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**Comprehension and Grammaticality Judgement
in Persian-Speaking Agrammatics**

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A Dissertation Submitted to
the Graduate School and Research
in Partial Fulfilment of the Requirements
for the Degree of Doctor of Philosophy
in Linguistics.

University of Ottawa

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To My Mother

Maryam Torabi

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ABSTRACT

This thesis examined the performance patterns of two Persian-speaking agrammatic patients and ten normal, Persian-speaking controls in two experiments, one syntactic and the other morphological. The goal of the Syntactic Experiment was to assess the patients' sensitivity to various simple and complicated sentence structures, as well as to agreement and word order violations in both Syntactic Comprehension and Syntactic Grammaticality Judgement Tasks. The Morphological Experiment focussed on the agrammatics' ability to process a certain set of morphological items, including clitic pronouns and null subject pronoun across three sub-experiments: a Morphological Comprehension Task, a Morphological Grammaticality Judgement Task, and a Morphological Cloze Test.

The design of the present study allowed us to investigate the extent to which aspects of morphology and syntax are differentially disrupted, and to see if agrammatics exhibit a predicted patterns of syntactic and morphological breakdown across language modalities. Moreover, it enabled us to examine the effects of language typology on the manifestation of agrammatism, as well as to obtain evidence that could distinguish between the adequacy of the two most divergent accounts of agrammatism, namely, representational and processing accounts.

The combined results of the Syntactic and Morphological Experiments provide strong evidence that our agrammatic subjects, despite presenting with impoverished output, retained a remarkably well-preserved tacit syntactic and morphological knowledge of Persian grammar. The patients' performance was inferior to that of the normal subjects. However, their high level of comprehension and grammaticality judgement performance and their remarkable sensitivity to grammatical violations indicate that they were able to recognize a wide variety of syntactic and morphological cues and to construct phrasal constituents which observe appropriate grammatical constraints in the various experimental tasks.

The findings of the present study suggest that none of the representational accounts of agrammatism provides an adequate characterization of the performance patterns of our two agrammatic subjects. Instead, it is proposed that their agrammatic deficit may be attributed to a reduction or disruption in the efficiency of the language processing mechanism. We suggest that both complexity of the linguistic materials and slowness of the language processing mechanism have converged to diminish or reduce the linguistic performance of the two agrammatic patients.

CHAPTER 1

INTRODUCTION

Linguistically-oriented research on agrammatism suffers from a shortage of data on patients' linguistic abilities across various modalities and languages. Most studies of agrammatism have been based on English and, to a lesser extent, on languages such as German and Italian. The general paucity of data on agrammatism in speakers of other languages has limited our ability to arrive at a more precise characterization of this syndrome.

Cross-modal as well as cross-language comparisons of agrammatic manifestations are of vital importance for identifying the precise nature of this syndrome and its effects on different levels and modalities of language. For example, patients with different language backgrounds may vary in their sensitivity to particular morpho-syntactic structures. Furthermore, most researchers agree that speech output is not always a reliable indicator of agrammatics' underlying language capacities. It is crucial, therefore, to design appropriate morpho-lexical and syntactic tests to assess agrammatics' production and perception of the same grammatical constructions in as many languages as possible. This research presents the first comprehensive effort at employing such a research design with Persian-speaking agrammatic patients.

The study explores two different aspects of dissociation in agrammatism:

dissociation across the modalities of production and comprehension, and dissociation of particular syntactic and morphological impairments from one another within a given language modality. To this end, we examine the performance patterns of two Persian-speaking agrammatic patients in two experiments, one syntactic and the other morphological. In the Syntactic Experiment, we investigate the patients' ability to handle various simple and complicated syntactic structures in both comprehension and grammaticality judgement tasks. In the Morphological Experiment, we deal with the patients' performance on a set of morphological categories, including clitic pronouns and null subject pronoun, across three tasks: a Morphological Comprehension Task, a Morphological Grammaticality Judgement Task and a Morphological Cloze Test. The study explores agrammatics' ability to employ different syntactic and morphological features for the assignment of theta roles in Persian. Our results should help to determine whether certain aspects of morphology and syntax are differentially disrupted, and whether cross-modal patterns of language disruptions occur in the same patient.

This study also examines the effects of language typology on the manifestation of agrammatism. Some recent research on agrammatism indicates that grammatical markers, such as inflectional endings, prepositions and articles, are selectively affected, while basic word order principles are universally preserved in both production and comprehension across languages. Conversely, there is growing evidence of cross-

linguistic variation in the breakdown patterns of morphological categories and word order, depending on the relative importance of these features in the affected language. To obtain a clearer picture of language-specific effects on the relationship between knowledge and performance in agrammatism, we focus on Persian agrammatics' sensitivity to violations of word order and certain closed-class morphemes under varying task conditions. As similar investigations have been carried out in English and Italian, the results of the present study permit cross-linguistic comparisons to be made.

Another major goal of this thesis is to determine whether a representational deficit account or a processing deficit account can best explain the pattern of disruptions in agrammatism. In representational accounts, agrammatism reflects the absence of particular component(s) of syntactic representation, whereas in processing accounts, the deficit is attributed to limitations in processing the intact morpho-syntactic elements. The data obtained from our subjects' performance both within and between tasks may help us to select the most accurate characterization of agrammatism.

The thesis comprises 6 chapters, including the present one. Chapter 2 presents a review of previous studies of syntactic and morphological deficits in agrammatism. Chapter 3 outlines the theoretical framework and goals of the present study, and discusses relevant syntactic and morphological elements of Persian grammar. Chapter 4 is devoted to methodology, describing both the subjects tested and the syntactic and morphological experiments designed for the study. In Chapter 5, results of the

Syntactic and Morphological Experiments are described. Finally, chapter 6 presents a discussion of the results and draws some conclusions from them.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

2.1. Introduction

In recent decades, linguists have devoted considerable attention to precisely describing the altered speech output of aphasic patients, and to associating these changes with the neuroanatomical localization of the impairment, as well as with the cognitive status of the relevant patients. In this respect, by far the greatest research efforts have been devoted to language disorders resulting from damage to Broca's area. Broca's aphasia, which is related to anterior brain damage, is marked by non-fluent and effortful speech, reduced phrase length, decreased verbal output, dysprosody and agrammatism. Moreover, unlike Wernicke's aphasia, which has been characterized as involving comprehension deficits at the syntactic, semantic, and single-word levels, Broca's aphasia is marked by relatively spared comprehension.

2.2. What is Agrammatism?

Agrammatism is one of the defining characteristics of the speech production of

most Broca's aphasics.¹ Despite the fact that the syndrome of agrammatism has been the focus of years of intense study, its precise formulation is still a matter of controversy (Caramazza & Berndt, 1985; Scholes & Willis, 1984; Caplan, 1985, among many others). Although, there is a general consensus among neurolinguists as to what characteristics are necessary for the diagnosis of agrammatism, their definitions diverge slightly with respect to some points. Agrammatism is characterized as an effortful, dysprosodic and telegraphic form of speech. However, the most agreed upon distinguishing characteristic of agrammatism is the frequent loss of grammatical functors, including function words and inflectional affixes, in contexts where they are required (see, for example, Goodglass & Kaplan, 1972; Kean, 1977; Berndt & Caramazza, 1980; Lapointe, 1983).² It should, however, be mentioned that omission is not the only difficulty that is represented in the speech output of this group of patients. Agrammatic subjects are likely to make substitutions in the production of function words and grammatical morphemes as well.

¹For years the impression was that only patients of the Broca type were agrammatic. However, it is now agreed upon that all Broca's aphasics are not agrammatic, nor can all agrammatic patients be clinically considered as suffering from Broca's aphasia. In fact, patients suffering from other aphasia types, such as Wernicke's aphasia, may also be agrammatic (Goodglass & Menn, 1985; Heeschen, 1985).

²The linguistic description of the omitted morphemes as well as the psychopathogenic mechanisms involved in their omission have been discussed in detail in the literature (Berndt & Caramazza, 1980; Lapointe, 1983; Grodzinsky, 1984; Caplan, 1987). As the clitics and null subject morphemes focussed on in the present study are not addressed in the literature, they are not discussed here in detail.

This substitution abnormality is more evident in the performance of agrammatics in languages such as Italian and Hebrew. Agrammatics in these languages do not omit bound grammatical morphemes, but instead produce an inflected form which is contextually inappropriate (Miceli, Mazzucchi, Menn, & Goodglass, 1983; Grodzinsky, 1984; Grodzinsky, Swinney, & Zurif, 1985). That is, the words are usually incorrectly inflected for grammatical elements such as tense in verbs. Inflectional affixes will be omitted only if the lexical item without the affix maintains its status as a well-formed word. This suggests that the performance deficit cannot be simply characterized as a loss of closed-class items, but rather "as a loss of the ability to select properly among inflected forms" (Grodzinsky et al., 1985, p. 70). The omission of inflectional morphemes by English-speaking agrammatics is seen as reflecting a tendency to select the more frequent, simple form (i.e., the null form) by default.³ A result more or less similar to the Hebrew one has been reported for a Persian agrammatic patient who tends toward substitutions for bound inflectional morphemes. By contrast, free grammatical particles are more susceptible to omission than to substitution in this patient (Nilipour, 1989).

Despite their impairment in appropriately using bound grammatical functors

³Grodzinsky et al. (1985) argue that this behavioural difference between Hebrew-speaking agrammatics and English-speaking agrammatics results from the difference in inflectional-morphological constructions between Hebrew and English-like languages. In Hebrew, derivational and inflectional morphology are not realized independently of the stem, whereas languages such as English have clearly delineated derivational and inflectional morphemes.

and free closed-class elements, agrammatics are still capable of producing them. In fact, there are no reports of agrammatic aphasics who totally omit grammatical functors. The percentage of omitted or substituted items, according to recent studies, ranges from a scant few to slightly over 50.00% (Miceli, Silveri, Romani, & Caramazza, 1989; Menn & Obler, 1990). Furthermore, agrammatics may also have difficulties with content words (Saffran et al., 1980). Generally speaking, agrammatics' problems with content words appear to be less severe and thus, less obvious than those with grammatical functors. Differential treatment within the class of content items has also been found in various experiments. For example, Kolk (1978) found that agrammatic subjects treated adjectives differently from nouns in a hierarchical clustering experiment.

Given the high level of behavioural variation among agrammatics within the classes of both grammatical words and content words, as well as their differential susceptibility to omission in agrammatic performance, it appears that the distinction in performance between content and function elements needs further refinement. Furthermore, in spite of the fact that the omission of function morphemes and inflections has been argued to be the fundamental disturbance of agrammatism, it is not unique to this syndrome and thus cannot be the sole determining factor in patient classification.

Thus far, we have only been concerned with expressive agrammatism and the

presence of abnormal characteristics associated with it. In the next section, we address the question of whether agrammatism also affects the perceptual aspects of language. In other words, is agrammatic production paralleled by agrammatic comprehension? The following section should be considered as a brief introduction to this topic, which will be treated in greater depth later on in this thesis.

2.3. Agrammatic Production Versus Agrammatic Comprehension: Is There Any Parallelism?

In contrast to their readily observable impairments in language production, agrammatics generally display adequate comprehension of ordinary conversations. Agrammatism was traditionally viewed as an expressive disorder occurring against a background of relatively intact comprehension (Goodglass & Kaplan, 1972; Brown, 1972). However, a number of studies over the past two decades have demonstrated syntactically-based comprehension deficits in agrammatics. In experimental settings, where fewer contextual clues are available, agrammatics have had difficulties with the auditory comprehension of certain grammatical structures, such as relative clauses and passives (see, for example, Caramazza & Zurif, 1976; Heilman & Scholes, 1976; Schwartz et al., 1980; Grodzinsky, 1986). The results of these experiments have played a crucial role in shaping recent theories of agrammatism which stress parallels between syntactic deficits in production and comprehension.

Theorists who considered impaired comprehension to be a major factor in

agrammatism opened a number of research issues. Foremost among these were the types of structures that agrammatics failed to adequately comprehend and the nature of the relationship between agrammatic production and perception, whether it be demonstrated in terms of comprehension, speed of lexical access or accuracy of grammaticality judgement. One of the earliest attempts to address these issues was made by Caramazza and Zurif (1976), who tried to identify and classify the structures that agrammatics are unable to interpret. The other issue they addressed was whether syntactic comprehension disturbances are distinct from and secondary to expressive agrammatism, or whether productive and receptive symptoms result from a disturbance of the same underlying mechanism.

Based on a considerable amount of data, several researchers, including Caramazza and Zurif (1976), have reached the conclusion that Broca's patients with agrammatic output tend not only to omit function-word vocabulary and inflectional items in their production, but they also experience selective problems in accessing syntactic formatives during the comprehension process. In other words, syntactic comprehension deficits in these patients are due to specific abnormalities in activating function-word vocabulary (Parisi & Pizzamiglio, 1970; Berndt & Caramazza, 1980; Bradley et al., 1980). For example, Parisi and Pizzamiglio (1970) presented data which demonstrated a lack of attention to some grammatical morphemes in comprehension. Bradley et al. (1980), using data obtained from lexical decision and picture verification

tasks, proposed a unified account of agrammatism encompassing production as well as comprehension. Such deficits in sentence production and comprehension were considered to result from a central disturbance in the syntactic component of language affecting both speech output and input processing in parallel ways (Schwartz, Linebarger, & Saffran, 1985; Berndt & Caramazza, 1980; Grodzinsky, 1984). Although the viewpoints of these researchers differed with respect to certain issues, all of them agreed that the same mechanism underlies aphasic production and perception. Thus, the important claim made by the proponents of this line of argument was that production and perception are both consequences of a disturbance affecting the use of function words and inflectional markers.

Despite its initial attractiveness, "parallelism" between agrammatic production and comprehension proved too simplistic to deal with discrepancies between agrammatic output and comprehension which were becoming increasingly apparent by the mid 1980's. More recent studies were indicating that the actual nature of the comprehension deficit was more complex than had previously been assumed. These included a series of grammaticality judgement studies utilizing a variety of tasks and structures conducted with agrammatics as well as with other types of aphasics. The results of these studies strongly challenged the assumption that agrammatism is a central parallel deficit extending to all language modalities, and that a comprehension deficit in agrammatism results from a failure to decode grammatical information.

For example, Linebarger, Schwartz, and Saffran's (1983) English-speaking agrammatic subjects performed at much better than chance levels in judging the acceptability of many syntactic structures, including ones involving closed-class elements such as auxiliaries. This partial sparing of the ability of agrammatic patients to apprehend grammatical structures and to process the function and inflectional items that are assumed to be absent in their production has also been demonstrated in several other languages, both in on-line and off-line paradigms (Miceli, Mazzucchi, Mann, & Goodglass, 1983; Goodglass & Menn, 1985; Kolk & Van Grunsven, 1985; Lukatela, Crain, & Shankweiler, 1988; Wulfeck, 1988; Wulfeck & Bates, 1990; Wulfeck, Bates, & Capasso, 1991; Bates, Pizzamiglio, Devescovi, Marangolo, Ciurli, & Razzano, 1996). These studies indicate that agrammatic aphasics are able to make grammaticality judgements with a high rate of accuracy. Spared sensitivity to grammatical violations implies that syntactic structures may be preserved in these patients, lending support to a dissociation between different language modalities, including production and comprehension. Clearly, evidence such as this is incompatible with a theory that argues for the loss of tacit syntactic knowledge in agrammatics. Rather, it militates in favour of preserved syntactic comprehension in the face of disturbed syntactic production.

