP only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. NP₁V</td>
<td>4</td>
<td>she loved; wheels working</td>
</tr>
<tr>
<td>7. V NP₁</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. V NP₂</td>
<td>1</td>
<td>find her</td>
</tr>
<tr>
<td>9. NP₂ V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. NP₁ XP (X=N,A,P,Adv)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. XP NP₁</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. V AP/PP/AdvP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. NP₁ V NP₂</td>
<td>2b</td>
<td>the prince [look for] him</td>
</tr>
<tr>
<td>14. NP₁ NP₂ V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. NP₂ NP₁ V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. NP₂ V NP₁</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. V NP₂ NP₁</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. V NP₁ NP₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. NP₁ V PP</td>
<td>2c</td>
<td>the prince look [for him]</td>
</tr>
<tr>
<td>20. NP₁ V AP/AdvP</td>
<td>1</td>
<td>she's poor</td>
</tr>
<tr>
<td>21. V NP₂ NP₃/PP</td>
<td>1</td>
<td>find her on the steps</td>
</tr>
<tr>
<td>22. NP₁ V NP₂ NP₃/PP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. NP₁ V PP PP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. NP₁ V PP NP₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. XP non-arg XP*</td>
<td>2</td>
<td>Cinderella in the morning</td>
</tr>
<tr>
<td>26. NP₁ V non-arg XP*</td>
<td>1</td>
<td>the prince come back again</td>
</tr>
<tr>
<td>27. NP₁ V XP non-arg XP*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. NP₁ V S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. automatized sequence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(unanalyzable but relevant)d</td>
<td>2</td>
<td>that's it (finality)</td>
</tr>
</tbody>
</table>

Total # of utterances analyzed: 29

---

*a one isolated instance + one instance in utterance #23, classified as category 25 (see Appendix B)
bassuming Reanalysis
cnot assuming Reanalysis
dthis category is not included in Saffran et.al. (1989) or Byng and Black (1989)

Total number of words in narrative core: 80
Total number of Ns = 33; Total number of Vs = 9; N/V ratio = 3.6
cases: "Cinderella...IN the morning" and "the dancing UNTIL one, TILL twelve"). The first utterance clearly demonstrates a case of main verb omission: the initial NP was followed by a pause, possibly signalling word finding difficulties. More importantly, the subject's manual gestures indicated sweeping or mopping of the floor; his problem here was clearly one of retrieval of the target V ("sweep" or "wash", etc). Similarly, in the second example, the NP "the dancing" was produced, perhaps in the place of a NP_{1}V structure such as "they (the prince and Cinderella) danced ...", and was followed by the temporal PP "until one" (corrected to "till twelve").

Let us now consider these data in the light of the hypothesis outlined above. Although no strong statements can be made on the basis of a sample this size, we can note the following:

(1) there are present in the corpus instances of sentential verbs produced which are followed by an argument PP
(2) there are present in the corpus utterances in which no verb is present but an adjunct PP is
(3) there are no instances of utterances in which a sentential verb is not present but an argument PP is; that is, we do not have utterances such as "prince...shoe on the steps" where the missing V would be "find" or "prince...shoe on Cinderella's foot" where the missing V might be "put".

Results on the elicited narrative task are thus consistent with the view that the production of prepositional phrases in a
sentence may be tied to the successful retrieval of the sentential verb. It is reasonable to expect that had a greater number of verbs been retrieved successfully, a greater number of prepositional phrases might have been produced.

We can now go on to consider the results on a more constrained production task, the sentence completion task.

3. Results on Sentence Completion Task

a. First Condition

The results on this task are summarized in Table 2. HC's raw score was 26/56, or 46%. Score for an age- and education-matched non-brain damaged control was 54/56, or 96%, hence HC's performance was poor on this task.

The best performance was obtained for the sub-categories of Locative, Instrumental, and Adjunct, as can be seen in Table 2. One characteristic common to all of these sub-categories is their status as optional PPs, except for 2 locative stimuli out of 8, where the Vs "put" and "place" are followed by an obligatory locative; however, HC responded correctly in these two instances. (The one locative where HC did not produce the correct preposition--"a salesgirl is writing the price NEAR/BESIDE/OVER the size"--also presented a problem for the normal control; HC inserted the content word "bill" -- "a salesgirl is writing the price BILL the size" and the control inserted a conjunction: "a salesgirl is writing the price AND
Table 2: SENTENCE COMPLETION I: Responses produced by HC for each prepositional sub-type

<table>
<thead>
<tr>
<th>TARGET x RESPONSE TYPE</th>
<th>Correct</th>
<th>CW subs</th>
<th>P subs</th>
<th>FW subs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjunct</td>
<td>5/8</td>
<td>2/8</td>
<td>0/8</td>
<td>1/8</td>
</tr>
<tr>
<td>Loc/Dir</td>
<td>7/8</td>
<td>1/8</td>
<td>0/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Dat/Ben</td>
<td>3/8*</td>
<td>1/8</td>
<td>2/8</td>
<td>2/8</td>
</tr>
<tr>
<td>Instr</td>
<td>7/8</td>
<td>1/8</td>
<td>0/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Pass</td>
<td>1/8*</td>
<td>1/8</td>
<td>6/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Subcat</td>
<td>0/8</td>
<td>0/8</td>
<td>7/8</td>
<td>1/8</td>
</tr>
<tr>
<td>Prt</td>
<td>3/8*</td>
<td>0/8</td>
<td>3/8</td>
<td>2/8</td>
</tr>
<tr>
<td>Totals</td>
<td>26/56</td>
<td>6/56</td>
<td>18/56</td>
<td>6/56</td>
</tr>
</tbody>
</table>

In every case, a determiner (the or some) * includes the substitution of a preposition which was not in target category but which did not violate pictorial constraints or syntactic constraints: a mother is buying groceries OF the family (target (t)=FOR)/the child is called TO the teacher (t=BY)/the family is cleaning IN the attic (t=OUT)
We may recall from the description of this task given in Part II that the subject was required to first identify the position of the missing element, though he was told that in each case an element was missing. Whenever HC produced a preposition (even if it was the wrong one) he placed it in the correct position in the sentence. 4/6 content word intrusions were placed in the position of the missing preposition; the remaining 2 content word intrusions and all 6 function word intrusions (all determiners) were placed immediately before the N in the second NP. The resulting sentences were ill-formed in that they contained either 3 consecutive NPs or two consecutive determiners. Despite these last instances of ill-formed sentences, overall performance demonstrates an ability to correctly identify the position of the missing element, and suggests that a correct syntactic parse may be operating. This confirms results obtained by Branchereau (1984).

