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Normal and Pathological Breakdown in Arabic.

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NORMAL AND PATHOLOGICAL BREAKDOWN IN ARABIC

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by
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ABSTRACT

The grammatical structure of Arabic allows for significant cross-linguistic comparisons in the study of slips of the tongue as well as aphasia. The dissertation presents a case study of aphasic deficit in the speech of a speaker of Arabic, in particular, the Hijazi dialect spoken in the Western Province of Saudi Arabia, with a subsequent comparison with regular slips-of-the-tongue in the same dialect collected and analyzed by the same author. Both of the slips-of-the-tongue data and the aphasia data have been collected in the city of Jeddah, Saudi Arabia, by the present investigator. It was observed that in such a highly inflected language, grammatical morphemes carry a heavier functional load than in analytical languages. Thus, those elements that do not carry a high informational load are deleted, whereas those that do are retained. Clitic pronouns are robust and resist errors in both the slips-of-the-tongue and aphasic errors. During processing, the third person singular masculine form becomes a "default" form for T.A. and accounts for the unidirectionality of his substitutions. The brain damage syndrome discussed here results in impairment that affects grammatical morpheme selection as well as lexical processing mechanisms. The locus of the functional damage is identical with the computations that specify the Positional Level of Garrett's (1984, 1988) model. Both slip and aphasic data argue for

Kiparsky's (1982) two level morphology, where Level I is responsible for irregular morphological forms, while Level II morphology computes regular morphological forms. The segmental errors analyzed in this study violate the syllabic position constraints proposed for Western languages such as English. These constraints appear to be language dependent rather than language universal. The dissociation of consonantal roots and vocalic patterns observed in the data (which has not been observed or documented before), demand a closer investigation and refinement of the long accepted syllable position constraint. This reported dissociation provides evidence for McCarthy's proposed two tier autosegmental representation for Semitic languages, where one tier contains the consonantal roots while the other contains the vocalic patterns.

CHAPTER ONE

INTRODUCTION

Recently, neurolinguistic and psycholinguistic research has increasingly considered aphasia as a testing ground for the psychological reality of linguistic components as well as an evaluation measure of psycholinguistic models of language processing.

The relationship, however, between language deficits and brain lesions has been noted as far back as the Greeks (Benton and Joynt 1960). Nevertheless, the credit goes to Paul Broca, who in 1861 correlated a language disorder, which he called loss of verbal memory, with damage to a specific brain structure, the third frontal convolution. A few years later, he emphasized that it was the third frontal convolution of the left hemisphere. This was, of course, followed by a multitude of case studies and descriptions of what is now known as aphasia. But it has not been until the last two decades that extensive linguistic analyses have been performed on the languages of these patients.

Aphasia, defined as an acquired language deficit secondary to a brain lesion in the dominant hemisphere, has been taxonomically divided into seven "classical" syndromes (Kertesz 1979): Broca's, Wernicke's, Anomic, Global, Conduction, Transcortical, and Semantic aphasia. The two aphasic syndromes that have received the most attention in neurolinguistic research

are Broca's and Wernicke's. Broca's aphasia is described in the literature as an expressive disorder of speech/language. The patient's output is nonfluent, slow, labored, and often agrammatic ("telegraphic": sentences often lacking functors of one sort or another). Syntactic structures are usually limited to simple sentences with few embeddings. Compared to the poor production, comprehension, naming and repetition are relatively intact. On the other hand, Wernicke's aphasia is described as a disorder of both the input and the output language systems. The patient's production is fluent and well articulated and the grammatical structures are relatively intact. Comprehension, however, is severely impaired and the semantic and phonological content of the output is disrupted. Naming and repetition are also severely compromised.

The last twenty years have witnessed increasing interest on the part of linguists in the field of neurolinguistics, where the primary goal is the understanding of the neurological bases for language and speech and the explanation of the nature of the mechanisms and processes that underlie language use. Blumstein (1988) credits Jakobson (1971) as the first linguist who realized the contribution linguistics can make in understanding the nature of language deficits subsequent to brain damage. Jakobson was also the first to point out the insights provided by the deficits in informing linguistic theory as well as presenting a remarkable testing ground for theoretical

linguistic assumptions, since, as he indicated, the organizational structure of the language system breaks down in linguistically "lawful" ways. Adult aphasia is of particular interest in neurolinguistics since it reflects damage to premorbidly normal linguistic and cognitive systems.

Linguistic theories attempt to describe as explicitly (and as elegantly) as possible those structural elements and components of language competence that are shared by all native users. Observed data (normal as well as impaired) can be used to test grammars or models of language structure or language processing. Models or theories that are incompatible with the data are obviously suspect (although compatible ones are not necessarily the most felicitous). Thus, models or grammars must be able to account for and to correlate with impaired productions. In other words, production should break down in terms of the representative and computational architecture of the theory. More recently, there has been a development of testing techniques where performance on a particular task (e.g. reading a list of content words) may be disrupted while performance on another task which required access to the same structural units is not (e.g. using the same content words in spontaneous speech). As a result, research has shifted its focus from deficits to the language structural components (i.e. a deficit to the competence) to deficits in the access of language components

(i.e. a performance deficit) where the components themselves are intact.

One of the most common clinical features of aphasia is anomia (see section 5.4.5), which is characterized by: inability to give the appropriate name (articulated label) of an object (naming deficit), groping for an appropriate word in spontaneous speech (word finding difficulty), or the use of non-specific lexical items such as 'thing' (empty speech). Anomia has been previously attributed to a deficit at the level of lexical representation or structure of lexical entries (Zurif, Caramazza, Myerson and Galvin (1974) and Goodglass and Baker (1976)). Recently, however, a number of studies (Blumstein, Milberg and Shrier (1982) and Milberg, Blumstein and Dworetzky (1987)) have disputed the claim that anomia is a deficit in the lexicon and have argued for characterizing it as a deficit in the many processing mechanisms required for lexical access. This last claim has been supported by studies of lexical access in normals during on-line processing. These studies showed that the mental lexicon is a network of entries, and access to it is extremely complex, requiring different computations. Thus, different anomic manifestations can be attributed to different stages of access and retrieval of lexical items, rather than due to the reorganization of the structure of the lexicon itself.

The second dimension of aphasic breakdown that concerns us here is in the syntactic nature of production (see section

5.4.4). In production, grammatical markers of the language are selectively affected resulting in agrammatism/paragrammatism (see section 2.1). Free grammatical lexical items such as determiners, auxiliaries and prepositions are disrupted. Bound grammatical markers such as verb inflections and plurals are either deleted (e.g. in English) or undergo substitutions (especially in languages such as Italian, where deletion would result in an unallowable pronunciation in the language). In languages like Italian, patients produced fully inflected forms that were inappropriate to the context. Patients usually favored a reduction in the complexity of the inflectional ending, preferring to produce the least complex forms in the language (see section 5.4.4). Severe restrictions on the syntactic structures produced by aphasics (such as the shortage of embedded sentences, complementizers, relative clauses or complex phrases) have been observed to accompany production deficits in Broca's aphasics.

The failure to produce syntactically well formed sentences does not seem to reflect a loss to the conceptual basis of these structures (see section 5.4.5). Both Goodglass, Gleason, Bernholtz and Hyde (1972) and Gleason, Goodglass, Green, Akerman and Hyde (1975) report alternate strategies used by patients to produce the synonymous meaning. For example, patients substituted an intensifier with a reduplication (very hot → hot hot), comparatives by two simple sentences (taller → He

is tall, she is not), and tense markers with adverbials (he went → yesterday, he go).

In the past, studies of language breakdowns have been based on a narrow range of very similar languages. This dissertation is part of a growing literature on breakdown in diverse languages (see Menn and Obler (1990). With its widespread use of bound grammatical morphemes, the grammatical structure of Arabic allows for significant cross linguistic comparisons in the study of aphasia. The major concern of this study is the investigation of an aphasic deficit in the speech of a speaker of Arabic, in particular, the Hijazi dialect spoken in the Western Province of Saudi Arabia. The dissertation will present a case study of an Arabic speaking aphasic, with a subsequent comparison of this type of aphasic speech with regular slips-of-the-tongue observed in Arabic and analyzed by the present author.

The analysis will show how speech production breakdowns are manifested in a highly inflectional language like Arabic and how the involved mechanisms fail. The data is used to evaluate: (a) if Garrett's (e.g. 1982, 1984) model of sentence production can still account for the computational operations involved in sentence production in such a language as Arabic, (b) what, where, and how the normal slips and the aphasic productions meet at converging points in the processing system, and (c) if

these operations hold across languages or if they are language dependent.

The analysis, in addition, will incorporate Shattuck-Hufnagel (1979, 1983) Serial Ordering mechanism as well as Lapointe (1985) Syntactic Processor into the computations that specify the Positional Level Representation of Garrett's model. The former will be used for the analysis of segmental errors, while the latter will provide a framework for the characterization of the grammatical morpheme deficit observed in the aphasia data.

CHAPTER TWO

HISTORICAL REVIEW

2.1. Agrammatism versus Paragrammatism:

Linguistic production deficits of a syntactic nature due to focal brain damage have been divided in the literature into two major categories; agrammatism and paragrammatism. Agrammatism consists of what impressionistically looks like telegraphic speech, characterized by syntactically impoverished sentences and by the omission, infrequent or incorrect use of function morphemes, both bound and free. Verbs, when used, are frequently uninflected. The speech is usually effortful with distorted articulation and the syndrome is most often associated with lesions of the anterior portion of the dominant hemisphere.

Paragrammatism is usually associated with lesions of the posterior portion of the dominant hemisphere. It involves the inappropriate juxtaposition of lexical items. The patients are usually identified as having fluent articulation and a number of grammatical constructions. The resultant language, however, is informationally empty or replete with grammatical distortions such as category violations (e.g. nominalized verbs occupying verb slots), selectional restriction violations, or substitution of content word forms.

Goodglass (1976) credits Pick (1913) for being the first to explain agrammatism as a specific disorder that is different from

what Pick called pseudoagrammatism. Pick not only described agrammatism but also offered the "law of economy" as an explanation for the syndrome. This "law" obliges the patient to use an "emergency" language with all redundant elements (connectives & inflections) discarded. Isserlin (1922) attributed the agrammatic syndrome to the difficulty in uttering the words i.e. to an articulatory problem. Goldstein (1948) offered some detailed descriptions and observed that agrammatism was a regular feature of motor aphasia.

Jakobson (1956) and Luria (1970) were the first to offer linguistic interpretations of the phenomena. Jakobson (1956) distinguished between syntagmatic and paradigmatic components of the language and explained that the grammatical structures affected by agrammatism as a "contiguity disorder" were structured in a "hierarchy of resistance." Thus, relations of government (e.g. possession) are more fragile than those of agreement (e.g. number agreement). Jakobson predicted the profusion of errors of the former type in relation to the latter. Luria (1970) explained motor agrammatism as an inability to arouse the "dynamic schemata of the sentence", observing that words were more often used in their static or "nominative" function than in their "predicative" one. Luria rejected the economy theory describing patients who come up with repeated attempts towards a successful production.

Goodglass and Hunt (1958) is the first reported formal study testing grammatical structures in agrammatic speech, in particular the inflectional ending /-s/ as the plural marker, possessive marker, and third person singular marker along with its allomorphic variations of /s,z,əz/. Jakobson's prediction was confirmed since the possessive was omitted twice as often as the plural marker. Later on, Goodglass and Berko (1960) devised a test to check the differences in aphasic's behavior on syllabic and nonsyllabic endings of both /-s/ and /-d/. Agrammatics found it easier to produce the syllabic ending / -əd, -əz/, whereas, nonagrammatics produced a greater number of errors in the syllabic allomorphs of these inflections. The nonagrammatic patients' performance mirrored the way children perform, treating the final sibilant or stop of the stem (e.g. dish, decide) as though already marked for plurality or past tense. The explanation they offered considered the syllabic component as more SALIENT for the agrammatics and, thus facilitated retrieval and production.

De Villiers (1974) noted that the loss of grammatical morphemes followed a particular pattern, which was similar to the hierarchy of their acquisition (see Brown 1973). For example, plural -s and progressive -ing were acquired first and were found to be the most resistant, whereas, possessive -s was the most vulnerable and was acquired latest. However, other grammatical morphemes did not demonstrate such clear

acquisition-dissolution parallels. For example, the copula is more resistant in adult agrammatism while past tense morphology dissolves faster. Brown (1973) shows that children at stage III produce a large number of equational or zero copula sentences and only combine auxiliary with main verb (not be), where auxiliary is [ing/pst], (i.e. they develop past tense before copula). Gleason et al (1975), using a story completion test to elicit different syntactic structures, also reported a similar hierarchy of bound grammatical morpheme omission.

An increase in detailed formal work on the linguistic nature of the deficit began with Howes and Geshwind's (1962) study in which they tested the differences in the use of high frequency words produced by Jargon aphasics, normals and Broca's aphasics. They demonstrated that severe Broca's aphasics used half the number of function words used by normals, whereas, Jargon aphasics used a higher percentage than normals. The Broca's also had a high percentage of use of personal pronouns as compared to function words. In another study, Goodglass, Fodor and Schulhoff (1967) observed that Broca's aphasics were more able to produce items with heavy stress or tonic accent, and since functors receive less stress relative to content words in sentential contexts, they were omitted. They further noted that another feature of an agrammatic speech pattern was the patient's difficulty in initiating sentences beginning with a word that is unstressed.

They reported a significantly higher rate of omission for unstressed function words in a sentential initial position (e.g. Do birds fly?) than for unstressed function words in a sentential medial position between two stressed content words (e.g. Dogs can bark). In addition, they pointed out that the effect of prosodic stress in initiating sentences outweighed grammatical complexity, since agrammatics produced less errors with sentences such as 'Can't he dance?' than with less complex interrogatives such as 'Can he dance?'. Goodglass and associates ran a number of other studies and concluded that the response threshold in agrammatic production is raised and an emphatic or "salient" element is needed to overcome this high threshold. They define saliency as the informational load, affective tone, increased amplitude and intonational stress. The above mentioned studies paved the way for one of the major distinctions made in the study of agrammatism, that between content and function words.

The differential treatment of fluent and nonfluent aphasics in their use of content words was also noted by Jones and Wepman (1965) and Goodglass and Hyde (1969), who ran statistical analyses and found that non-fluents used more utterances with nouns or adjective + noun than did fluents or normals. They also observed that the less severe their deficit, the closer they matched the normal's production. Within the non-fluent type agrammatics were observed by Gardner and Zurif

(1975) to have fewer errors reading picturable nouns than grammatical morphemes. Nespoulous (1973) and Kolk (1978) both observed that there is also a hierarchy of preference within the content word category itself. Thus, patients were noted to have a higher noun to verb ratio during interviews or to ignore adjectives, preferring to concentrate on nouns within a particular task. Other experimental work by Zurif, Caramazza and Myerson (1972) and Zurif and Caramazza (1976) reported that agrammatic patients not only ignored function words but were also insensitive to the structural roles of functors. Using a word-relatedness task, aphasics were asked to judge how words in written sentences (e.g. 'The man was hurt' or 'The baby cries') went best together in these sentences. Zurif and Caramazza (1976) found that aphasics coupled the content words together (e.g. 'man + hurt' or 'baby + 'cries') and ignored the relationship between the content and the function words within noun or verb phrases, thus implicating the syntactic structure of the sentence.

The results of these experimental investigations have stimulated interest in the disrupted linguistic patterns as well as in the development of models that attempt to account for those patterns. Those models have in turn driven more experimental work. The last decade witnessed increased sophistication in the type of explanations offered for agrammatism. Improved theories guided questions and those questions when tested, in turn,

modified theories. More tightly constructed tests such as picture verification tasks, story telling tasks, story completion tasks, anagram tasks, and relatedness judgments to mention a few were devised to investigate some of the specific issues discussed below.

What makes a patient fall into the category of agrammatism? Is the distinction between agrammatism and paragrammatism psychologically real? What are the linguistic features that result in the clinical impression of agrammatism? Or, what is agrammatism? Here, the picture becomes hazy and confused. What follows is a brief review of the controversy surrounding this puzzle.

Reduced phrase length (RPL) was suggested by Goodglass (1976) to be a diagnostic feature and a relatively objective criterion for agrammatism since a large number of cases have been documented to exhibit short, telegraphic sentences. Nevertheless, he reports one paragrammatic patient who fell into the reduced-phrase-length group. Kolk and Van Grunsven (1981) and Miceli, Mazzucchi, Menn and Goodglass (1983) both document cases of agrammatism where patients produced considerably long phrases, while their utterances were nevertheless considered agrammatic. Thus, both Kolk and Van Grunsven (1981) and Miceli et al (1983) conclude that Reduced Phrase Length is not necessarily a diagnostic feature of

agrammatism, and that RPL could be attributed to the severity of the brain lesion or to an articulation deficit.

Patients' tendency to have simple sentence types and to ignore structures that involve more complex syntactic relations has been reported to combine with reduced phrase length as a distinguishing feature of agrammatics. Goodglass (1976) also argued that this was not a satisfactory or necessary criterion, thus rejecting Pick's (1913) economy principle, which renders the speech telegraphic. Goodglass and colleagues (1976:254) observed that the telegraphic nature of agrammatism was not due to a simplification process, since "the patient's persistent efforts at self-correction almost always were in the direction of standard English grammar," i.e. not agrammatical. Kolk, Van Grunsven and Keyser (1985) reanalyzed data from their agrammatic patient in light of Garrett's (1980) model of sentence production (outlined below) and under their new formulation considered the telegraphic speech "grammatical", since the simplification process appeared to take place at the message level as a compensatory strategy to overcome the syndrome. Thus, whether reduced phrase length and telegraphic speech are necessary features of agrammatism is still questionable.

Goodglass (1968) claimed that word order errors were not part of the agrammatic symptom complex. Saffran, Schwartz and Marin (1980), using a picture description task depicting action relations (e.g. a boy running to his mother) or locative relations

(e.g. a spoon on a cup) between two objects, report that agrammatics had difficulties expressing the directionality of propositions when the two objects were either both animate or both inanimate. They noted that agrammatics do indeed represent thematic role relations at some level of cognition, but they cannot translate this representation into a properly sequenced linguistic code. Animacy seemed to be a more important factor than agency governing the selection of subject in a sentence. The basic noun-verb-noun order was preserved but the assignment of roles was disrupted when the animacy variable was neutralized. Caramazza and Berndt (1985) found that agrammatics were not alone in experiencing this difficulty. Other types of aphasics exhibited these errors as well. Bates, Friederici, Wulfeck and Juarez (1988) provided evidence from Italian and German (languages that have less rigid word order) aphasic data that the canonical sentence order was preserved for both fluent and non fluent aphasics. Nor were the syntactic difficulties due to a word order problem, since patients tended to overuse the canonical word order as a "safe harbor".

Grammatical metalinguistic judgment of agrammatics has been raised as one of the possible features to characterize the syndrome as a syntactic deficit. Caramazza, Berndt, Basili and Koller (1981) required patients to order written words to produce well-formed sentences. They discovered that agrammatics were severely impaired in their performance on this

task. Linebarger, Schwartz and Saffran (1983) minimized the effect of the visual code and presented the stimuli aurally. In this case, the patients were required to judge whether or not a string of words formed a grammatical sentence. The patients tested in Linebarger's study did very well on this task as compared to their agrammatic on-line speech production. Caramazza and Berndt (1985) argue that the intonation contour of the sentence could have cued the patients to the ungrammatical sentences. So, whether syntactic metalinguistic judgment is impaired or not is left unresolved.

Related to the metalinguistic judgment issue is one of the most controversial points in production deficits. This concerns the involvement, extent, and type of a comprehension deficit. The intuitive clinical picture gives the impression that agrammatic patients comprehend well. However, Caramazza and Zurif (1976) and Heilman and Scholes (1976) both argue that some form of disruption in comprehension occurs in particular sentence structures that require close, surface syntactic structure analysis. Subsequently, Caramazza and Berndt (1978) labelled this behavior "asyntactic comprehension." Kolk (1978) argues that the comprehension deficit observed parallels the production deficit and that it could therefore result from a deficit to the same underlying function. These investigators are not alone in their claim. Zurif and Blumstein (1978) and Schwartz, Saffran and Marin (1980) emphasize that the

agrammatism in Broca's aphasia comprehension parallels that in production. Consequently, the term agrammatism is broadened to include comprehension difficulties. Recently, however, Kolk and Van Grunsven (1981) and Miceli et al (1983) as well as Nespoulous, Dordain, Perron, Ska, Bub, Caplan, Mehler and Lecours (1988) all report cases of agrammatism without, or with minimal, impairment of comprehension. The possible involvement of the language comprehension system leads to theoretically important questions such as whether the deficit is central or peripheral, whether it is unitary or multicomponent, whether there is a total loss or simply a difficulty in access, and whether it is a deficit in competence or performance.

For many decades it was felt that the omission of function words or closed class category elements was a necessary criterion for labelling a patient agrammatic. However, recently Miceli et al (1983) and Miceli, Silveri, Villa and Caramazza (1984), using Italian data, a highly inflected language in which verbs must appear with a bound morpheme in order to be phonotactically well formed in normal speech, showed that agrammatics observe the phonotactic constraints and do not simply omit inflected endings from verbs. That is, in languages where bare verb stems are normally not pronounceable, agrammatics 'substitute' other verbal affixes rather than omit inflected endings from the correct forms. Thus, agrammatics in their data exhibited 'substitution' of functors as well as

omission. Two other major studies have challenged the classical definition of agrammatism as the deletion of grammatical morphemes (along with the clinical distinction between agrammatism and paragrammatism) - Grodzinsky (1984) with Hebrew data, and Menn and Obler (1990) with a cross-linguistic study in diverse languages. Both report the omission as well as the misselection (substitution) of grammatical morphemes.