The syntactic comprehension ability of patients with agrammatic production varies widely, further contradicting the view that there is a single disrupted mechanism

underlying agrammatic production and comprehension. A myriad of bizarre dissociations have been observed in such patients. There are agrammatic aphasics who have good syntactic comprehension, but show severe agrammatic output. Other patients with expressive agrammatism have been reported to preserve perfect comprehension in the presence of severe production disturbances⁴. On the other hand, there are also patients with agrammatic perception disorders who retain intact speech output (see, for example, Miceli, Mazzucchi, Menn, & Goodglass, 1983; Kolk, Van Grunsven, & Keyser, 1985). These patterns of double dissociation between asyntactic speech output and input ultimately gave rise to a rejection of the unitary hypothesis for aphasic production and comprehension, and provided reasonable support for the demarcation of these modalities.

The evidence to date implies a comprehension impairment essentially different from the one in production, and is consistent with a model involving two distinct mechanisms, one dealing with production, and the other dealing with comprehension (Caplan, 1982; Caplan & Futter, 1986; Caplan & Hildebrandt, 1988). This has led some researchers to focus on specific questions about representational structures in production or comprehension, rather than attempting to construct a unitary account for impairments in both modalities. This, as Caramazza and Berndt (1985, p. 50) argue,

⁴This kind of dissociation has been reported in case studies of individual agrammatic subjects. Kolk and Van Grunsven (1981) and Miceli et al. (1983) have studied patients who show patterns of grammatical morpheme omission, but minimal impairment of syntactic perception.

stems from the rationale that "the assumption of separate processing modules for comprehension and production provides a more natural framework for interpreting the complete dissociation of expressive agrammatism from other language processing deficits than does the assumption of a unitary syntactic processing module".

Lastly, it should be pointed out that despite all the apparent shortcomings of the parallel view, it has not been altogether abandoned. In fact, some modern hypotheses, including the ones proposed by Kolk and Van Grunsven (1985), Kolk (1995) and Friederici (1983, 1988) have attempted to capture aberrations in both production and comprehension mechanisms within a parallel theoretical framework. We shall examine Kolk et al.'s view in greater detail in a subsequent section of this chapter.

In the most recent work on the topic, agrammatic impairments have been characterized as either deficits in the representation of linguistic structures or deficits in the processing of sentence structures and their interpretations. In the following sections, we will consider a variety of representational and processing analyses of agrammatism, and try to lay out the essentials of each of them.

2.4. Accounts of Agrammatism

2.4.1. Overview

Recent research on agrammatism has been based, by and large, on either representational/structural accounts or processing/computational accounts. These two classes of accounts differ in terms of whether they consider knowledge of language or processing capacity of language to be disrupted.

Various representational and processing theories of agrammatism differ in a number of respects, and may be grouped according to a number of criteria. Some theories hold that both agrammatic production and comprehension are associated and parallel abnormal behaviours stemming from the same compromised mechanisms, and should be explained within a unified account (e.g., Caramazza & Zurif, 1976; Kean, 1977a, 1979; Berndt & Caramazza, 1980; Bradley et al., 1980; Zurif, 1980). Other theories, by contrast, maintain that agrammatic production is not necessarily accompanied by disorders of comprehension. Thus, agrammatic production and comprehension are dissociated reflections of the deficit, and do not derive from the same underlying mechanism (Caplan, 1982; Linebarger et al., 1983; Caplan & Futter, 1986; Caplan & Hildebrandt, 1988). Kolk et al. (1985), for example, deal with output symptoms, and take agrammatism to be essentially a production disturbance.

By far, the greatest controversy is related to the nature of the comprehension deficit in agrammatism. Some hypotheses attribute agrammatic comprehension to a

working memory deficit (e.g., Linebarger et al., 1983; Kolk & Van Grunsven, 1985; Ostrin & Schwartz, 1986), whereas several representational theories have sought to ground agrammatic comprehension difficulties involving functional and inflectional morphemes in various levels of linguistic representation. For instance, Kean (1977, 1979) saw the basis for an agrammatic comprehension deficit at the level of phonological representation, whereas Lapointe (1983) and Bradley et al. (1980) accounted for the deficit in terms of a breakdown in morphology and lexicon, respectively. Also, researchers such as Caramazza and Zurif (1976), Caplan and Futter (1986), Grodzinsky (1986, 1995), and Mauner, Fromkin, and Cornell (1993a) considered the agrammatic comprehension deficit as a syntactically-based disorder.

Theories of agrammatism can also be ranged from "deep" to "surface" depending on the stages of processing or levels of representation which are assumed to be impaired. Moreover, they vary as to whether the deficit is considered to result from the interaction of several stages of processing/levels of knowledge or to be a specific disturbance of one stage/level (Menn & Obler, 1990).

As was discussed earlier, dissociations in agrammatic production and comprehension systems, as well as the ability of some patients to make metalinguistic judgements of grammatical acceptability, call into question the credibility of structural theories of agrammatism, which assume loss of syntactic ability across language modalities. Retained sensitivity to syntactic structure in agrammatics cannot be

accounted for within a syntactic deficit theory. This line of reasoning led to the emergence of a different approach, reflected in processing hypotheses of agrammatic aphasia, based on a model of agrammatism in which disturbed access and processing operated over a preserved linguistic knowledge base (Friederici, 1988; Bates, Wulfeck, & MacWhinney, 1991; among others).

The structural components of a language contain the lexicon as well as the various levels of linguistic representation, i.e., phonology, syntax, and semantics. A processing account, however, is based on the assumption that language processing not only deals with the assignment of structural representations, but is also associated with specific operations for sorting and retrieving linguistic information, and for coordinating the transfer of this information between different levels of linguistic representation. Thus, the agrammatic's failure to comprehend is not necessarily a direct outcome of some disruption of the representational aspects of language, but can result from a deficiency or limitation in the operational system and processing capacity for the language. The following sections review and contrast various representational and processing accounts of agrammatism.

2.4.2. Representational Accounts of Agrammatism

2.4.2.1. Overview

One of the most controversial issues in the study of agrammatism has been whether this syndrome represents selective damage to the structural component of the language apparatus. In fact, a series of studies, indicating that agrammatic subjects frequently fail to comprehend complex syntactic structures, suggests that some patients are incapable of properly assigning and interpreting syntactic structure. From this perspective, agrammatism is seen as a loss of syntactic knowledge, necessarily affecting both production and comprehension.

This view of agrammatism as a central syntactic deficit was first documented in Caramazza and Zurif (1976). They conducted a variety of experiments involving comprehension tasks with different groups of aphasics from which they concluded that patients with Broca's aphasia are unable to construct certain syntactic structures. Agrammatics performed well on active declarative sentences such as (1), subject cleft sentences such as (4), and subject relatives such as (6) and made no errors in assigning thematic roles to syntactic elements. In contrast, they performed at chance level when they were confronted with passive sentences, truncated passive sentences, object cleft sentences, and object relatives, as shown in (2), (3), (5) and (7), respectively.

- (1) The mole chased the rat.
- (2) The rat is chased by the mole.
- (3) The rat is chased.
- (4) It is the mole that chased the rat.

- (5) It is the rat that the mole chased.
- (6) The mole that chased the rat is fat.
- (7) The rat that the mole chased is fat. (From Pulvermüller, 1995)

Despite several objections to Caramazza and Zurif's original interpretation of their data, (cf. Caplan & Hildebrandt, 1988), a more or less similar inconsistency in the performance of agrammatic subjects has also been reported in a number of subsequent investigations (e.g., Heilman & Scholes, 1976; Schwartz et al., 1980; Grodzinsky, 1984; Caplan & Futter, 1986; Caplan & Hildebrandt, 1988). However, it should be borne in mind that due to differences in methodology and theoretical assumptions, the analyses presented by these authors actually represent different views of how agrammatic aphasics interpret syntactic structures. The remainder of this section examines theories primarily concerned with disturbed agrammatic comprehension. The primary difference between these theories is the extent to which they invoke a disrupted representation as the underlying source of the disturbance.

2.4.2.2. Complete/Global Asyntactic Accounts

The hypotheses characterizing agrammatic comprehension as reflecting full loss of syntactic ability are generally classified as global asyntactic accounts. The syntactic deficit theory has been argued and formulated most explicitly by Berndt and Caramazza (1980). They view the language system as being divided into four components. These are a phonological analyzer, a syntactic parser, a lexicon, and a

semantic interpreter. They conclude that it is the syntactic parser which fails in agrammatism. This claim also implies that both productive and receptive mechanisms are affected by this disruption in the syntactic component of the language.

2.4.2.3. Interpretive/Mapping Accounts

One of the most radical theories of agrammatic comprehension was presented by Schwartz et al. (1986) and Saffran et al. (1980). In a series of experiments, they set out to investigate how well agrammatics exploit word order in speech production and perception. They found a strong effect of animacy upon the position of the nouns around the verbs. When the stimulus picture showed an animate noun acting upon an inanimate noun, the patient's utterance always had the animate noun in the pre-verbal position, whereas when an animate noun acted upon another animate noun, the animate noun agent appeared before the verb in only a third of sentences. Given these results, Schwartz and her colleagues argue that these patients could not use the basic word order (N-V-N/SVO) to express thematic roles of lexical items, and that animacy is the determining factor for the position of nouns around verbs. This conclusion implies that agrammatics have either lost the basic notions of thematic roles or they cannot utilize word order to express these features. As a result, within the framework of this analysis, agrammatic production and comprehension occurs without the benefit of any underlying syntactic structure.

Caplan (1983, 1987) has questioned this claim by arguing that some of the data in Saffran et al.'s approach does not correspond to the claim that animacy alone determined word order. He rejects the view that agrammatics have lost the ability to appreciate sentence word order. Nevertheless, he does not deny the influence of the animacy factor on word order. Saffran et al.'s analysis encounters another criticism from Scholes and Willis (1984), who look at this issue from a different theoretical angle. According to them, Saffran et al.'s theory appears to posit a grammar of exactly one rule, viz.: $S \rightarrow LE, LE, LE \dots$ (i.e., a sentence consists of a string of lexical entries). The first problem with such a grammar is that of termination, since without structure, there is no cue to recognize when an S is fully formulated or how to terminate the stringing of LE's. The data do not support such an assumption. Even the most severely impaired patients do not simply randomly sequence strings of lexical items, but rather appear to know when to stop. The second problem is that the strings are not internally random. They actually consist of allowed sequences of "parts-of-speech".

Another theory regarding the nature of impaired syntactic comprehension is developed in a series of articles by Linebarger, Schwartz and Saffran (1983). Known as the "Mapping Deficit Hypothesis", the theory claims that there is virtually no syntactic deficit in agrammatism and that impaired comprehension is due to a failure to map syntactic structure onto semantic representation. Their views are based on a comparison between agrammatic comprehension and syntactic judgement abilities.

While the patients carry out complex syntactic judgements and show a sensitivity to structure and grammatical categories, their performance in comprehension tasks is poor. This observation has led Linebarger et al. to propose that the agrammatic problem is not at the level of syntactic representation, but at the level of the thematic role assignment or mapping stage.

2.4.2.4. Partial Asyntactic Accounts

2.4.2.4.1. Heuristic or Linear Account

This account of agrammatic comprehension was proposed by Caplan (1983, 1985) and Caplan and co-workers (Caplan, & Futter, 1986; Caplan & Hilebrandt, 1988). This analysis, as opposed to the one put forth by Berndt and Caramzza (1980), should be taken as a partial asyntactic account of agrammatism in the sense that it does not argue for a full syntactic disruption of the linguistic system. According to this argument, chance performance of agrammatics on constructions such as passives and object clefts is the result of sensitivity to linear ordering of nouns and verbs and the application of an interpretive rule on the basis of heuristic strategies which assumes the first nominal phrase refers to the agent and the second to the patient or theme. In other words, agrammatic aphasics are unable to map thematic roles onto hierarchical structures and do not have any access to phrasal nodes (NP, VP, etc.). They only appreciate major lexical category nodes (nouns, verbs and adjectives) and their linear

sequences, through which they try to assign thematic roles. Given this proposal, only a limited linguistic capacity is attributed to the agrammatic aphasic.

This account has also been countered with numerous counterexamples. Pulvermüller (1995) argues that Caplan's analysis cannot account for chance performance on passive sentences. That is, if an agrammatic patient employs only a "first-agent, second-theme" strategy, then he is always expected to consider the first NP as the agent in passives, meaning that his performance should be well below chance level when confronted with passive constructions. On the other hand, as Mauener, Fromkin, and Cornell (1993) point out, agrammatics' ability to make many accurate well-formedness judgements in an off-line task indicates that their judgement capacity depends on phrase level syntactic relationships, and is not restricted to linear sequences of lexical categories.

2.4.2.4.2. Trace-Deletion Theory

Based on Chomsky's Government and Binding theory, Grodzinsky (1986, 1989, 1990) provides a partial/restrictive syntactic analysis of a range of deficits in sentence comprehension involving sentences with empty categories. The theory is considered partial because it focuses on some particular aspects of syntactic processing as the locus of the agrammatic problem.

Grodzinsky proposes the Trace-Deletion Hypothesis according to which the

agrammatic perception disturbance results from deletion of so-called traces in the surface structure representation of sentences. Within the framework of GB theory, whenever a constituent is moved by a transformational rule from the level of D-structure to the level of S-structure, a trace is left behind by the transformation. As a consequence, theta role assignment to the moved constituents will take place through mediation of the chain that the trace and its antecedent constitute. Agrammatic patients, however, are unable to maintain the grammatical link between the trace and the moved constituent. This follows from the assumption that traces, which are bearers and transmitters of thematic roles, are absent from the agrammatic's S-structure representation of movement-derived constructions. Thus, the moved NP will not receive any theta role. This analysis predicts that agrammatic aphasics are capable of generating complete syntactic representations except in the case of constructions involving transformations, such as relative clauses and passives. According to this proposal, therefore, agrammatics have a much less severe deficit than that postulated by researchers such as Schwartz et al. (1980).

Given that the Trace-Deletion Hypothesis is incapable of explaining the asymmetry in comprehension of constituents with subject movement as opposed to object movement, Grodzinsky proposes that agrammatics resort to a cognitive default strategy to heuristically assign thematic roles to NPs in transformationally-derived sentences. The default strategy assigns the role of agent to clause-initial NPs. This

strategy gives rise to correct interpretation for sentences such as subject-gap relative clauses (*the boy that pushed the girl is fat*) in which the original word order has been preserved. By contrast, agrammatics perform at chance with respect to sentences such as object-gap relative clauses (*the boy that the girl pushed is fat*) where two NPs appear in a pre-verbal position. The occurrence of two possible agent candidates force agrammatic patients to choose between them at random.