Of the 30 errors, 20% were content word intrusions, 20% were function word intrusions, and the remaining 60% represented preposition substitutions. All the content word intrusions were semantically related: for example, "a purse LADY is being stolen the thief" (the placement of this intrusion is interesting: an animate NP was placed in sentence initial position) or "a chef is cooking the meal DINNER the guests".

Let us take a closer look at the 18 preposition substitution errors, which were three times more frequent than either of the
other error types. Six of these errors occurred in the category PASS; the target preposition "by" was replaced by the preposition "with": for example, "the stove is being fixed WITH the repairman". Notice that the resultant sentences are ill-formed because they violate selectional restrictions only: the preposition "with" could occur in sentences with the same categorial structure if we change the last NP (in the example cited above, "the stove is being fixed WITH the wrench/hammer/tools/great force..."). The same is true for the sentence "the burglars are robbing the house OF jewels": the idiosyncratic preposition "of" (category SUBCAT) was also replaced by "with" and this violates selectional restrictions only. Does this error pattern reflect an [unprincipled and random] bias towards use of the preposition "with" or might it reflect a sensitivity to the syntactic frame of the verb? (they are reminiscent of the types of errors purported to reflect "syntactic sensitivity" produced by agrammatics and reported in Nespoulous and Branchereau (1988)). We will not attempt to provide a definitive answer to this question just yet, but will return to the issue during the discussion of results on the second version of the sentence completion task. For the time being, we will note the following facts: (a) given a passive sentence, HC produced "with" 5 times out of 8; (b) given an instrumental sentence, HC produced "with" 7 times out of 8; (c) these instances exhaust all occurrences of "with" except for one, in the sentence "the burglars are robbing the house WITH
the jewels" (category SUBCAT) where once again only selectional restrictions are violated. These facts argue against the "random bias" hypothesis: the preposition "with" is never inserted in other sentence types.

Another possible factor affecting the production of prepositions on this task should be mentioned. Several of the intra-category substitution errors can be argued to reflect a "pictorial" response bias. For example in, "the child is freeing the rabbit OUT the trap" (target=FROM, category SUBCAT) or "the waiter is throwing IN the garbage" (target=AWAY, category PRT) perhaps the subject is cueing in to the pictorial representations of a child taking a rabbit OUT of a trap and to a waiter who is throwing a bag of garbage IN(TO) a garbage can, respectively. Some of the errors could be argued to reflect either of these two kinds of effect, syntactic or pictorial. For example, in "the cookbook is being written ON the great chef", the preposition "on" could occur in this position if it is followed by an NP such as "the paper" "the table" or "the counter". In fact, in the corresponding picture, the chef is depicted as writing on a counter. Of course, the notion of a "picture effect" is a purely intuitive one; it would be extremely difficult to prove that such an effect is actually operating. Since it entails much inferencing on the part of the examiner, it has little explanatory value. However, it is also true that for any given picture, the number of spatial relations encodable by prepositional structures is not an unlimited set;
if pictures are eliminated entirely from this kind of task, it is conceivable that error patterns might be different.

A close look at the distribution of the 18 erroneous prepositions produced clearly shows a preference for the prepositions "with" (n=6), "in" (n=5), "on" (n=3), and "to" (n=3). A parsimonious explanation of the preference for these forms that involves no inferencing as to syntactic sensitivity or possible pictorial effects would make appeal to the fact that these prepositions are monosyllabic and high frequency (7289/21341/6742/26149, respectively, according to Kucera and Francis 1967), two features frequently invoked to explain differential retrieval patterns for lexical items. However, the spontaneous production of these prepositions speaks against Kean's claim (cf. supra, Chapter 3) that it is the polysyllabic prepositions which are retained in agrammatism.

b. Second Condition

Results on this task are summarized in Table 3. HC's raw score was 37/56, or 66%. Score for an age- and education-matched neurologically intact control was 56/56. Not surprisingly, HC's performance improved considerably on this version of the sentence completion task.

When compared to the first condition, performance on sub-types Adjunct and Instrumental was consistently good; performance on the Subcat category was consistently the worst,
Table 3: SENTENCE COMPLETION II: Responses produced by HC for each prepositional sub-type

<table>
<thead>
<tr>
<th>TARGET x RESPONSE TYPE</th>
<th>Correct</th>
<th>CW subs</th>
<th>p subs(^1)</th>
<th>p subs(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjunct</td>
<td>6/8</td>
<td>2/8</td>
<td>0/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Loc/Dir</td>
<td>5/8</td>
<td>2/8</td>
<td>1/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Dat/Ben</td>
<td>6/8</td>
<td>2/8</td>
<td>0/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Instr</td>
<td>6/8</td>
<td>2/8</td>
<td>0/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Pass</td>
<td>5/8</td>
<td>1/8</td>
<td>2/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Subcat</td>
<td>4/8</td>
<td>2/8</td>
<td>2/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Prt</td>
<td>5/8</td>
<td>3/8</td>
<td>0/8</td>
<td>0/8</td>
</tr>
<tr>
<td>Totals</td>
<td>37/56</td>
<td>14/56</td>
<td>5/56</td>
<td>0/56</td>
</tr>
</tbody>
</table>

\(^1\) Substitution of a preposition which could occur with V, but violates either pictorial constraints or selectional restrictions (see text)  
\(^2\) Substitution of a preposition/particle that could not co-occur with V (never chosen)
and performance on all other categories except Locative improved. Overall better performance is consistent with the view that active retrieval of an item is more difficult than recognition of that item. What is hard to explain is the fact that performance for the category Locative worsened; for the time being, we will not speculate on this point.