Berndt (1987) examined six agrammatic patients and has shown that even the most basic features such as dysfluency, structural simplification, and asyntactic comprehension co-occur in different combinations. She reports dissociation of omission of grammatical markers from dysfluency, from structural abnormalities, and from syntactic comprehension. She argues that these different symptoms must arise from deficits to the processing operations, which can be separately disrupted. Therefore she reasons, agrammatism cannot be a unitary deficit. This dissociation within the symptoms and the variation of performance within the agrammatic category has been reported by other researchers as well. Miceli et al (1983) report a patient who omits auxiliary, determiners, prepositions + determiners, and clitics but whose main verbs are retained. His main verb inflections, however, were inappropriate. On the other hand, Saffran et al (1980) point out that the omission of main verbs is a common feature of speech characterized as agrammatic. They also report another agrammatic patient who satisfied the omission

of function word criteria, but who substituted nouns for verbs and when verbs were employed they were semantically inappropriate. This dissociation has also been reported between syndrome and lesion site. Nespoulous et al (1988) report a patient with agrammatism where the lesion spared Broca's area (left hemisphere precentral gyrus and the inferior frontal gyrus known as Broadmann's areas 44 and 45) usually associated with agrammatism, while affecting other left hemisphere areas of the perisylvian region (supramarginal gyrus and the superior temporal gyrus known as Broadmann's areas 40, 41 and 42) usually associated with Wernicke's aphasia and paragrammatism.

The arbitrariness of the sets of criteria and diverse features (presence or absence) in the production of patients categorized as agrammatic have led researchers such as Grodzinsky (1984), Badecker and Caramazza (1985), and Goodglass and Menn (1985) to suggest abandoning the rather misleading notion of a unified category for agrammatism, since it is functionally indistinguishable from paragrammatism. Badecker and Caramazza (1985) argue that the term agrammatism cannot be used to classify or distinguish patients, since the observed variation in performance profile among different agrammatic patients each exhibiting a different pattern of omission does not form a single category. Caplan (1987) argues that the locus of both deficits is the same affecting the same set of morphological items. In both cases the disturbance involves a substitution or

misselection within the set. The distinction lies in the fact that agrammatism exhibits the preference for a phonologically null element. The similarities between the behavior of agrammatics and paragrammatics are assumed to have different underlying causes. However, Goodglass and Menn (1985) argue that the similarity rests with the underlying cause (the same cognitive problem of encoding/decoding morphological and syntactic relationships), the difference owing to variations in the "strategies" adopted to overcome what is basically the same deficit. They indicate that the agrammatic speaker

> "..receives little or no help from the nearly automatic chaining of probable morpheme sequences in production, while the paragrammatic speaker can rely on his output mechanism to set up sentence frames and insert grammatical morphemes (although not necessarily the correct ones)." (Goodglass and Menn 1985:26)

Badecker and Caramazza (1986) argue that since the grouping of patients into the agrammatic category is based on subjective clinical impressions rather than objective linguistic criteria, the category must be abandoned. There seems to be no agreement in the literature as to what objectively counts as the agrammatic deficit or what constitutes the "same" type of linguistic disturbance any two aphasics exhibit. This brings us to the recent acrimoniously debated issue in neurolinguistic and psycholinguistic research; can group or single patient data be

used to test psycholinguistic models of normal language processing?

2.2. Group versus Single Patient Data:

For decades cognitive neuropsychological research has been performed on groups, and group data performance has been used to test models or theories of language processing. With aphasia data, the same holds. Clinically categorized groups such as agrammatics, deep dyslexics, etc., have been subjected to designed tasks and their performances have been used to test hypothesized theories. Caramazza and associates in a number of papers present compelling arguments for abandoning group studies and for embracing single case studies in cognitive neuropsychological research. Their arguments are based on two major assumptions, which form the heart of cognitive neuropsychological research; the homogeneity of the group under study, and a well articulated theory that will predict group performance in very specific ways.

The dissatisfaction with group classification has emerged in the literature with Caramazza (1984) questioning the logic of using aphasic classifications in neuropsychological research. He reasons that one can use group data from brain damage patients as evidence for normal language processing only after one has a tightly constructed and highly detailed theory of normal performance.

The strongest arguments were developed in Badecker and Caramazza (1985, 1986) and Caramazza (1986). Badecker and Caramazza (1985) questioned the coherence of agrammatism as a "psychological entity" since the "commonalities" believed to be shared by members of this category are not theoretically motivated. There seem to be no objective measures to identify manifestations of the category or to determine the extension of, for example agrammatism, within the aphasic population. Which differences of performance are truly diagnostic in the patients' production, and are they predetermined "a priori" by a well articulated theory of normal language processing? They point out that it is no arbitrary matter what will count as significant variation and what will not.

> "The case against group study is based among other things on the arbitrariness of the delimitation of the categories since these categories are not based on computationally adequate theories of linguistic performance." (Badecker & Caramazza 1985:117).

They point out that the only difference between inferences to the normal language system from impaired and normal performance lies in the types of conditions imposed on the normal system to result in the impaired performance. The variation presented in the syndrome discussed in 2.1 above comprises a heterogeneous class and makes it difficult to justify any grouping. The homogeneity of a group is what any theory of normal processing must assume a priori (what Caramazza calls

the "Transparency Condition"). It is claimed that if the same category label (for example, agrammatism) is applied to diverse patients, the researcher would have to ignore many of the distinct details of each individual's output. The leveling of variation by averaging out performance of group data will render important differences opaque. The insignificance of these differences to the evaluation of any model or theory will have been decided a priori.

Caramazza (1986) and Badecker & Caramazza (1986) present detailed theoretical reasons against group studies. They argue that the homogeneity principle that justifies grouping is really based on the larger assumption of the universality of cognitive structures. This universality must be assumed to hold true in the case of impaired performance since "brain damage does not result in the de novo creation of cognitive operations" (Caramazza 1986:52) different from normal ones. They also point out that the "locus" of the damage to the cognitive operations is not known a priori, and it may very well vary from one patient to another and still result in the same observational behavior or performance. They add that averaging out the performance of patients can only be done if one assumes that the damage in each patient's cognitive system is identical in all "theoretically relevant aspects." For normal performance, the assumption of universality is used to motivate the use of group data to draw inferences about a particular model. The performances of

individuals are averaged out because the group is believed to be homogenous and observations of individual subjects will be equivalent in "theoretically relevant aspects." With brain damage there is the confounding variable of the functional "locus" of the damage that cannot be held constant or assumed identical among different individuals, and their performance on any given task cannot be averaged out in theoretically motivated ways. Caramazza (1986:59) concludes that:

> "the homogeneity assumption for patient-group studies is satisfied only by carrying out a series of single-case studies to establish that the nature of cognitive damage is the same for each patient in a group."

The theoretical dependency of data selection and use as evidence for or against theories of normal cognitive processing is further developed in Caramazza and McClosky (1988) and McClosky and Caramazza (1988). They argue that since brain damage results in selective loss of some ability in the face of otherwise normal performance, cognitive deficits can be used to test and constrain theories of normal cognitive processing. They point out, however, that the relevancy of evidence is interdependent on the nature of the proposed theory. They argue that patient classification

> "..gives precedence to a subset of a patient's performance over other theoretically significant aspects of performance even though both sets of performance are needed to decide issues of theory." Caramazza and McClosky (1988:526).

With brain damaged patients there is the added variable of functional lesion to the system which is not controlled by the investigator, and, therefore, an explicit relationship must be established between the processing structure (the site of the functional lesion) and the specific performance. For group data the functional damage must be established to be equivalent for all the patients grouped together. The functional lesion is treated as an experimental condition imposed on the normal cognitive system. This 'condition' is imposed by 'nature' and, therefore, unknown in a sense that has important consequences for both theory and methodology. Patients included in a group may have damage to different cognitive mechanisms. When differences between patients' performances are observed and are accepted as important, then they either reflect a mistake in assuming the same component damage or that one patient has an additional deficit that affects his/her performance. In either case, they argue that one needs a patient - by - patient analysis backed up by a well constructed theory before grouping patients.

Caramazza and Hillis (1989) point out that since speech production involves several linguistic representations and a number of independent processing mechanisms, the variation in performance argues for multiply dissociable syndromes rather than a unitary deficit. The clinical picture results from damage to several or different processing components. This leads to the

abandonment of categories (such as agrammatism) as theoretical and functional viable entities. Instead, it is

> "... individual patterns of language impairment whether clinically identifiable as agrammatism, paragrammatism or some other clinical type (that) may be used to constrain models of sentence production." (Caramazza and Hillis 1989:626).

A central point to Caramazza and Badecker's (1989) argument is that an a priori classification of patients must be theoretically arbitrary. They point out again that the basic unit of analysis in cognitive neuropsychology must be the individual patient, who naturally presents a homogenous class, and that only single patient studies allow valid inferences from impaired performance concerning the structure of normal cognitive mechanisms. Since brain damaged patients result from "experiments of nature", one of the experimental conditions "the functional lesion" can not be determined in advance and is only inferred from the patient's performance. Thus, the researcher cannot control all relevant manipulations in the experimental design.

Recently, Zurif, Swinney and Fodor (1991) invoked the Duhem/Quine principle in support of group studies. They argue that in all sciences, according to this principle, experimental conditions that are manipulated by the investigator can never be "determined in advance." As such, Caramazza and associates' arguments set cognitive neuropsychology aside from other

sciences. They point out that the researcher's ignorance about the conditions imposed by brain damage does not invalidate group studies, since the ideal set up of experimental design presented by Caramazza and associates where all conditions are controlled is not what truly happens. Since cognitive neuropsychology is an "observational science", taxonomies of syndromes do not have to be theoretically motivated; they have to be "expirically" motivated.

Caramazza and Badecker (1991) argue that the issue is not of "what" the experimenter is manipulating, but whether or not whatever is being manipulated is of sufficient similarity across subjects to warrant averaging group performance. They suggest that,

> "..if we have reason to suppose that the behavioral criteria for clinical categorization are consistent with more than one underlying cognitive impairment, the groupings of patients based on clinical standards cannot serve as the starting point for reasoning about the normal system, nor can they be used to motivate explanations of acquired deficits in terms of damage to specific cognitive mechanisms." (Caramazza and Badecker 1991:213).

They conclude by reiterating their previous viewpoint that the use of impaired performance to test and constrain cognitive theory can only be meaningful by using single patient methodology.

CHAPTER THREE

SPEECH ERRORS AND PSYCHOLINGUISTICS

3.1. Speech Errors:

Tanenhaus (1988) credits Chomsky's 1957 notion of transformational grammar for shaping the first decade of research in psycholinguistics, where Standard Theory (Chomsky 1965) formed the basis for much of the psycholinguistic research forged in the 1960s and early 1970s. The components of the standard theory grammar of phonology, syntax and interpretive semantics as well as the distinction proposed between surface structure and deep structure influenced the design of psycholinguistic research that followed.

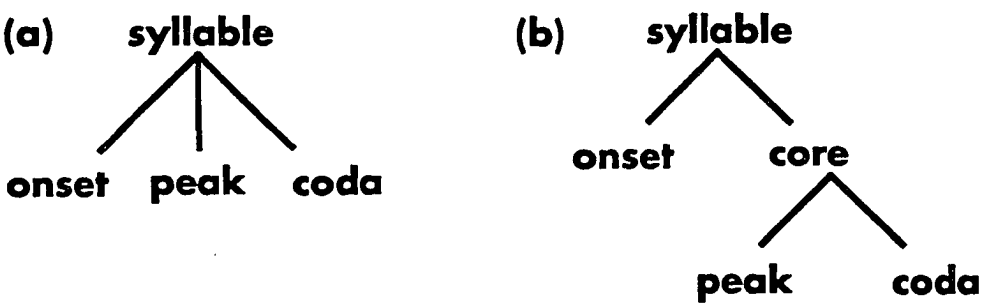
In the past, psycholinguistic research focused on experimental studies of largely off-line processing designed mainly to infer the nature of the linguistic units and the role of transformations (Clark & Clark 1977). However, in the last several decades, the focus has shifted to research performed on on-line data collected from a range of different sources (slips of the tongue, aphasia, on-line priming effects, etc.). This type of data is used to illuminate the nature of processes (operations) of the language system (competence) that the linguistic theories attempt to model.

In addition to data elicited from pathology, normal transient speech errors have been for a long time considered a

great source of evidence for the levels of structure and the mechanisms involved in speech production. Directly, they point out to how the system can go wrong and indirectly they indicate how the system normally operates. Anwar (1983) credits Arab linguists eleven centuries ago for being the first to recognize speech errors and to use them in the development of Arabic linguistic theory. The tradition goes back to 858 with Ibn al-Sikkit's "al-Qalb wa-l-'Ibdaal" (metathesis and substitution) and al-Zubaydi's "laHn al-9awaam" (errors of the populace) published in 989. Both works contain collections and descriptions of speech errors from everyday speech. Reports of malapropisms go back as early as 868 with al-JaaHiz's "al-Bayaan wa-l-Tabyiin" (elucidation and elucidating). Anwar (1983) points out that the development of Arabic studies on phonetics, grammar, lexicography and dialectology have been guided by Arab linguists' interest in speech errors.

In the Western world, however, the publication of Meringer and Mayer (1895) rekindled interest in linguistic errors and provided the first source of carefully collected data (Cutler and Fay 1978). On the heels of Meringer and Mayer, Freud (1901) presented his psychological treatment of speech errors attributing them to unconscious competing intentions. Nevertheless, modern interest in linguistic errors owes its most recent debt to Fromkin (1971), who showed that although slips of the tongue are anomalous, they are by no means random. She

pointed out that errors show, for example, that speakers observe the phonotactic constraints of their language. Shattuck-Hufnagel (1979) and Shattuck-Hufnagel and Klatt (1980) investigating the role of phonetic similarity in single segment substitution found out that errors will more likely occur if the competing segments available during processing are phonologically similar. She concluded that any two concurrently available segments are more likely to interact the more similarities they share. Clements and Keyser (1983) using segmental error data as well as other sources of phonological argumentation suggest the flat syllable structure shown in (a) as opposed to the standard binary syllable structure shown in (b) (Pike and Pike 1947; Fudge 1987).



They point out that the syllable structure in (b) cannot account for errors like (1) below, where the movement affects the onset and the peak leaving the coda behind.

(1) "leaf is ruking"
(T= roof is leaking)

Cutler (1980) examined errors on the suprasegmental level of an utterance and found out that lexical stress errors (see example (2-3)) are not the result of errors in stress assignment, but rather the result of the partial selection of another morphologically related lexical item with a different stress pattern.

(2) "compuTAted" (from 'computation')

(3) "psychoANalysis" (from 'psychoánalize')

Cutler suggested that this type of error occurs much earlier - at the level of lexical selection and not at the point where the lexical items are in the motor programming stage.

Baars, Motley and MacKay (1975) and Baars (1980) were interested in eliciting spoonerisms (exchanges of sound segments, see example (4-5)) experimentally and found that the resulting errors were usually lexical items and that the lexically biased errors (4) occurred at a significantly higher rate than non-lexical errors (5).

(4) "barn door"
(T= darn bore)

(5) "those lugs are raying"
(T= those rugs are laying)

Shattuck-Hufnagel (1983) found out that the majority of segmental exchange errors involve single consonants or vowels and can involve exchanges of consonant clusters. She also points out that most sound exchanges occur between onset consonants in stressed syllables and that the exchanged elements occupy

corresponding positions in their new environment (i.e. onsets exchange with onsets and codas exchange with codas). To account for these facts she proposed a serial ordering mechanism in sentence production (the mechanism will be presented below in section 5.3).

On the lexical level, Hotopf (1980) showed that word substitutions on a semantic base shared the grammatical category of their intended targets, pointing out that these substitutions often represented major class categories such as adjectives, nouns or adverbs. Hotopf also pointed out that they were either antonyms or co-hyponyms (for example (6) and (7), respectively).

(6) "early"
(T=late)

(7) "hour"
(T= week)

Errors in this category do not involve synonyms since, as Hotopf reasoned, they would go unnoticed except by the speaker him/herself. The theoretical linguistic division between function and content words has been empirically justified in the slips of the tongue studies of normals (Garrett 1980, 1982, 1988, 1990, which is discussed below in section 3.2). This division was also justified in word recognition studies of normal speakers using lexical decision tasks (Bradley 1978). Other researchers, such as Dell (1990) have reinterpreted much of the slips of the tongue evidence as showing not so much a content vs. function

morpheme distinction as a distinction between low and high frequency morphemes in general. Dell (1990) argues that due to their high frequency of usage alone, function words are not subject to phonological speech errors.

Although the nature of early work on speech errors was concentrated on collecting errors and classifying them into categories, later work is characterized by an increased interest in the interpretation of errors in light of different theories or models. Production (as opposed to comprehension) has been the least studied area in psycholinguistic models of language use, since the processes that translate a conceptual message into a linguistic utterance are inaccessible to the investigator and are not easily subject to controlled manipulations in experimental design. Nevertheless, a number of models have been proposed based on different characteristics of the utterance.

Goldman-Eisler (1968, 1972) using hesitations and pauses found that speakers pause at points of uncertainty, more often before content words than before function words. She proposed a model that consists of two major stages of processing. The first stage constitutes the Message Level Planning, while the second forms what she calls Routine Planning. Message Level Planning constructs the pragmatic aspect of the message, lexical specification (semantic based) and the computation of abstract syntactic relations. The Routine Planning stage, on the other

hand, computes the syntactic organization (equivalent to the surface structure representation) and the articulatory output.

Fromkin's (1971, 1973) proposed model consists of different levels or stages of utterance generation, and these levels operate in a strict hierarchical sequence. The levels are connected by input arrows and they indicate the flow of information from one level to another, where the output of one level serves as input to the next level and so on. The syntactic structure and semantic structure generators operate on the meaning representation to generate the syntactic-semantic structures. The intonation contour generator then operates and computes sentence stress and intonation. Using semantic features, the lexical items required are then selected from the "lexicon", and subsequently incorporated into the syntactic structure. Three additional processes; morphophonemic rules, the phonetic rules and the motor commands operate later in the hierarchy to complete the generation of the utterance.

Dell and Reich (1981) offered a model that combines relational grammar and the principle of spreading activation to account for errors. Under their formulation, the model contains the lexicon, a phonological inventory, and a grammar connected by associative relations of various sorts. The connections between similar units act as pathways for spreading activation during processing. In production, the planned word is activated and a lesser activation of the next word takes place. This direct

activation spreads outward along all the connections. Unplanned words that share activated phonemes with the planned word are also activated. The more direct the connection the greater the activation flow from one item to another. Errors occur when units other than the targets are more highly activated than the targets. Using a computer model that applied this activation network, Dell and Reich were able to simulate errors that matched naturally occurring ones.

Butterworth (1982) proposed a model that contains: semantic, syntactic and intonational representations; lexical selection and phonetic processes; a phonological assembly system and a number of control modules that handle the input and output to their associated representational systems. The major difference between Fromkin's (1973) model and Butterworth's rests with the nature of processing. Butterworth's model operates in a parallel fashion where the higher level representations have direct and independent access to the most lower level ones. Thus, the semantic representation module has direct access to the module that controls the output of the phonetic processes and so on.

Shattuck-Hufnagel (1979) introduced a frame slot model. Linguistic segments are selected to fill independently computed slots. In other words, the production system generates slots for consonants or vowels which are filled by the appropriate phonemes (see section 5.3 for a detailed description).

Bierwisch (1982:585) notes that "the spectrum of possible errors must be more than simply a chaos describable merely as a set of grammatical defects." The bulk of research since 1895 has shown slips to be highly rule-governed performance errors. To what extent are speech errors tokens of action errors and to what extent do they have special or unique properties? This was addressed by researchers such as Hotopf (1983) on slips of the pen, Garnes and Bond (1980) on slips of the ear and Norman (1981) on action slips. It appears that intriguingly similar cognitive processes involved in slips of the tongue could be related to those involved in other linguistic and nonlinguistic phenomena.

The goal of research involved in speech errors is to use the errors to shed some light on the mechanisms involved in the production of speech. Cutler states that,

> "The goal of speech-error research is not to account for all or even most errors, but to identify, for particular issues of psychological or linguistic theory, the particular errors or error classes which can provide relevant evidence. Speech-error researchers always look for individual informative errors rather than an exhaustive corpus." (Cutler 1988:219).

3.2. Garrett's Model:

Garrett's model of sentence production (1976, 1980, 1982, 1984, 1988, 1990) constructed on his own corpus pulls together as well insights from Fromkin's (1980) error based model and

Goldman-Eisler (1972) hesitation model. Based on thousands of naturally occurring slips of the tongue, Garrett has proposed and elaborated a serially ordered model of language production comprising five distinct and independent levels of processing and sets of inter-level processes (operations) that map the representation of one level onto the other (see Figure 3.1 for a reproduction of the model).

The first set of processes in his model are the inferential ones and they constitute the Message Level. The Message Level builds the conceptual representation that determines sentence level processes. Garrett points out that language production is the real time on-line development of sentence level structures under Message Level control. This level of representation is not linguistic and is not to be identified with the semantic level of formal grammar, since it develops under linguistic as well as non-linguistic information. The nature and internal structure of the set of the 'thought' processes and how they are connected to the linguistic representations that give rise to language production are left unspecified, since Garrett is more interested in the sentence level of production rather than the message or articulatory levels. However, Garrett treats it as a real-time conceptual construct, constructed by a conceptual syntax that uses a pragmatic as well as a semantic input. The ultimate products of the Message Level, according to Garrett, are propositions that are compatible with the language utterance and

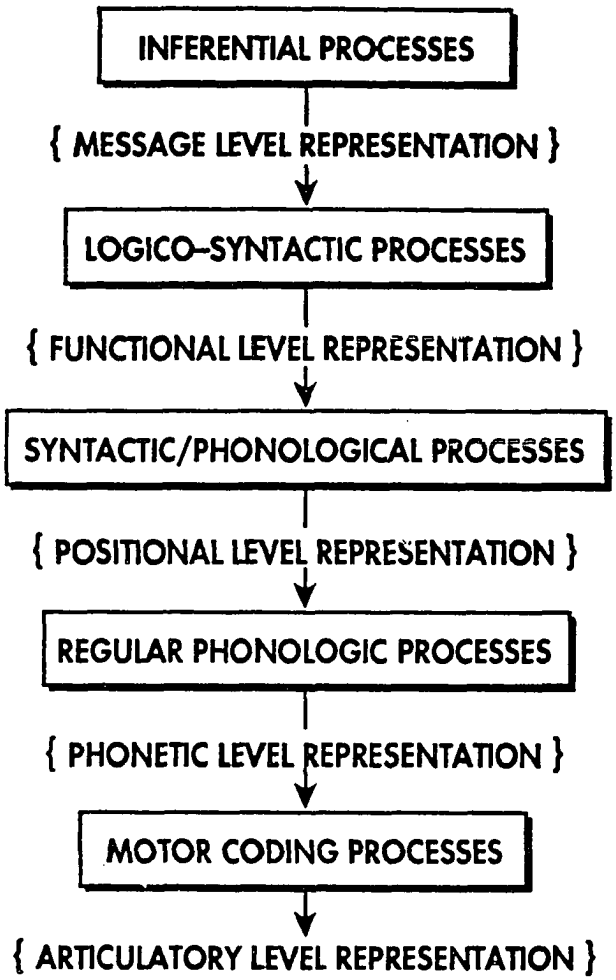


Figure 3.1 A diagram of Garrett's model of sentence production (adopted from Garrett 1984: 174).

are available for mapping onto the first linguistic level, the Functional Level. The propositional vocabulary and syntax is assumed by Garrett to approximate functional level representations in predicate-argument notation. Garrett does not commit himself to one clause at a time at the Functional Level, since as he demonstrates, word exchanges (discussed below) often cross clausal boundaries.