Grodzinsky (1995) modifies his earlier Trace-Deletion Hypothesis in a theoretically more restrictive way. The revised proposal differs from the earlier one in two respects. The first difference is that the current theory assumes that only traces in theta positions are deleted, whereas other empty categories are left intact. This contrasts with his previous hypothesis, which claimed that all traces were deleted from the structural representations interpreted by agrammatics. The second difference concerns the application of the default interpretive strategy. Grodzinsky's new formulations maintain that the default strategy should be restricted to apply only to referential NPs. According to this argument, agrammatic subjects utilize a referential strategy whereby a referential NP is assigned a role by its linear position if and only if it has no theta role.⁵

⁵Grodzinsky's referential strategy is based on the finding of Hickok and Avrutin (1995) who suggest that *which-N* questions elicit agrammatic subject-object asymmetry in comprehension, whereas *who* questions do not. In other words, movement from object position causes comprehension failure if the moved element is referential, viz. *Which-N*, but not if it is the non-referential element *who*. This dissociation, as Hickok and Avrutin discuss, can be accounted for in terms of the types of bindings chains that *which-N* and *who* phrases form. That is, *which-N*

Though the Trace-Deletion Hypothesis appears to be original and quite influential, several important objections have been raised against it. The first major objection regards Grodzinsky's limited range of data and his overly narrow interpretation of them. The second objection concerns the fact that the results of Grodzinsky's studies are not consistently supported and confirmed by other researchers' data and observations. There are marked individual differences among agrammatic subjects. Some patients assign less syntactic structure, while others are capable of assigning more syntactic structure than Grodzinsky claims. Patients also represent highly variable individual error patterns. Thus, Trace-Deletion analysis cannot be generalized to all agrammatic subjects, and is at most applicable to a sub-set of patients, as argued by Caplan and Hildebrandt (1988).

A further objection concerns Grodzinsky's proposal regarding the default strategy. Given the considerable variation of error patterns of agrammatic subjects on passive predicates and object-relativized structures, both Hickok et al. (1993) and Maunder et al. (1993a) have suggested that chance performance on the relevant structures can be derived without invoking a default strategy. Another important objection is that the theory of Trace-Deletion does not offer any explanation for agrammatics' difficulty with perceiving function words. Nor it is apparent how a

phrases are entitled to binding chains, while *who* phrases are entitled to government chains. This may lead to the conclusion that it is binding processing but not government processing which is affected in agrammatism.

theory merely restricted to the deletion of empty categories could account for a deficit in the perception of function words. And finally, as proposed by Pulvermüller (1995), within Grodzinsky's account the disturbances in production and in perception are not correlated with each other, and so cannot be explained under a unified analysis.

2.4.2.4.3 Other Partial/Restrictive Asyntactic Accounts

There are other theories regarding the relationship between expressive agrammatism and syntactic comprehension impairments which view the deficit in a very restrictive way. One of these theories, advanced by Rizzi (1985), claims that the elements which are more likely to be integrated into the agrammatic's linguistic representations are those which are entitled to theta (θ) roles. That is, theta-role assignees and assigners are retained in agrammatism, whereas items accomplishing neither of these functions are impaired. On this basis, Rizzi specifies which elements participate in theta-role assignment and which do not.

Rizzi has put forward a highly specific theoretical formulation in which agrammatism is very narrowly interpreted, and is tied to specific words. Moreover, the database supporting his analysis is too small and is limited to only one language. It is evident that agrammatism does not involve just a single category, and agrammatics demonstrate extensive variability in their abnormalities. So, contrary to Rizzi's claim, the deficit analysis proposed in his account cannot hold for all agrammatic subjects.

Nonetheless, despite all the shortcomings of this analysis, more empirical investigations are needed before we can accept or reject it totally.

Most recently, Hagiwara (1995) has offered a syntactic analysis of agrammatism based on the structure of phrases following recent advances in X-bar theory. She addresses the issue of why certain functional elements are more impaired than others, and why agrammatics are differentially sensitive to configurational aspects of surface structure. Hagiwara maintains that functional heads in lower positions of phrase structure are better preserved than those in higher positions. This means that functional projections of Determiner Phrases (DPs) and Complementizer Phrases (CPs) are more susceptible to disruption than functional categories of Inflectional Phrases (IPs) and Negation Phrases (NPs).

Reznik (1995) suggests a revised form of Hagiwara's account in which contentful functional categories will be less impaired in agrammatism than those with no content, because they are present both in syntax and in Logical Form. Undoubtedly, it would be very interesting to find out whether there are differences between IP versus CP and DP elements across languages. However, as Maurer et al. (1993a) point out, there are also semantic and pragmatic factors which should be taken into account when analyzing the differential sensitivity of agrammatic patients to various functional categories. Violations of IP elements may be less frequent in agrammatism because they are semantically or pragmatically less felicitous than violations of CP and DP

elements.

The two analyses by Reznik (1995) and Hagiwara (1995) sketched above try to define agrammatism syndrome within a highly restrictive syntactic framework. Given the multifaceted characteristic of the deficit, we may question the validity of any account relying on extremely narrow explanations. Nonetheless, the extent to which each of these hypotheses can be applicable to agrammatic patients merits further investigation.

2.4.2.5 Phonological Accounts

One of the most widely debated proposals concerning agrammatism has been the phonological account by Kean (1977, 1979, 1980). This account is basically concerned with the proper categorization of the data into word types and with distinguishing the omitted from the spared elements in agrammatism. Kean has argued that one can distinguish the class of phonological clitics (closed-class items/function words) from the phonological words (open-class items/content words) on the basis of systematic linguistic criteria. This model predicts that agrammatic patients will be impaired in their use of phonological clitics, as these are not subject to word-level phonological processes.

Kean's phonologically-based theory stems from the rationale that the class of elements affected in this syndrome are to be defined in terms of aspects of their sound

pattern. She suggests a model of agrammatism in which the syntactic representation is reduced to only those linguistic units that contribute to its stress pattern. The rules for stress assignment in English assign stress to phonological words (N, A, V), and ignore free-standing function words and inflectional affixes. As a consequence, the unstressed morphemes, or phonological clitics in Kean's terminology, will be excluded from both the production and comprehension of sentences.

Kean's proposal has been subject to criticism on a number of grounds. In reaction to her theory, Lapointe (1983) has provided an alternative formulation in which the distinction between closed/omitted-class and open/spared-class items is claimed to be accounted for within a morphological generalization. However, both his and Kean's accounts offer limited descriptive generalizations and fail to account for data cross-linguistically. The major problem with Kean's proposal arises in connection with languages whose morphological properties differ from those of English. The prediction of this account concerning the omission of clitics and the retention of phonological words can be valid only if we assume that phonological words and clitics are continuous and linearly organized. Given the existence of languages with non-concatenative morphological structure (like Semitic languages), the generalization made by Kean cannot be considered universal, because its scope appears to be limited to languages which represent English-like morphology. In this connection, the theory is criticized for another incorrect prediction. The crucial assumption underlying this

phonologically-based theory is that omission is the only error type that agrammatics make. However, it has already been noted that substitution of grammatical morphemes may be another behavioural pattern observed in agrammatism. The last point to mention here is that the distinction between the two groups of words in Kean's account is based on stress patterns in English. Therefore, this theory predicts that phonological clitics are deleted in agrammatism because they are excluded from stress assignment. However, if there proves to be a language which does not distinguish the two groups of words in terms of stress, then this would be counterevidence against the phonological account.

2.4.3. Processing Accounts of Agrammatism

2.4.3.1. Overview

In the preceding sections, we have reviewed and considered the adequacy of a number of proposals aimed at providing a representational/structural description of agrammatism. These proposals hold that the pattern of disruption in agrammatic subjects can be characterized in terms of a representational limitation in one or another module of the normal grammar. Agrammatics, thus, would fail to assign correct syntactic representation to sentences because they are missing some portion(s) of the syntax.

There is a great deal of evidence that calls into question any form of

representational account of the deficit. It has been argued that agrammatic aphasics show inconsistent performance patterns in different tasks. They might succeed in a particular task which minutes later causes them great difficulty. Moreover, there are studies reporting a dissociation between agrammatic production and comprehension. For example, some patients demonstrate agrammatic symptoms in production, but not in comprehension (Miceli et al., 1983; Kolk et al., 1985). On the other hand, there are reports on a group of patients who exhibit agrammatic comprehension, but maintain intact production (Smith & Bates, 1987).

Findings that agrammatics are able to make grammaticality judgements with a high rate of accuracy present a further challenge to structural accounts of agrammatism.. This ability has also been reported for patients who were severely agrammatic in both production and comprehension (Linebarger et al., 1983). Spared sensitivity to grammatical violations implies that syntactic structures may be preserved in these patients and that their impaired production and comprehension may be due to problems in some other component of the language apparatus. In the light of preserved grammaticality judgement abilities in agrammatics, some researchers have taken a fresh look at processing accounts of agrammatism (Bradley et al., 1980; Linebarger et al., 1983; Kolk & Van Grunsven, 1985; Caplan & Hildebrandt, 1988; Friederici & Kilborn, 1989; Haarman & Kolk, 1991; Kolk, 1995).

The basic assumption underlying processing accounts is that agrammatism does

not result from the lack of grammatical knowledge, but rather from a disruption in accessing or manipulating this knowledge. Moreover, these accounts predict three kinds of variability in the performance of agrammatics: performance variability across sentences, performance variability across patients, and performance variability across languages. Although processing accounts diverge slightly with respect to their theoretical assumptions, they mainly consider temporal factors to be the underlying source of disrupted processing in agrammatism. These factors, as cited in Frazier and Friederici (1991), are attributed either to disruptions of the early availability (Bradley et al., 1980), late decay (Hagoort, 1989), or simultaneous availability of information (Friederici, 1988). Although the source of processing difficulty might be routed in working or short-term memory limitations, these limitations are assumed to allow for the construction but not the interpretation of syntactic structures (Linebarger, 1983). The evidence supporting this claim is that the phonological processing system, on which the verbal working memory depends, is usually disrupted in non-fluent aphasics (Caramazza et al., 1983). A possibility suggested by Swinney and Zurif (1995) is that the broad cortical area implicated in Broca's aphasia sustains multiple functions including speed of activation and memory. Memory capacity can be subject to disruption as a consequence of slower-than-normal activation.

In the following sub-section, we attempt to outline two different processing accounts of agrammatism. It is important to note here that these analyses differ from

one another with respect to how the processing component of the linguistic system is disrupted.

2.4.3.2. Adaptation Theory

Kolk and co-workers (Kolk & Van Grunsven, 1985; Kolk, Van Grunsven, & Keyser, 1985; Kolk & Friederici, 1985, Kolk, 1995) proposed a processing model which treats agrammatic production as a timing disruption. In this model, it is assumed that agrammatics suffer from a delayed activation of computational processes and/or an accelerated deactivation of syntactic categories. The ensuing deficits associated with agrammatism are the result of an adaptive strategy which is developed and exploited by the patient for communicative purposes. Generally speaking, Adaptation Theory encompasses the following three assumptions (Kolk & Van Grunsven, 1985, p. 183):

1. Omissions in agrammatic speech do not result from the impairment itself. They are the consequence of the particular way in which the patient, by means of an unimpaired system, adapts to the impairment.
2. The impairment that underlies agrammatism is not the loss of some basic piece of knowledge or ability, but a delay in the processes that underlie sentence production.
3. Adaptation is not a necessary consequence of the underlying impairment. It results from a decision the aphasic speaker has to make. He has to decide whether or not to

adapt.

According to these assumptions, agrammatic spontaneous speech is a simplified message which results from the aphasic's adaptive reaction to his limitations in linguistic resources and capacity overload.⁶ The limitations and impaired capacity are due to a slowing down of the syntactic processing component that interferes not only with the computation of structures but also with the selection of the required grammatical morphology. It is assumed that syntactic representations have to be generated within a certain period of time. Otherwise, because of limited duration in memory, the sentence representations will be subject to disintegration. Similarly, every element which participates in a sentence representation needs some time to reach a peak level of activation. During this time, considerable information about the morpheme is retrieved from the mental lexicon. A delay in the retrieval process, however, will have a negative impact on the production of the morpheme, and increases its chance of being prematurely forgotten. Thus, the impairment that underlies agrammatism is not a disturbance of syntax *per se*, but rather follows from a slow-down in computational processes located at the sentence or word level. The delay hypothesis predicts different patients to have different amounts of delay in syntactic processing, and therefore to exhibit varying levels of performance in both their production and comprehension. That is why some patients perform at chance

⁶Adaptation Theory is inspired by an argument in Isserlin (1922). In fact, as Kolk states, the message simplification hypothesis was first proposed by Isserlin (cf. Kolk, 1995, p. 293).

level on structures such as passives, while other patients might show above-chance performance on these constructions (Kolk & Van Grunsven, 1985).

The other prediction derived from the delay hypothesis concerns variability in performance level across different sentence types. Agrammatic aphasics are expected to demonstrate serious problems with syntactic structures that impose heavy demands on the processing system. In this respect, the most salient sentence properties requiring greater processing demands are claimed to be sentence length and sentence complexity. This means that longer as well as syntactically more complex sentences will take more time to process and will consequently be more affected by a delay. Such difficulties should be observable in normals as well, because their syntactic operations are subjected to the same type of real time constraint and similar effects of sentence length and sentence complexity should also hold for them. Agrammatics and normals, according to this argument, may only differ with regard to their level of performance, not their pattern of performance. Aphasics' problems occur at an earlier point, with less complicated syntactic constructions, whereas normals show the same pattern of performance under more extreme circumstances, at a later point and with more complicated sentences. Hence, the differences in sentence processing between normals and aphasics could be described as differences of degree/quantity (rather than of quality) of the temporal window which is available for the computation of sentence structure. Kolk and Heeschen (1992) have argued that the grammatical constructions

used in agrammatic speech are a sub-set of the normal repertoire. This sub-set consists of elliptical constructions normal speakers produce under certain time-stressed conditions.

Another important point to consider is that a telegraphic utterance is not the sole option available to patients. Agrammatic subjects may, in fact, exhibit different styles of output. An agrammatic might abandon the adaptive strategy of omission if a telegraphic form could not fulfil his purposes. This prediction is reinforced by several studies, indicating that the omission rate of function words depends on the degree of formality of the speech situation (Miceli et al. 1983; Heeschen, 1985; Kolk & Heeschen, 1992). In informal situations, the patient's output tended to be more agrammatic and elliptical. This contrasted with formal situations in which the patient's production, despite containing more pauses and repetitions, was more complete and grammatical.

Given the predictions made by Adaptation Theory, Haarmann and Kolk (1991) have developed a computer model, SYNCHRON, which simulates the temporal course of the construction of a hierarchical phrase structure representation. This model is based primarily on the assumption that activations of syntactic elements are interdependent. That is, information about a syntactic category, say the subject, must be available in order for the proper form of the verb to be retrieved. This indicates that there must be computational simultaneity or synchrony between the two types of

information. A syntactic slow-down will, therefore, lead to temporal compromise or desynchronization of language processing which is assumed to be the underlying cause of the premature disintegration of sentence structures in agrammatism. The agrammatic patient can escape from the consequences of disintegration of the underlying representation by resorting to a telegraphic style.