What is striking is the overall error pattern here: content word substitutions (n=14: 4 x V, 7 x N, 3 x Adj) are twice as frequent than in the first condition. As can be seen, half of these cross-category substitutions are nouns. These substitutions result in ill-formed sentences, and as such constitute counterexamples to the "syntactic sensitivity" claim. On the other hand, within-category substitutions (n=5) exhibit a pattern which could speak for this same claim: all 5 instances of within-category substitutions resulted in sentences which violated either pictorial constraints or selectional restrictions only. Errors of the first kind are the following: "the waitress is placing dishes BESIDE the tables" (target=ON, category LOC) and "the rope is being pulled AT the sailors" (target=BY, category PASS). Errors of the second kind are the following: "the stove is being fixed WITH a repairman" (target=BY, category PASS), "a child is freeing the rabbit WITH the trap" (target=FROM, category SUBCAT), and "the couple is sharing the food BY the boys" (target=WITH, category SUBCAT).

It was never the case that a preposition/particle that could not co-occur with the sentential V was chosen. These facts give
added weight to the suggestion made in the discussion of First Condition error patterns that some syntactic sensitivity is operative here.

The obvious question is, then, why would this subject ever choose content words to fill in the blank? The tendency to choose nouns as content word distractors is fairly clear in this patient might these lexical items be more "visible" in some sense than other categorial choices? Given the fact that they were chosen (Second Condition) almost twice as often as they were spontaneously produced (First Condition), perhaps their actual printed presence is, in some sense, a distracting one.

Let us now return to this subject's presumed preference for the preposition "with": what are the cross-task facts? In the Second Condition, "with" is offered as one of the five choices in 20 instances; ten times as the target (8 x Instr + 2 x Subcat), and ten times as a foil (2 x Loc + 4 x Dat/Ben + 3 x Subcat + 1 x Pass). When it was the target, it was chosen correctly 7 times out of 10. More importantly, it was chosen incorrectly (i.e. when a foil) only 2 times out of 10 (once for the category Pass and once for the category Subcat), and in both cases the resulting sentences violate selectional restrictions only.

So far, these facts argue against the random bias hypothesis, and confirm results gained in the first condition of the Sentence Completion Task.

Discussion of how these performance patterns can be explained
by the various "dissociable dimensions" set forth in section A) above will be postponed until all the results on the single tasks have been presented. However, an important observation is in order. Aside from consistent data showing preservation of temporal adjuncts and instrumentals, performance on this task does not provide consistent evidence that either the proportion of correct responses or error type varies as a function of prepositional sub-type. There may be many underlying causes for this; these will be discussed shortly.
4. Results on Grammaticality Judgment Task

The results on this task are summarized in Table 4, and the Contingency Table and Index of Sensitivity are provided in Table 5. Since HC accepted all (50/50) grammatical sentences as grammatical, but demonstrated a tendency to accept ungrammatical sentences as grammatical, his performance is similar to that of the agrammatics reported in Linebarger et.al. 1983. With respect to overall performance, HC's A' score was .896 (see Table 5); it thus approaches the level (.9) considered to be indicative of sensitivity to structural information, according to Linebarger et.al. The control performed as follows on this task: all 50 grammatical sentences were judged grammatical, and 54/56 ungrammatical sentences were judged as ungrammatical.

The best performance was obtained on Adjuncts; next in line are Locatives (not surprisingly) and Dative/Benefactive (surprisingly). Performance was poor in the Passive and Particle categories and worst for the category Subcat.

When compared to results on the previous tasks, the most striking difference is in performance level for the category Instrumental: only 1 bad sentence out of 8 (i.e. where the preposition "with" was either missing or replaced by another preposition or content word) was correctly rejected. Furthermore, in the cases where "with" appeared as the wrong preposition, the resulting sentence was never rejected. It thus
Table 4: GRAMMATICALITY JUDGMENT: Responses produced by HC to ungrammatical sentences for each prepositional subtype

<table>
<thead>
<tr>
<th>TARGET PREPOSITION TYPE</th>
<th>X</th>
<th>ERROR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>AC</td>
<td>CR</td>
</tr>
<tr>
<td>Adjunct</td>
<td>3/3</td>
<td>0/3</td>
</tr>
<tr>
<td>Loc/Dir</td>
<td>2/3</td>
<td>1/3</td>
</tr>
<tr>
<td>Dat/Ben</td>
<td>1/3</td>
<td>2/3</td>
</tr>
<tr>
<td>Instr</td>
<td>1/3</td>
<td>2/3</td>
</tr>
<tr>
<td>Pass</td>
<td>1/3</td>
<td>2/3</td>
</tr>
<tr>
<td>Subcat</td>
<td>1/3</td>
<td>2/3</td>
</tr>
<tr>
<td>Prt</td>
<td>1/3</td>
<td>2/3</td>
</tr>
<tr>
<td>Totals</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

CW Sub= content word substitutions; P Sub= preposition substitutions; Omis= omissions of preposition; CR= correct rejections (bad judged as bad); AC= erroneous acceptances (bad judged as good)

*bias: never rejected any sentence containing with, regardless of grammaticality condition (G or B sentence). Accepted all B sentences containing with (see text)
Table 5: GRAMMATICALITY JUDGMENT: Contingency Table and Index of Sensitivity for HC

I. Contingency Table

\[ N = 106 \ (50G + 56B) \]

\[ \text{SG} = \text{good sentences} \quad \text{SB} = \text{bad sentences} \]

\[ \text{RG} = \text{response: "good"} \quad \text{RP} = \text{response: "bad"} \]

<table>
<thead>
<tr>
<th></th>
<th>SG</th>
<th>SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>RB</td>
<td>0</td>
<td>21</td>
</tr>
</tbody>
</table>

\[ x = \text{proportion "false alarms"} \]

\[ x = \frac{35}{56} = 0.625 \]

\[ y = \text{proportion of "hits"} \]

\[ y = \frac{50}{50} = 1 \]

II. Index of Sensitivity:

\[ A' = 0.5 + [((y - x)(1 + y - x))/4y(1 - x)] \]

where 0.5 represents Yates correction for continuity

\[ A' = 0.5 + [((0.375)(1.375))/4(0.325)] \]

\[ A' = 0.5 + 0.396 \]

\[ A' = 0.896 \]

n.b. where \[ A' > 9 \] is considered a very good score; hence HC performance on this task approaches that level. This result is in line with expectations, and confirms Linebarger et al.'s (1983) claim that agrammatics display a considerable sensitivity to structural information.
seems as if HC has a **random bias** for sentences containing the preposition "with": no sentence containing "with", regardless of grammaticality condition (good or bad) was rejected. (There were 6 bad sentences containing "with" which were distributed as follows with respect to target preposition type: 1 in Adjunct, 1 in Locative, 2 in Passive, 1 in Subcat and 1 in Prt.) This is in direct contrast to the results obtained in the constrained production task, and the pattern is difficult to explain. This kind of cross-task variability clearly raises a problem. Although we may make appeal to the concept of differing, task-specific demands, it is not clear exactly how these can account for the present data in a straightforward way. Given strong evidence from the production task against the random bias hypothesis, we do not want to reject it.