The Functional, Positional and Phonetic Levels of representation are responsible for the lexical specification and phrasal arrangement of an utterance. The logical and syntactic processes operate on the Message Level to produce the first linguistic representation - the Functional Level. This level is proposed to account for slip data such as meaning based substitutions, and whole word exchanges. For example, (Garrett 1984:176)

(8) "He rode his bike to school tomorrow"
(T= .. to school yesterday).

(9) "You're not allowed to put use to knowledge"
(T= .. put knowledge to use).

Functional Level processes (see Figure 3.2) include the determination of functional structures, the first lexical look up, which is meaning based, and lexical assignment to phrasal roles. Errors that occur at the Functional level are of corresponding grammatical roles (i.e. nouns or verbs) in distinctly different phrases.

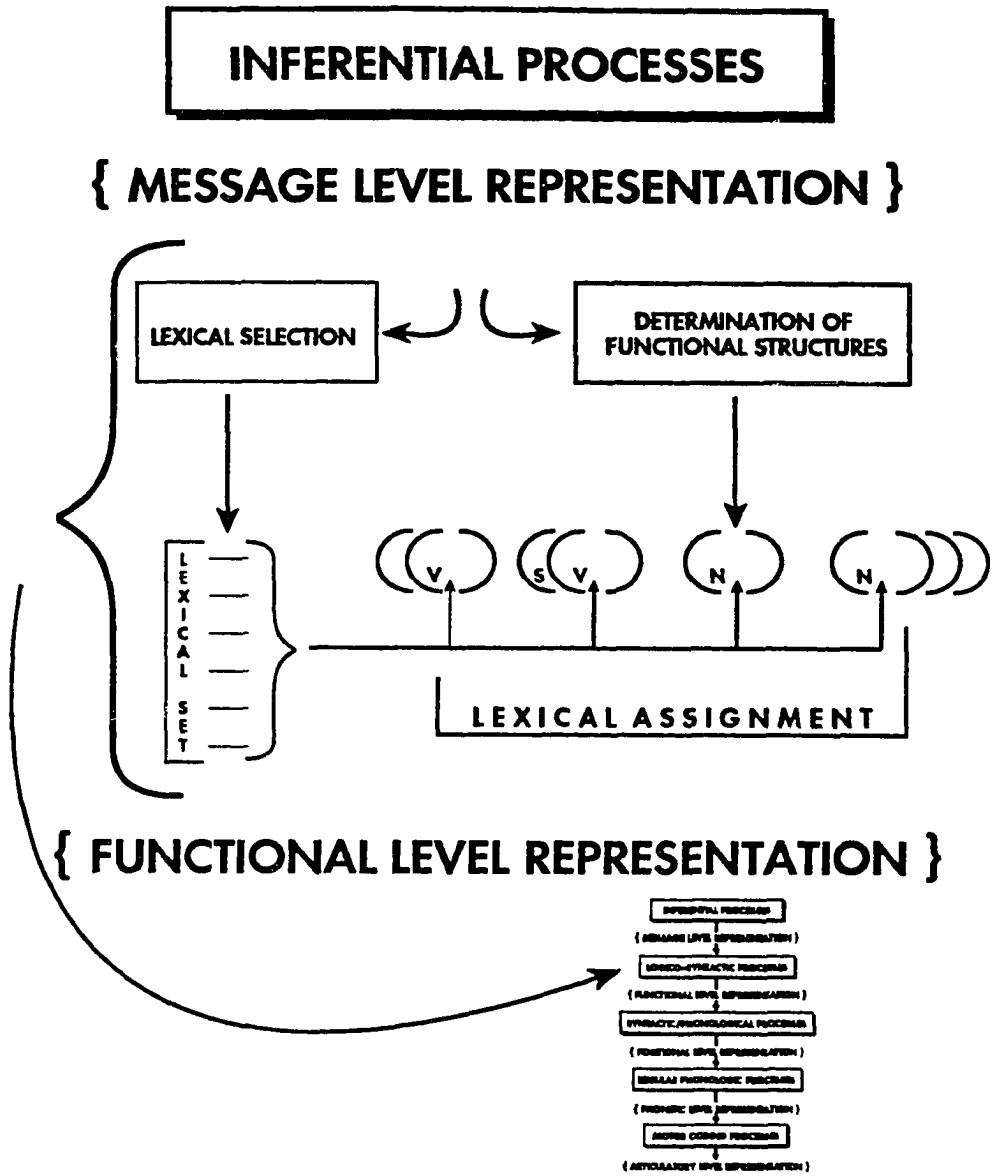


Figure 3.2 A diagram of the computational processes that map the Message Level Representation to the Functional Level Representation in Garrett's model of sentence production (adopted from Garrett 1984: 176).

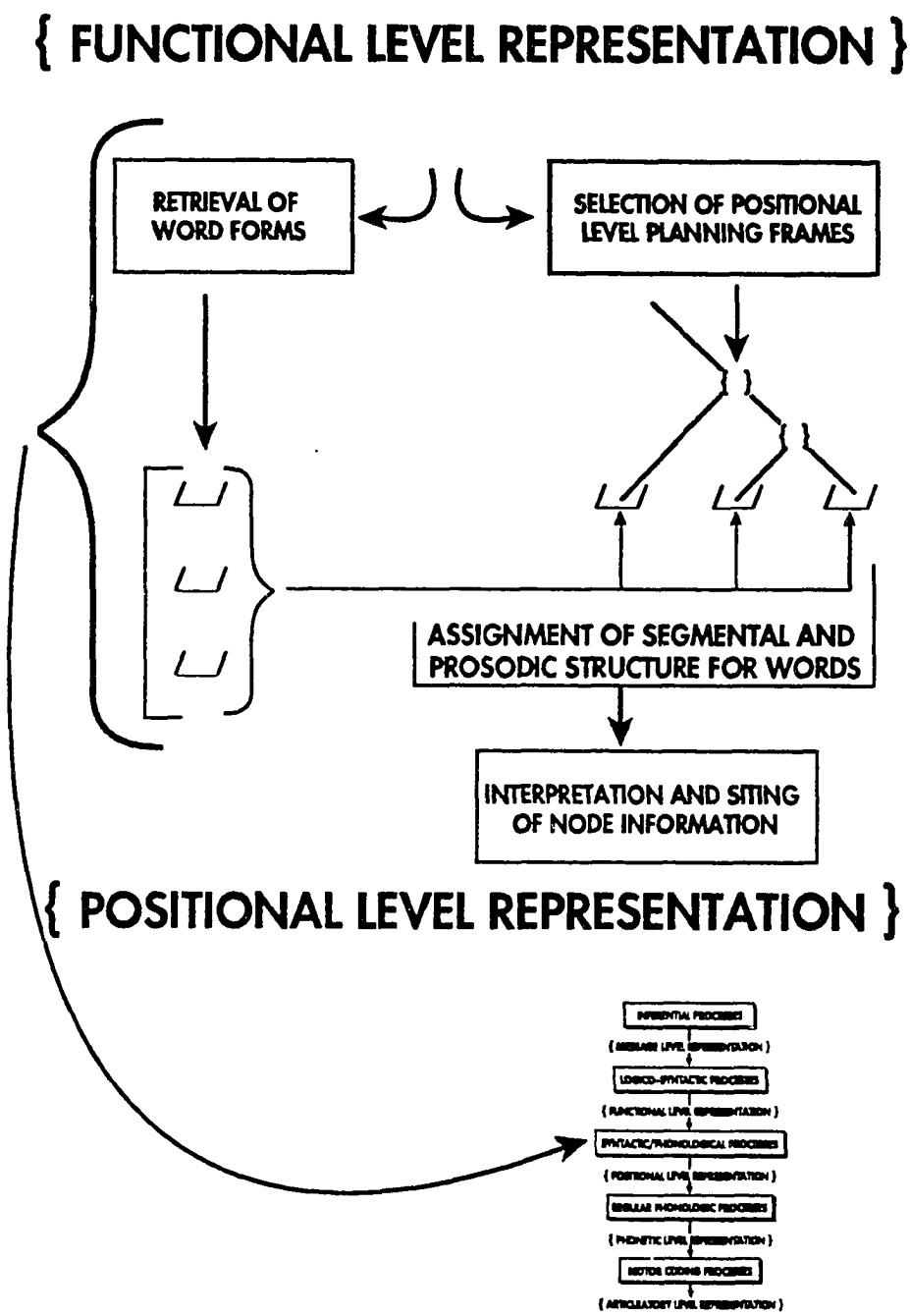


Figure 3.3 A diagram of the computational processes that map the Functional Level Representation to the Positional Level Representation in Garrett's model of sentence production (adopted from Garrett 1984: 178).

The syntactic and phonologic processes, the third set, operate on the Functional Level to yield the Positional Level, which reflects the surface sequence of elements. This transition involves processes such as the second lexical look up, which is form based, assignment of lexical forms to phrasal positions, determination of phrasal geometry and interpretation of node information (see Figure 3.3 above). This is based on slip data that involve form based substitutions, sound exchanges, stranding exchanges and shifts (see examples (10-13) Garrett 1984:176). Garrett is not explicit on the nature of the phonological information transferred from the lexicon to the planning frame. However, it is assumed to be a phonemic representation.

(10) "a slip which considered"
(T= consisted)

(11) "a disorder of speech, spictly streaking, is.."
(T= .. strictly speaking)

(12) "It waits to pay"
(T= .. pays to wait)

(13) "You have to do learn that"
(T= you do have to learn that).

The two levels are postulated to account for the fact that meaning based substitutions are not related in form and, conversely, form based substitutions are not related in meaning. In addition word exchanges cross phrasal boundary, while sound transpositions and exchanges are phrase or clause internal.

Exchanged sound elements are similar, but there is no evidence of form similarity for word exchanges, again, because they are presumed to occur at the Functional Level.

An important distinction the model makes is the distinction between content and function words (open and closed class vocabulary, respectively), which show different type errors and seem to play different computational roles in the sentence production. Word and sound exchanges and meaning and form based substitutions involve content words. The processes described above of selection, retrieval and assignment apply only to this class of lexical items. Both free and bound function words are introduced as features of the planning frame, since they are not involved in exchange processes. When content words exchange they strand the closed class items (see example (12) above). Garrett (1984) points out that closed class vocabulary items appear to be insulated from exchange processes. The model predicts that exchanges between, for example, inflections will never occur. They do, however, get misplaced during the interpretation of the features of the phrasal frame, and they shift (see example (13) above). Function words are not subject to sound exchange errors on Garrett's view because they are already specified in the matrix frame structure at the positional level. Thus, for Garrett, the function versus content word distinction is built in to the architecture of the model.

The Phonetic Level representation results from the application of the regular phonological processes to the Positional Level. This is postulated by Garrett to account for accommodation errors, where the phonetic character of the error conforms to the regular constraints of the language. For example, (Garrett 1984:180):

(14) "a money's aunt"
[z]
(T= an aunt's money)
[s]

where the form of the indefinite article (an) and the shape of the inflectional possessive morpheme (-s) accommodated to the new error induced environment. These phonetic accommodations show that the phonetic character of elements is not specified until shifts or sound exchanges are completed at the Positional Level. The last set of processes transforms the phonetic level representation into actual articulatory commands for production. The prosodic and phonetic structures are translated into commands for respiration and articulation.

The debate over how different levels of processing communicate guided most of the studies on models of sentence comprehension or production. One position argues for autonomous processing 'modules' in which each module computes a level of representation. The output of higher level units serves as input and influences lower level units. The alternative position is to have a highly interactive system in which parallel

processing takes place at a number of different levels with information from different levels communicating freely throughout the system.

Garrett's model outlined above has a built in assumption that the Functional Level operations are unaware of information available at the Positional Level and that Positional Level operations are also unaware of information processed at the Functional Level. This independence of levels results in the interpretation of these operations as serial. Thus, they are treated as real-time constructs operating along the time dimension and they cannot communicate with each other; they are "cognitively encapsulated," in the sense of Fodor (1983). The processing of one level must be completed prior to the initiation of the other level.

Dell & Reich (1981) and Dell (1990) challenged Garrett's claims about the autonomy of the stages of sentence production. Dell and Reich (1981) found a higher than chance level of phonological bias in semantic based errors. They also indicated that a number of speech error phenomena exhibit interactions between the Functional and Positional levels. For example, sound errors tend to create more words than non-words, phonological and semantic similarities raise the probability of lexical substitutions, and that words that are involved in sound errors tend to be phonologically related. They argued that such findings rule out the serial and autonomous interpretation of

Garrett's model. Conversely, therefore, Dell and Reich opt for an interactive and parallel interpretation to account for such biases. Garrett, however, points out that if there were a lexical bias, then there should be some effect of frequency of occurrence. In other words, the products of sound errors should be words that occur more frequently in the language.

Recognizing, however, the plausibility of 'pseudo-parallel' processing between levels, Garrett points out that,

> "The evidence is somewhat mixed, but fairly summarized by saying that in those cases where informational contact seems a bit promiscuous for a modular system, it also seems describable in terms of purely lexical processes. The evidence of separation of effect in the systems that determine sentence form is better than that for insulation of the corresponding classes of information associated with lexical items." (Garrett 1988:93).

CHAPTER FOUR

THE STRUCTURE OF ARABIC

This chapter will not present a complete analysis of the structure of spoken Arabic, since that is not the scope or purpose of this dissertation. However, a brief description of the morphological complexity of the Hijazi spoken dialect relevant to the data analysis to follow in chapter five is necessary (see Appendices A, B and C for notes on the transcription).

4.1. Zero-Copula:

In sharp contrast to English where every sentence must contain a verb, Arabic has two types of sentences, one of which (the equational sentence) does not require a copula. For example, Arabic has sentences like the following:

(1) as-sayyaara jadid-a
d-CARf new-f
The car (is) new.

(2) as-sayyaara aj-jadid-a Hamra
d-CARf d-new-f REDf
The new car (is) red.

(3) as-sayyaara taHat
d-CARf below
The car (is) below/downstairs.

(4) sayyaara-t maHamad fi-l-garaaj
CARf-g Mohamad in-d-garage
Mohamad's car (is) in the garage.

where the predicates in the sentences do not contain the copula. Prepositions such as 9ind 'at', ma9 'with', and 9ala 'on/against' are sometimes suffixed with clitic personal pronouns and used in equational structures (for examples, see the pronominal paradigm, section 4.5 below). The copula does, however, obligatorily surface with the perfect (past) tense and exhibits the regular verbal affixation of the nominal personal clitic pronouns (kunt 'I was', kunti 'you(f) were', kunt 'you(m) were', kaan 'he was', kaanat 'she was', kunna 'we were', kuntu 'you(pl) were', kaanu 'they were'). For example,

(5) as-sayyaara kaanat jadid-a
d-CARf pstBE3sf new-f
The car was new.

(6) feyn kaan ad-daktoor?
where pstBE3sm d-doctor?
Where was the doctor?

4.2. Word Order:

The issue whether or not Arabic is an SVO (Subject, Verb, Object), SOV, VSO, etc., language is still unresolved. In any event, Arabic does allow some flexibility with word order. In the first example below (7) the subject precedes the verb and in the second one (8) the order is reversed without altering the sentence meaning.

(7) maHamad jaa
Mohamad pstCOME3sm
Mohamad came.

(8) jaa maHamad
pstCOME3sm Mohamad
Mohamad came.

The same is true in a zero-copula sentence. For example,

(9) al-bint hinaa
d-GIRLf here
The girl (is) here.

(10) hinaa al-bint
here d-GIRLf
The girl (is) here

The same pattern is observed in a passive sentence. For example,

(11) anDarab maHamad
pasBEAT3sm Mohamad
Mohamad (was) beaten.

(12) maHamad anDarab
Mohamad pasBEAT3sm
Mohamad (was) beaten.

This word order flexibility holds true even with embeddings, where the head noun in a relative clause construction (as subject or object in the relative clause) can precede or follow the relative clause itself without any change in meaning. For example,

(13) al-bint illi kallamt-aha raaHat
d-GIRLf that pstTALK1s-3sf pstLEAVE3sf
The girl that I talked to left.

(14) illi kallamt-aha al-bint raaHat
that pstTALK1s-3sf d-GIRLf pstLEAVE3sf
The girl that I talked to left.

Although case inflections on nouns marking subject - object thematic roles such as agent and recipient have been lost in the spoken dialects, the word order flexibility is still retained. For example,

(15) maHamad Darab 9ali
Mohamad pstBEAT3sm Ali
Mohamad beat Ali.

(16) 9ali Darab-u maHamad
Ali pstBEAT3sm-3sm Mohamad
Mohamad beat Ali.

In both sentences Mohamad is the agent and Ali is the recipient, and these roles are assigned in (16) merely by the addition of the cliticized accusative pronoun -u, coindexed with Ali as the object of the verb Darab 'beat'.

4.3. The Noun Paradigm:

Arabic nouns are either masculine or feminine. Inanimate nouns are arbitrarily marked for grammatical gender. Feminine nouns often end with /-a/ such as sayyaara 'car', Taawla 'table', and daktora 'female doctor'. Adjectives and verbs must agree with nouns in gender and number. For example,

(17) aT-Taalib-a aj-jadid-a
d-student-f d-new-f
The new female-student.

(18) aT-Taalib aj-jadid
d-student d-new
The new male-student.

where the adjective 'new' is marked in (17) with /-a/ to agree with the feminine noun Taaliba 'female student', while in (18) it is unmarked to agree with the masculine noun Taalib 'male student'.

The Arabic plural system is a rich one. There are three plural marking rules in Arabic. The first two are the additive rules for the regular plural marking (regular, classically known as "sound feminine/masculine plural"). The plural of feminine nouns is indicated by using /-aat/ suffixed to the end of the noun.

(19) Taalib-a -- Taalib-aat
student-f -- student-pf (students)

(20) sayyaara -- sayyaar-aat
CARf -- CAR-pf (cars).

Since the preferred syllable structure in Arabic is CV, the feminine singular marker /-a/ is deleted as a result of the addition of the feminine plural /-aat/, which also begins with a vowel (aa, ii, and uu in Arabic are treated as single long vowels). The regular plural of masculine nouns is the suffix /-iin/ added to the end of the noun. For example,

(21) muhandis -- muhandis-iin
engineer -- engineer-pm (engineers)

(22) musaafir -- musaafir-iin
traveller - traveller-pm (travellers).

The irregular plural marker (classically known as "broken plural") is a replacive morpheme which involves internal vowel changes, for example,

(23) kitaab -- kutub
book -- BOOKp (books)

(24) kursi - karaasi
chair - CHAIRp (chairs).

Although the dual marking system has disappeared from English since the Norman Conquest, it is an active morpheme /-eyn/ suffixed to the noun in Arabic. Since feminine nouns end in a vowel /-a/ and the preferred syllable structure, as mentioned above is CV, an epenthetical /-t-/ (also known as the feminine /t/) appears between the feminine /-a/ and the dual suffix /-eyn/. For example,

(25) walad - walad-eyn
boy - boy-dl (two boys)

(26) sayyaara - sayyaara-teyn
CARf - CARf-dl (two cars).

4.4. The Adjective Paradigm:

Adjectives in Arabic sentence structures follow the nouns they modify, and they agree with them in number and gender. The gender agreement, however, operates only on singular nouns. For example,

(27) walad Tayyib
boy good
(a) good boy.

(28) bint Tayyib-a
GIRLf good-f
(a) good girl.

(29) awlaad/banaat Tayyib-iin
BOYp/GIRLp good-pm
good boys/girls.

When they act as modifiers they also agree with their head nouns in the definite/indefinite dimension, whereas, when they function as predicates in zero-copula sentences, agreement is not necessary. For example,

(30) walad Tayyib
boy good
(a) good boy

(31) al-walad aT-Tayyib
d-boy d-good
The good boy

(32) al-walad Tayyib
d-boy good
The boy (is) good.

Number agreement is either singular or plural. When dual nouns are used then the following adjective is pluralized. For example,

(33) awlaad Tayyib-iin
BOYp good-pm
good boys

(34) walad-eyn Tayyib-iin
boy-dl good-pm
Two good boys.

The comparative and superlative forms are not inflectional in Arabic as they are in English. They are derived forms. For example,

(35)	kabiir	akbar	al-akbar
	big	bigger	biggest
(36)	Saghiir	aSghar	al-aSghar
	small	smaller	smallest.

The number and gender agreement is not a parameter with the comparative or superlative forms.

4.5. The Pronominal Paradigm:

The free and bound forms indicate the gender distinction in the second and third person for the singular, but the distinction is neutralized with the plural forms. The full set of free standing pronouns is presented in Table 4.1 below. These free forms are used as subjects of zero-copula structures, with verbs as intensifiers, and with three pronouns in a row, where two are cliticized and the third one is a free form. For example,

(37) anaa Tayyib
1s good
I (am) good.

(38) huwwa katab
3sm pstWRITE3sm
He wrote.

(39) aktubi-l-i hiyya
impWRITE2sf-to-1s 3sf
Write it for me.

ARABIC	ENGLISH
anaa	I
intaa	you (m)
intii	you (f)
huwwa	he
hiyya	she
iHna	we
intuu	you (pl)
humma	they
xxxx	it

Table 4.1 The full set of free standing Arabic personal pronouns (there is no pronoun equivalent to "it").