Kolk and his colleagues attempt to explain agrammatism within a purely processing framework. One important piece of evidence cited in support of their Adaptation Theory is the instability and variation observed even within the same patient's performance. This has been attributed to intentional switching from a telegraphic, to a complete style depending on the informality or formality of the circumstances in which agrammatics find themselves. Only the most impaired, telegraphic agrammatics and the least impaired, fluent ones exhibit invariant production (Kolk et al., 1985, Heeschen, 1985). The majority of agrammatics who fall somewhere between these groups are presumably more likely to vary their production. Unfortunately, it is difficult to determine how much factors such as poorly controlled experiments and imprecise interpretation of findings might also contribute to the impression of variation in production.

Although Kolk et al.'s account is extremely promising and may lead to a greater understanding of agrammatism, it also raises a number of questions. For instance, their theory does not explain why degree of disruption in language processing time varies

across agrammatics. In addition, there are no independent neuropsychological or theoretical criteria for distinguishing patients with severe delay from those with mild or medium delay. Finally, complex sentences are assumed to further slow down the already compromised processing mechanism, although it is not clear how syntactic complexity is defined in Kolk et al.'s model.

2.4.3.3. The Avoidance Hypothesis

Heeschen (1985) developed the Avoidance Hypothesis which, like Kolk et al.'s Adaptation Theory, maintains that agrammatic disturbances in spontaneous output are a reflection of the patient's response to the deficit rather than the deficit itself.⁷

According to the Avoidance Hypothesis, agrammatics are able to develop a strategy as a reaction to their language problems "by avoiding any potential source of syntactic trouble in their spontaneous speech". The emergence of the avoidance strategy may be at least partially due to a degree of awareness present in agrammatic subjects. Agrammatics are usually aware of their linguistic deficiencies as evidenced by their constant self-blaming and depression.

Despite the similarity between Kolk et al.'s Adaptation Theory and Heeschen's

⁷Heeschen also claimed that paragrammatics suffer from the same underlying deficit as agrammatics. However, because paragrammatics are not as sensitive to or aware of their language breakdown, they do not avoid syntactic trouble spots in their spontaneous speech. This results in the substitution of incorrect forms instead of avoidance, especially during informal and unrestricted conversational situations. Heeschen claims that under controlled experimental conditions, both groups of patients reveal similar syntactic patterns in their output.

Avoidance Hypothesis, the two accounts diverge from each other on one major point. According to Kolk, the deficit is defined as a delay in language performance, and has nothing to do with a disruption of the syntax, whereas Heeschen maintains the opposite view, that syntax *per se* may be disrupted. Therefore, based on Kolk's theory, agrammatism is accounted for in terms of a processing disruption. By contrast, it could be attributed to a representational disturbance in Heeschen's hypothesis. Yet Heeschen does not clarify how syntax is affected and what the sources of syntactic disturbances are.

2.4.4. Concluding Remarks

The intent of this review was to examine the most significant and influential linguistically-based models of agrammatism. These models generally focus on different linguistic levels as the origin of agrammatism, with no model to date providing a unitary account of all its characteristics. In fact, it seems unlikely that a single explanation of agrammatism (whether based on syntax, phonology, semantics, etc.) could adequately account for the considerable diversity in the pattern of symptoms across patients, as well as the intricate patterns of within- and cross-modality dissociations. Given the increasing documentation of performance variability and patterns of dissociation among patients, it is even becoming difficult to specify a core set of symptoms based on which to formulate a unitary model of agrammatism. This

variation in the behavioural patterns of agrammatics is the result of a complex set of factors which interact with the severity of patients' impairments. These factors include structural characteristics that vary in complexity both within and across languages.

Considering the extent of variation across patients and languages together with the number of alternative accounts, agrammatism syndrome might appear as a fuzzy and chaotic phenomenon. However, it is still possible to make some generalizations about agrammatics. These include, but are not restricted to, their structurally-impooverished sentences, their tendency toward omission/substitution of grammatical morphemes and their relatively preserved comprehension ability. Although these generalizations provide us with an essential core upon which we can build our understanding of agrammatism, we are limited by the number of languages from which they have been obtained.

By studying agrammatics from a larger pool of languages and carefully considering the particular structural properties of each language, data that are ambiguous as to level of impairment in one language may be clear-cut in another. For instance, accounts of agrammatism in English speakers have been proposed at the phonological level. However, as Grodzinsky (1984) has shown, phonological accounts are inapplicable to Hebrew. Also, as languages sometimes employ different means to achieve the same grammatical ends, different manifestations of agrammatic symptoms may occur. For example, in languages such as Finnish, which have more bound than

free grammatical morphemes, patients tend greater toward morpheme substitution than in languages such as Dutch, which rely heavily on free grammatical morphemes (Menn & Obler, 1991). Similarly, agrammatic speakers of languages with few zero bound morphemes exhibit more substitution of bound inflectional morphemes, while impaired speakers of languages with a large number of zero morphemes favour omission of bound inflections. Ideally, agrammatism must be defined in a way which is independent of the grammatical devices that any language uses. In sum, precise cross-linguistic information and comparisons are required in order to obtain an accurate linguistic/psycholinguistic characterization of agrammatic behaviours.

A number of other problems plague research in agrammatism. These include inadequacies in experimental methods, overly narrow interpretation of deficits and inappropriate patient grouping. Inconsistent results obtained from agrammatic subjects may also be due to extralinguistic factors such as subjects' education, occupation, general intelligence, etc. These issues should be given serious consideration in order to formulate coherent accounts of the deficit (see Caplan, 1995, for a detailed discussion of these problems).

From a linguistic point of view, the structure of the human language faculty is assumed to consist of a grammar, characterizing an individual's knowledge of his language, and a processor, characterizing the computational systems by which grammatical knowledge is utilized. As the efficiency of both these inter-related

components is evidently a necessary condition for the functioning of the normal language system, research on agrammatism should consider the possibility that this family of deficits may involve disruption at both the levels of representation and processing. Support for this view is provided by several studies suggesting that comprehension difficulties encountered by agrammatics are more consistent with a processing limitation than with a syntactic deficit (Kolk & Van Grunsven, 1985; Kolk & Friederici, 1985; Kolk, 1995). These studies make it increasingly unlikely that accounts relying merely on representational aspects will yield satisfactory explanatory models of agrammatism. Thus analyses of agrammatic performance should include a specification of the adaptations and processing strategies patients make to their primary deficit. By combining an explicit theory of grammar and its representation with a processing account, such as Kolk et al.'s Adaptation Theory, we are more likely to provide an adequate interpretation of the apparently contradictory data on agrammatism.

The major goal of the current study is to compare representational versus processing accounts of morpho-syntactic difficulties in agrammatism through an in-depth investigation of the performance of two Persian-speaking agrammatic aphasics. By focussing on the comprehension and grammaticality judgement performance of these patients, the present research could provide greater insight into patterns of morphological and syntactic disruptions in agrammatics, and may help us to broaden

our understanding of the true nature of this syndrome.

CHAPTER 3

THE PRESENT STUDY

3.1. Introduction

This research focuses on the comprehension and grammaticality judgement capabilities of two Persian-speaking agrammatic aphasics. The stimuli were designed to explore their sensitivity to certain syntactic constructions and morphological markers of pronominal clitics and null subject pronoun. The subjects' performance was investigated in two experiments using five different tasks. Two tasks (A, B) were designed to examine syntactic performance and three (A, B and C) were designed to explore morphological ability.

1. Syntactic Experiment:

- A. Syntactic Comprehension Task
- B. Syntactic Grammaticality Judgement Task

2. Morphological Experiment:

- A. Morphological Comprehension Task
- B. Morphological Grammaticality Judgement Task
- C. Morphological Cloze Test

To obtain a clear and thorough picture of the aphasic subject's linguistic abilities and disabilities on a particular test, it is essential to determine whether their performance difficulties are restricted to that particular linguistic task or whether they extend across other task demands and modalities. To achieve this, it is necessary to test the subjects on both comprehension and grammaticality judgement tasks which include similar sets of stimuli. Such a comparative examination of the two tasks in the same data set would enable us to precisely delineate the type of relationship that might exist between the ability to comprehend sentences and to perform grammaticality judgements. More specifically, it is crucial to verify whether subjects demonstrate a more or less equal performance in comprehension and grammaticality judgement or whether they turn out to have more difficulties with the former than with the latter task. We can also determine whether comprehension and grammaticality judgement ability are constant across various sentence types.

Before proceeding into an elaboration of the issues addressed in this research, it is necessary to present certain syntactic and morphological features of Persian grammar that are of particular relevance to the present study. These features include word order, inflectional characteristics, pronominal clitics and null subject pronoun in Persian.

3.2. A Brief Analysis of Relevant Aspects of Persian Grammar

3.2.1. Word Order

Persian is an Indo-European language whose canonical or unmarked word order is SOV (Greenberg, 1963; Windfuhr, 1979; Karimi, 1989). Based on Karimi (1989), the following underlying word order can be suggested for Persian:

(8) (S) (PP) (O) V

However, pragmatic factors can lead to variations in word order in both main and subordinate clauses. Certain types of reordering of the phrasal categories are possible in Persian pre-verbal as well as post-verbal positions. This means that Persian, despite being a verb-final language, is not a rigid type III language.⁸ Also, unlike typical type III languages, which are post-positional, Persian is a pre-positional language, as illustrated by example (9).

(9) Afshin be mādar-bozorg gol rā dād.
Afshin to mother-grand flower DO gave
"Afshin gave the flower to the grandmother."

3.2.2. Inflectional Characteristics

Persian is considered to be an inflectional language. However, its inflectional system is not as rich as that of languages such as Greek, Serbo-Croatian and Italian. This means that syntactic categories such as subject and object are not inflectionally

⁸Greenberg (1963) has classified Persian as a type III language. Type III languages are verb-final and post-positional languages, with their modifying genitives and adjectives preceding the head noun.

case marked. Instead, case is usually encoded by functional morphemes, such as free-standing prepositions and the direct object article “rā”, as shown in sentence (10).

- (10) Man ketāb rā az Ali gereft-am.
I book DO from Ali took-1st sg.
“I took the book from Ali.”

Despite having a weaker inflectional system than some other inflectional languages, Persian appears to share more similarities with respect to word order and morphological characteristics with languages such as Italian than with English. Both Persian and Italian have relatively loose word order and stronger inflectional systems. English, by contrast, has fixed word order and a weak inflectional system.

3.2.3. Pronominal Clitics

The pronominal clitics in Persian, as shown in (11), are a set of multi-functional bound morphemes which encode person and number features, and are classified as inflectional morphemes. Depending on the elements that they are cliticized to, they may have different syntactic functions.

(11)	<u>Singular</u>	<u>Plural</u> ⁹	
	-m	-mān/mun	“our”
	-t	-tān/tun	“your”
	-s	-šān/šun	“their”

When attached to the subject agreement marker at end of the verb, pronominal clitics behave syntactically as direct object, as in example (12).

- (12) Man xarid-am-eš.
I bought-1st sg.-it
“I bought it.”

They function as indirect object after a preposition, as in (13).

- (13) Be-t goftam-im.
To-IDO told-1st pl.
“We told you.”

Example (14) indicates that clitic pronouns can appear in post-noun position, taking the role of possessive pronoun.

- (14) Pa-t
Leg-your
“Your Leg”

3.2.4. Null (Ø) Subject Pronoun

Persian is a *pro-drop* language. The grammatical overt subject may be dropped,

⁹The plural forms *mun*, *tun* and *šun* usually occur in the colloquial pronunciation of Persian.

but the verb inflection still indicates person and number information. The following examples show that the subject can be missing in both main and subordinate clauses.

- (15) Ø xune xarid-and.
House bought-3rd pl.
“They bought a house.”
- (16) Ø goft-am be to ke Ø xune xarid-and.
Told-1st sg. to you that house bought-3rd pl.
“I told you that they bought a house.”¹⁰

3.3. Syntactic Issues Under Investigation

3.3.1. Syntactic Comprehension Task

In designing the Syntactic Comprehension Task, our purpose was to answer basic questions regarding the occurrence and the nature of syntactic comprehension deficits and skills in agrammatism. More specifically, we wished to assess the patients' ability to assign thematic roles to noun phrases in different syntactic positions. This ability to assign thematic role, as Caplan and Hildebrandt (1988) discuss, indicates sensitivity to the fundamental aspects of syntactic organization, including the linear order of major lexical categories, the hierarchical organization of categories, verb argument structure, and function and inflectional elements. The agrammatics' responses to a variety of structures would permit us to see if they exhibited a predicted

¹⁰The appearance of the direct object article “rā” in Persian depends on the specificity characteristic of the direct object NP in the sentence. In (15) and (16), for example, “rā” has not occurred in post-object position, as the NP “xune” is a non-specific direct object.

breakdown over a particular set of syntactic structures, and if a hierarchy of difficulty for different sentence types could be found. Moreover, we could determine to what extent, if any, agrammatic interpretation is carried out on the basis of a heuristic strategy.

It is well-documented that agrammatic aphasics have problems with complex syntactic materials (Caramazza & Zurif, 1976; Goodglass, 1976; Caplan & Futter, 1986; Caplan & Hildebrandt, 1988). These problems are considered to be directly related to the degree of complexity of sentences. That is, the more complex a sentence, the more problems the patient shows in his/her performance. In particular, a number of studies have revealed that agrammatics have particular difficulty comprehending non-canonical sentence structures (i.e., non-SVO sentences in English, and non-SOV sentences in Persian) in which the order of major lexical items does not reflect their functional relations (Heilman & Scholes, 1976; Schwartz, Saffran, & Marin, 1980; Grodzinsky, 1986, 1989). This observation is consistent with the finding that patients perform above chance level in the comprehension of simple active, subject cleft and subject relative sentences. By contrast, their comprehension is only at chance level on passives, object clefts and object relatives. This subject-object asymmetry in comprehension found for clefts and relative clauses has provided the theoretical basis for Grodzinsky's Trace-Deletion Hypothesis, according to which constructions such as object clefts and object relatives are derived through transformational derivations,

while the other, less problematic structures are not.

To examine the effects of sentence complexity on the comprehension ability of Persian agrammatics, our subjects were tested on the following five types of sentences: simple actives, subject clefts, object clefts, subject relatives and object relatives. Among these sentence types, relative clauses may be considered as the most difficult syntactic constructions. Relative clauses require that thematic roles be assigned to nouns in relation to two verbs, whereas in both active and cleft sentences, thematic role assignment to nouns takes place in relation to only one verb.

This design also allows us to address the validity of the different major hypotheses regarding the precise nature of syntactic defects in agrammatism. The results of this approach could lead us to either account for the comprehension deficit patterns in terms of the representationally-oriented theories that postulate a complete syntactic disorder (Berndt & Caramazza, 1980) or to analyze them in terms of a partial syntactic disorder (Caplan & Futter, 1986; Grodzinsky, 1986, 1989). If a partial disorder turns out to hold for agrammatic comprehension patterns, then it should be determined which components of syntactic representation have been affected. Another crucial issue is whether our results provide a replication of the comprehension patterns predicted by theories such as the Trace-Deletion Hypothesis; that is, above chance performance on subject clefts and subject relatives, and at chance performance on object clefts and object relatives.