Another apparent difference in performance on these tasks concerns the status of sentences in which the preposition was missing. As Table 4 shows, for this category of bad sentences, all instances were erroneously accepted except for those occurring in the category Adjunct, where they were correctly rejected both times. This confirms the claim that this category is better preserved than the other prepositional sub-types, and furthermore, that this is true across tasks. What can be said, then, about HC's apparent insensitivity to the fact that an element is missing on sentences presented in this task? We can recall that in the first version of the Sentence Completion Task he correctly identified the position of the missing element. In
this case, the cross-task performance difference is easily explainable on the basis of task demands: in the completion task the subject knew an element was missing; in the judgment task he was to determine whether an element was missing or not, undoubtedly a more difficult task.

5. Results on the Sentence-Picture Matching Task

Results on this task are summarized in Table 6. Normal performance on this task (age and education matched control) was 87/93 or 93.5%. HC's overall raw score was 61/93 or 66%. This score indicates that the deficit which implicates processing of prepositional structures in this subject extends as well to comprehension.

Performance was best on the categories PRT and NUL; scores were 88% and 87%, respectively. Neither of these results are surprising; the fact that the subjects performance on particle constructions is better on this task than on the others is a result of the type of constraints operating in this particular task (see discussion in Part II, section 4). Particle constructions could only be contrasted with each other ("the maids are putting AWAY the clothes" vs. "the maids are putting ON the clothes") or against NUL ("the man is taking 0 the radio" vs. "the man is taking APART the radio") or in one case only, with a locative ("the boy is turning OFF the television" vs. "the boy is turning BESIDE the television").
Table 6: SENTENCE-PICTURE MATCHING TASK: Target Prepositional type x foil type

<table>
<thead>
<tr>
<th></th>
<th>NULL</th>
<th>LOC</th>
<th>D/B</th>
<th>PASS</th>
<th>COM</th>
<th>INST</th>
<th>SUBC</th>
<th>PRT</th>
<th>TOTAL (#corr; %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NULL</td>
<td>--</td>
<td>4/5</td>
<td>1/1</td>
<td>--</td>
<td>--</td>
<td>2/3</td>
<td>3/3</td>
<td>3/3</td>
<td>13/15; .87</td>
</tr>
<tr>
<td>LOC</td>
<td>5/6</td>
<td>--</td>
<td>1/2</td>
<td>--</td>
<td>1/1</td>
<td>2/4</td>
<td>6/7</td>
<td>1/1</td>
<td>15/21; .76</td>
</tr>
<tr>
<td>D/B</td>
<td>--</td>
<td>2/2</td>
<td>--</td>
<td>1/3</td>
<td>1/3</td>
<td>--</td>
<td>1/1</td>
<td>--</td>
<td>5/9; .56</td>
</tr>
<tr>
<td>PASS</td>
<td>--</td>
<td>--</td>
<td>2/3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1/1</td>
<td>--</td>
<td>3/4; .75</td>
</tr>
<tr>
<td>COM</td>
<td>0/1</td>
<td>0/1</td>
<td>2/2</td>
<td>0/1</td>
<td>--</td>
<td>--</td>
<td>5/5</td>
<td>--</td>
<td>7/10; .70</td>
</tr>
<tr>
<td>INST</td>
<td>1/3</td>
<td>1/3</td>
<td>0/1</td>
<td>1/3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>3/10; .30</td>
</tr>
<tr>
<td>SUBC</td>
<td>0/2</td>
<td>4/6</td>
<td>0/1</td>
<td>0/1</td>
<td>2/3</td>
<td>--</td>
<td>2/4</td>
<td>--</td>
<td>8/17; .47</td>
</tr>
<tr>
<td>PRT</td>
<td>3/4</td>
<td>1/1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>2/2; 6/7; .88</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>16</td>
<td>18</td>
<td>10</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>21</td>
<td>6</td>
<td>61/93; .66%</td>
</tr>
</tbody>
</table>

(NULL= no prep; LOC= locative; D/B= dative/benefactive; PASS= passive; COM= comitative; INST= instrumental; SUBC= other subcategorized prepositions; PRT= particle)
Good performance for the category NUL ("the maid is washing O
the mop" vs. "the maid is washing WITH the mop") is not a
surprising result either, given the structural simplicity of
these constructions.

Good performance (76%) was also obtained for the subcategory
LOC. An inspection of the stimuli used in this task (see
Appendix E) shows that none of the locative PPs present are of
the obligatory subcategorized type (cf. "the puppy is eating
BESIDE the sofa"); that is, their link to the verb is not as
strong as in sentences containing Vs such as "put" or "place".
Similarly, performance on the category COM, in which the
relevant PPs can be argued to bear the status of adjuncts (they
are never required by any verb) is good (70%), as expected.

Performance on the Passive category (75%) is better on this
task than on the others. This may be due to a number of factors
(type of foil used, high "picturability" of this type of
construction...) though the small number of stimuli used where
the corresponding passive sentence was a target does not allow
for any strong conclusions to be drawn.

Scores for Dative/Benefactive constructions (56%) are
relatively poor, as in the first version of Sentence Completion
and in the Grammaticality Judgment Task. Performance on the
category Subcat was also poor (47%), which we might predict
given performance levels for this sub-type on other tasks.

Once again, performance level for the category Instrument was
low (30%). HC's comprehension results for this category thus
mirror those obtained in the metalinguistic judgment task, and stand in contrast to results obtained on the constrained production tasks. We may now proceed to a general cross-task discussion of the results obtained, in order to see if performance patterns fall out along any of the lines set forth in Chapter 3.