ENGLISH PERSONAL PRONOUN	(A) SUBJECTIVE	(B) OBJECTIVE	(C) GENITIVE
he	**Darab**	Darab**u**	kitaab**u**
she	Darab**at**	Darab**ha**	kitaab**aha**
you (m)	Darab**t**	Darab**ak**	kitaab**ak**
you (f)	Darab**ti**	Darab**ik**	kitaab**ik**
I (m,f)	Darab**t**	Darab**ni**	kitaab**i**
they	Darab**u**	Darab**hum**	kitaab**ahum**
you (pl)	Darab**tu**	Darab**kum**	kitaab**akum**
we	Darab**na**	Darab**na**	kitaab**ana**

Table 4.2 Clitic personal pronouns. In (A) and (B) they are affixed to the verb root /Drb/'beating.' In (C) they are affixed to the noun Kitaab 'book'.

Bound pronouns or clitics are shorter forms that exhibit the case distinction of nominative, accusative, and genitive case. Table 4.2 shows the different forms of these personal pronoun clitics suffixed to a verb and a noun. They are often affixed to prepositions as well, such as min-ak 'from-you' or 9ashaan-i 'for-me'.

With certain prepositions the pronouns act as subjects of zero-copula structures. For example,

(40) ma9-ak al-kitaab
with-2sm d-book
You (have) the book.

(41) 9ind-ana al-kitaab
at-1p d-book
We (have) the book.

Demonstrative pronouns are marked for number and gender. They, however, show the gender distinction in the singular form only.

	This	That
masculine	haada	hadaak
feminine	haadi	hadiik
plural	hadool	hadolaak

4.6. The Verb Paradigm:

Verbs in Arabic have a more complex morphology than English. Arabic verbs follow predictable derived form patterns, and each form is conjugated into the present or past tense form.

Every conjugation then shows the pronoun declensions. For example,

Pattern I: CaCaC is usually the perfect form which is equivalent to the simple past in English. For example, katab (he wrote), jalas (he sat), and daras (he studied).

Pattern II: CaCCaC is formed by geminating the second consonant. It has several meanings one of which indicates intensiveness. For example, kattab (he caused to write), jallas (he caused to sit down), and darras (he taught).

Pattern III: CaaCaC usually indicates a reciprocal action. For example, kaatab (wrote to somebody)and jaalas (sat with somebody).

Pattern IV: ?aCCaC which carries the meaning of 'become'. For example, ?aSbaH (became morning).

Pattern V: ?atCaCCaC gives the passive form of pattern II. For example, ?at9allam (he was taught).

There are over 50 combinations of patterns in Arabic. Table 4.3 shows the verb katab of pattern I in the maaDi 'perfect' and muDaari9 'imperfect' conjugations along with the pronoun declensions. The perfect indicates past time (equivalent to the English -d form) while the imperfect refers to present or future time (equivalent to the English -s form).

Arabic does not have any lexical auxiliaries equivalent to the English 'do', 'have', 'be' or modals, and there is no infinitive form of the verb. Following the classical grammarian

ENGLISH PERSONAL PRONOUNS	PERFECT	IMPERFECT
he	katab	yiktub
she	katabat	tiktub
you (f)	katabti	tiktubi
you (m)	katabt	tiktub
I	katabt	?aktub
they	katabu	yiktubu
you (pl)	katabtu	tiktubu
we	katabna	niktub

Table 4.3 The perfect and imperfect conjugations of the verb /ktb/ 'writing'.

tradition (see al-Kitaab by Siibawaih (796)), verbs are cited in the perfect form for 'he'. Variations within the same vowel pattern do occur such as CaCaC and CiCiC for pattern I, such as, kizib (he lied) and shirib (he drank). This variation is lexically determined.

The complex derivational nature of Arabic can be presented with this paradigm of 'write' represented by the triconsonantal root 'ktb': katab, kitaab, kaatib, maktaba, makaatib, maktuub, kutaab, maktab, etc.

4.7. Definiteness:

The definite article in Arabic is /al/. The alveolar liquid /l/ of the definite article completely assimilates to the place and manner of articulation of the following sound, if that sound is produced around the alveolar region. Such sounds include /s, S, sh, t, T, D, n, z, and r/. [These sounds were labelled 'sun letters' by the classical Arab grammarians, since the word shams 'sun' begins with one of them. The rest of the consonantal inventory are known as 'moon letters', since the word qamar 'moon' does not begin with an alveolar sound.] For example,

(42) al-kitaab
d-book
the book

(43) aT-Taalib
d-student
the student.

There are no indefinite articles in Arabic equivalent to 'a' or 'an' in English. However, indefinite nouns or adjectives are marked by the absence of the definite marker /al/.

4.8. Syllable Structure:

The preferred syllable structure in Arabic is CV, and although consonant clusters are undesirable they do occur in a small percentage of words (short vowels are generally inserted to break up consonant clusters). Few words begin with vowels but usually a glottal stop /?/ is inserted in the beginning to retain the CV structure. McCarthy (1981) has argued that inflectional and derivational distinctions do not apply to Semitic languages in general. He described the non-concatenative nature of Semitic languages in the sense that stems consist primarily of two discontinuous morphemes, one referring to the root which carries the principle meaning (e.g. /ktb/ 'writing') and the other being the vocalic pattern which gives the root its distinctive meanings (see Table 4.4 below). The root consists of tri- or quadriconsonantal units that are unpronounceable on their own. The stem is the result of mapping the vocalic pattern onto the root morpheme. The result of this mapping is a meaningful pronounceable lexical item. For example, in Table 4.4, the root /ktb/ is unpronounceable until the application of some vocalic pattern to instantiate the distinctive meaning associated with the resultant form.

VOCALIC PATTERN	RESULTANT FORM	DESCRIPTION	MEANING IN ENGLISH
CaCaC	katab	V, pst, 3, s, m	he wrote
yiCCuC	yiktub	V, pres, 3, s, m	he writes
maCCuuC	maktuub	participle	written
CiCaaCa	kitaaba	noun	writing
maCCaC	maktab	noun	office
CiCaaC	kitaab	noun	book
maCCaCa	maktaba	noun	library
CuCaaC	kutaab	noun	Qura'anic School
CaaCiC	kaatib	noun, agent	writer

Table 4.4 Distinctive meanings derived from the application of different vocalic patterns to the root /ktb/ with the principle meaning of 'writing'.

In autosegmental terms, McCarthy (1981) argues that the root morpheme is represented on an autosegmental tier and the vocalic pattern on another. These two are then mapped onto a third tier that represents the canonical syllable pattern of CVCV.

CHAPTER FIVE

DATA AND DISCUSSION

5.1. Case History:

T.A. was a 36 year old right-handed Saudi male. He was born in Makkah but grew up and received his education in the city of Jeddah. Before his illness he enjoyed good health and was holding a position as an investment manager in one of the leading international banks in the Kingdom. In May 1987, he suffered a sudden onset of vomiting followed by loss of consciousness. At the hospital he was confused, dysphasic, and had right-sided weakness. His first CT (Computerized Tomography) and MRI (Magnetic Resonance Imagery) investigations showed the presence of left temporal intracerbral haematoma of unknown etiology, which was evacuated surgically. When the patient developed epileptic fits postoperatively, two additional CT scans were performed which showed cerebral haemorrhage on both sides of the brain with a large area of cerebral haemorrhage in the left inferior temporal area bulging out of the bone flap due to massive brain edema. The bone flap was removed and the patient was ventilated. In July 1987 he had another CT scan in Riyadh, which showed that the associated edema was causing compression of the ventricles on the left side and a severe shift of the mid-line structures with no major changes in other brain structures. Due to logistical problems, copies of T.A.'s CT scans could not be obtained for inclusion in

this dissertation. The cliniconeurological findings presented below were abstracted from the patient's file.

The physical examination showed that he was conscious and was responding to painful stimuli. His pupils were equal and reactive and there was no neck stiffness. He was found to have mild palsy of the left sided upper motor neuron of the seventh nerve. He showed some right sided weakness and incoordination and exhibited expressive aphasia and occasional agression. He showed no sensory loss. He was mobile when discharged with the exception of a weakness in the right hand and right grip and a slight limp. Physical therapy and speech therapy were recommended but, unfortunately, there was no speech therapy available.

He was seen by a neurologist at Jeddah Hospital on February 1988 nine months after the initial onset. He had retained the mild hemiparesis and the expressive dysphasia. He was seen by the researcher shortly thereafter in February.

The first assessment by this investigator showed the patient to be very depressed. He had difficulty articulating words. His speech was hesitant, telegraphic (with some automatic speech). He used gestures, facial expressions, pointing, drawing, or variations in tone or combinations of all to help express himself. He was cooperative and his attention was good but easily fatigued. Despite his difficulty with words, his pragmatic use was preserved (e.g. commenting, explaining,

questioning, etc., were appropriate and communicative). His auditory comprehension as well as his visual comprehension were relatively intact. He had no left-right confusion and no neglect or agnosia. Writing was very limited, since he had great difficulty writing with his hemiparetic right hand. He wrote numbers when requested and accurately performed simple mathematical problems such as addition, multiplication, subtraction and division.

5.2. Data Collection:

The slip-of-the-tongue data were collected by the investigator during the period in which the aphasia data were collected. The slip collection followed the traditional notebook technique of recording on-line naturally occurring slips in the speech of close family, friends, and colleagues not, of course, of the aphasic patient T.A. The slips were written down in Arabic orthography immediately after being uttered, and then broadly transcribed. Phonetic discrepancies that could not be captured by the Arabic orthography (e.g. actual pronunciation of /q/ as /g/) were immediately transcribed using the IPA symbols. Notes on who said the utterance to whom, participants, context, etc., that may have contributed to the error were recorded next to each slip at the time of utterance.

For the aphasic data, the patient was seen at the Jeddah Hospital in Jeddah, Saudi Arabia, as an outpatient where testing

by the investigator took place in a small examination room to minimize distractions, noise, and family interference. The patient's output was recorded on a cassette player (REALISTIC MINISETTE - 15) using a Maxell 60 cassette and then broadly transcribed. To elicit the data, portions of the Western Aphasia Battery (Arabic version, in preparation) were administered to provide some structured settings which included naming, single word repetition, sentence repetition, picture description, reading aloud, and writing, in addition to math and drawing. Spontaneous speech was elicited through casual conversation with open-ended questions covering general topics (usually topics the patient preferred to talk about). All the orthographic tasks were written in large boldfaced Arabic orthography on 5" by 8" index cards. The picture stimuli included the picnic scene from the Western Aphasia Battery (see Figure 5.2, section 5.4) as well as a black and white drawing of a local scene (see Figure 5.3, section 5.4).

For the assessment of auditory verbal comprehension the patient was requested to perform three tasks. In the first task the patient was asked twenty yes/no questions ranging from "Is your name Ahmad?" to "Is Hadj obligatory for Moslims before the age of seven?". In the second task he was asked to point to thirty items within five different categories. The task consisted of real objects selected from everyday items and placed in front of him (e.g. cup, toothbrush, watch, etc.), pictures of the

same objects drawn on one index card, six blocks of colors presented on the same size index card, objects in the room, and his left - right body parts. For the third task he was requested to follow and fully perform ten orally presented instructions which ranged from "close your eyes" to "put the pen on the book and give me the watch."

Two major tasks were performed for the assessment of visual comprehension. The first task consisted of matching the written label of an object with the real item placed in front of the patient. These were the same six objects used in the verbal comprehension task. The second task was more complex than the first. Here, the patient was requested to point to the correct missing word to complete a sentence. Six sentences were written on index cards with dots indicating the missing word slot. Four answers, two syntagmatically and two paradigmatically related, were provided on the same index card, although there was only one correct answer.

Along with spontaneous speech, oral production was assessed on two additional tasks: naming and repetition. Ten familiar everyday objects were used and the patient was asked to name each item presented separately. He performed relatively poorly on this task although he gestured their functions. For the repetition task he was instructed to repeat after the investigator a total of ten words and phrases ranging from monosyllabic lexical items such as "door" to complex sentences

such as "Ahmad joined the army because he wants to serve his country."

Both writing and reading aloud were strongly objected to. He complied reluctantly to writing his name, address, a few numbers, and some letters of the alphabet.

Simple mathematical operations (addition, multiplication, substraction, and division) were presented on individual cards and he was instructed to select (point to) the correct answer from the four possibilities on the card. Using his left hand, the patient had no difficulty complying with verbal stimuli in drawing figures such as a circle, a house, a tree, a clock and a person, although he insisted he could perform better with his preferred but hemiparetic right hand.

The percentages of his correct performances are presented in Table 5.1. A binary scoring system of $\emptyset$ or 1 was used in evaluating T.A.'s performance. He received a score of 1 when he produced the correct response (even after repeated attempts), and a score of $\emptyset$ if he failed to.

TEST OF	TASK	DESCRIPTION	TOTAL # OF ITEMS	# OF CORRECT RESPONSES	# OF INCORRECT RESPONSES
Auditory Verbal Comprehension	I	Yes / No Ques.	20	20	0
	II	Real Objects	6	6	0
		Picture of Objects	6	6	0
		Colors	6	5	1
		Objects in Room	6	6	0
		Left / Right Body Parts	6	6	0
	III	Oral Commands	10	9	1
Visual Comprehension	I	Name / Real Object Matching	6	6	0
	II	Complete Sentence	6	6	0
	III	Visual / Aural Stimuli Matching	5	5	0
Oral Production	I	Naming	10	7	3
	II	Repetition	10	9	1
Other	I	Math	12	12	0
	II	Drawing	5	5	0

Table 5.1 T.A.'s scores on the Arabic version of the Western Aphasia Battery.

DESCRIPTION	# OF OCCURRENCES	PERCENTAGE OF TOTAL (n)
I. Lexical	**45**	**39.13**
Exchanges	8	6.96
Substitutions – meaning	14	12.17
Substitutions – form	4	3.48
Blends	19	16.52
II. Segmental	**64**	**55.65**
Exchanges – segments	27	23.47
Exchanges – roots	8	6.96
Anticipation / Perseveration	17	14.78
Substitutions	11	9.57
Deletions	1	0.87
III. Morphological	**3**	**2.61**
Shifts	1	0.87
Additions	2	1.74
IV. Syntactic	**3**	**2.61**
Blends	3	2.61
TOTAL	115	100.00%

Table 5.2 Classification of the Arabic corpus of Slips-of-the-tongue. (n=115)

5.3. Slips-of-the-tongue Data:

The slip data was catalogued according to observed similarities. Table 5.2 above shows the distribution of the errors along the traditional categories.

Lexical exchanges according to Garrett's model occur at the Functional Level during the first lexical assignment to functional slots and they usually occur in parallel constructions. As with the English data, lexical exchanges in the Arabic corpus occurred between members of the same grammatical categories. In example (1) the exchange took place between two nouns, ?akil (food) and 9aSiir (juice), both acting as direct objects of their respective verbs, kuli 'eat' and ashrabi 'drink'. The exchange demonstrates the two clause range at the Functional Level of Garrett's model.

(1) "kuli al-9aSiir w ashrabi al-?akil"
impEAT2sf d-juice and impDRINK2sf d-food
Eat the juice and drink the food
(T= kuli al-?akil w ashrabi al-9aSiir)
(T= Eat the food and drink the juice).

Both exchanged elements retained their definite status. The definite marker is, however, stranded in example number (2) where the second noun in the target was definite while the first one was not.

(2) "fii Saala fi-t-tilifown"
in HALLf in-d-telephone
(There is) a hall in the telephone
(T= fii tilifown fi-S-Saala)
(T= (There is) a telephone in the hall).

In general, the /l/ of the definite article /al/ assimilates to the place and manner of articulation of the following sound, if that sound is produced around the alveolar region (see section 4.7). In addition the vowel /a/ is deleted if the preceding word ends with a vowel to maintain the preferred CVCV structure. The definite article /al/ was stranded during the exchange in (2) and accommodated to its new environment in the error. In the target /l/ would have assimilated to /S/; but in the error it assimilated to /t/ to adjust to the new environment of tilifown 'telephone'. Garrett points out that post-error, correct accommodation processes argue for the existence of a subsequent phonetic level of representation, since the phonetic character of sound exchanges and shift errors that occur at the positional level remains undisturbed - being computed later in the processing.

When adjectives exchange, they occupy the same phrasal position. In Arabic, that position follows the noun that is modified. For example, when the adjectives kawitsh 'plastic' and shaami 'Syrian' exchanged in (3) they followed the head nouns jazma 'shoe' and lubaan 'gum'.

(3) "ishtareyt jazma shaami wu lubaan kawitsh"
pstBUY1s SHOEf Syrian and gum rubber
I bought a Syrian shoe and a rubber gum
(T= ishtareyt jazma kawitsh u lubaan shaami)
(T= I bought a rubber shoe and a Syrian gum).

The contrast between English, where the adjective precedes the noun, and Arabic, where it follows it, provides evidence that

these errors follow language specific word order restrictions. The morphophonemic accommodation observed in (3) with the conjunction corresponding to 'and' is worth noting. The regular phonological representation of the conjunction in Arabic is /wu/. When the following word, however, begins with a vowel, the vocalic component /u/ of the conjuction is deleted to maintain the preferred CV structure. On the other hand, the conjunction assumes a vocalic value /u/ in a C--C environment (i.e. when the preceding word ends with and the following word begins with a consonant). Thus, in the target, the surface phonological representation of the conjunction would have been /u/ in the consonantal environment of /sh/ and /l/. However, since the error no longer contains the C--C environment in the context of /i -- l/ of the error, the conjunction accommodated to the new environment by assuming its regular phonological form /wu/.

In example (4) below two verbs, Suk 'close' and aftaH 'open, exchanged and both retained their imperative form. (see, however, the aphasia data below for breakdowns in verb form production). The exchange here also demonstrates the two clause involvement at the Functional Level.

(4) "Suk fam-ak w aftaH xushm-ak"
impCLOSE2sm mouth-2sm and impOPEN2sm nose-2sm
close your mouth and open your nose
(T= aftaH fam-ak u Suk xushm-ak)
(T= open your mouth and close your nose).

As opposed to English errors where inflections such as past tense and plural are stranded in exchange errors, the

Arabic plural in example (5) (nujuum 'stars', the singular being najma 'star') below was moved along with the exchanged noun.

(5) "awarri-ik aD-Duhur fi-9iz an-nujuum"
preSHOW1s-2sm d-noon in-height d-STARp
I show you the noon in (the) height (of) the stars
(T= awarri-ik an-nujuum fi-9iz aD-Duhur)
(T- I show you the stars in (the) height (of) the noon).

This would imply that the full plural form is stored in the lexicon along with the singular, especially since irregular "broken" plurals in Arabic are not the result of affixation. Thus, the plural of kitaab 'book' is kutub 'books', while the plural of galam 'pen' is ?aglaam 'pens' and so on (see section 5.4.3 for a detailed discussion of regular/irregular plural forms in Arabic).

An exchange between nouns in a genitive construction where the possessive role is indicated by the cliticized forms /ik/ and /u/ of the personal possessive pronouns results in interesting errors.

(6) "shuufi raas-ik axu-u aTxabaT"
impSEE2sf head-2sf brother-3sm pasHIT3sm
See your head his brother (was) hit
(T= shuufi axu-ki raas-u aTxabaT)
(T= see your brother his head (was) hit).

The exchanged nouns in the above are not in a parallel construction, and the exchange resulted in stranding the possessive bound pronouns /ki/ 'your f.' and /u/ 'his'. /ik/ and /ki/ are morphophonemic accommodations of the genitive 'your f.'. /ki/ appears on words that end with a vowel to maintain the

CV structure. This error implies that the mechanism involved in pronoun processing is not the same one responsible for processing major lexical items. This would also imply that these clitic pronouns are psychologically realized as features of the planning frame at the positional level, since they are not involved in errors on the semantic level (see the aphasia data below in section 5.4 for additional comments on pronoun processing). In the Arabic speech error corpus, clitic pronouns were not involved in exchange or movement errors nor did they undergo any shift. They did not violate grammatical categories in that their subjective or objective forms appeared on verbs and the genitives appeared appropriately on nouns. However, they are involved in errors of misselection internal to their category in aphasia (see aphasia data below).

Meaning based lexical substitutions were more numerous in the corpus than form based lexical substitutions (see Table 5.2 above). The substitutions covered all major grammatical categories, nouns substituting for nouns (7) and adjectives for adjectives (8) and so on.

(7) "9ashaan al-9iid aj-jadiid"
because d-holiday d-new
Because (of) the new holiday
(T= 9ashaan as-sana j-jadiid-a)
(T= because (of) the new year).

(8) "ma-hum galiil"
neg-3p few
They (are) not few
(T= ma-hum katiir)
(T= they (are) not many).

(9) "ba9ad 9aam-eyn"
after year-dl
After two years
(T= gabil 9aam-eyn)
(T= before two years).

Garrett (1984) argues that meaning based substitutions such as (7-9) and lexical exchanges respect grammatical categories and syntactic roles and that they occur at the Functional Level. However, meaning based substitutions, unlike lexical exchanges, are assummed to occur during the first lexical look up rather than during the assignment to the functional structure. The substitutions here are motivated by similarity of meaning alone, since the targets and errors are not related in form. Typically, they involve paradigmatic substitutions, usually antonyms (8 (few for many) & 9 (after for before)) and co-hyponyms (7 (holiday for year)) (see Hotopf 1980). Although the substitution in (7) resulted in a masculine noun (9iid) as opposed to the feminine target (sana), agreement accommodated the error rather than the target and the adjective jadiid 'new m.' correctly agrees in gender with its new head noun (see, however, the aphasia data below for breakdowns in agreement).

Free prepositions (unlike bound prepositions) are involved in this type of substitution (example (9) above) acting as major

grammatical categories. However, pronouns have not been observed in meaning based substitutions, neither in their full free forms nor in their bound clitic forms. For example,

(10) "akkili-h mooya
impFEED2sf-3sm water
Feed him water
(T= sharribi-h mooya)
(T= drink him (some) water, i.e. make him drink water).

where substitution of the verb akkil (make someone eat) for sharrib (make someone drink) is noted. None of the slips collected by this author, however, demonstrate any substitution of subject or object clitic pronouns (again, see T.A.'s productions in section 5.4).

Dell and Reich (1981) point out that the probability of word substitutions is higher than chance when the target and error show strong semantic and phonologic similarities. Although this may be true with form related substitutions discussed below, none of the meaning based substitutions in the Arabic corpus bear any phonological similarity (also see the aphasic data below).

Form based substitutions were few in both the speech error and aphasia data, constituting less than four percent in the slips data. Although there are semantic similarities between tilifown and tilifizyown (occurring in both corpora), both being technologically new items, the substitution is more form motivated than meaning, since fidiyo 'video' would be a closer meaning substitute than tilifown. (see also aphasia data below).