3.3.2. Syntactic Grammaticality Judgement Task

A further goal of the present study is to obtain evidence that could distinguish between the adequacy of the two most divergent accounts of agrammatic comprehension, namely, the structural account (Caramazza & Zurif, 1976; Kean, 1977; Bradley, Garrett, & Zurif, 1980) and the processing account (Wulfeck, 1987; Friederici, 1988; Kolk, 1995). One approach to resolving this issue is suggested by reports of intact grammaticality judgement ability in agrammatics with impaired comprehension ability. This important finding has been confirmed in more recent reports of preserved grammaticality judgements in the face of impaired comprehension (Wulfeck, 1987; Wulfeck, 1988; Wulfeck & Bates, 1990; Saddy, 1992). Agrammatics' ability to make subtle grammaticality judgements questions the credibility of the central deficit hypothesis, which holds that the deficit associated with agrammatism has parallel reflections in all language modalities (Gardner, Denes, & Zurif, 1975; Caramazza, Berndt, Basili, & Koller, 1981). Furthermore, it may suggest that agrammatism results from an impairment in the accessing of linguistic information rather than from the loss of linguistic knowledge *per se*. On the other hand, according to both Zurif and Grodzinsky (1983) and Wulfeck (1988), the dissociation between patients' performance on grammaticality judgement and comprehension tasks may indicate that comprehension and grammaticality judgement involve separate processes and operate on different aspects of linguistic input.

To examine the preserved grammaticality judgement ability of agrammatic aphasics, we designed a syntactic grammaticality judgement task that focusses on recognition of various word order and agreement violations. Data from a number of cross-linguistic studies suggest that basic word order principles remain more resistant to damage in agrammatism than closed-class morphological elements. This means that word order violations should be easier for agrammatics to detect than agreement violations, a prediction that is also confirmed by the research to date (Bates, Friederici, & Wulfeck, 1987a,b; Bates, Friederici, Wulfeck, & Juarez, 1988; Wulfeck, Bates, & Capasso, 1991; MacWhinney, Osmán-Sági, & Slobin, 1991). However, the claim regarding the selective vulnerability of morphology has been based mostly on data from English, which has strong constraints on word order, but relatively weak morphology. Given the typological profile of English, these findings appear to be compatible with the Competition Model (MacWhinney & Bates, 1989), which predicts that the strongest cues in a language tend to be the best preserved ones. If this model is correct, we would expect to find the reverse pattern for languages with a rich morphological system and a weak word order. An initial examination of the available research findings suggests that this is not the case. Research on Italian (Wulfeck et al., 1991), German (Bates et al., 1987) and Serbo-Croatian (Smith & Mimica, 1984), languages whose grammatical morphology is stronger and more fixed than their loose word order, demonstrates that morphological cues, by and large, show a greater tendency toward

disruption than does word order.

Although findings across all languages studied so far appear to support the claim that morphology is more compromised in agrammatism than word order, a more careful examination of these studies indicates that the degree to which morphology is compromised relative to word order in agrammatics is inversely related to the degree of strength and syntactic value that morphological markers carry in a language. In this regard, the literature includes reports of significant cross-language differences associated with agreement and word order information. For example, Bates and MacWhinney (1987) report that both English-speaking and Italian-speaking agrammatic patients exhibited greater ability in detecting word order errors compared with agreement errors. However, their Italian-speaking aphasics detected more agreement violations than their English-speaking counterparts, whereas the English-speaking agrammatics detected more word order violations than did the Italian speakers. This supports the view that the strongest cues of a language remain less impaired in agrammatism, and that language-specific characteristics play an important role in determining agrammatics' behavioural patterns. By including stimuli with word order and agreement violations in our Grammaticality Judgement Task, we were able to further test the validity of the Competition Model. The design of this part of the study is based loosely on Wulfeck (1988), but with Persian-speaking agrammatic subjects.

3.4. Morphological Issues Under Investigation

The Morphological Experiment focusses on agrammatics' ability to process a particular set of morphological elements, and to investigate the relationship that exists between their morphological comprehension ability and their ability to detect morphological violations in a grammaticality judgement task.

Research on morphological errors observed in agrammatics' performance has always been one of the most controversial issues in aphasia. There is a great deal of evidence indicating that function words, such as determiners, prepositions and pronouns, as well as inflectional morphemes, are particularly subject to disruption across languages (Bates, Friederici, & Wulfeck, 1987; Kehayia, 1990; Friederici, Weissenborn, & Kail, 1991; among many others). Bradley, Garrett, and Zurif (1980) have suggested that agrammatics are impaired in their ability to access the closed-class vocabulary, and are thus unable to mark the syntactic relations between phrasal constituents within a sentence.

The view of a loss of closed-class vocabulary in agrammatism has, however, been challenged by a number of researchers. Various cross-linguistic investigations illustrate that agrammatic patients have access to morpho-syntactic knowledge, and are sensitive to closed-class elements in various tasks, even though their processing of these elements is delayed relative to that of normals (Swinney, Zurif, & Cutler, 1980; Friederici & Schönle, 1980; Lukatella, Crain, & Shankweiler, 1988; Rosenthal &

Goldblum, 1989). Despite these findings of relatively well-preserved morpho-syntactic abilities in agrammatics, it is still unclear what type of morpho-syntactic information is available to this group of patients, and which aspects of morphological knowledge are responsible for their processing problems. Furthermore, the extent to which aspects of morphological processing might be differentially disrupted needs greater specification. The results of the present experiment contribute to this debate by providing data on morphological disruption in Persian agrammatics.

The examination of clitic pronouns in Persian is relevant from both a morphological and a syntactic perspective. First, these elements are homophones. Thus, the identical phonetic realizations of these items do not help the patients determine their grammatical functions. Second, these elements can appear as both clitic and non-clitic forms (i.e., phonological clitics and phonological words according to Kean's definition). This clitic/non-clitic distinction makes it possible to see if patients' reactions are influenced by the phonological status of these pronouns. Third, these pronouns assume different syntactic functions (direct object/indirect object/possessive) depending on the phrasal categories and sentence positions in which they occur. Given this property of Persian, we can test the effects of phonological and syntactic factors on agrammatics' performance within one language.

The Persian pronominal system, as briefly discussed above, involves two classes of strong and clitic pronouns for certain forms. These are direct object (DO),

indirect object (IDO) and possessive pronouns, as represented in the following examples.

- | | | |
|------|---|---------------------------|
| 17a. | Ali u ra did.
Ali he/she Do saw
"Ali saw him/her." | DO strong pronoun |
| 17b. | Ali dide-š.
Ali saw-him/her
"Ali saw him/her." | DO clitic pronoun |
| 18a. | Moʔallem bā u sohbat mikon-e.
Teacher with him/her talk do-3rd sg.
"The teacher is talking with him/her." | IDO strong pronoun |
| 18b. | Moʔallem bā-š sohbat mikon-e.
Teacher with-him/her talk-3rd sg.
"The teacher is talking with him/her." | IDO clitic pronoun |
| 19a. | Ketābe u ruye miz-e.
Book his/her on table-is
"His/her book is on the table." | Possessive strong pronoun |
| 19b. | Ketābe-š ruye miz-e.
Book-his/her on table-is
"His/her book is on the table." | Possessive clitic pronoun |

In all of these instances, the use of the clitic pronoun is optional. So, unlike Spanish (Reznik, Dubrovsky, & Maldonado, 1995), there is no context in Persian in which the use of a clitic pronoun is obligatory. The examples in (20) also show that a direct object strong pronoun (or a phrase) and a direct object clitic pronoun can be duplicated optionally.

20. Ali u/Amir rā dide-š.
Ali he/she/Amir DO saw-him/her
"Ali saw him/Amir."

This duplication pattern is not permitted for the IDO and possessive pronouns. It should be pointed out here that the homophonous nature of the clitic forms might give rise to some ambiguity in the assignment of case. However, the ambiguous forms can be functionally disambiguated within the sentential context. The homophony pattern of Persian clitics is realized in a regular fashion. That is, the singular forms *-m*, *-t*, and *-š*, and the plural forms *-mun*, *-tun*, *-šun* can function as either DO, IDO or possessive clitic pronouns.

As the examples above indicate, the DO clitics differ from both IDO and possessive clitics with respect to their position. In example (17a), the DO strong pronoun appears in a pre-verbal position, while in (17b), the DO clitic pronoun occurs in sentence-final position, and is attached to the verb. By contrast, the position of the IDO and possessive clitic pronouns does not differ from that of the non-clitic ones, as observed in (18) and (19). Following Reznik et al.'s (1995) argument regarding Spanish pronouns, we suggest that structures such as (17b) involve a chain formation process.

21. Ali ei dide-š*i*.
Ali saw-him/her.

In these structures, the verb cannot assign the thematic role to its internal argument in

the sub-categorized position. The appearance of the clitic "š" in a non-base position, however, leads to the establishment of a chain shown by the co-indexation between the empty sub-categorized element of the verb and the clitic pronoun. As Reznik et al. (1995) propose, all of the Spanish clitic pronouns can be accounted for in terms of the chain formation process. In Persian, by contrast, it is only the DO clitic pronoun which may be considered as an instance of this process.

The phenomenon of null subject can also be explained in terms of chain formation. Example (22) illustrates how this chain results from the relationship of the null element and the verbal morphology.

22. Ø Diruz be ketābxune raft-im.
Yesterday to library went-2nd pl.
"We went to the Library yesterday."

e: Diruz be katābxune raft-im_i.

Thus, there are two types of pronoun in Persian that can be considered as instances of syntactic chains. These are the DO clitic pronoun and the null subject pronoun. Unlike the case with IDO clitic and possessive clitic pronouns, the interpretation of sentences containing DO clitic pronouns and null subjects relies on the accurate co-indexing of the clitic and null element with their antecedents.

This experiment, therefore, would allow us to provide some insight into the issue of chain disruption in agrammatism. If it is true that the mechanism of chain co-indexation is disturbed in agrammatism, then the patients would be expected to show

a selective impairment in their interpretation of constructions involving DO clitic and null subject pronouns. In this case, the result would be in accord with Grodzinsky's Trace-Deletion Hypothesis (1986, 1989), which states that non-lexical terminal nodes/traces are deleted in the syntactic representations of agrammatics. By contrast, if the subjects perform equally well on all types of clitic and null subject pronouns, it implies that they have access to a highly articulated syntactic representation, and are able to generate well-formed constructions, including those which require the make-up of a chain and accurate computation of a phonetically null element.

The design of this experiment also allows us to investigate whether strong and clitic pronouns are processed differentially by agrammatic subjects. Depending on the results, we may argue for or against the Phonological Deficit Hypothesis proposed by Kean (1977, 1979). According to this hypothesis, lexical elements are divided into two classes of phonological words and clitics. Agrammatism is considered as a phonological impairment in which the class of phonological words are preserved, whereas the class of phonological clitics are omitted during language processing. The Phonological Deficit Hypothesis would predict that non-clitic pronominal forms/strong pronouns are processed more easily than clitic pronominals by Persian-speaking agrammatics. Although this prediction was not borne out for French-speaking agrammatic aphasics (Friederici et al., 1991), this study permits us to assess the credibility of the Phonological Deficit Hypothesis on the basis of data from a different

language.

As in the Syntactic Experiment, the Morphological Experiment also includes a Grammaticality Judgement Task which employs the same stimuli as the Morphological Comprehension Task. This task aims at evaluating the subjects' sensitivity to grammaticality and agreement violations. A Cloze Test was also administered to the patients. The inclusion of these two tasks enabled us to compare the agrammatics' behaviour on similar language constructions but in different performance modalities. Moreover, it provides us with further means to examine the relationship between the patients' underlying morphological capacities and their performance, and to investigate whether the patients' error patterns were due to the loss of knowledge or a disturbance in the process of accessing that knowledge.

CHAPTER 4

METHODOLOGY

4.1. Subjects

For the purpose of this study, two Persian-speaking agrammatic aphasic patients were tested. The selection of these patients was based on their medical records, including neurological examination, CT scans and EEG, as well as on language diagnostic information. The subjects were diagnosed as Broca's aphasics, although one patient (MG) presents a more severe form of this disorder than the other (RL). They were initially diagnosed by neurologists at a hospital in Tehran. Further diagnosis was conducted by the speech pathologist at the speech therapy clinic there. Diagnostic criteria included their performance on a battery of verbal and non-verbal cognitive tests standardly used for that purpose in Iran.

The etiology in both cases was a single cerebrovascular accident (CVA) causing left cerebral hemisphere damage. Both patients are very similar in terms of their extent and locus of neurological damage. Neither of the patients had any serious health problems prior to their stroke. Both of them were tested approximately one and a half years post-onset at a point when their initial global aphasia had resolved into a non-fluent effortful output.

The patients were tested on the syntactic and morphological comprehension and grammaticality judgement batteries developed for this study over the course of three sessions in June and July 1998 in Tehran, Iran. At the time of testing, they were enrolled in rehabilitation outpatient services. No evidence of hearing loss or tactile problem was observed in the patients, and their visual fields were reported to be normal. Neither of the patients has a family history of left-handedness or ambidexterity. Individual patient histories are listed in Table 1.

Table 1
Agrammatic Patients' History

Patients		
	MG	RL
Sex	F	M
Age at onset	32	49
Education	12	8
Occupation	Housewife	Businessman
Time post-onset	1 ½ Years	1 ½ years
Classification	Broca	Broca
Etiology	CVA	CVA

4.1.1. Subject 1: MG

MG is a 32-year-old right-handed housewife with a complete high school education. Her native language is Persian. However, she has a minimal knowledge of Turkish as a result of growing up in a bilingual family. She suffered an embolic CVA in 1996, which was likely caused as a side effect of birth control pills. Subsequent neurological examination and CT scanning revealed a left frontal lobe lesion specifically affecting Broca's area (Figure 1 and 2). At the time of testing, MG still suffered from a right-sided hemiplegia. However, she was able to walk without any assistance, and was capable of using her right hand to a limited extent. The patient initially presented with complete muteness which gradually, following intensive speech therapy, resolved into a very disfluent and labourious form of aphasia. She has shown a noticeable progressive improvement in all language modalities, particularly in production, between different sessions of rehabilitation and testing since the onset of her stroke. However, she still presents, in marked degree, with the characteristic features of Broca's aphasia, and her verbal output has remained extremely halting, effortful and telegraphic, with flat intonation. The following is a sample of her speech output.