It is clear from the information provided in the tables that for all the categories except Adjunct, there is no strong evidence that either performance level or type of error varies reliably as a function of prepositional sub-type. The first observation to be made concerning these patterns of performance as they relate to the different prepositional sub-types regards the considerable cross-task variability displayed. A single prepositional sub-type (the most striking example being instrumental "with") yielded different levels of performance on different tasks. If linguistic theory and psycholinguistic models allow us to differentiate classes of prepositions, and we make predictive hypotheses based on the properties of these classes as described by the theory, what do we do in the face of evidence that relative performance levels for the sub-types yield different hierarchies of difficulty on different tasks? Unfortunately, as Nespoulous et.al. (1988) state, there is no easy answer to this question, although for these authors it is clear that we must weigh the effects of non-structural factors (such as attention) more heavily when accounting for performance patterns. As we mentioned above (Section B) this thorny problem
has led some researchers in the field (for example Caramazza 1984) to favor task-specific performance models over linguistic models.

One constant in HC's performance patterns is the preservation of adjuncts (temporal adjuncts on all production tasks, constrained and unconstrained, and on grammaticality judgement, and those locative and comitative constructions which are never strictly required by a verb on the comprehension task). Another constant is poor performance for the category Subcat across all tasks. Taken together, these observations suggest that the argument/adjunct distinction may be operative on a processing level. According to this hypothesis, we would not expect good performance on instrumentals (which are arguments) but would expect good performance on verb + particle constructions, insofar as the particles are analyzed as part of the verb (they are inserted under the node V or V'). Although neither of these predictions bears out on the sentence completion task, both are borne out on the sentence-picture matching task. This hypothesis also handles the data regarding dative/benefactive constructions; we recall that on the first version of the sentence completion task (where the greatest inter-category variation was displayed) and on the comprehension task, performance was poor. Insofar as these PPs are closely tied to the verb conceptually (especially in dative constructions) we would expect that they would be impaired, given that those PPs which are not conceptually linked to the verb (adjuncts) are
being retained.

What about the interpretation of these results in terms of the other predictive hypotheses based on properties of government, and of theta-marking? Let us first consider Grodzinsky's claim that ungoverned prepositions are retained. We may recall that this category includes adjunct PPs and passive "by" as well as verb + particle constructions. The only task in which these categories group together is the sentence-picture matching task (where no temporal PP adjuncts could be tested, but where the locatives and comitatives might be analyzed as adjuncts).

The theta-assignment hypothesis fares poorly in the face of data from the sentence completion task if we assume an analysis of instrumental constructions such as Baker (forthcoming): if instrumental "with" does not help to determine the semantic role of the NP it governs, we would not expect good performance in this category. Yet good performance was obtained on both versions of the sentence completion task. Let us assume for the sake of argument that this was the only aspect of the data that did not conform to the particular theta-marking hypothesis assumed. We would now be faced with two choices: assume the basic logic behind a theta-marking hypothesis is sound and hence reject the particular view of instrumental "with" as non-theta-marking, or assume that the analysis of instrumental "with" as non-theta-marking is correct and hence reject the theta-marking hypothesis. In the latter case we would have to look to an alternative hypothesis in order to account for the data.
Obviously, at the level of a single case, there is no reason to favor one approach over the other. It is only in consideration of a large body of data relating to performance on instrumental constructions that such a decision can be made in a non-arbitrary manner. Ideally, once it has been shown that the theta-marking hypothesis is viable, i.e. that it makes the correct predictions regarding other types of PPs, in the case where several contradictory theoretical analyses exist (for instrumental PPs, for instance), data from language breakdown may be invoked in discussions of the relative merits (explanatory power) of the different analyses. Getting back to the actual data on hand, the theta-marking hypothesis makes the wrong prediction in the case of dative/benefactives: performance should be good in this category but (as we mentioned above) it is not.

In summary, even considering the limited data examined here, it seems that the hypothesis best able to account for performance patterns is the adjunct/argument hypothesis. Given that this subject has a problem of verb retrieval, this is not very surprising. In fact, if it is true that successful retrieval of the sentential verb means accessing as well structural information relevant to sentence-level processing, it is exactly what is expected. This interpretation of HC's performance thus suggests that his difficulty with prepositional structures may be related to his verbal retrieval deficit.
ENDNOTES

5. See Menn and Obler (1988) and Saffran et.al. (1989)
6. Saffran et.al. (1989) p.446

9. Unlike the studies cited, sentences in which no element was missing were not included in our version in order not to confound a production task with a metalinguistic judgment task.
10. See Zurif and Grodzinsky (1983) for relevant methodological discussion on this point.
12. Zingeser and Berndt (1990) p.25
15. Zingeser and Berndt (1990) p.27
17. Zingeser and Berndt (1990) pp.27-28; emphasis mine
18. See Saffran et.al. (1988) for discussion
CONCLUSION

The work presented in Chapters 1-4 represents an initial attempt to answer the question, how might prepositional structures be compromised in language breakdown? Relevant observations in the fields of theoretical linguistics, psycholinguistics, and linguistic aphasiology were evaluated and correlated. In Chapter 3 a comprehensive critical review of the relevant aphasiological literature was provided. Such a review is not available elsewhere, and was the necessary first step in approaching the problem. Different studies were compared, and it was determined that conflicting claims exist concerning the prepositional deficit.

A careful lectura of the studies was made possible by the presentation of the linguistic and psycholinguistic frameworks in Chapters 1 and 2. In these chapters an attempt was made to formalize the intuitive notions of "primarily semantic" and "primarily syntactic" prepositions. In Chapter 1, some of the essential properties of prepositional phrases were outlined. At certain points in the discussion some explanatory inconsistencies were pointed out which demonstrate that much work still needs to be done on the thematic structure of prepositions. We may also recall that grammatical judgments regarding crucial constructions (such as the pseudopassive) are cloudy and display much inter-speaker variation. Consideration of these facts bears on the issue of the
theoretical utility of dichotomies (such as theta-assigner vs. non-theta-assigner). We can ask ourselves if a treatment of prepositional structures which relies on these dichotomies is capable of capturing the subleties of their semantic/syntactic properties. This brings to mind once again a notion which has surfaced at various points in our discussion: Chomsky's 1965 notion of "DEGREES of cohesion" holding between a verb and a preposition in a sentence. While such a notion of degrees on a scale is undoubtedly less tractable than a dichotomy (i.e. it is more difficult to formalize), an approach which seriously treats information regarding the conceptual structure of the sentential verb may well yield a more satisfactory account of prepositional structures than one which does not. We will return to this issue presently.