(11) "majalat at-tilifown"
MAGAZINEf d-telephone
Magazine (of) the telephone
(T= majalat at-tilifizyown)
(T= magazine (of) the television).

(12) "turaasi"
HERITAGE
Heritage
(T= wuraasi)
(T= inherited).

Fay and Cutler (1977) studied form based substitutions and found that target and error shared initial segments, were of comparable length and had the same stress pattern. They point out that the likelihood for substitutions increases if they also shared morphological prefixes. Garrett (1988) adds that there is also a grammatical constraint such that the target and error correspond in grammatical category. Stemberger (1985) has argued that the phonologicial similarities of meaning based substitutions argues for a one step processing (instead of Garrett's proposed two steps), where spreading activation of meaning and form is done in one step. However, Garrett (1988) argues that the "segmental overlap" for form related errors is much higher than that for semantic related errors. In addition, he points out that within a semantic field, a higher likelihood of occurrence of form determined substitutions should be observed, but "no consistent effects were found." This motivated Garrett to postulate that form-based lexical substitution errors occur at the Positional Level during the second lexical look up.

Hotopf (1980) pointed out that synonymous substitution errors rarely occur and if they do, they go unnoticed except by the speaker him/her seif. However, he did point out that errors of synonymy do occur but they result in lexical blends. Garrett argues that lexical blends involve both the functional and positional levels of processing. Their locus originates at the Functional Level during the first meaning based lexical look up where two synonymous lexemes are simultaneously selected. They are carried subsequently to the Positional Level where both forms are selected during the second lexical look up. The resultant error combines parts of each, and the switch usually occurs at some shared segment (see Fay 1982). From my corpus, witness:

(13) "baTaaTim"
(T= baTaaTis and TamaaTim)
(T= potato and tomato).

(14) "shamiin"
(T= shumaal and yamiin)
(T= left and right).

(15) "al-?anbaar"
(T= al-?anbaa? and al-?axbaar)
(T= both words mean 'news').

The highest percentage of errors in the Arabic corpus, however, involves segments, constituting more than 56 percent of the total. Shattuck-Hufnagel (1979, 1983) proposed a scan-copy device to account for segmental errors. Figure 5.1, adopted from Buckingham (1985, 1986), shows a schematic

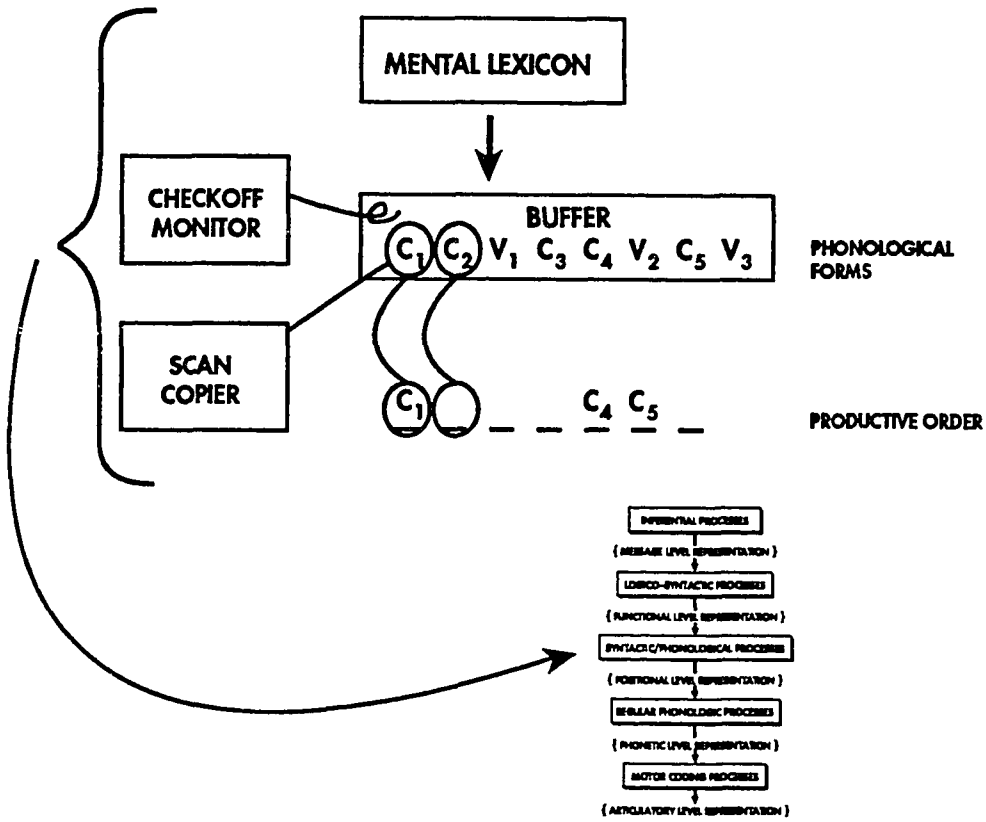


Figure 5.1 A representation of Shattuck-Hufnagel's serial ordering mechanism (adopted from Buckingham 1985: 129).

representation of how the stored lexical representations form the input to the articulatory command level. The reordering of the phonological representation forms part of the processes that operate at the Positional Level of Garrett's model. The phonological form of the lexical item is placed into the Buffer, a short term memory device that retains forms for further processing. The retreived lexical entries are coded for rhythmic (intonation, stress, pitch) and syllabic structure. The Scan Copier scans the segments in the Buffer and copies them into their productive order syllable template slots. The suprasegmental information and syllable structure presumably direct the Scan Copier into copying candidate segments into their appropriate utterance order positions. The Checkoff monitor checks off the copied segments to prevent reiterative copying of the same element.

Sound exchanges in the Arabic corpus outnumber the other type sound errors (e.g., anticipation/perseveration or substitution). Sound exchanges do not obey grammatical category restrictions since they are form related and are assumed to occur at the Positional Level (Garrett 1984).

(16) "bunaabi 9ala 9unni"
(T= 9unaabi 9ala bunni)
(T= Maroon on brown).

(17) "naami raayim"
(T= raami naayim)
(T= Rami (is) asleep).

(18) "aj-jins w al-ʔin"
(T= al-ʔins w aj-jin)
(T= The humans and the jins).

It is interesting to point out that error (18) demonstrates the phonemic psychological reality of the glottal stop /?/ in Arabic (exchanging with /j/). In addition, the definite article /al/ has undergone the morphophonemic accommodation /aj/ required for its new environment. The exchanges in (16-18) followed the same syllable restrictions imposed for the English data where the exchanged sounds moved from onset to onset. However, examples such as (19) and (20) below show segmental movements that violate this restriction.

(19) "jowz"
(T= zowj)
(T= pair).

(20) "nasf-i"
(T= nafs-i)
(T= my self).

Although in (19) the onset exchanged with the coda of the same syllable, in (20) the exchange occurred across syllable boundary, where the coda of the first syllable /f/ exchanged with the onset of the second syllable /s/. Note that the final /i/, the genitive marker 'my', in (20) marks a morpheme boundary. If the exchange took place after all morphological combinations are completed (i.e. the genitive morpheme is specified in the Buffer), /s/ is resyllabified to act as the onset of the second syllable. The error, thus, is the result of an exchange between the coda and the onset of two contiguous

syllables. If, however, the exchange occurred before the addition of the genitive /i/, then the error simply rearranged the consonant cluster sequence of the coda. This, in turn, would imply that clitic pronouns are not included in the Buffer. But, the error in (21) presents an interesting problem, since it is the opposite of (20).

(21) "badalu"
(T= balad-u)
(T= his country).

The elimination of the clitic pronoun, this time the genitive /u/ 'his' from the Buffer, would still lead to an exchange between an onset and a coda. The inclusion of the clitic will result in a normal exchange between two onsets, since /l/ would be resyllabified as the onset of the final syllable.

(22) "guSmaan"
(T= gumSaan)
(T= shirts).

Although the error above (22) includes a different kind of morpheme, this time the irregular plural morpheme, the exchange nevertheless involves an onset /m/ and a coda /S/, the exchange crossing contiguous syllables. The examples in (23) and (24) below are free of inflections and clitics and yet still exhibit the same phenomenon.

(23) "TawTiir"
(T= TaTwiir)
(T= development).

(24) "mi9laga"
(T= mil9aga)
(T= spoon).

The syllabification rules assign /T/ and /l/ in both targets respectively as codas of the first syllables and assign both /w/ and /9/ as onsets of the second target syllables respectively. The exchanges here are clearly between an onset and a coda of two different syllables. This consonantal movement disobeying syllabic slot restrictions is apparent in example (25) below.

(25) "Dalaam kaaHil , Dalaam kaaliH , Dalaam Haalik"
(T= Dalaam Haalik)
(T= dark pitch).

It is apparent from example (25) that the consonantal components of the root /Hlk/ are easily movable. It could be that the segmental units held in the Buffer for Arabic are the consonantal roots and that there are no restrictions on the movement of their components as to what syllable positions they will end up in. The question that can be raised at this point is: Do these errors present counter arguments for the syllable structure hierarchy and constraints proposed for comparable English data? Or, are there other facets to the phenomena?

The data below demonstrate that segmental exchanges are not limited to individual segments, but can involve complete root exchanges across words.

(26) "sugf u gaTaab"
(T= guTb u sagaaf)
(T= QuTb and Sagaf, two proper names).

(27) "dafa9 al-miDrab"
(T= Darab al-midfa9)
(T= Sounded the canon, i.e. the canon was fired).

(28) ?ashdaad-i ma9Suuba
(T= ?a9Saab-i mashduuda)
(T= my nerves (are) stretched).

In the above examples the triconsonantal roots have exchanged leaving the vocalic patterns behind. In (26) /gTb/ exchanged with /sgf/, and in (27) /df9/ exchanged with /Drb/, while in (28) /9Sb/ exchanged with /shdd/. These cannot be analysed as lexical exchanges occurring at the Functional Level because they violate grammatical categories; a noun and a verb in (27) and a noun and an adjective in (28). It is also interesting to point out that in every case above it was the consonantal roots that exchanged while the vocalic patterns did not seem to undergo these sound exchanges. In Arabic, the difference between grammatical categories is captured by the shape of the vocalic pattern. In other words, CaCaC will be a third singular masculine perfect form of a verb, while CaaCiC will be the agent form of a noun. This may account for the strength of vocalic patterns and their resistance to errors as well as for the fact that in the errors above the verb position or the noun position were both preserved by the vowel patterns. Errors (24-27) argue persuasively for McCarthy's (1981) proposal of the two discontinuous autosegmental templates, one for the consonantal root and the other for the vocalic pattern (see section 4.8 above). This division can be accommodated by Shattuck-

Hufagel's model. The vocalic pattern is the 'stable' part of the lexical phonological representation and must be a component of the syllabic template. On the other hand, the consonants are the segmental entries in the Buffer which are subject to scanning, copying, and checking and, therefore, subject to errors. It is also evident that these operations are subject to language dependent constraints.

When lexical items exchanged at the Functional Level (1-6) the words exchanged as whole units (consonontal root and vowel pattern). Compare example (29) with (30) below.

(29) "shiili boot-ik u jazmat axu-ki"
impREMOVE2sf boot-2sf and SHOEf brother-2sf
Remove your boot(s) and the shoe(s) (of) your bother
(T= shiili jazmat-ik u boot axu-ki)
(T= Remove your shoe(s) and your brother's boot(s)).

(30) "yiHilu-uk li-saab-ak"
(T= yisibu-uk li-Haal-ak)
(T= preLEAVE3p-2sm to-self-2sm,
i.e. they leave you to yourself).

A complete lexical exchange is shown in (29) while (30) exhibits a root exchange. (29) involves two members of the same category (i.e. the two nouns jazma 'shoe' and boot 'boot'), while (30) involves two members of different categories (i.e. a verb and a noun). These two different slips argue for two different levels of processing; one in which the word is processed as a whole unit, and another at which the roots and the vocalic patterns are decomposed. The level of decomposition corresponds to the level where grammatical categories are not relevant for

sound errors - the Positional Level of Garrett's model. This dissociation of consonantal roots from vocalic patterns is also observed in the lexical blends (13-15) above and (31) below.

(31) "daraarij"
(T= daraj + salaalim)
(T= both words mean 'stairs').

In every case, the resultant blend assumed the vocalic pattern of one of the competing lexical items. The vocalic patterns did not blend. Both intended forms in (31) are irregular plural forms for synonymous words for 'stairs'.

The issue of vocalic patterns raises another interesting point proposed by Dell and Reich (1981) in which they claim that spreading activation during processing activates all similar forms that share a phoneme with the target. However, due to the rhythmic nature of Arabic which is based on the vocalic patterns (e.g., kaṭab, daras, Darab 'wrote, studied, and hit', respectively), and also the relatedness of forms based on their shared root consonants (e.g., maktaba, maktuub, makaatib 'library, letter, and offices', respectively), the question one might ask is; due to the dissociation mentioned above, on what similarity basis does activation take place with Arabic forms? Or at what level does activation occur; the vocalic pattern, the consonantal root or at the level where they are combined?

Although other types of segmental errors, such as anticipation or perseveration discussed below did, affect functors such as prepositions (see example 33), root exchanges did not.

Example (32) below shows the root exchange stranding bound functors.

(32) "yasiiru bi-Huth-an xaTiiT-a"
(T= yasiiru bi-xuT-an Hathiith-a)
(T= preMARCH3sm with-STEPp-acc SERIOUS-f).

The bound preposition bi- 'with' and the objective case marker -an on the noun and the feminine marker -a on the adjective were all stranded. This root exchange must, therefore, occur at a level prior to the final assembly of all segments.

The failure of segmental errors in Arabic to obey syllable position constriants is also observed in the anticipation/perseveration type errors. Although 70 percent of these errors involved the movement of consonants into a corresponding syllable position (33-35), some did not (36).

(33) "raaD-9a 9an"
(T= raaD-ya 9an)
(T= pleased-2sf with)

(34) "tahdiid al-?ahdaaf"
(T= taHdiid al-?ahdaaf)
(T= parSET d-GOALp, i.e. setting the goals).

(34) "xafat al-xaraara"
(T= xafat al-Haraara)
(T= pstLIGHT3sf d-TEMPf,
i.e. the temperature went down).

(36) "beyT bi-T-TamaaTim"
(T= beyD bi-T-TamaaTim)
(T= EGGp with-d-tomato).

One can not argue that the anticipation of /T/ in (36) was triggered by the first occurrence of /T/, since it is the definite

article and its phonetic shape of /T/ is not realized until the Phonetic Level where all accommodations take place, (phonologically the definite form is /al/). Therefore, the anticipation is triggered by the first or second occurrence of /T/ of the lexical item, both of which are onsets of their syllables.

In all occurrences of segmental substitutions, the target and error segments differed in only one feature (also, for that matter the segments involved in the anticipation/perseveration category). For example, (37) shows a difference of voice - /gh/ for /x/, (38) a difference of place of articulation - /s/ for /sh/, and (39) a difference of the feature +emphatic - /T/ for /t/.

(37) "miin ?aghad al-baHth"
(T= miin ?axad al-baHth)
(T= Who pstTAKE3sm d-research).

(38) "?eys al-ghada"
(T= ?eysh al-ghada)
(T= What (is) d-lunch).

(39) "9aTaba"
(T= 9ataba)
(T= STEPf).

In the 64 segmental errors in the Arabic corpus, none involved the vocalic component of the phonological form.

5.4. Aphasia Data:

A corpus of 1831 words was obtained from T.A's spontaneous speech and the two picture description tasks. The mean length of utterance (MLU) was difficult to assess with high reliability. T.A. was a rapid speaker whose terminal points indicated by a falling intonation were very short. Unfilled pauses mostly indicated lexical searches. In addition, the investigator was expected to maintain a high degree of overlap (a feature of conversational style in Arabic) during the spontaneous speech segment to preserve the natural conversational structure.

Nevertheless, T.A.'s production displays a marked grammatical deficit as evident in the speech samples below. (40) is his attempt to describe the picnic scene from the Western Aphasia Battery shown here in Figure 5.2, while (41) is his attempt to describe the local scene shown in Figure 5.3 below. The third sample (42) was obtained from T.A. during the spontaneous speech session. In this last sample, T.A. was attempting to convey to the investigator his mother's treatment of his three sisters. One of T.A.'s sisters is a teacher and is not married, while the other one is a divorcee with two children (according to T.A., his mother was behind the divorce). The third sister is a doctor who lives in Riyadh with her husband and child (see Appendices A, B, and C for notes on transcriptions).

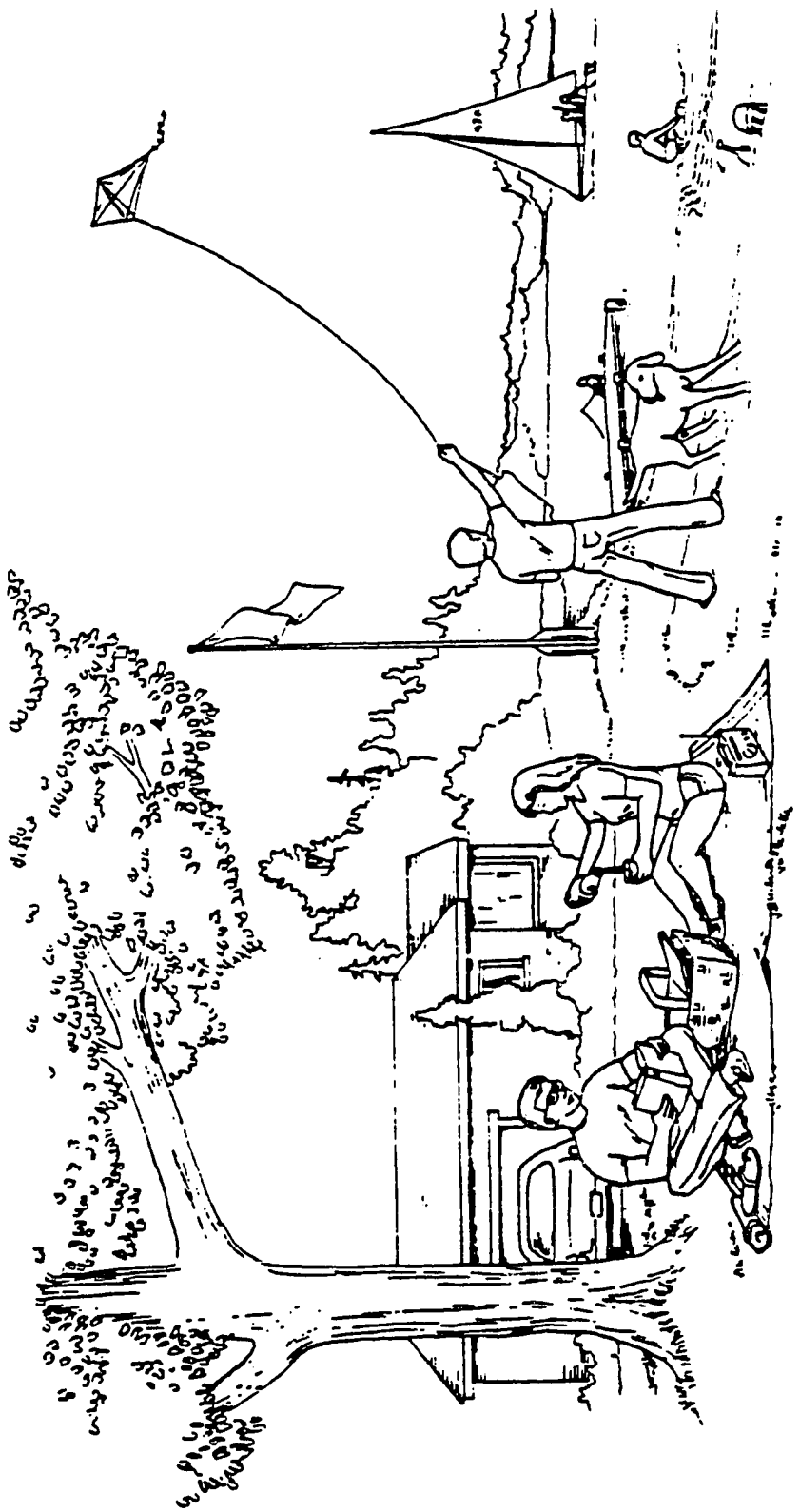


Figure 5.2.The Picnic Scene (Western Aphasia Battery)

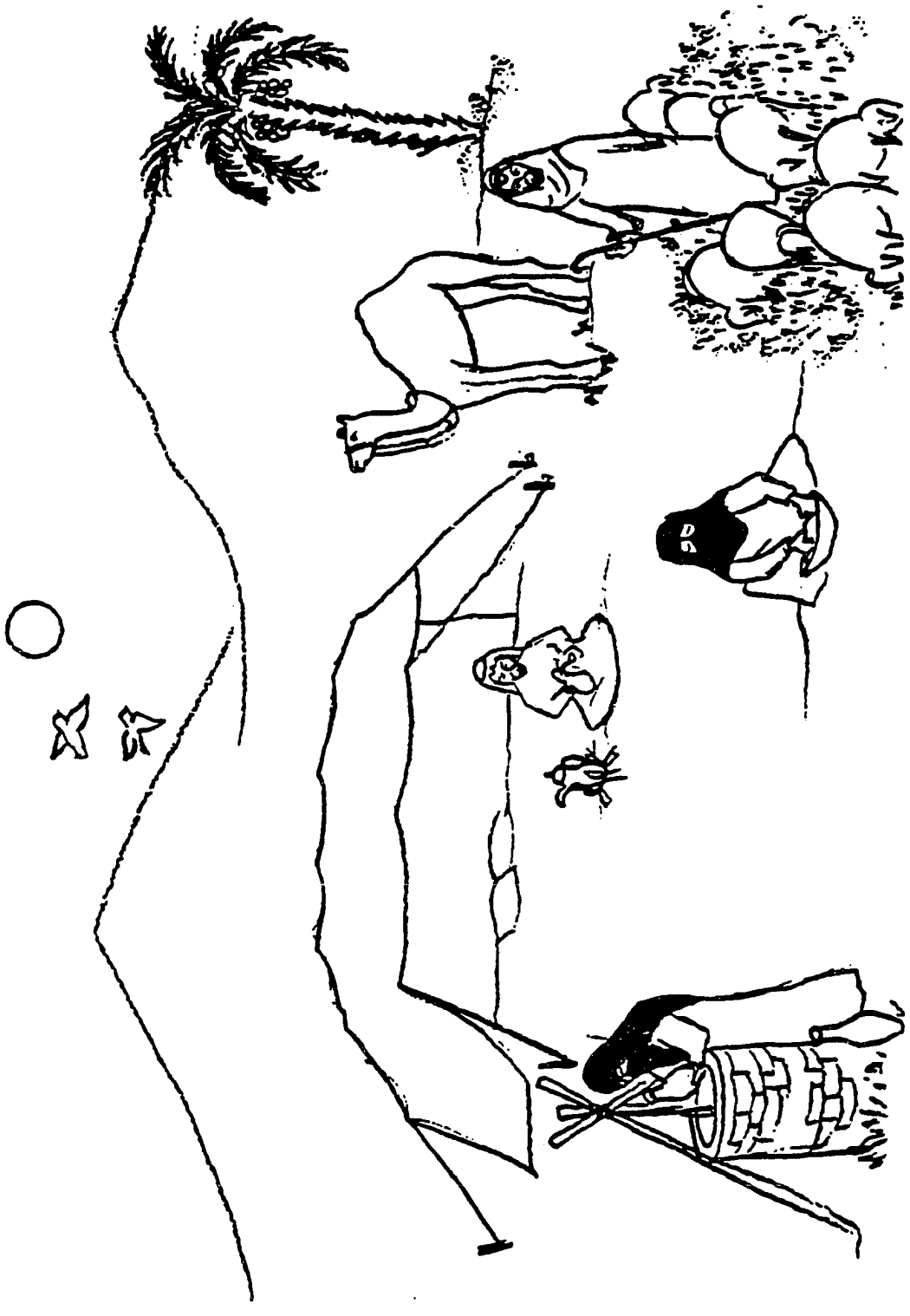


Figure 5.3. The Local Scene.