Example of MG's spontaneous speech (March 1998)

Examiner: How many children do you have?
MG: Se...se...t....tā
"three...three...t...number"

- Examiner: Where did you live when you were a child?
 MG: Man...Hamedān
 "I...Hamedān"
- Examiner: Are your parents living in Hamedan now?
 MG: Bale
 "Yes"
- Examiner: Where have you travelled?
 MG: Ā...bā...dān, Ha...bān
 "Ābādān, Ahvāz"
- Examiner: Have you gone to the north of Iran too?
 MG: Bale
 "Yes"
- Examiner: Which cities?
 MG:
- Examiner: Do you go to the north every summer?
 MG: Bale
 "Yes"
- Examiner: When did you go to Ābādān? Recently?
 MG: Na
 "No"
- Examiner: Did you go a long time ago?
 MG: Māmān...māmān...Ā...bā...dān...bābā
 "Mother...mother...Ābādān...father"
- Examiner: You went with your parents. Do you remember it?
 MG: Bale
 "Yes"
- Examiner: What else do you remember about that trip?
 MG:

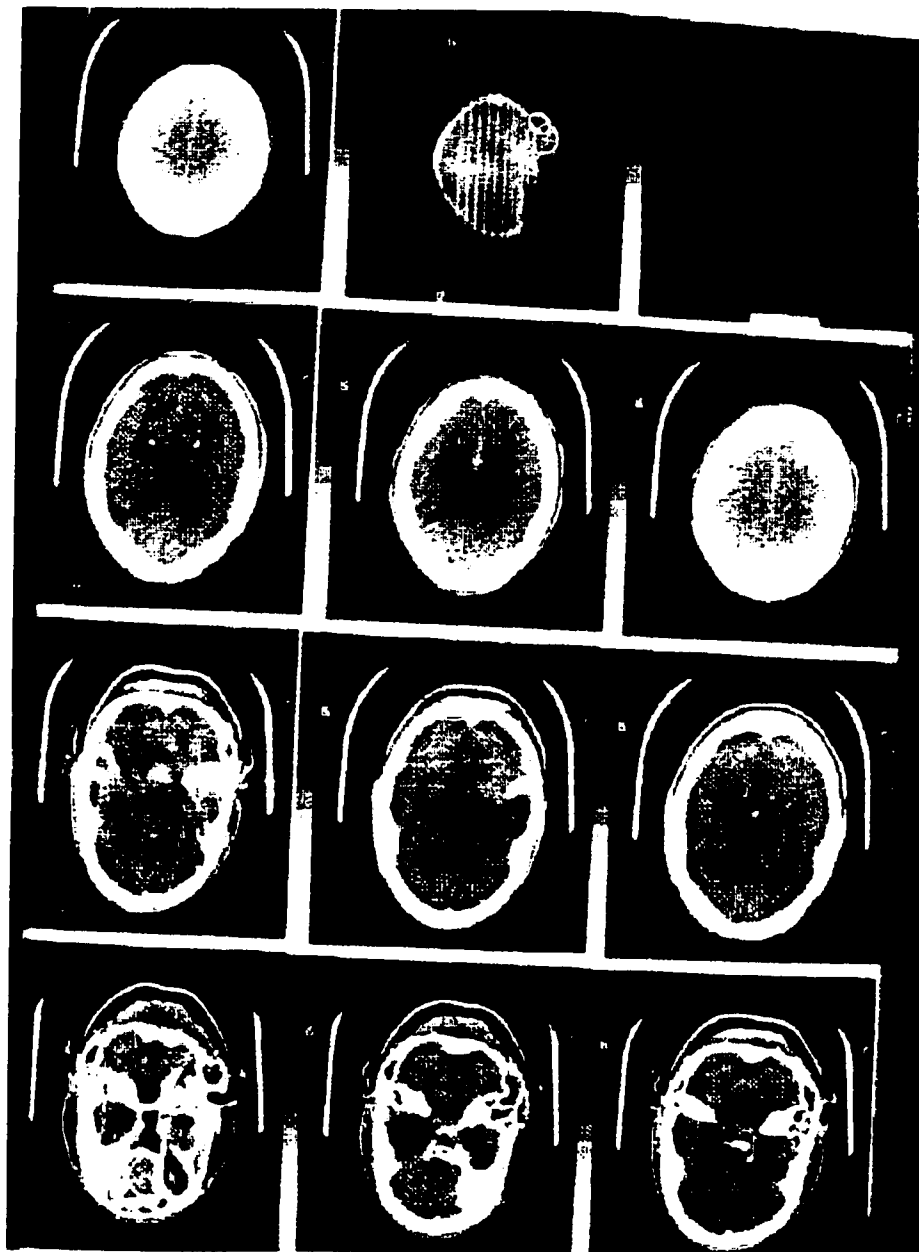


Figure 1: MG's CT Scans

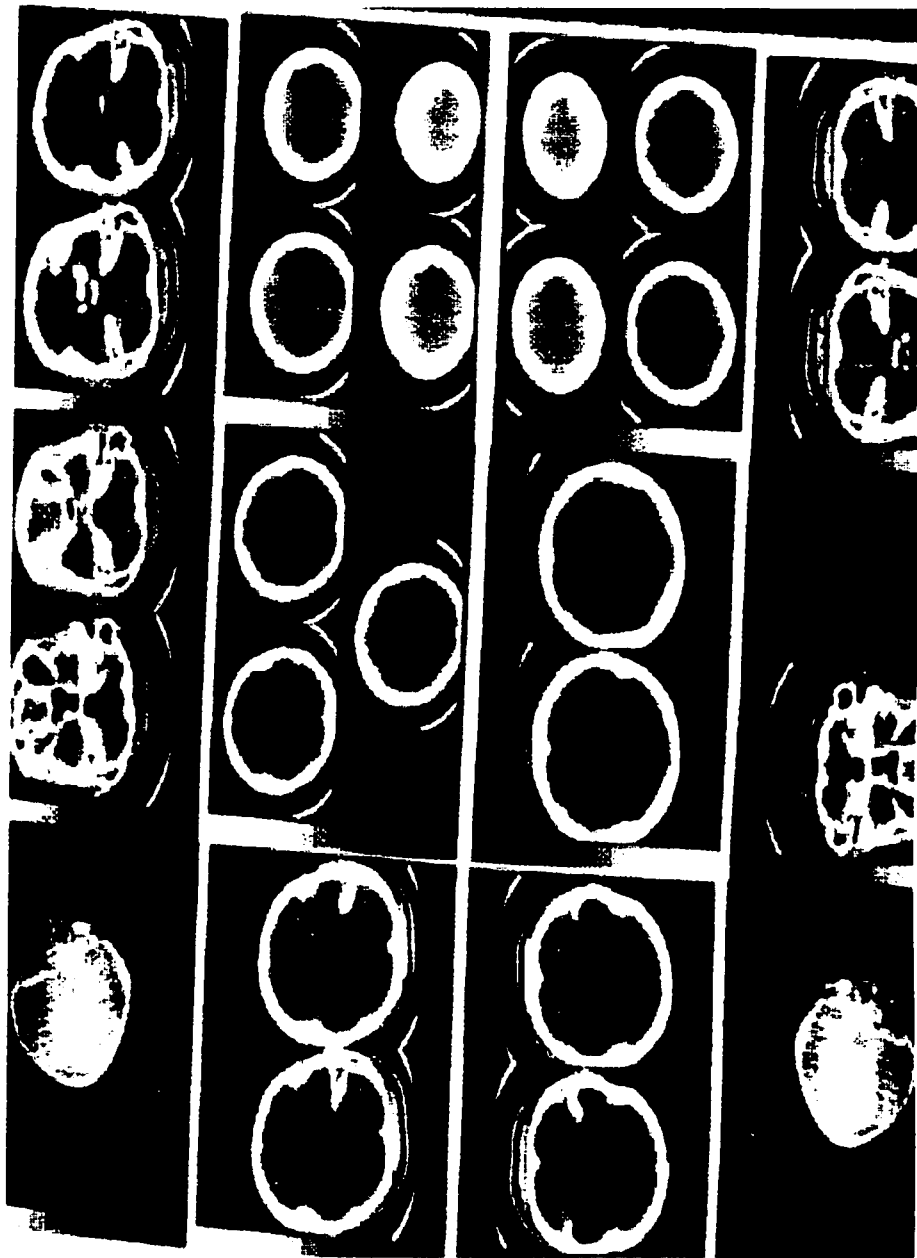


Figure 2: MG's CT Scans

The Persian version of the Bilingual Aphasia Test (BAT) (Paradis, Paribakht, & Nilipour, 1987) was administered to the patient around one and a half years after the insult. As measured by the results of the BAT, MG can be considered a prototypical agrammatic aphasic. Her clinical picture matches the classic profile of severe agrammatism syndrome. Figure 3 represents MG's Persian profile on the BAT.

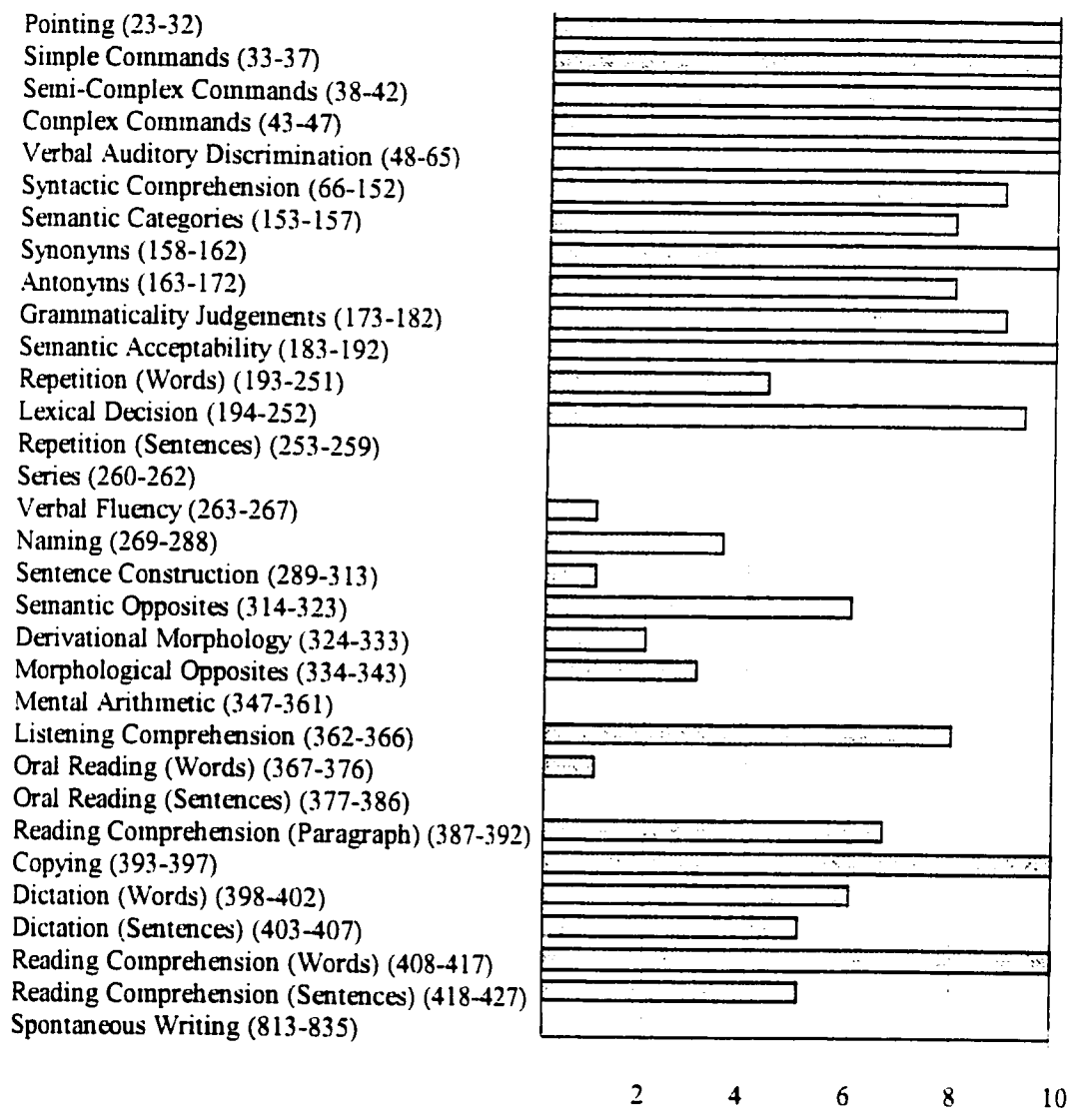


Figure 3: MG's Persian Profile on the BAT

MG's spontaneous speech is extremely telegraphic in nature, and is restricted to the production of content words. As predicted by the BAT, confrontation naming and word repetition are also impaired, but are superior to speech production. Unlike her word repetition, which is moderately disturbed, her sentence repetition is severely impaired. She demonstrated severe problems and apraxic blocks in oral reading of words, sentences and paragraphs. MG's auditory comprehension (i.e., identification of objects or body parts, and following commands) is almost intact. This result also corresponds to the BAT criteria, which predict that agrammatics should obtain better scores on tasks which do not require a verbal response. In contrast to her auditory comprehension ability, she shows a severe-to-moderate impairment in spontaneous writing and dictation. According to Paradis and Libben (1987), Broca's aphasics' written language is likely to be as impaired as their spoken language. MG demonstrates a relatively mild impairment on tests of semantic opposites, whereas her ability to do mental arithmetic seems to be totally disturbed. Poor derivational morphology, poor morphological opposites, and poor sentence construction are also among MG's deficits.

Despite having impoverished verbal production, MG retains remarkably well-preserved syntactic comprehension abilities. Thus, her poor production stands in contrast to her near-normal performance on tests of syntactic comprehension, suggesting that the patient is able to use her knowledge of syntax to decode the

meaning of sentences. In addition, the patient's high score on the BAT grammaticality judgement test illustrates that her ability to recognize the syntactic well-formedness of different sentences is very good. This preservation of grammaticality judgement is an indication that the patient has access to structural information, and that she does not have difficulty choosing between different inflected forms and syntactic phrase structures. The results of MG's performance on comprehension and grammaticality judgement is also consistent with the BAT characterization of Broca's patients, according to which comprehension and grammaticality judgement impairments do not necessarily co-occur with expressive agrammatism, although they can be observed in more severe cases of this syndrome.

4.1.2. Subject 2: RL

RL is a right-handed, 49 year old male with eight years of schooling. He ran his own business and was a heavy smoker. The patient is considered a bilingual speaker of Persian and Turkish. However, his educational background was solely in Persian.

At the age of 47 RL suffered a cerebrovascular accident that rendered him almost totally mute. Diagnostic tests showed an occlusion of the left internal carotid artery. A CT scan revealed an extensive lesion in the left hemisphere involving the fronto-temporal lobe (Figure 4).¹¹ RL was initially characterized as having severe

¹¹We were only able to obtain copies of RL's CT scans. Thus, compared to MG's CT scans in Figure 1 and 2, the pictures in Figure 4 are somewhat blurry.

aphasia, right hemiplegia, and apraxia of speech, as well as anomia. He can currently walk unsupported, but very slowly. However, he is not able to use his right hand at all. Following regular speech therapy, the patient showed rapid improvement of linguistic abilities, particularly his production, upgrading his diagnosis to mild agrammatism and marked anomia in spontaneous speech, as shown by the following sample of his speech production.