In Chapter 2 a psycholinguistic sentence production model was examined in order to determine to what extent it was compatible with the distinctions made available by linguistic theory. Although Garrett's model is compatible with analyses of prepositional structures which classify the same according to thematic lines, it was determined that the model is underspecified, i.e. unable to capture differences among prepositional structures other than at the most general level. Furthermore, it is not clear exactly at what level or in what manner adjunct PPs would arise in sentence formation processes.

In Chapter 4 it was suggested that more recent sentence
processing models--such as that sketched in Bock and Kroch 1989--may prove to be more adequate in this respect. From the discussion contained in Chapters 1-3, a set of possible predictive hypotheses was extracted which propose different dimensions along which prepositional structures are dissociable in language breakdown.

Chapter 4 contained the report of a case study. Results displayed considerable cross-task variability: although they were not conclusive, certain aspects of the data allow us nevertheless to make suggestions regarding the nature of the subject's deficit. It was noted that adjunct PPs were spared, relative to other types of PP, and it was argued that HC's difficulty with prepositional structures is related to his difficulty in accessing verbs.

Let us consider this issue a bit more carefully. Given the co-occurrence of main verb omission phenomena and agrammatism, what might be the implications for processing of prepositional structures? Recent accounts of verb retrieval deficits view them in syntactic terms, as discussed in Chapter 4 above. In order to test the validity of rich lexical representations for verbs, the phenomenon of main verb omission provides an excellent testing ground. Suppose we look at cases of agrammatism which do not display main verb omission on the one hand and cases which do on the other. Analyses of these contrasting cases would allow us to factor out lexical/syntactic effects of verbs and their arguments. The
behavior of prepositional structures, which are conceptually related to the sentential verb in varying degrees, would prove crucial. Is it the case that (i) main verb omission always results in a prepositional deficit where only adjunct PPs are retained and (ii) agrammatism without main verb omission results in a less severe prepositional deficit? These are empirical questions which future research can address. In fact, this might prove to be the most fruitful approach to the investigation of the "prepositional deficit" in aphasia. It is consonant with much recent work done on the argument structure of verbs (cf. recent work by Jackendoff (1990), Shapiro et.al.(1987)). Perhaps one of the reasons why data did not pattern neatly is precisely because stimuli were not organized along tightly controlled classes of verbs, classes which are defined in terms of possible complement structures and semantic similarity. It is reasonable to expect that the prepositional data will fall out in cleaner lines. Furthermore, we will be better equipped to address the problem of how verb retrieval problems, now understood to be quite pervasive, affect the processing of prepositional structures. Insofar as the data concerning how prepositional structures dissociate in aphasia can be invoked in discussions of the mental representation of verbal structure, we have a perfect example of the bidirectional model of relations between linguistic theory and aphasiological language data. Such data would speak directly to theoretical issues concerning the
correct characterization of lexical entries present in the lexicon, and how much syntactic information is stored and retrieved along with a lexical item.


Nespoulous, J.L., P. Villiard and A.R. Lecours. (1989) "What is to be done with linguistic variability—cross-linguistic or otherwise—when dealing with (aphasic) pathological data?" Aphasiology 3: 151-154.


APPENDIX A

Background information on HC
--APPENDIX B--

Narrative Speech Sample:  HC
Story:  "Cinderella"

ANALYSIS: CODED TRANSCRIPT

1.//I can...I can see in my mind, but.../
2./Cinderella...(1)/
3./not yet/

4./lovely girl(1)/
5./Cinderella..IN THE MORNING(25)/
6./stepmother and daughters/(1)
7./she loved(6)/
8./she...she's...poor(20)/
9./and the boy came(6)/
10./the uh..prince COME BACK again(26)/
11./I can see it/I can see everything/but I can't../
12./and the shoes(1)/
13./and the [strupj](1)/
14./one shoe(1)/
15./all the time/see?/I could see ev...all the time/
/but I can't say it/I will/I will/

{What happened then, with the shoes?}
16./they...(1)/
17./the rumpkin..[pAnkən]...(1)
18./you 'member?/
19./and the mice, two, four, six(1)/
20./and the [boltn](1)/
21./and wheels working(6)/
22./and the dancing UNTIL ONE, TILL TWELVE(n.b. (2) in (25))
23./and that's it(29)/
24./find her ON THE STEPS(21)/
25./and the French(1)/
26./the stepdaughters(1)/
27./the girl couldn't THINK ABOUT THEM(13 or 19)/
28./and he's...(6)/
29./the prince LOOK FOR HIM(13 or 19)/
30./find her(8)/
31./and that holding(2)/
32./both and Cinderella...(1)/
(You wrote "marriage")
33./yes..marriage(1)/
34./that's it(29)/

/ / denotes utterance boundaries.
( ) denotes experimenter's contribution.
Underlined text denotes the portion of the narrative included in tabulations.
Text not underlined denotes "asides", comments made to experimenter which were not part of narrative per se.
Numbers in parentheses ( ) denote category of utterance.
Parts of text in CAPITALS denote phrases of particular interest.

COMMENTS ON ANALYSIS

1. comments made by subject regarding nature of his own disorder
2. NP produced and followed by pause
3. an aside, accompanied by gestures indicating words were not forthcoming
4. NP not part of any larger utterance
5. main V omission; subject gesticulated motion of sweeping floor; temporal (adjunct) PP
6. NP not part of any larger utterance; "NP and NP" construction
7. n.b."love" is normally a two-place predicate; NP in VP missing
8. copula present in contracted form
9. first clear subject NP + V construction
10. Verb + particle construction; uninflected V; "boy">"prince"
11. same as utterance 1 above
12. NP not part of larger utterance
13. target N probably "slipper"
14. quantified N
15. commentary; see utterances 1 and 11 above
16. NP realized as a pronoun, followed by pause
17. NP repeated and followed by pause
18. commentary made to experimenter; see 1, 11, 15 above
19. isolated and quantified NP with N occuring before numerals
20. isolated NP with uninterpretable N
21. determiner missing from NP; possible semantic paraphasia: subject's gestures indicated turning
22. nominalization of V (presence of determiner rules out
V analysis; temporal (adjunct) PP
23. unanalyzable sequence denoting finality, with accompanying gesture
24. subject NP missing; instance of 21 if locative PP "on the steps" is an argument PP; possible instance of 26, (minus NP1) if an adjunct
25. ambiguous NP: [det + N] or [det + adj] (N missing)
26. isolated NP with determiner
27. instance of 13 if verb + idiosyncratic preposition (=think about) undergo reanalysis; instance of 19 if reanalysis is not assumed
28. copula present in contracted form
29. instance of 13 if verb + idiosyncratic preposition (=look for) undergo reanalysis; instance of 19 if reanalysis is not assumed; incorrect pronominal reference: "her" > "him"
30. subject NP missing
31. nominalization of V (demonstrative "that" appears to rule out verbal analysis; accompanied by hugging gesture
32. "NP and NP" construction (see utterance 6 above)
33. isolated NP without determiner
34. see utterance 23 above
---APPENDIX C---