(40) "haadi 9ind-u waHda .. walad u bint wa .. wub ..
THISf have-3sm ONEf boy and girl and /../
This he has one boy and girl and

b , eybi Saghiir .. ba9deyn 9ind-u ... haadi 9ind-u
baby small , then have-3sm , THISf have-3sm
(a) small baby, then he has , this he has

Tay, Tayyaara [..] Saghiir-a , ba9deyn ... walad Hag
/../ , PLANEf [..] small-f , then , boy belongs
(a) small plane, then , (a) boy belongs (to)

al-a .. aa . 9alam .. ba9deyn hinaa boot .. a .. Sa ..
d- /../ flag , then here boat .. /../
the , flag , then here (is) (a) boat

aa , boot m, muu boo , haada boot , ba9deyn ...
/../ boat neg /../, THISm boat, then ,
boat, not , this (is) (a) boat, then ,

ba9deyn haada .. aa .. sa .. sa .. sam .. sana Hag
then THISm /../ belongs
then this belongs (to)

assana .. sanad hinaa , ba9deyn ku .. aa . buk biyi
/../ /../ here, then /../ book /../
here, then , (a) book

.. aa .. ba.. gi ..shajara .. ba9deyn .. haa .. aa . beyt
/../ TREEf , then .. /../ house
(a) tree, then , a house

haada , Saghii.. sawi sayyaara..9in-ahum.. ha..ta..aa .
THISm, /../ CARf , have-3p /../
this (is) , car, they have

ba . 9ind-u kamaan waHid 9ind-u.. talafown,muu tala
/../ have-3sm also one have-3sm , telephone neg /../
he has also one he has telephone, not

tal talafown aa . wa . mu , sajil musajil .. ya9ni .. ma ,
/../ telephone /../ recorder , I mean , /../
telephone , (a) recorder, I mean ,

mabSuT-iin an-naas yibgh , yibghu aakil ..
happy-pm d-PERSONp /../, preWANT3p food
the people (are) happy , they want food,

kofi walla shayy .. waHid yiji w
coffee or something , one preCOME3sm and
coffee or something, one comes and

at-taani mabSuuT , ma-hu..aa . fuu . beyt hinaa..shaa.
d-second happy , neg-3sm /../ house here /../ .
the other (is) happy, he (is) not , here (is) (a) house

shaa . aa . sa . siin .. aa . aa. siin.. Hag al-a .. al-boot
/...../ .. belongs d- , d-boat
/../ belongs (to) the, the boat

Saghiir .. ya9ni m .. haada raayHiin barra .. 9ind-u
small , I mean , THISm parGOp out , have-3sm
small I mean, this (are) going outside , he has

sayyaara Saghiir-a ba ... sayyaara wu beyt Saghiir uu ..
CARf small-f /../ CARf and house small and
(a) small car , (a) car and (a) small house and

maa ... fi-sh-shaari9 ma-hu fi-l-beyt .. mabSuT-iin
neg , in-d-street neg-3sm in-d-house , happy-pm
not , in the street, he (is) not in the house, happy,

ya9ni , maa.. uma.. alhamdillaa.. uu.. yimkin 9ind-akum
I mean , neg /../ thanks-to-allaah and maybe have-2p
I mean , not, thanks-to-Allaah , and maybe you have

hinaa akil Saghiir ma9-ana wu 9anni , mabSuT-iin an-naas"
here food small with-1p and /../ , happy-pm d-PERSONp
here small food with us and , the people (are) happy.

(41) "la? .. ya9ni haadi .. haaadiii fi-l-a .. fi-S-SaHaar ,
No , I mean THISf , THISf in-d- in-d-/../ ,
No, I mean this , this (is) in the , in the ,

fi-S-SaHaar .. waHid 9in-ahum bi-nafs-u , raaH
in-d-/../ , one have-3p with-self-3sm, pstGO3sm
in the , one they have by himself, went

yibgha .. aa .. yibgha .. fi-l .. balad .. balad hadool
preWANT3sm /../ preWANT3sm, in-d, town, town these
he wants , in the , town , these (are) town

kull-ahum .. aa .. muu ba , balad .. Ha . 9um
all-3p /../ neg /../ , town /../
all (of) them, not , town

.. muu 9umaal .. ya9ni su9uud-iin .. yiji
neg WORKERp , I mean Saudi-pm preCOME3sm
not workers , I mean Saudis , he comes

hinaa ..?aleyn daHiin raayiH .. badu badu ..
here, until now parGO3sm, BEDOUINp BEDOUINp
here until now he (is) going, bedouins, bedouins

raayHiin .. uu 9ind-ahum waHda masalan 9ind-u ..
parGOp and have-3p ONEf like have-3sm
they (are) going, and they have one like he has

aa . 9ind-u ... yiji , kul isbuu9 yiji
/../ have-3sm , preCOME3sm, all week preCOME3sm
he has, he comes every week he comes

hinaa , fi-sh-shaari9 haada hinaa ... yiji ,
here, in-d-street THISm here, preCOME3sm,
here, in the street this here, he comes,

ahlan-u-sahlan, ahlan , u raayH-iin .. huwwa
welcome, welcome , and parGOp , 3sm
welcome, welcome and they (are) going, he

yiruuH .. jidda almadina masalan bas huwwa waHid
preGO3sm , Jeddah Madinah like but 3sm one
goes like Jeddah, Madinah but he (is) one

9ind-u laazim .. 9ind-u .. aa . ba . aa , ba , akil fi-l-a..
have-3sm must , have-3sm /../ food in-d-
he must have , he has , food in the,

Ha .. Ham .. ru . ruma . rumaan , muu rumaan .. Ha ,
/../ pomegranates , neg pomegranates /../
pomegranates, not pomegranates

[..] .. aa , aa , yiji huwwa wu yiruuHu .. jidda ma ,
[..] /../ preCOME3sm 3sm and preGO3p , Jeddah /../
he comes he and they go, Jeddah ,

almadina laazim hinaa .. u ba9deyn hinaa wu
Madinah must here , and then here and
Madinah must here, and then here and

ba9deyn hinaa .. yiji .. haada Hagga ... ma
then here, preCOME3sm THISm /../ neg
then here, he come , this , not

yiji .. wu haada fii mooya .. fii mooya, fa-humma laazim
preCOME3sm , and THISm in water, in water, so-3p must
come and this (has) water .. (has) water, so they must

hinaa .. almadina jidda almadina , laazim
here .. Madinah Jeddah Madinah, must
here, Madinah Jeddah Madinah, must

mooya maa yigdar yiruuH .. tarararara , laazim hinaa .."
water neg preCAN3sm preGO3sm /../, must here
water, he can not go , must here.

(42) "agul-ak .. al-mushkila . ?umm-aha wu banaat-ahum
preTELL1s-2sm d-PROBLEMf mother-3sf and GIRLp-3p
I tell you, the problem , her mother and their daughters

kull-ahum .. ya-?ax-i . ?umm-i , ?umm-i waHda , sittiin
all-3p ..oh-brother-1s. mother-1s, mother-1s ONEf, sixty
all (of) them, brother, my mother (is) one, sixty

sana w aktar min sittiin sana . ma-hu .. bint ..
YEARf and more from sixty YEARf, neg-3sm,GIRLf ,
year(s) and more than sixty year(s), he (is) not, girl,

mudarris-a daHiin , min zamaan .. ma yibgha , xalaaS ..
teacher-f now, from past .. neg preWANT3sm , finish ,
teacher now, along time, he not want(s) , finish,

xallaS al , sittiin sana .. ma yibgha .. ?eysh
pstFINISH3sm d-, sixty YEARf ..neg preWANT3sm, what
he finished the , sixty year(s), he not want , what

yibgha? .. bi . min . vership ?aleyn daHiin ... w at-taani
preWANT3sm? /../ until now ... and d-SECONDm
he want? /../ until now, and the other,

. waHda [..] .. ba beybi itneyn , barDu 9ashaan .. aa .
ONEf [..] /../ baby two , also because /../
one, two baby(s) also because,

wu ma .. ?abgha-a min zamaan mm ?abgha wu balarlarlara,
/../ preWANT1s-3sm from past preWANT1s and /../,
want him a long time I want and,

w at-taanya , daktoor-a . fi-rriyaaD .. daHiin ..
and d-SECONDf, doctor-f in-Riyadh, now,
and the other (is) (a) doctor in Riyadh, now,

ma yiji-hum , daHiin mamnuu9 ba ... yibgha-ha
neg preCOME3sm-3p, now forbidden /../ preWANT3sm-3sf
he not come (to) them, now forbidden, he wants her

bas 9ashaan.. ma.. 9ind-u beybi.. walla ma yibgha-hum ..
only because.. neg.have-3sm baby or neg preWANT3sm-3p
only because, not, he has (a) baby or he not want them

al-ha..arri.. ar-riyaaD , mar, mu, muhandis , ma yiji-hum
d- /../ d-Riyadh, /../ engineer, neg preCOME3sm-3p
Riyadh , engineer, he not come (to) them

fi-l-beyt , xalaa .."
in-d-house, /../
in the house.

5.4.1. Problems with Data Analysis:

There are problems with the analysis of the aphasic data on at least two levels, one methodological and the other theoretical. Operating within the time constraints (a one hour session the investigator was allowed to spend with the patient), methodological considerations could not be rigorously observed. For example, realizing that the patient produced a high number of verbless sentences during the Picnic Scene's description, the investigator pressed the patient to describe what people were "doing" for the Local Scene description. This may account for the relatively higher number of verb occurrences in the latter. Cultural constraints and the inaccessibility of the patient resulted in the investigator's inability to verify or refine testing design or environment. In my data elicitation procedures, moreover, there may be some effect from the different task types used. In the picture description task, the patient is primarily in control of what referents will be identified, how they will be characterized and the extent to which information is verbalized. In the fact-to-face interactive conversation, there is a constant shift of who is in control, and the patient is not

typically able to create a monologue of his own design. However, given the topics of an everyday conversation, the patient may be able to call on already constructed chunks of discourse, describing family situations and relationships for example, whereas in the picture description task, the on-line construction of the discourse will be totally novel. Wallace and Canter (1985) have demonstrated that personally relevant language materials resulted in significantly better performance in comparison to personally irrelevant communication. These and other factors will variably influence the nature of the patient's output. Such variable effects were not controlled for in this investigation.

The lack of videotaping facilities rendered some of the data difficult to represent and interpret, since T.A.'s communication was by and large restricted to fragments or prefabricated expressions and so much meaning is embodied in paralinguistic information. The patient compensated for his expressive deficit by increased utility of nonverbal communication, such as mime, gesture, body posture, pointing, facial expressions, etc., which could not be captured in the auditory recorded data.

The theoretical difficulty with the data is related to what has been discussed by Brown and Yule in the subjectivity of representing normal 'text' (the transcription of tape recorded data). Brown and Yule (1983:11) point out that, since

> "a great deal of interpretation by the analyst has gone on before the reader encounters this data ... there is a sense, then, in which the analyst is creating the text which others will read."

Many theoretically relevant questions arise at this stage. Is the representation of the corpus a representation of the speaker's production or the hearer's (investigator's) representation of the production? And, is it a representation of the production or is it the investigator's interpretation of the production? Brown and Yule (1983:25) state that "what the textual record means is determined by our interpretation of what the producer intended to mean." Since we are dealing with aberrant data, and since there is no direct means of accessing the intended meaning behind many utterances, a number of plausibly competing intended targets can arise.

Accepting Caramazza's (1986) uncontroversial premise (which goes back to Hughlings-Jackson (Taylor (ed.) 1931)) that brain damage does not result in the creation of novel cognitive operations raises yet another theoretical problem. This problem rests with the uncertainty of whether utterances reflect the residual system in operation or compensatory strategies adopted by a self monitoring patient to overcome recognized difficulties. There is abundant evidence in my data, reinforced by many earlier observations on the use of paralinguistic signalling, that this patient is self-monitoring and is using compensatory strategies in communication. Does some deletion/substitution, therefore, adumbrate a difficulty in

producing the linguistic element or does it imply a conscious avoidance of producing an item that is plagued by error. For instance,

(a) "ba9deyn hinaa 0 boot"
then here 0 boat
then here 0 (is) a boat

can reflect either a deletion of fii 'there' or a strategy of substituting a gender neutral place deixis hinaa 'here' for an obligatorily gender marked demonstrative pronoun haada 'THISm'. Kolk et al (1985), discussed earlier in Chapter Two, have considered "agrammatic" speech "grammatical", since the simplification process under their formulation appeared to take place at the Message Level of Garrett's model as a compensatory strategy to overcome the syndrome.

In addition, the inaccessibility to the premorbid linguistic state of the patient further complicates the investigator's judgements on the status of linguistic units present in the patient's speech. For example, are lexical items, such as baby, coffee, one million, and nurse, part of the lexicon of this patient or are they the result of strategies adopted to compensate for a recognized difficulty with grammatical gender, since the English items are not marked for grammatical gender, while the Arabic equivalents would have to be. The desire for efficient communication and the ability to use alternative strategies may very well disguise the linguistic deficit. There is no simple answer to the question of whether hesitations, false

starts and phonological cueing reflect a lexical retrieval deficit or conscious attempts at self repair.

It is clear that T.A.'s speech does not in all cases permit facile interpretation, since it is not always possible to construct the intended elements from T.A.'s fragmented utterances. Before discussing, however, some of the decisions resorted to for the analysis, it is important to point out that alternative accounts of variable degrees of plausibility for the performance reported here may very well arise. Nevertheless, the approach adopted here is the most conservative in which the analysis is confined to the word or clause level. Variables that affect the processing of natural production at the Message Level, such as context and environment, age, sex, socioeconomic background, education, nationality, family, psychological state, and occupation of both the patient and the investigator have been left unspecified.

Paralinguistic information not represented in the transcription has been considered only when it contributed to an enhanced understanding of an utterance, and hence formed the basis of a particular interpretation. For instance, example (69) section 5.4.3, where 'pomegranates' substituted for 'dates' was identified as a meaning based substitution because the patient was pointing to the fruits on the palm tree in the Local Scene. Semantic paraphasias were defined as single word substitutions where the word produced bears a semantic relationship (antonymy, hyponymy) with an identifiable target.

The aphasic data had to be analyzed much more conservatively than the slips data largely because it was not possible to verify intended targets when phonemic distortions were observed. For example, the form /SaHaar/ is a possible version of the noun SaHraa 'desert' and could have been transliterated as such. That procedure was avoided in this analysis because the investigator would have been making very large assumptions about the patient's intentions. In an analysis that was concerned primarily with the nature of phonemic paraphasias, such data items would, of course, be the subject of great scrutiny and interest.

Other examples include possible complex transformations where a phonemic paraphasia may have occurred on a semantic paraphasia, example (b), and conceivable blends, example (c), as well as incomplete potential lexical items, example (d). Once again these data items were not transliterated.

(b) "?aHmad , "aswad"
(T= ?abeyaD , ?aswad 'white, black" - (semantic substitution) - ?aHmar 'red" ?aswad - (phonemic substitution) - ?aHmad , ?aswad

(c) "jaaHat"
(T= jaat 'she came' + raaHat 'she left')

(d) "Saghii"
(T= Saghiir 'SMALLm' or Saghiir-a 'small-f').

The symbol /../ has been used to represent phonologic material excluded in the transliteration and has been assigned to

hesitations and aborted utterances as well as partial phonemic segments that may be identified as attempts at partial production of expected elements. These elements, although interesting enough, have been excluded since they do not lend themselves readily to the analysis adopted here and cannot, at this stage, be given a psycholinguistic interpretation (see appendices A, B and C for additional notes and symbols used in the transcription).

5.4.2. General Features:

T.A.'s speech is characterized by: (a) short phrases, such as;

(43) "anaa ma ?agdar .. ma ?abgha .. Hagg-i Hagg-i"
1s neg preCAN1s, neg preWANT1s , belongs-1s belongs-1s
I can not , I want not , mine (is) mine.

(44) "walad Hag al-a .. 9alam"
boy belongs d-a .. flag
A boy belongs (to) the .. flag
(T= A boy is raising the flag).

(45) "ya9ni ma .. mabSuuT-iin an-naas"
I mean /../ happy-p the-PERSONp
I mean the people (are) happy.

(b) automatic speech, such as;

(46) "?alHamdillaa"
Thanks to Allaah

(47) "?inshaala"
Allaah's willing

(48) "ahlan-u-sahlan"
welcome

(49) "xalaaS"
finish

(c) the omission of main verbs, such as;

(50) "?intaa .. ∅ waHid taani"
2sm .. ∅ one second
you ∅ a second one.
(T= you [write] another one) (write -- ∅)

(51) "?abgha .. ∅ taani marra"
preWANT1s .. ∅ second time
I want ∅ a second time.
(T= I want to [send] a second time)(send -- ∅)

(52) "?eysh ?agdar .∅"
what preCAN1s . ∅
What I can ∅
(T= what can I [do]) (do -- ∅)

and (d) the omission of other contentives such as nouns or adjectives, for example,

(53) "9ind-ahum waHid, ?itneyn, talaata, ?arba9a ∅"
have-3p one, two, three, four, ∅
(T= they have one, two, three, four [N]) (noun -- ∅)

(54) "lamman .. ∅ .. muu ∅ .."
when .. ∅ .. neg ∅ ..
(T= when [V] , not [Adj]) (Adj -- ∅)

(55) "maf .. aa . ∅ .. ta .. ta9baan"
/../ ∅ /../ tired
(T= [N] tired) (N -- ∅)

T.A.'s speech is also marked with the omission of bound grammatical markers, phrases usually containing multiple errors. For example, (56) and (57) below demonstrate the deletion of the

definite article. Unlike English, the absence of an article in Arabic is not ungrammatical, since it indicates an indefinite noun. However, T.A.'s deletion in a semantically obligatory context is evident from the examples below, the intended nouns being definite (his house (56) and a particular member of the Royal family (57)).

(56) "ruuHt fi-ϕ-beyt"
pstGO1s in-ϕ-house
I went into (a) house
(T= I went into the house) (def -- ϕ)

(57) "madaam ϕ-?amiir ma jaa"
since ϕ-prince neg pstCOME3sm
since (a) prince (did) not come
(T= since the prince did not reply) (def -- ϕ)

Grammatical markers indicating number, such as the plural and the dual, have also been omitted. For example,

(58) "kul al-mudarris-ϕ ..ϕ 9abdalla kuwayyis"
all d-teacher-ϕ ..ϕ Abdallah good
All the teacherϕ ..ϕ Abdallah (is) good
(T= All the teacher[s] say Abdallah (is) good) (pl -- ϕ)

(59) "9ind-u talafown-ϕ ?itneyn"
have-3sm telephone-ϕ two
He has two telephoneϕ
(T= he has two telephone[s]) (dual -- ϕ)

T.A.'s difficulty with marking feminine gender as well as the genitive pronoun clitics is exhibited in (60) and (61) respectively.

(60) "?ajiib waHidϕ shaghaal-ϕ taaniϕ"
preBRING1s oneϕ servant-ϕ SECOND0
I bring one second maid
(T= I will bring another maid) (fem -- ϕ)

(61) "mu shuga-ϕ .. yimkin shugat , waHid taani"
neg APTf-ϕ .. maybe APTf one second
Not ϕ apartment, maybe the apartment of someone else
(T= Not [their] apartment, maybe ..) (gen -- ϕ)

Examples (62) and (63) below show the omission of free and bound prepositions in obligatory context.

(62) "?abuu-ya .. ϕ makka"
father-1s ϕ makka
My father ϕ Makkah
(T= My father is [from] Makkah) (prep -- ϕ)

(63) "ruHt-ϕ-ahum"
pstGO1s-ϕ-3p
I went ϕ them
(T= I went [to] them) (prep -- ϕ).

The structure of Arabic does not permit complete deletion of all grammatical morphemes, since the result would be unpronounceable roots of three or four consonants. It is, therefore, not unusual that we find a large number of substitutions of grammatical markers rather than deletions in this grammatical deficit. T.A.'s data sample is replete with mis-selections of grammatical markers that usually result in violations of gender (64), number (65), and tense agreement (66).

(64) "huwwa yijii 9ashaan umm-i yibgha ?al-akil"
3sm preCOME3sm because mother-1s preWANT3sm d-food
He comes because my mother wants the food.
(T= tibgha = preWANT3sf).