Example of RL's spontaneous speech (March 1998)

- Examiner: Tell us how your problem started. What happened?
 RL: Vällä...man...do šabe piš...man tu maqāze budam. nešaste budam
 "well...I...two night ago...I in store was-I. sitting was-I"
 Un vaqt...čiz...injā didam...āb oftād...in
 "Then...thing...here saw-I...water fell...this"
- Examiner: From your lips?
 RL: Gušeye lab-am..unvaqt raft-am piše un yāru...goft-am ke bebin-am
 "Corner lip-my...then went-I to that person...told-I that see-I"
- Examiner: To whom?
 RL: Un...āqā...yāru yeki az čizāye man bud...maqāze man (rā) dāšt (**deletion of rā**)
 "That...man...person one of things my was...store my had"
- Examiner: He had rented your store?
 RL: Na...injā māle man bud, unjā māle un bud
 "No..here mine was, there his was"
- Examiner: Your partner?
 RL: Hā...un vaqt..goft-am ke injā man čiz kard goft-**and (inflectional substitution)**...
 "Yeah...then..told I that here I thing did told they...
 eyb nadāre..boro xune..yek yek...xorde...asal boxor..čiz še...un vaqt...
 problem does not have..go home..a a..bit..honey eat...thing becomes...then...
 umad-am xune...čiz..hammāmao gerft-am...raftam...raftam...unja rā (**addition of rā**)
 came I home...thing..shower took I...went I...went I...there"
- Examiner: Where did you go? To the hospital?
 RL: Āre
 "Yes"

Examiner: What's the name of the hospital?
RL: Nemidun-am
"Don't know-I"

Examiner: Bānke Melli?
RL: Bānke Melli ha...unvaqtam...xeyli...dar hodude dah tā...haft haštā doktor
"Bank Melli yeah...then...many...about ten...seven eight doctor
umad (-and) (deletion of inflectional morpheme) ruye sar-am...unvaqt...
came...on head-my...then...
goft (-and) (deletion of inflectional morpheme)...čiy-e āqā..goft-am ke..
told...what is Sir..told I that..
negā kard-an...goft-an bāyad bexāb-i...goft-am na
look did-they...told-they must hospitalize-you...told-I no"

Examiner: Did they hospitalize you?
RL: Na..naxābund-an..kāš...mixābund-an...kāš..mixābund-an
"No..didn't hospitalize-they..wish hospitalize-they...wish..hospitalize-they"

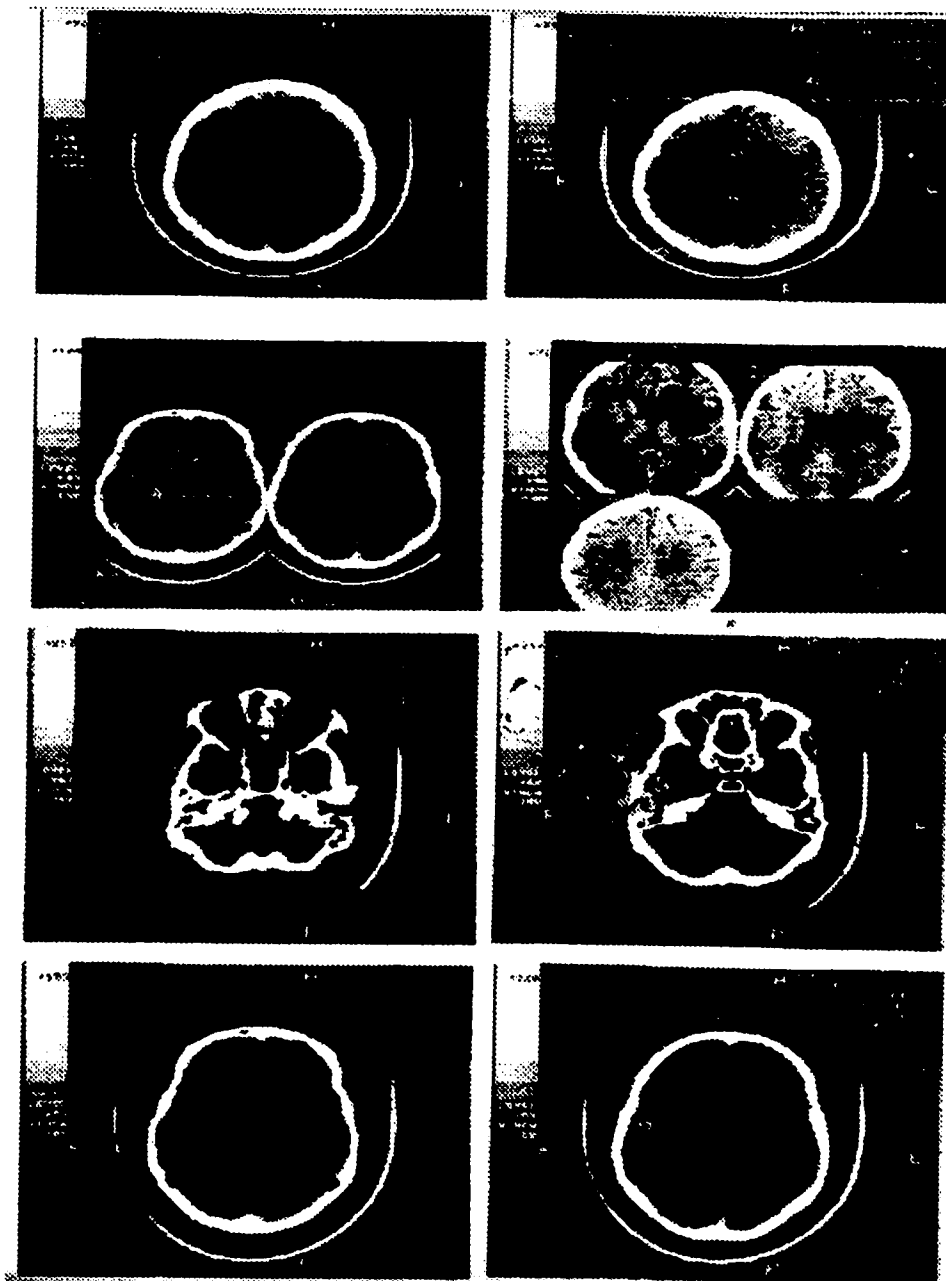


Figure 4: RL's CT Scans

Pointing (23-32)
 Simple Commands (33-37)
 Semi-Complex Commands (38-42)
 Complex Commands (43-47)
 Verbal Auditory Discrimination (48-65)
 Syntactic Comprehension (66-152)
 Semantic Categories (153-157)
 Synonyms (158-162)
 Antonyms (163-172)
 Grammaticality Judgements (173-182)
 Semantic Acceptability (183-192)
 Repetition (Words) (193-251)
 Lexical Decision (194-252)
 Repetition (Sentences) (253-259)
 Series (260-262)
 Verbal Fluency (263-267)
 Naming (269-288)
 Sentence Construction (289-313)
 Semantic Opposites (314-323)
 Derivational Morphology (324-333)
 Morphological Opposites (334-343)
 Mental Arithmetic (347-361)
 Listening Comprehension (362-366)
 Oral Reading (Words) (367-376)
 Oral Reading (Sentences) (377-386)
 Reading Comprehension (Paragraph) (387-392)
 Copying (393-397)
 Dictation (Words) (398-402)
 Dictation (Sentences) (403-407)
 Reading Comprehension (Words) (408-417)
 Reading Comprehension (Sentences) (418-427)
 Spontaneous Writing (813-835)

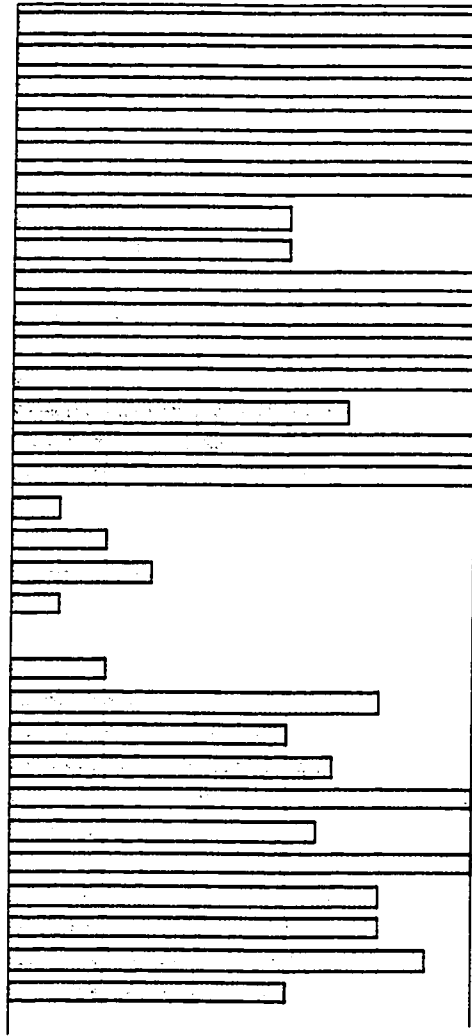


Figure 5: RL's Persian Profile on the BAT

The Persian version of the BAT was administered to RL in Winter 1998, one and a half years post-onset (see Figure 5). His BAT scores fall within the range that is consistent with a non-fluent aphasic whose language production is more impaired than his auditory comprehension. In fact, he is characterized clinically as a mild agrammatic aphasic with occasional word finding problems in spontaneous speech, and a slightly impaired comprehension ability.

RL suffers from a milder degree of agrammatism than MG, as well as many of the agrammatic cases described in the literature. His output is more fluent, and he does not exhibit the same tendency toward omission of function and inflectional morphemes as other agrammatic aphasics usually do. By contrast, MG's spontaneous speech is restricted to a limited number of content words and does not contain free or bound grammatical morphemes. Although both patients scored perfectly on word discrimination, commands and object or body part identification tests, only RL retained intact repetition ability of both words and sentences.

Written language was problematic for RL at both the word and sentence levels. Reading comprehension is also more difficult for him beyond the single-word level. RL performed poorly on the following tasks: verbal fluency, naming, sentence construction, semantic opposites and morphological opposites. Although he scored 60.00% on the synonym and antonym tasks, he had severe trouble with derivational morphology.

RL demonstrated near-perfect performance on tests of syntactic comprehension, but exhibited moderate problems with listening comprehension. Thus, like MG, RL's comprehension abilities are considerably better-preserved than his verbal output. In fact, his comprehension of various syntactic constructions appears to be rather normal. Similarly, his perfect score on the grammaticality judgement test of the BAT demonstrates that his interpretation of complex sentences is significantly better than chance, and that he does not rely solely on lexical semantics to assign syntactic relations.

The linguistic profile demonstrated by both of our subjects on comprehension and grammaticality judgement fit the BAT profile for agrammatism. Based on the BAT, agrammatic patients are most impaired in the production modality, especially in tasks requiring verbal responses with respect to the morphological aspects of the language. Despite RL's relatively mild agrammatic production, the general picture of linguistic disturbances obtained from the performance of both patients on various tests of the BAT are quite similar to one another.

4.1.3. Control Group

A non-brain-damaged control group was included to ensure that all stimulus items could induce consistent performance from intact, native speakers of Persian. The control group comprised ten subjects (five males and five females), roughly matched

to the aphasic patients in age, handedness and educational background. The age of this group ranged from 29 to 54 years, and their educational levels ranged from 10 to 18 years. None of the control group reported any prior history of brain disease.

4.2. Syntactic and Morphological Experiments

The study is divided into two main syntactic and morphological experiments. The Syntactic Experiment is designed to assess the patients' sensitivity to syntactic features and constructions, while the Morphological Experiment is concerned with the performance of the subjects on tasks that require attention to morphological and morpho-lexical aspects of Persian. Each experiment is further divided into two sub-experiments, one on comprehension and the other on grammaticality judgement abilities. In addition, in order to have a better understanding of the patients' preserved morphological knowledge, a forced-choice Cloze Test is also included in the Morphological Experiment. A complete list of test stimuli appears in Appendices 1-4.

4.2.1. Syntactic Experiment A: Syntactic Comprehension Task

4.2.1.1. Materials and Design: Syntactic Comprehension Task

The Comprehension Test of the Syntactic Experiment is designed to assess subjects' difficulties with various syntactic structures, including both simple and complex sentences. The test included sentences of the following five types: simple

actives, subject clefts, object clefts, subject relatives and object relatives.

There are 12 tokens for each of the five different syntactic constructions, resulting in a total of 60 grammatical sentences. The 12 tokens for each sentence type include 6 which are reversible and 6 which are non-reversible. We have incorporated semantically reversible sentences because they are argued to be more difficult for aphasics to comprehend than are non-reversible ones (Caramazza & Zurif, 1976). This is ostensibly because, unlike non-reversible sentences which can be interpreted on the basis of semantic constraints, reversible sentences require a correct syntactic analysis. All of the relative clauses are of the centre-embedded type. A sample of each sentence type is presented in 23-27.

23. Active sentences:

Non-reversible Mard divār-o næqqāši mikon-e.
Man wall-DO paint do-3rd sg.
"The man paints the wall."

Reversible Gorbe xarguš-o gāz migir-e.
Cat rabbit-DO bite take-3rd sg.
"The cat bites the rabbit."

24. Subject clefts:

Non-reversible In pesare ast ke māšin-o hol mid-e.
This boy is who car-DO push do-3rd sg.
"It is the boy who pushes the car."

Reversible In sage ast ke paranda-ro donbāl mikon-e.
This dog is that bird-DO chase do-3rd sg.
"It is the dog who chases the bird."

25. Object clefts:

Nonreversible In deraxt-e ke doxtar āb mid-e.
This tree-is that girl water give-3rd sg.
"It is the tree that the girl waters."

Reversible In xerse ast ke asb hol mid-e.
This bear is that horse push give-3rd sg.
"It is the bear that the horse pushes."

26. Subject relatives:

Non-reversible Zani ke ketāb mixune boland qadd-e.
Woman who book read tall-is
"The woman who is reading a book is tall."

Reversible Gorbe-i ke muš-o dide siyāh-e.
Cat-the that mouse-DO seen black-is
"The cat who has seen the mouse is black."

27. Object relatives:

Non-reversible Lebās-i ke doxtar otu mikon-e gerun-e.
Dress-the that girl iron do-3rd sg. expensive-is
"The dress that the girl is ironing is expensive."

Reversible Kalāq-i ke gorbe migir-e siyah-e.
Crow-the that cat catch-3rd sg. black-is
"The crow that the cat is catching is black."

4.2.1.2. Procedure: Syntactic Comprehension Task

An act-out task was employed to evaluate the aphasic subjects' comprehension of the stimulus sentences. Patients were tested individually by one of two Persian-speaking experimenters. Testing was performed on MG in the speech clinic of the hospital where she regularly goes for therapy. RL preferred to be tested in his own home.

Subjects were told that they would hear a sentence which they would then be required to act out with a set of toy figurines. They were instructed to listen carefully to each sentence and then demonstrate the action of the sentence through appropriate manipulation of the toys. The experimenter read the stimulus sentences in a natural manner with a normal intonation contour. The figurines were placed on the table in front of the patients in random order before the presentation of each sentence. The sentences were read for the second time only at the patients' request. At the beginning of each session, practice trials consisting of four sentences were used to familiarize the subjects with the test procedure and task demands. Based on how the sentences were acted out, the experimenter determined whether subjects' comprehension was intact, and whether the thematic roles were assigned to nouns accurately.

There was no strict time limit for this task. Each subject participated in three individual, hour-long sessions. The testing sessions were separated by intervals of at least one week. The stimulus sentences were presented to each patient in the same random order.

4.2.2. Syntactic Experiment B: Syntactic Grammaticality Judgement Task

4.2.2.1. Materials and Design: Syntactic Grammaticality Judgement Task

This experiment was designed to investigate the relationship between comprehension and grammaticality judgement abilities in agrammatic patients, as well

as to specify the degree of patients' awareness of word order and agreement violations.