Sentences and pictures for Sentence Completion Task: choices were given in Second Condition only (see text)

1. The purse is being stolen ___ the thief. money--BY--to--for--grab

2. The workers are pushing the carts ___ the store. over--entrance--with--INTO--heavy

3. The man is reading a speech ___ the crowd. off--loud--stage--TO--with

4. The students are smoking cigarettes ___ classes. bad--in--off--AFTER--field

5. The tailor is cutting the cloth ___ the scissors. into--sew--out--WITH--pattern

6. A vase is being broken ___ the children. for--out--delicate--BY--trouble

7. The customers are buying gifts ___ closing time. crowded--with--sale--of--BEFORE

8. A mother is buying food ___ the family. away--choose--market--FOR--with

9. The woman is supplying the nurses ___ caps. WITH--crisp--of--for--uniform

10. The child is freeing the rabbit ___ the trap. woods--pull--FROM--with--up

11. A chef is cooking the meal ___ the guests. off--FOR--dinner--by--tasty

12. The family is eating breakfast ___ seven. table--AT--to--hungry--for

13. A nurse is writing ___ the information. hospital--of--worried--about--DOWN

14. The judge is pounding the bench ___ the gavel. court--WITH--angry--towards--to

15. The boy is leaving high school ___ the army. with--student--down--young--FOR

16. The child is being called ___ the teacher. yard--away--to--small--BY
17. The burglars are robbing the house ___ valuables.
   for--quiet--OF--room--to

18. The leader is telling stories ___ the campers.
   fire--out--quiet--TO--across

19. The cowboys are riding horses ___ the mountain.
   for--TOWARDS--saddle--up--fast

20. A cookbook is being written ___ the great chef.
   to--taste--out--recipe--BY

21. The people are signing the paper ___ a pen.
   write--WITH--for--busy--off

22. The rope is being pulled ___ the sailors.
   ship--long--BY--out--at

23. The ushers are walking people ___ the theater.
   INTO--late--with--from--seat

24. The children are putting the toys ___ the chest.
   under--playroom--mess--IN--of

25. A carpenter is fixing the chair ___ the glue.
   tool--off--WITH--for--hard

26. The father is driving the kids ___ the morning.
   driveway--busy--before--IN--of

27. The couple is sharing food ___ the boys.
   WITH--by--nice--out--park

28. The man is hiding money ___ the mattress.
   heavy--on--to--UNDER--bed

29. The coach is throwing the ball ___ the gym.
   sport--away--quick--by--ACROSS

30. A woman is looking ___ the phone number.
   to--read--of--UP--booth

31. A guard is chasing the burglar ___ midnight.
   AT--off--shoot--for--crime

32. The butcher is slicing the steak ___ a knife.
   to--sharp--for--meat--WITH

33. The driver is turning ___ the radio.
   away--OFF--car--drive--for

34. The family is cleaning ___ the attic.
   near--OUT--room--to--dark
35. A doctor is ordering pills __ the drugstore. 
FROM--medicine--at--phone--to

36. The kids are writing a letter ____ Santa Claus. 
cold--by--in--mail--TO

37. The waiter is throwing ____ the garbage. 
off--AWAY--dirty--for--alley

38. The men are playing poker ____ Saturday night. 
cards--of--after--cheat--ON

39. A cashier is handing ____ the money. 
customer--count--OVER--by--down

40. A worker is borrowing money ____ the boss. 
office--up--with--ask--FROM

41. The girl is picking ____ a pair of shoes. 
new--by--OUT--store--up

42. The patients are breaking the rules ____ weekends. 
across--hospital--disobey--ON--in

43. A waitress is placing the dish ____ the table. 
beside--wipe--ON--restaurant--to

44. The hydrant is being hit ____ a car. 
street--over--BY--of--noisy

45. The nanny is washing the baby ____ a cloth. 
out--WITH--tub--for--gentle

46. The sailor is leaving home ____ a long time. 
house--of--FOR--carry--in

47. The stove is being fixed ____ the repairman. 
oven--BY--hot--of--with

48. A waiter is pouring wine ____ the gentleman. 
fancy--away--bottle--FOR--on

49. The workers are removing the dirt ____ shovels. 
towards--truck--away--messy--WITH

50. The maids are putting ____ the clothes. 
on--AWAY--pack--trunk--for

51. A salesgirl is writing the price ____ the size. 
DESIDE--sell--ticket--under--off

52. The musicians are playing songs ____ the crowd. 
sing--FOR--instrument--with--out
53. The boy is being frightened off to run by the field.
54. The police are reminding the man of the crime.
55. The man is opening bottles with a corkscrew.
56. The friends are giving a present to the child.
PICTURES FOR SENTENCES 5-8
PICTURES FOR SENTENCES 13-16
PICTURES FOR SENTENCES 37-40
--APPENDIX D--

Sentences for Grammaticality Judgement Task

The firemen are eating supper at eight o'clock.
The students are eating lunch at one o'clock.
The captain is leaving home for many years.
The husband is throwing the keys across the room.
The boys are breaking windows on weekends.
The guys are playing baseball hit Monday morning.
A woman is taking the dogs in the summer.
The women are buying chocolates to holidays.
A neighbor is taking the baby off the afternoon.
A repairman is putting the tools in the box.
A woman is throwing away the newspapers.
A girl is riding a bicycle towards the river.
A repairman is putting the tools.
A student is looking up the information.
The mailman is handing letters the package.
A student is picking out a new car.
A woman is throwing off the alarm.
The mailman is handing over the package.
Some girls are smoking cigarettes the morning.
Some girls are smoking cigarettes.