(65) "ad-dakaatra .. gaal ruuH al-beyt"
d-DOCTORp .. pstSAY3sm impGO2sm d-house
The doctors said go home.
(T= gaalu = pstSAY3p)

(66) "laazim ta .. a .. <name-f> .. raaH
must / ../ <name-f> .. pstGO3sm
<Female referent> must went
(T= tiruuH = preGO3sf)

Although Arabic has relatively flexible word order (see section 4.2 above), it is not a completely free word-order language, and certain word-order errors have been observed in T.A.'s speech. For example, free personal pronouns precede rather than follow verbs, and verbs precede their prepositional phrases. Both (67) and (68) are anomalous because they violate these word order principles.

(67) "<name-f> .. ma yiji-ha ?anaa"
<name-f> .. neg preCOME3sm-2sf 1s
<Female referent> he not come (to) her I.
(T= <name-f> .. ?anaa ma ?aji-ha)

(68) "fi-l-beyt ruuH"
to-d-house impGO2sm
To the house go.
(T= ruuH fi-l-beyt)

Word order violations have not been observed in normal slips and T.A.'s violations can be explained as efforts to correct recognized errors. In other words, in an attempt to repair, T.A. may have recognized the error in producing the third singular masculine form of the verb yiji 'he comes' instead of the desired first singular form ?aji 'I come' (example (67)), and as a

result produced the full form of the subject pronoun ?anaa 'I' (see also examples 104 and 105, section 5.4.5 below).

Compared to his relatively intact comprehension, naming and repetition (see Table 5.1 above), T.A.'s production exhibits a marked deficit on two major dimensions; (a) the mis-selection of grammatical markers exemplified primarily by the bound personal clitics, and (b) the lexical processing mechanisms involved in the selection, retrieval and production of content words (both of which will be discussed in detail in 5.4.4 and 5.4.5, respectively).

5.4.3. Aphasic Error and Slips-of-the-tongue:

Some of T.A.'s linguistic breakdowns can be readily correlated with errors from slips of the tongue in normals. Not unlike those in section 5.3, meaning based substitutions in the aphasic sample reflect a breakdown at the Functional Level of Garrett's model during the first lexical look up. Moreover, like slips, the verbal paraphasias occurred with all grammatical categories. For example,

(69) "rummaan"
Pomegranates
(T= tamur = dates)

(70) "9ummaal"
Workers
(T= badu = bedouins)

(71) "HuTT-u fi-l-akil"
impPUT2sm-3sm in-d-food
Put it in the food
(T= maTbax = kitchen)

(72) "?ashuuf"
preSEE1s
I see
(T= ?asma9 = preHEAR1s)

(73) "Saghiir"
Small
(T= galiil = few)

Similar to semantically based lexical substitution slips in normals, the aphasic errors here do not reveal any phonological similarities. The substitution in (70) retained the plural marking, which in both target and error is an irregular plural formation. It is also worth noting that of the 401 nouns produced by T.A. only 16 plural nouns occurred 14 of which were irregular ones that are internally marked by a change in vowel pattern (such as banaat 'girls', naas 'people' and dakaatra 'doctors', the singular forms being bint, ?insaan and daktoor, respectively), while only two carried the regular plural. The issue of regular versus irregular form processing will be discussed in more detail below.

Substitutions of pronouns (free or bound) were not observed in the slip data. However, as can be seen from (74) and (75) free form personal pronouns were substituted by the aphasic.

(74) "huwwa illi tibgha"
3sm that preWANT3sf
He that she wants
(T= hiyya = 3sf)

(75) "huwwa raaHu"
3sm pstGO3p
He they go
(T= humma = 3p)

The majority of T.A.'s free pronoun substitutions were unidirectional. In other words, if there was a substitution of a full form personal pronoun, it more often than not substituted with the third singular masculine form huwwa 'he'. Clitic pronoun substitution will be discussed in section 5.4.4.

Although not represented in the slips corpus collected by this author, substitutions of proper names have been reported before by Abd-El-Jawad and Abu-Salim (1987). Proper names were substituted when addressing or referring to one member of a group producing the name of another person in the group. T.A.'s sample contained instances of proper name substitutions, such as;

(76) "maajid"
(T= SulTaan)

(77) "Taarig"
(T= patient's own name)

In (76) the intended target and the error are both names of two highly influential brothers of the governing Royal family, both occupying high governmental offices: the minister of defense and aviation and the Amir (governor) of the city of Jeddah,

respectively. Taarig in (77) is the name of the patient's brother. Hotopf (1980) argues that the frequent use of names in similar verbal contexts causes them to lose some of their distinctiveness and trigger their substitutions.

The highly frequent and common intonational pattern of Arabic words mentioned above should result in more meaning based substitutions that are also closely form related according to the activation models proposed by Dell & Reich (1981), Fromkin (1985) and Morton & Patterson (1980). However, this does not hold, neither in the slips corpus, nor in the aphasia corpus. The majority of meaning based substitutions did not share any phonological similarity whether of the vocalic pattern or the consonantal root. Only two form based substitutions were noted in T.A.'s speech samples, the first one occurred in the description task of the local scene and the second one in the spontaneous speech portion.

(78) "balad hadool"
town these
These (are) town.
(T= badu = bedouins)

(79) "talafown"
Telephone
(T= talafizyown = television)

Although balad 'town' and badu 'bedouins' can be remotely related semantically since bedouins do not live in towns, the error is clearly more form related than meaning related. Both target and error are bisyllabic, share some consonants and have

the same first syllable and same stress pattern. The appreciation of meaning is clear with the presence of hadool 'these', since it indicates the plurality of badu the target. The substitution of talafown 'telephone' for talafizyown 'television' was noted earlier in the slips data (see example (11) in section 5.3 above).

In the corpus of 102 slips only one error involved the grammatical morpheme marking plurality. Error (80) below shows an incorrect addition of the regular feminine plural -aat to the intended singular feminine noun 9alaama 'point'.

(80) "9ishriin 9alaam-aat"
twenty point-pf
Twenty points
(T= 9ishriin 9alaama)

Arabic nouns preceded by numbers above ten retain their singular form. In other errors involving plurals discussed above, the plurality was unaffected by the errors. In other words, the intended target and the error produced agreed in number. In addition, they were all irregular plural forms marked by internal modifications rather than by an additive suffix similar to the regular plural marker -aat shown above. Errors of number marking are notably widespread in the aphasic data, usually also involving the regular dual -eyn and the regular plural -iin or -aat marking. Taken from the Picnic Scene description, the example below demonstrates the patient's difficulty with regular plurals. T.A. pointed to the group of trees in the background and produced

(81) "haadi Saghiir-a .. shajara shajara shajara
THISf small-f .. TREEf TREEf TREEf
(T= shajar-aat = trees).

Moreover, T.A. exhibited a tendency to repeat lexical items to indicate a more than once occurrence, in this case shajaraat 'trees'. Evidence from slips and aphasic errors shows that irregular plurals are treated by the processor as whole units (lexical exchanges involving irregular plurals moved their plural with them) while regular plurals are treated as separable units.

The slip data as well as the aphasia data lend support to Kiparsky's (1982) proposal of a two level lexical morphology. Kiparsky (1982) argues for Level I morphology which includes irregular inflectional/derivational morphemes that trigger phonological modifications, such as keep - kept and divine - divinity, in the base. Level II, on the other hand, includes affixes which do not trigger any phonological processes that affect the root morpheme such as -s, -ed, and -ing. Irregular plural marking in Arabic would belong to Level I morphology, since it conditions a quality change with the vocalic pattern for the derivation of the form. For example, CiCC (bint, 'girl') is singular while CaCaaC (banaat, 'girls') is the plural. At the same time, regular plural markings belong to Level II morphology, since they do not trigger any major changes in the stem. For example, muhandis 'engineer' is the singular masculine while muhandis-iin 'engineers' is the plural masculine. Level I morphology seems to require that there are separate lexical

entries in the lexicon for all related forms, while Level II morphology is more likely computed at the planning frame of Garrett's Positional Level, the root forms alone being stored in the lexicon.

The examples mentioned above are not atypical or unique to Arabic. Job and Sartori (1984) report a dyslexic Italian patient who makes more errors reading regular verb forms (e.g. mangio, mangiamo 'I, we eat') than reading irregular forms (e.g. vado, andiamo 'I, we go'). This pattern of error, they point out, can only be explained if irregular forms do not undergo any morphological analysis, have separate lexical entries, and are processed as whole units. They also point out that regular verbs are subject to more errors, since they require decomposition. The same finding was also reported by Kehayia, Caplan and Piggot (1984) for agrammatic patients who had more difficulty repeating words affixed with Level II morphology (goodness, worthless) than words affixed with Level I morphology (national, continuity). Thus, it appears that Level I has separate entries in the lexicon for morpheme alternates, which can be read without morphological parsing. It is not clear, however, how lexical items affixed with Level II morphology (regular inflection and derivation) are stored or accessed.

5.4.4. Grammatical Structures:

The majority of T.A.'s recoverable grammatical structures are equational sentences (zero-copula structures), which account for the false impression of fluency exhibited in the two descriptive tasks. There, T.A. produced rapid sequences of these equational structures. His speech was highly telegraphic on the spontaneous production portion of the battery. Yet, a closer examination of even his most basic equational structures reveals that grammatical markers are not intact, and his utterances usually contain multiple errors. The examples below (82-84) are extracted from T.A. description of the Picnic Scene in Figure 5.2 above.

(82) "ϕ shajara"
ϕ TREEf
(T= [haadi] shajara)
(T= [THISf] TREEf).

(83) "ϕ sayyaara"
ϕ CARf
(T= 9inda-hum sayyaara)
(T= have-3p CARf).

(84) "ma-hu ϕ jidda
neg-3sm ϕ Jeddah
Not 0 Jeddah
(T= ma-hu [fi] jidda)
(T= not [in] Jeddah).

Although copula deletion in Arabic is blocked in the past tense (see section 4.1), T.A. deleted the copula in this obligatory context. For example,

(85) "lamman ?anaa ϕ fi-l-bank"
when 1s ϕ in-d-bank
When I ϕ in the bank
(T= lamman anaa [kunt] fi-l-bank)
(T= when I [was] in the bank).

His preference for equational (zero-copula) structures does not indicate, however, an impoverished syntax. T.A. produced a large number of verbal constructions, coordinate and subordinate (both relative and noun clauses) structures and wh-questions. For example,

(86) "iza ?abuu-ya ma yigdar u huwwa illi ?abuu-ya"
if father-1s neg preCAN3sm and 3sm that father-1s
if my father can not and he that (is) my father, ..

(87) "xalli-i fi-l-a .. Saloon walla tibgha fi-S-Saloon"
impLEAVE2sm-3sm in-d- LR or preWANT2sm in-d-LR
Leave it in the LR or you want (it) in the LR.

(88) ma ?adri leysh maa .. yigdar"
neg preKNOW1s why neg . preCAN3sm
I not know why not he can.

Thus, his deficit does not seem to lie in the construction of relatively complex branching structures. T.A.'s difficulty, however, with morphemes indicating relations of 'agreement' such as gender and number and in particular personal pronouns is striking.

As mentioned above (section 5.4.3) T.A.'s free personal pronoun substitutions (examples (74) and (75)) were unidirectional. There were 105 occurrences of full form personal pronouns, an average of six percent of the 1831 total word

sample collected. This figure is twice as high as the three percent occurrence of free pronouns in a speech sample produced by the investigator during T.A. spontaneous speech assessment session. A high percentage (61%) of T.A.'s free pronominal forms are the first person singular form anaa. Although there is no statistical reference to compare to, this ratio would appear high, since subject (as well as direct object and indirect object) pronouns are usually cliticized and affixed to the verb form. In fact, the subject in particular is coalesced with the verb in the normal production (see chapter 4, section 4.6 above), and its appearance in full form is used only for emphasis. The second highest occurrence is the third person singular masculine pronoun huwwa 'he', which occurred 31 times - constituting 30 percent of the total free pronoun instances. Only in ten of these occurrences is it correctly coreferenced with its antecedent. In the other 21 cases huwwa replaced either the third person singular feminine hiyya (15 times or 48%) or the third person plural humma (6 times or 19%).

The difficulty in marking gender and number with personal pronouns is also evident in the cliticised forms. Where T.A. produced a total of 327 verb forms or verb groups (a verb group includes all the cliticized pronouns), 129 (39%) of them showed the cliticized subject pronoun form for third person singular masculine, followed by 111 forms (34%) of the first person singular form. After discarding 17 occurrences where

antecedents could not be retrieved, the high frequency of occurrence of the third person masculine form is further increased considering that 52 percent of them were incorrectly coreferenced, the antecedents being the patient's mother, the maid (both feminine), and his family (a plural antecedent). The examples below demonstrate these kind of errors.

(89) "9ashaan ummi yibgha al-akil"
because mother preWANT3sm d-food
Because my mother wants the food.
(T= tibgha = preWANT3sf).

(90) "<name-f> yigdar ∅ ?ingilizi"
<name-f> preCAN3sm ∅ English
<Female referent> can [speak] English
(T= tigdar = preCAN3sf).

(91) "Taariq u [..] kull-ahum ma yigdar"
Taariq u [..] all-3p neg preCAN3sm
Taariq and all (of) them not can
(T= yigdaru = preCAN3p).

(92) "an-naas yibgha-ni fi-l-beyt"
d-PERSONp preWANT3sm-1s in-d-house
The people want me in the house
(T= yibghu-ni = preWANT3p-1s).

In addition, when directly addressing the researcher, T.A. always used the clitic form of second person masculine rather than feminine. For example:

(93) "?ajib-l-ak"
preBRING1s-to-2sm
I bring to you
(T= ?ajib-l-ik = preBRING1s-to-2sf).

(94) "ma gult-al-ak"
neg pstSAY1s-to-2sm
I (did) not say to you
(T= ma gult-al-ik = neg pstSAY1s-to-2sf).

(95) "jiib-u"
impBRING2sm-3sm
Bring him
(T= jiibi-h = impBRING2sf-3sm).

It is important to point out that clitic pronouns have undergone major substitutions as is evident from the above discussion, but they have not been deleted. Slobin (1991) and MacWhinney and Osman-Sagi (1991) both point out that for Turkish and Hungarian, respectively, grammatical deficits do not result in the deletion of clitic pronouns but rather in substitutions, since they carry a high semantic informational value. Since they indicate subjects, objects, and direct objects they are better preserved than in analytical languages (such as English), which depend on word order. Slobin (1991) showed that both Turkish speaking Broca's and Wernicke's aphasics preserved the verb inflections, especially those of subject and direct object. A similar pattern was reported by MacWhinney and Osman-Sagi for Hungarian, another agglutinating language, where there were no omissions of subject and few deletions of direct objects. Menn and Obler (1989) also report the substitution of pronouns in other inflectional languages such as Finnish, Polish, and Icelandic. They also attribute the resistance to omission and the preference for substitution to the high semantic informational value encoded in pronouns. Blumstein,

Goodglass, Statlender and Biber (1983) point out that aphasics' pronoun comprehension decreased markedly when only syntactic cues were available for their interpretation. Recently, Frederici, Weissenborn and Kail (1991) compared the comprehension of pronouns in three different languages-French, Dutch and German. They show that their subjects (half for each language classified as agrammatic and the other half as paragrammatic) maintained a high level of performance on the comprehension of pronouns, which they attribute to the semantic information encoded in pronouns. Lapointe (1985) writes that the difference in behavior between function words either omitted or substituted (deletion in English, substitution in Italian) is related to the semantic load of each item in each language. In other words, those elements that do not (at the point of message construction) carry a high load of morphosemantic complexity are deleted, while those that do carry a semantic load seem to be retained or substituted.

Lapointe's argument lies in the distinction between the 'form' of grammatical markers and the 'functions' they serve. In general, a grammatical form such as the -ing verb form can serve a gerundive nominal, an action nominal, or a predicative nominal (Lapointe 1985:103). For example,

(96) (a) Mary's proving the theorem.

(b) Mary's proving of the theorem.

(c) Anne is walking.

It is the simplification of the semantic notions (functions), not of the verb 'form', that is the feature of aphasic syntactic deficits. He further elaborates these different semantic notions expressed by verb markers including notions such as the speaker's attitude about the truth of the utterance, voice, aspect, tense, and agreement. Within every semantic notion there is a hierarchy of subnotions. For example, within the semantic notion of agreement, subject is less complex than direct object, singular is less complex than plural, which in turn is less complex than dual. Third person is less complex than second person, which is less complex than first person. Within the semantic notion of tense, present is less complex than past and future, which are less complex than nonfinite verb forms. Therefore, in substitutions, the replacing item is one of the least complex combinations of these semantic notions.

Dealing with the production of verb forms in grammatical deficits, Lapointe points out that one is not dealing with an absolute restriction on what is and is not produced but rather with a hierarchical gradation of some sort - some forms are very likely to occur, other forms are produced sometimes but are less likely to occur, while others are rarely found at all. Exactly which forms fall into each of these groups for any patient is likely to be related to the severity of that patient's impairment as well as the structure of the language.

Lapointe, concerned mainly with verb phrases, provides an outline of a processing account based on an extension of Garrett's model to capture this substitution phenomena. He elaborates on the operations of a "Syntactic Processor" that is responsible for the production of verb phrases (as well as noun phrases). The Syntactic Processor is assumed by Lapointe to be part of the computations that map the Functional Level onto the Positional Level of Garrett's model. Although the input to his Syntactic Processor is not clearly defined, it is assumed to include information such as, indicative, active, present, singular, and third person specified by the Functional Level. This, in turn, would lead to the selection of a positional frame of the sort shown in figure 5.4 below (adopted from Lapointe 1985:130).

This 'fragment' represents the maximal phrase structure associated with any head category (a V, or a N), showing all the higher nodes (a VP, or an NP) and all lower nodes (stems and affixes). It includes slots defined as empty spaces under certain nodes, where the head lexical element (a verb) and dependent function words (auxiliaries) will be inserted. The circled nodes represent positions where other constituents (a NP), which have their own internal structure and fragments, can be attached. Lapointe proposes two separate stores, one contributes lexical head categories (N store, V store, etc.), while the other contributes the dependent function elements

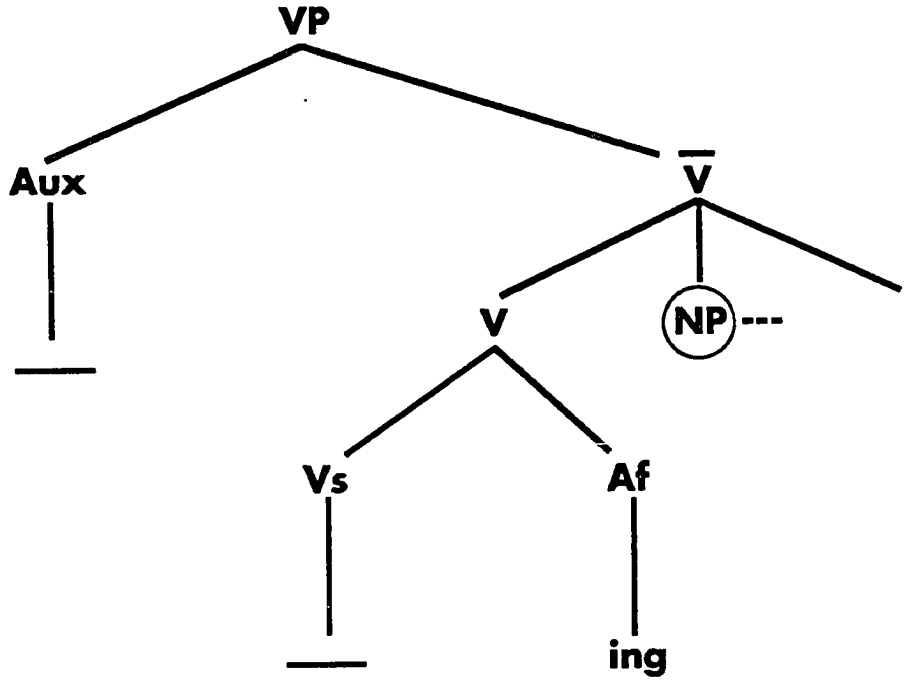


Figure 5.4 A verb positional frame (adopted from Lapointe 1985: 130).

(determiners, auxiliaries, etc.). The main function of the Syntactic Processor is to access fragments from these stores and combine them.

The other important aspect of Lapointe's (1985) argument rests with the internal organization of these stores. Lapointe argues on the basis of the morphosyntactic complexity mentioned above that a verb fragment store (for English) might look like the one shown in Table 5.3 below (adopted from Lapointe 1985:132).

The leftmost phrase structures are the least complex with increasing complexity moving right. In every column the least complex forms within each structural type are at the top of each column. For the auxiliary fragment store, Lapointe suggests the 'be' form occupy the leftmost column followed by the 'have' forms, then the 'do' forms and finally the modal auxiliaries (being the most complex).

Figure 5.5 shows the subcomponents of the Syntactic Processor and the operations it performs. It contains a Control Mechanism which receives input from the Functional Level and activates an address index to find the exact locations of the required cells in the fragment as well as the function word stores. The Control Mechanism then passes this information to the Locator. The Locator consists of a set of read/copy devices (not unlike the Shattuck-Hufnagel Scan-Copier device), one for each fragment store and one for each function word store. Each

V	Aux V+ing	Aux V+ed"	Aux being V+ed"
V+s	Aux been V+ing	Aux been V+ed"	Aux been being V+ed"
V+ed			
Aux V+ed			

Table 5.3 Verb Fragment Store for English (adapted from Lapointe 1985 : 132).

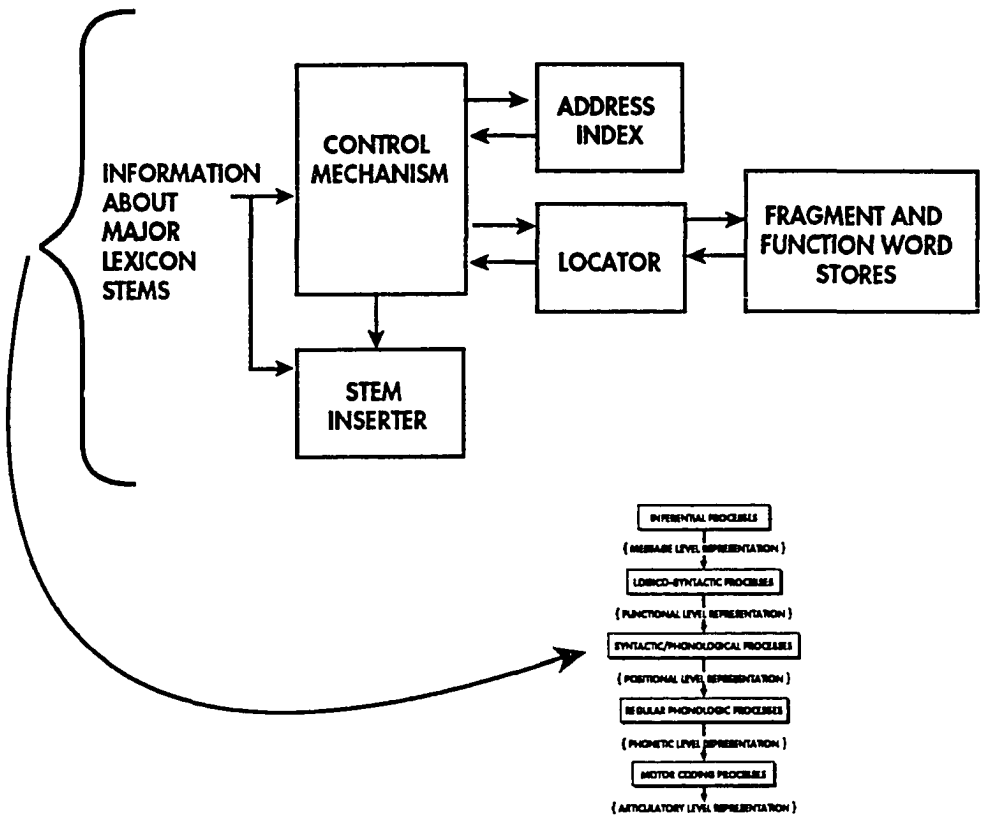


Figure 5.5 A diagram of Lapointe's "Syntactic Processor" as another component of the syntactic and phonological processes of Garrett's model of sentence production (adopted from Lapointe 1985: 133).

device can move along rows and columns. The read/copy device is at 'rest' in the top left hand corner of each store. Thus, the concept of the complexity of a form is computed on the basis of the distance the read/copy device has to travel to the required cell address and the energy expenditure on the round trip. The more complex the form, the more distance the device has to travel and the more energy expended. In addition, the device can only access one cell at a time per trip. When the Locator activates the relevant read/copy device the input is then transferred to the Control Mechanism, which then combines these fragments and function words and transfers the result to the Stem Inserter. The phonological representations which are the result of Garrett's second lexical look up are inserted by the Stem Inserter into the appropriate positions. Shattuck-Hufnagel's serial ordering mechanism then copies the forms into their surface structure slots. Thus, Lapointe argues that the deletion/substitution observed in syntactic deficits results from the read/copy devices,

> "not having sufficient resources to retrieve information from cells located as deep in the SP (Syntactic Processor) stores as would be required in the normally functioning speech system." (Lapointe 1985:137).

Lapointe predicts that in a language like Italian (in the present dissertation, Arabic) where morphemes are already attached within fragments in the syntactic processor stores, the

type of errors that affect morphemes will be ones of substitution of one fragment for another. Bare stems (i.e. deletion of all grammatical morphemes equivalent to that in English) will not occur since all verb fragments in the language contain morphemes.

Since there are no infinitive verb forms in Arabic, T.A. predictably used verbs with inflections for tense, aspect, person and number, albeit containing many errors. Of the 265 verb forms produced during the spontaneous speech portion, T.A. was, by and large, limited to four basic verb-like forms (159 occurrences or 60%) expressing simple past and present. The other 13 verbs that appeared in his speech sample were used 106 times altogether comprising 40 percent of the total. A tabulation was done on each verb to see the dominant verb forms and verb patterns. A count was then conducted on the number of affixes, including subject, direct object, and indirect object. A separate tally was also done for each tense and aspect, noting occurrences with the range of suffixes for person, number, voice as well as modality. Of the possible range of over fifty verb pattern combinations in Arabic, T.A. used four verb forms of mainly one pattern, Pattern I, in its perfect and imperfect combinations and only in the indicative mood. There were no occurrences of passive, future, present progressive, causative, conditional, etc. The dominant verbs seemed to be simple past

and present of Pattern I, mainly for singular , third person, and masculine.

It appears that, (since Arabic does not have an infinitive form and since these semantic notions are language dependent) in processing, the third person singular masculine form is the least complex in Arabic, and thus becomes a kind of "default" form for T.A. This may account for the unidirectionality of substitution of the third person singular masculine form in T.A.'s utterances. The third person singular masculine form CaCaCa, such as kataba 'he wrote' and darasa 'he studied' has been treated for centuries by Arab Grammarians (for example, the classical work by Sibaawaih (796) "Al-Kitaab") as the basic stem from which all the other forms are derived.

5.4.5. Anomia:

The other striking deficit in T.A.'s speech is manifested in his word finding difficulty or anomia. Buckingham (1979) argues that a number of surface manifestations such as hesitations, semantic paraphasias, limb gestures, and circumlocutions reveal the presence of a word finding difficulty. T.A.'s anomia is more evident in his spontaneous speech portion as opposed to his performance on confrontation tasks (see Table 5.1). This difficulty is marked by his frequent gropings and hesitations, such as his attempt in (97) to denote the Arabic lexical kalb equivalent to the word 'dog' in the Picnic Scene

(Figure 5.2). It is important to point out that /haw/ in Arabic signifies the sound made by a dog.

(97) "u haada .. haw haw sahaw, eysh huwwa .. haw"
and THISm .. haw haw sahaw, what 3sm .. haw
and this (is) .. haw haw sahaw, what is it .. haw.

The word finding difficulty is also evident in T.A.'s false starts and attempts at self corrections that suggest some monitoring for appropriateness. For example, (98) below indicates a lexical search for the word badu 'bedouins' in the description of the Local Scene (Figure 5.3).

(98) " fi-l .. balad .. balad hadool, kull-ahum ..aa ..
in-d .. town .. town these, all-3p .. aa ..
in the.. town.. these (are) town, all (of) them

muu ba , balad .. Ha . 9um .. muu 9umaal .. ya9ni
neg /../ town .. / ../ neg workers .. I mean
not town , not workers .. I mean

su9uud-iin .. yiji hinaa"
Saudi-p preCOME3sm here
Saudis , he comes here.

In addition, T.A. produced lengthy elaborations that reflect his lexical anomia. For example, in (99) (from the Picnic Scene description, Figure 5.2), he realized that the flag he is describing is a Western flag rather than a Saudi one, since the picture represents a Western scene not a local one.

(99) "haada 9alam, Hag al .. su9udiya .. laa madam Hag-a
THISm flag, belongs al , Saudi , no since belong-3sm
This flag belongs (to) Saudi .. No, since this (is) his

beyt-u haada Hagg-u [..] masalan al .. ya .. 9alam ..
house-3sm THISm, belongs-3sm [..] like al .. ya.. flag..
his house, his [..] like al .. ya.. flag..

krismis haada , Tab9an Hag-at-u"
Christmas THISm , definitely belongs-3sf-3sm
this (is) Christmas, definitely belongs (to) him.

Marshall and Tompkins (1982) point out that circumlocutions are considered compensations for the absence of an adequate semantic representation and that they reflect correction attempts where the aphasic patient recognizes that there is a discrepancy between an error he produced and what he intended. T.A. produced very informative circumlocutions that reflect his intact semantic representations. For example, attempting to name a traditional clay water container called 'jarra' that can be often found in Makkah or Madinah, and which uses the evaporation process to cool water (zamzam is a special sacred underwater spring in Makkah). He produced,

(100) "ba9deyn fi aa . tha . ta .. zamzam, walla zamzam ..
then in /../ .. zamzam, or zamzam ..

mooya .. bard .. 9ashaan al-a .. hinaa .. haadi .. bi-l-a
water .. cold .. because d-a .. here .. THISf .. with-d-a

.. bi-l-a .. makka fii 9ind-ahum, bard"
.. with-d-a .. Makkah in have-3p, cold.

Beside the semantic paraphasias discussed above in section 5.4.2, T.A. exhibited a considerable verb finding problem, often substituting a verb-like form that is neither meaning nor form related to the target (examples (101-103) below). As mentioned

earlier, the four basic verb forms used often by T.A. are classified by the Arab grammarians as al-af9aal an-naasixa or Defective verbs, which usually function in a quasi-auxiliary capacity to help bring out certain aspects of the Arabic verb system. However, they are the verbs usually acquired by children initially, and thus, remain more resistant to dissolution in aphasia.

(101) "fi-t-talafown yigdar , ?axbaar"
in-d-telephone preCAN3sm, news
in the telephone he can (the) news
(T= on television she understands the news).

(102) "?abgha wan milyon min 9ind-i ?ajib-ahum, kull-ahum"
preWANT1s one million from preBRING1s-3p,all-3p
I want one million from me I bring them, all(of) them
(T= I want one million from me, I give to them, all of them).

(103) "ruuH at-talafizyown .. Hagg-i"
impGO2sm d-television .. belongs-1s
Go the television .. mine
(T= They took my television).

Examples (104) and (105) below represent T.A.'s attempts at self correction and demonstrate his conscious recognition of the discrepancy between what he is saying and what he intends to say.

(104) "an-naas naayim naayim .. ah ..da .. muut"
d-PERSONp parSLEEP parSLEEP /../ impDIE2sm
The people sleeping sleeping , die
(T= the people (are) dying).

(105) "jaab al..bi-l-9arabi jaabat-ha .. min al .. jibt-ahum"
pstBRING3sm , pstBRING3sf-3sf , pstBRING1s-3p
He brought, in Arabic she brought her, from, I brought them
(T= I wrote it).

Benson (1979) classified the underlying causes of word-finding disorders into three major groups: (a) word production anomia, (b) word selection anomia, and (c) a semantic anomia. However, Kohn and Goodglass (1985) studying aphasic errors in a naming task point out that anomia is a single disorder affecting all aphasics, although they do not allude to its underlying cause(s). Studies on anomia have related the deficit to a lexicosemantic disturbance in which semantic representations can be impaired (Whitehouse, Caramazza and Zurif (1978)), disintegrated (Zurif, Caramazza, Myerson and Galvin (1974)), or disorganized (Goodglass and Baker (1976)). Lately, however, Howard, Patterson, Franklin, Orchard-Lisle and Morton (1985) attribute the origin of anomia to a disorder in the operations that access semantic representations (with the representations intact). The deficit has been postulated by some to correspond to a breakdown to Garrett's first lexical look up during the computations of lexical selection based on semantic properties. Le Dorze and Nespoulous (1989), on the other hand, proposed a second hypothesis, which attributes anomia to a lexical retrieval problem that corresponds to the second lexical look up in Garrett's model. This selection computation is form based and occurs at the Positional Level.

T.A.'s word finding difficulty does not rule out "knowing" the word, since he produced very informative circumlocutions that reflect his intact semantic representations. His recognition of visually and aurally presented stimuli which required access to the lexicosemantic representations is intact. His circumlocutions were semantically informative, and he seemed to recognize that there was a discrepancy between what he intended to say and an error he produced. This implies some preservation of processing at the semantic level (Functional Level) and consequently his word finding difficulty may very well lie in his inability to access or retrieve the phonological forms during the second lexical look up at the Positional Level of Garrett model.

T.A. benefitted from and reacted rapidly to partial cuing of the phonemic representation, which supports the above mentioned hypothesis of a breakdown of the operations involved in the form based lexical access. For example, (106-108) show his attempts at self-partial-phonemic cueing with an initial, final, as well as a medial segment.

(106) "fii raH .. dam .. ta .. ta .. tamur, tamur"
(T= tamur = dates)

(107) "shiish, shash .. sha .. shash .. Hash .. Hashash .. Hashiish Hashiish"
(T= Hashiish = grass)

(108) "Sa .. aa .. Saan .. ma ..Sa .. HuSaan"
(T= HuSaan = horse)

Garrett (1982) proposed that access to the formal representations is based on a "linking address" which operates between semantic and formal representations. This linking address contains formal traits such as the number of syllables, stress pattern and the initial phoneme of the lexical item to be retrieved. Disruption to the computations of the linking address will block access to the formal representations of lexical items and will ultimately result in a word finding difficulty. Postulating the breakdown at this level will leave the semantic representations intact.

CHAPTER SIX

CONCLUSION

T.A. presents an interesting challenge to the clinically oriented classifications of aphasic syndromes. With a focal brain lesion affecting the left inferior temporal area (an area associated with receptive aphasia), T.A. retained intact visual and auditory comprehension, naming and repetition. And although his spontaneous speech is hesitant, telegraphic and marked with the omissions of free and bound grammatical morphemes, T.A.'s most striking deficit is apparent in his mis-selection of grammatical markers as well as in the lexical retrieval of content words.

The aphasia syndrome described here confirms Miceli et al's (1983, 1984) claim that in languages where bare verb stems are normally not pronounceable, patients substitute other verbal affixes rather than omit inflected endings from the correct forms. T.A. produced fully inflected lexical items, which in the majority of instances where erroneously inflected.

Bates et al (1988) state that,

> "the way that grammar breaks down in a richly inflected language differs strikingly from familiar patterns exhibited by English speaking aphasics." (Bates et al 1988:550)

More recently, Menn and Obler (1990) have pointed out that the features of grammatical deficits,

> "especially the omission of bound grammatical morphemes and the use of infinitive verb forms, appear to vary in accord with differences in the grammars of the different languages." (Menn and Obler 1990:1370)

The findings discussed in the present study reveal a striking preservation of many elements of grammar in Arabic aphasia as observed in T.A. In such a highly inflected language, grammatical morphemes carry a heavier functional load than in analytical languages, such as English, which are word order dependent. This semantic load plays an important role in the manifestation of grammatical deficits. Those elements that do not carry a high informational load are deleted, whereas those that do are retained. Clitic pronouns are very robust and resist errors in both the slips-of-the-tongue and aphasic errors. They carry high informational values indicating subjects, objects and indirect objects, and therefore, are preserved in Arabic errors.

The brain damage syndrome discussed here results from damage to several autonomous components. One pattern of impairment in this case affects the grammatical morphemes, while the other affects lexical processing mechanisms. The locus of both these functional deficits rests with the computations that specify the Positional Level of Garrett's model. Both deficits affect retrieval mechanisms that access the phonological representations from their respective stores. I have suggested that the third person singular masculine form is the least

complex in Arabic, and thus, could serve as a "default" form for T.A. when speaking, thus, accounting for the unidirectionality of the substitution observed.

Both the slips-of-the-tongue and the aphasic data argue for the psychological reality of Kiparsky's (1982) two level morphology, where Level I is responsible for irregular morphological forms, and where Level II morphology is responsible for regular morphological forms. Irregular plural forms in the Arabic corpus appear to be stronger than regular forms and have not been subject to error. Thus, Kiparsky's (1982) Level I would have separate entries in the lexicon and can be accessed without morphological parsing. Level II (inflectional and derivational) has a single entry and would involve morphological decomposition during access.

For over a decade, the syllable constituent structure and syllable markedness have been understood to provide the framework for the language productive mechanism during the processing of segments (Fromkin (1971), Kahn (1976), Blumstein (1978), Buckingham (1980, 1986), and Stemberger (1982)), and have been used to account for diverse phenomena such as child language, tip-of-the-tongue, slips-of-the-tongue as well as aphasia. These researchers have all argued that segmental errors affect segments in analogous syllabic slots and obey structural syllable position constraints.

The linear segmental errors in Arabic analysed in this study do not obey the syllablic slot constraints proposed for Western languages such as English, where onsets move to onset positions, codas to codas, etc. (e.g. Buckingham 1980). Consonantal segments involved in movement errors move to non corresponding syllable positions. Evidently, there may be a misordering of root consonants (ex. 25, p 84) at their tier, which is dissociated from vocalic segments. The misordered consonants would pay no heed to their ultimate slotting vis a vis the vowels. These segmental errors also demonstrate an interesting dissociation of consonantal roots and vocalic patterns, since they affect only the consonants in the phonological representations. Further evidence for this dissociation is observed with errors involving complete consonantal root exchanges as well as with lexical blend errors. The dissociation of consonantal roots and vocalic patterns, which has not been observed in error data from Western languages, supports McCarthy's proposed two tier autosegmental representation for Semitic languages, where one tier contains the consonantal roots while the other tier contains the vocalic patterns, and challenges the universal applicability of the syllable position constraint in segmental linear ordering errors.

From the data presented here, it appears that the formal representation of lexical items in Arabic is decomposed into consonantal roots and vocalic patterns. It is possible to

speculate that the skeletal framework proposed by Shattuck-Hufnagel (1983), which represents the rhythmic and syllabic structural representations and which constitutes the 'stable' part of the phonological entries, must also compute the vocalic pattern representations in Arabic. The consonantal units form the 'movable' part of the phonological representations placed in the Buffer, and, therefore, subjected to movement errors.

The Arabic data provides an interesting challenge for spreading activation models proposed in the literature, where spreading activation during processing activates all similar forms that share a phoneme with the target. It is not clear how such models can accommodate the highly rhythmic nature of Arabic words (based on shared vocalic patterns) and their form relatedness (based on shared root consonants) as well as the observed dissociation of these two phonologic representational components.

In addition, I have provided further evidence for the importance of accommodation processes. The accommodation of the conjunction wu - u observed in example (3), of chapter five, the second person feminine possessive pronoun ik - ki noted in example (6), of chapter five, as well as the realization of the feminine /t/ in example (29), of chapter five, all of which serve to guard against the occurrence of marked sequences of VV or of CC in Arabic.

In conclusion, both the slips and the aphasic data can be meaningfully characterized by recourse to the two psycholinguistic levels of processing proposed by Garrett, where meaning and membership of grammatical category are relevant for the computations of one level (the Functional Level), while the formal decomposition of consonantal roots and vowels (and the irrelevancy of grammatical category classifications) is appreciated during the computations of the other (the Posititonal Level). Lower level accommodation processes at the phonetic level remain intact, thereby, assuring that the errors will for the most part abide by CV canonical constraints.

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APPENDIX A

The following conventions have been used in displaying the data:

1. The first line of each data set displays a broad phonological representation of the utterance.

2. The second line is a trans-literation of the morphological units in the utterance.

3. The third line is an English translation of the meaning.

4. The fourth line represents the intended target.

5. Prefabricated expressions, such as alHamdillaa 'The thanks (is) to Allah', which are believed to be processed as whole units, have not been analyzed into their component morphemes.

6. Phonemic distortions, unfilled pauses, hesitations and aborted utterances in T.A.'s speech sample were assigned /../ in the transliteration and were excluded from the analysis.

7. Unintelligible utterances, either because the patient mumbled or whispered, or due to environmental noise, have been transcribed as [..].

8. Since all nouns in Arabic are marked for grammatical gender (masculine or feminine), only the feminine nouns were marked by (f). The unmarked form is assumed to be the masculine.

9. Since Arabic adjectives agree with their nouns in number and gender, the unmarked form in the data represents the singular masculine form, unless otherwise indicated.

10. With Arabic lexical items that cannot be literally translated, and which have several possible meanings in English, the closest potential meaning was assigned in the

transliteration and the most logical one was given in the translation. For example, laazim can mean: necessary, ought to, and must. Must was used in the trans-literation Another example, includes fii which can mean both 'in' and 'there is'. 'In' was used in the trans-literation and 'there is' was used in the translation when appropriate.

11. Abbreviations were used for the sake of convenience. For example, TEMP for temperature, and LR for Living Room.

12. A small - has been used to indicate morpheme boundary.

13. A lexical item in the transliteration is CAPITALIZED when the Arabic phonological realization marks (internally) more than one morpheme. The CAPITALIZED segment indicates the principle meaning. For example, naas 'people' is represented as PERSONp.

14. The first occurrence of a pronoun after a verb form indicates the subject, while the second occurrence indicates the direct object. For example, jibt-aha 'I brought her' is represented as pstBRINGls-3sf.

15. The occurrence of a pronoun after a noun marks a genitive clitic pronoun.

16. Double vowels represent a long vowel, while double consonants represent gemination.

APPENDIX B

The following symbols have been used in displaying the data:

,	comma, for short pauses
..	periods are used for longer pauses with the number of periods being roughly proportional to the length of the pause.
[..]	mumbling or unintelligible portion
( )	on line 3 indicate elements not present in Arabic
[ ]	deleted item
/../	phonological material

1	first person
2	second person
3	third person
m	masculine
f	feminine
s	singular
pm	regular plural masculine marker
pf	regular plural feminine marker
p	irregular plural marker
dl	dual
d	definite article
neg	negative
pst	past
imp	imperative
pre	present
pas	passive
par	participle
prog	progressive
LR	Abbreviation for Living Room
APT	Abbreviation for Apartment
TEMP	Abbreviation for temperature
CAP	lexeme
-	morpheme boundary
∅	deletion

APPENDIX C

Phonetic symbols other than the IPA used in the phonological transcription of the data.

Symbol	Description	Equivalent Arabic Symbol
H	voiceless pharyngeal fricative	ح
9	voiced pharyngeal fricative	ع
x	voiceless velar fricative	خ
gh	voiced velar fricative	غ
S	emphatic voiceless alveolar fricative	ص
T	emphatic voiceless alveolar stop	ط
D	emphatic voiced alveolar stop	ض
sh	voiceless alveopalatal fricative	ش
?	glottal stop	ء

VITA

Sabah Safi was born in the holy city of Madinah, Saudi Arabia on April 5, 1959. She attended primary and secondary school there and then moved to Jeddah, Saudi Arabia where she earned a Bachelor Degree in English in 1981 from King Abdulaziz University. Determined to study and understand American life and culture after becoming Mrs. Sabah Safi-Stagni, her plans for the Masters and Ph.D. were postponed. In August of 1983, however, she started her graduate work at Louisiana State University in Baton Rouge, Louisiana. She was awarded the Masters Degree in Linguistics in May 1986. In August of the same year, she started her doctorate studies at Louisiana State University, and before she left for Saudi Arabia in August 1987 to collect data for her dissertation she completed her General Ph.D. Exams and was in ABD status. She was in Riyadh, Saudi Arabia throughout Operation Desert Storm. During her years at LSU she was awarded a teaching assistantship and taught Spoken American English and an introductory course in Transformational Generative Grammar. She also taught Spoken Arabic to non-native speakers through the LSU Leisure Program.

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Sabah Safi - Stagni

Major Field: Linguistics

Title of Dissertation: Normal and Pathological Breakdown in Arabic

Approved:

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Date of Examination:

December 18, 1991