Some workers are cleaning out the basement.
The family is putting away the food.
The maids are cleaning busy the closet.
The maids are throwing of the old clothes.
The patient is turning for the television.
The detective is looking the address.
The mailman is handing letters the package.
The nurse is writing by the information.
The repairman is putting the tools.
A visitor is buying candy for the patient.
The clown is telling jokes to the children.
The man is giving the keys to a neighbor.
The chef is cooking breakfast for many people.
The host is pouring wine for the guests.
The mayor is reading a speech to the crowd.
The girl is playing the piano for the family.
A lady is writing a note desk a friend.
The students are buying flowers give the teacher.
The thief is telling lies guilty the police.
The parents are giving a car of the boy.
The maid is cooking soup on the family.
The babysitter is pouring juice away the kids.
The owner is reading the rules the tenants.
The woman is singing songs the crowd.
The man is washing the car with a sponge.
The girl is opening the drawer with a key.
The mother is slicing the cake with a knife.
The man is cutting paper with a scissor.
The children are signing the card with pencils.
The plumber is fixing the sink with pliers.
The neighbors are removing the snow with shovels.
The woman are washing the clothes scrub soap.
The janitor is opening the door tenant key.
A waiter is slicing the meat sharp a knife.
The boy is pounding the nails of a hammer.
The clerk is cutting tape for a razor.
The woman is fixing the plate to some glue.
The mayor is signing the papers a pen.
The cleaner is removing spots bleach.
The building is being hit by a truck.
Some kittens are being chased by a dog.
The poem is being written by a child.
The door is being fixed by a carpenter.
The glasses are being broken by the waitress.
The painting is being stolen by a burglar.
The nurse is being called by a patient.
The bicycle is being hit smash a car.
A wagon is being pulled yard a child.
A deer is being chased quick a hunter.
The machine is being fixed to a repairman.
The window is being broken with some boys.
The soldiers are being called across the sergeant.
The story is being written the author.
The jewels are being stolen a thief.
The woman is supplying the girl with sheets.
The man is ordering rugs from a store.
A man is robbing the museum of paintings.
A clerk is reminding the customer of the price.
The girl is borrowing a dress from a friend.
The fireman is freeing the kitten from the tree.
The family is leaving the city for the country.
The school is supplying the students write pencils.
The ducks are leaving the pond nest a lake.
The patient is sharing a room large a friend.
The thieves are robbing the house to the paintings.
The secretary is reminding the boss with the meeting.
The boy is borrowing a bike to a friend.
The soldiers are freeing the men the camp.
The teacher is ordering books a catalog.
--APPENDIX E--

Sentences and Pictures used in Sentence Picture Matching Task

Set 1:
The nanny is hiding the children.
The nanny is hiding from the children.
The nanny is hiding with the children.
The nanny is hiding behind the children.

Set 2:
The couple is looking at a house.
The couple is looking for a house.
The couple is looking behind a house.

Set 3:
The woman is reading to the children.
The woman is reading about the children.
The woman is reading beside the children.

Set 4:
The child is playing the piano.
The child is playing on the piano.
The child is playing with the piano.

Set 5:
The man is drawing a pen.
The man is drawing on a pen.
The man is drawing with a pen.

Set 6:
The woman is wiping the cloth.
The woman is wiping with the cloth.
The woman is wiping under the cloth.

Set 7:
The boy is listening for his mother.
The boy is listening to his mother.
The boy is listening with his mother.

Set 8:
A song is being sung by the children.
A song is being sung to the children.
A song is being sung with the children.

Set 9:
The boy is turning the television.
The boy is turning on the television.
The boy is turning beside the television.

Set 10:
The boys are talking behind the girl.
The boys are talking to the girl.
Set 11:
The child is pouring for the teacher.
The child is pouring on the teacher.

Set 12:
The students are marching from the school.
The students are marching to the school.

Set 13:
The repairman is pounding on the board.
The repairman is pounding with the board.

Set 14:
The girl is waiting for the bus.
The girl is waiting in the bus.

Set 15:
The artist is painting a friend.
The artist is painting for a friend.

Set 16:
The parents are cooking for the kids.
The parents are cooking with the kids.

Set 17:
The children are painting with their hands.
The children are painting on their hands.

Set 18:
The maid is washing the mop.
The maid is washing with the mop.

Set 19:
The child is staring at a mask.
The child is staring through a mask.

Set 20:
The kids are laughing at the clown.
The kids are laughing with the clown.

Set 21:
The thief is stealing the suitcase.
The thief is stealing from the suitcase.

Set 22:
The puppy is eating the sofa.
The puppy is eating beside the sofa.

Set 23:
The man is walking the dog.
The man is walking to the dog.
Set 24:
The package is being taken by the man.
The package is being taken to the man.

Set 25:
The jewels are being given by the queen.
The jewels are being given to the queen.

Set 26:
The woman is being surprised by a puppy.
The woman is being surprised with a puppy.

Set 27:
The boy is being frightened by a snake.
The boy is being frightened with a snake.

Set 28:
The dress is being bought by the woman.
The dress is being bought for the woman.

Set 29:
The vase is being broken by the mouse.
The vase is being broken with the mouse.

Set 30:
The boy is being saved by the dog.
The boy is being saved from the dog.

Set 31:
The box is being sent with the man.
The box is being sent to the man.

Set 32:
The maids are putting on the clothes.
The maids are putting away the clothes.

Set 33:
The boy is throwing the ball.
The boy is throwing away the ball.

Set 34:
The boy is holding the dog.
The boy is holding back the dog.

Set 35:
The man is taking the radio.
The man is taking apart the radio.
PICTURES FOR SET 2
PICTURES FOR SET 4
PICTURES FOR SETS 12 & 13
PICTURES FOR SETS 14 & 15
PICTURES FOR SETS 16 & 17
PICTURES FOR SETS 18 & 19
PICTURES FOR SETS 22 & 23
PICTURES FOR SETS 24 & 25
PICTURES FOR SETS 28 & 29
PICTURES FOR SETS 30 & 31