Stimuli for the Grammaticality Judgement Task include a total of 120 sentences: 60 ungrammatical target sentences, 40 grammatical control sentences and 20 distractors (10 grammatical and 10 ungrammatical) of different lengths and non-target structures. The 60 ungrammatical sentences were taken from the Comprehension Experiment and altered to contain either word order or agreement violations. Word order violations were created by changing the position of one of these items: main verb, auxiliary verb, the direct object article "rā", and the complementizer "ke". In the following examples, the misplaced items are in boldface and their correct position is identified by square brackets [].

28. ***Mixun-e** in mo?alleme ke ketāb-o [].
Read-3rd sg. this teacher who book-DO []
"It is the teacher who is reading the book."
29. *Mard divāro naqqāši [] mikard **dašt**.
Man wall paint []did had
"The man was painting the wall."
30. *Pesar-i ke **rā** panjere [] šekast qad boland-e.
Boy-the who DO window []broke tall-is
"The boy who broke the window is tall."
31. ***Ke** doxtar-i [] gol-o āb mid-e mehrabun-e.
Who girl-the [] flower-DO water give-3rd sg. kind-is
"The girl who waters the flower is kind."

Sentences involving agreement violations were constructed by violating either the person or number agreement between the subject and the auxiliary or main verb. The

distractor sentences consisted mainly of conjoined-clause structures. In the following examples, the incorrect agreements are in boldface. The correct form of each sentence appears immediately below the ungrammatical version.

32. *Gorbe xarguš-o gāz migir-**am**.
Cat rabbit-DO bite take-1st sg.
"*The cat am biting the rabbit."
Gorbe xarguš-o gāz migir-e.
Cat rabbit-DO bite take-3rd sg.
"The cat is biting the rabbit."
33. *Bačče dar-**and** bā arusak bāzi mikon-e.
Child are with doll play do-3rd sg.
"*The child are playing with the doll."
Bačče dar-e bā arusak bāzi mikon-e.
Child is with doll play do-3rd sg.
"The child is playing with the doll."

4.2.2.2. Procedure: Syntactic Grammaticality Judgement Task

The sentences were presented orally as well as in writing to minimize possible effects of memory overload. Subjects were then asked to judge whether they were correct or incorrect. To familiarize the subjects with the task, a brief training session preceded the actual test. The stimuli were presented to each subject in the same random order.

4.2.3. Morphological Experiment A: Morphological Comprehension Task

4.2.3.1. Materials and Design: Morphological Comprehension Tasks

The Morphological Comprehension Experiment examined subjects' comprehension of personal clitic pronouns and null subject. An important question to be addressed was whether errors were equally disrupted across morpheme type or whether there were error patterns which could be accounted for within a specific theory of agrammatism.

The test was comprised of 60 items. These included 10 sentences for each type of clitic: DO, IDO and possessive. In half of these sentences, the clitic was in a singular form. In the other half, the clitic was in a plural form. To investigate the agrammatics' comprehension of *pro-drop* sentences, there were 10 sentences with the verb in either the singular or plural form. In addition, there were 20 grammatical active sentences of varying lengths which did not include any clitic or null-subject pronouns.

Comprehension was assessed via a sentence-picture matching task. All target and distractor items were black line drawings on a white page.

4.2.3.2. Procedure: Morphological Comprehension Task

To minimize memory load, the stimulus sentences were presented both orally and in writing. The patients were asked to attend carefully to the test items, and to choose the correct picture out of an array of target and distractor pictures

corresponding to a given sentence. For each trial, three pictures, arranged in a vertical fashion, were presented. The correct picture was randomly assigned to top, middle or bottom position. The target picture depicted the correct meaning of the sentence, while the distractor pictures erred either with respect to the number of the pronominalized element or the concept of the main verb. Correct and incorrect responses were tape recorded for later verification. Prior to testing, a short trial session was held to acquaint the subjects with the experimental procedure. The stimulus sentences were arranged in the same random order for each subject.

4.2.4. Morphological Experiment B: Morphological Grammaticality

Judgement Task

4.2.4.1. Materials and Design: Morphological Grammaticality Judgement Task

To obtain further evidence regarding the processing capacities of our agrammatic subjects, we constructed a grammaticality judgement task incorporating the same structures used in the Morphological Comprehension Task. For this purpose, 40 ungrammatical sentences were created. The ungrammaticality of these stimuli resulted from agreement violations between the clitic and the noun antecedent in constructions containing clitic pronouns or from agreement violations between the non-overt subject and verbal inflection in the case of *pro-drop* sentences. The

following ungrammatical examples illustrate the error types.

34. *U doxtare darsx āni ast va moallem dust-am dārad.
She girl hard working is and teacher like-me has
“*She is a hard working girl and the teacher likes me.”
35. *In gorbe-i ast ke aza-šun negahdāri mikard.
This cat-a is that he from-them taking care did
“*This is the cat that he was taking care of.”
36. *Dandānpezešk be baččeha tosiye kard ke dandānhaye-mān rā xub
Dentist to kids recommend did that teeth-our DO well
mesvāk bezan-and.
brush do-they.
“*The dentist recommended the kids to brush our teeth well.”
37. *Be pesar čand ketāb dār-am midah-i..
To boy some book have-I give-you.
“*(I) am you give some books to the boy.”

These 40 ungrammatical sentences were combined with 30 grammatical versions of sentences from the Morphological Comprehension Task plus 10 distractors. The distractor sentences consisted of a variety of sentence structures which did not involve any clitic or null subject pronouns.

4.2.4.2. Procedure: Morphological Grammaticality Judgement Task

The stimulus sentences were presented both orally and in writing to minimize possible effects of memory overload. Subjects were then asked to judge whether the sentences were correct or incorrect. The actual test was preceded by a brief training

session to acquaint the subjects with the task. The stimuli were presented to the subjects in the same random order.

4.2.5. Morphological Experiment C: Morphological Cloze Test

4.2.5.1. Materials and Design: Morphological Cloze Test

In addition to the comprehension and grammaticality judgement experiments, we employed a forced-choice Cloze Test to assess our agrammatic subjects' sensitivity to syntactic features of pronominal items. Subjects were required to select the correct clitic form or the overt subject pronoun from a choice of three alternatives that best completed a sentence (mæn/*šoma/*una u ra didam "I/*you/*they saw him"). The test consisted of 40 items to be completed. Two representative examples from the test are provided below.

38. Pedar dar mazrae kār mikon-ad va pesar *behe-šān/ *behe-**m**/behe-š komak mikon-ad.
Father in farm work do-3rd sg. and son *to-**them**/*to-**me**/to-**him** help do-3rd sg.
"The father is working in the farm and the son is helping *them/*me/him."
39. Yek keyke xošmaze dār-ad *mipaz-**and**/mipaz-**am**/*mipaz-**ad**.
A cake delicious have-1st sg. *bake-**they**/bake-**I**/bake-**she**
"*They/*I/she is baking a delicious cake."

The Cloze Test was included to obtain a more precise picture of the patients' morpho-syntactic knowledge within a constrained production context. By accurately performing the task, the subjects would be demonstrating their ability to recognize

certain morpho-syntactic features of Persian. We could thus conclude that their spontaneous production did not reflect a loss of morpho-syntactic knowledge.

4.2.5.2. Procedure: Morphological Cloze Test

This test was presented both orally and in writing. Each sentence and the corresponding insertion items were read aloud twice by the tester before the subjects were asked to select the appropriate item to be inserted into the sentence. A total of 40 sentences were presented to the patients, and their responses were tape recorded. A training session with two practice sentences was also administered prior to the Cloze Test. All items were presented to both subjects in the same random order.

CHAPTER 5

RESULTS

5.1. Introduction

This chapter presents the results of the Syntactic and Morphological Experiments. The normal, Persian-speaking control subjects scored 100.00% correct on all of the tests developed for this research. This indicates that these tests pose no problems for normals from a linguistic point of view. Due to the flawless performance of the control group, it was not possible to compare error types between the controls and the aphasic subjects.

5.2. Results of the Syntactic Experiment

In the Syntactic Experiment, our goal was to investigate the subjects' ability to process simple and complex syntactic structures, as well as to assess their degree of sensitivity to different kinds of grammatical violations. The main focus of this section is, therefore, on the nature of the syntactic comprehension errors made by the normal and aphasic subjects. In this respect, the quantitative and qualitative similarities and differences observed in the subjects' syntactic performance will be discussed.

The Syntactic Experiment, as discussed in detail above, involves two sub-

experiments of Syntactic Comprehension and Syntactic Grammaticality Judgement. The results for each syntactic construction are presented in terms of the number and percentage of errors. The subjects' responses were judged to be correct if their act-out performance in the Comprehension Experiment could be interpreted unequivocally as appropriate, or if they could give an intelligible Yes/No answer in the Grammaticality Judgement Task. Any other responses, such as "I don't know", were scored as errors. A descriptive statistical analysis of the patients' performance on the two tasks will also be presented in the following sub-sections.

5.2.1. Experiment A: Syntactic Comprehension Task

Although the performance of the agrammatic patients on the Syntactic Comprehension Task was not error-free, their error rate was surprisingly much lower than predicted. In fact, both patients' comprehension of various sentence types was very close to perfect. RL made 3/60 (5.00%) errors and MG made 2/60 (3.33%) errors on this test, indicating that the two agrammatics are quite similar with regard to their comprehension capacities. This result is quite striking in the light of the patients' markedly impaired production abilities. We have already noted that MG presents with severe agrammatic production, while RL's production is only mildly agrammatic. Yet MG made only one less error than RL on the Comprehension Task. This result suggests a lack of association between severity of agrammatic production and syntactic

comprehension.

Table 2
Syntactic Comprehension Task
Number and percentage of errors by sentence type

Patients				
	MG		RL	
Sentence type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
Simple active	0.00%	0/12	0.00%	0/12
Subject cleft	0.00%	0/12	0.00%	0/12
Object cleft	8.33%	1/12	8.33%	1/12
Subject relative	0.00%	0/12	8.33%	1/12
Object relative	8.33%	1/12	8.33%	1/12

The number and percentages of errors for the agrammatic subjects on the different types of sentence structures are shown in Table 2. Both MG and RL scored perfectly on simple active and subject cleft sentences. This result appears to replicate earlier findings according to which comprehension of active and subject cleft structures poses the least difficulty for agrammatics (see, for example, Goodglass, 1976; Caplan & Futter, 1986). Processing of other sentence types were quite similar for both patients, despite the differences in length and syntactic complexity of these stimuli. The fact that the patients only had problems with more complex object clefts, subject

relatives and object relatives suggests that their errors were not random, but seemed to be influenced by grammatical constraints.

The very low number of errors by both patients suggests that they have retained thematic role assignment and interpretation of word order in both simple and complex sentence structures to a remarkable degree. They also appear to have a relatively spared ability to extract grammatical features. Nor do they demonstrate any serious syntactic breakdown in their comprehension of correct functional and inflectional morphology.

As stated earlier, the 60 stimuli can be divided into two equal groups, one with reversible and the other with non-reversible structures. As two patients performed similarly and virtually at ceiling on both types of structures, we have no real indication of whether reversible constructions are more problematic than non-reversible ones (see, Table 3). Although RL had a slight tendency to process non-reversible sentences more easily than reversible ones, the difference is too small to interpret.

Table 3
 Syntactic Comprehension Task
 Number and percentage of errors for reversible and non-reversible sentences

Patients				
	MG		RL	
Sentence type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
Reversible	3.33%	1/30	6.66%	2/30
Non-reversible	3.33%	1/30	3.33%	1/30

5.2.2. Experiment B: Syntactic Grammaticality Judgement Task

The results indicate that both patients were able to judge the grammaticality of most sentence types accurately. RL made 32/120 (26.66%) errors and MG made 14/120 (11.66%), indicating that the two patients exhibited well above-chance ability to discriminate between grammatical and ungrammatical sentences. This finding supports previous reports, according to which agrammatics demonstrate a relatively well-preserved grammaticality judgement ability (Linebarger et. al, 1983; Wulfeck, 1988; Lukatela et. al, 1988; Wulfeck & Bates, 1990).

There was greater inter-subject variability on the Syntactic Grammaticality Judgement Task than on the Comprehension Task, with MG exhibiting a more preserved ability to perform syntactic grammaticality judgements than RL. The subjects also varied in their reaction to different sentence types. The number and

percentage of errors for each sentence type are displayed in Table 4.

Table 4
 Syntactic Grammaticality Judgement Task
 Number and percentage of errors by sentence type

Patients				
	MG		RL	
Sentence type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
Simple active	(11.11%)	2/18	(16.66%)	3/18
Subject cleft	(4.76%)	1/21	(38.09%)	8/21
Object cleft	(5.00%)	1/20	(25.00%)	5/20
Subject relative	(28.57%)	6/21	(38.09%)	8/21
Object relative	(15.00%)	3/20	(15.00%)	3/20

Table 4 shows that there is no major difference between the patients' performance on simple active and relative clause structures. By contrast, the patients behaved differently with respect to cleft sentences. While MG performed nearly flawlessly on both subject cleft and object cleft structures, RL showed a rather high percentage of errors on these structures. In fact, MG scored higher on subject cleft and object cleft sentences than on simple actives, despite the fact that clefts are longer and syntactically more complex structures than simple actives. Both patients, however, scored above-chance level on all structures.

Table 5
 Syntactic Grammaticality Judgement Task
 Number and percentage of errors for grammatical and ungrammatical sentences

Patients				
	MG		RL	
Sentence type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
Grammatical	2.00%	1/50	6.00%	3/50
Ungrammatical	18.57%	13/70	41.42%	29/70

As shown in Table 5, both agrammatic subjects exhibited a strong tendency to accept ungrammatical sentences rather than reject grammatical ones. MG and RL correctly accepted grammatical sentences 98.00% and 94.00% of the time, whereas they rejected ungrammatical sentences 81.43% and 58.58% of the time, respectively. This suggests that processing of grammatical sentences was considerably easier than processing of ungrammatical sentences for both patients. However, we cannot rule out the possibility that both subjects had a response bias toward accepting sentences as grammatical.

The results of the Grammaticality Judgement Test, as represented in Table 6, also reveal that RL was equally sensitive to both violations of word order and agreement. By contrast, MG was better at detecting violations of agreement than violations of word order. MG's pattern of sensitivity to violations appears to be more

consistent with that of Italian aphasics, who were reported to be more accurate than English-speaking subjects on agreement violations (Wulfeck et. al. 1991).

Table 6
Syntactic Grammaticality Judgement Task
 Number and percentage of errors for word order and agreement violations

Patients				
	MG		RL	
Violations	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
Word order	22.91%	11/48	40.10%	20/48
Agreement	9.09%	2/22	40.90%	9/22

Tables 7 and 8 show RL and MG's error rates on each sentence type in the Syntactic Comprehension and Syntactic Grammaticality Judgement Tasks, respectively. With the one exception of object cleft sentences for MG, both subjects demonstrated greater error rates for the Syntactic Grammaticality Judgement Task than for the Syntactic Comprehension Task for all sentence types. However, they do not display the same hierarchy of difficulty for the various sentence structures across the two tasks.

Table 7
 Syntactic Comprehension versus Syntactic Grammaticality Judgement
 Number and percentage of errors by sentence type

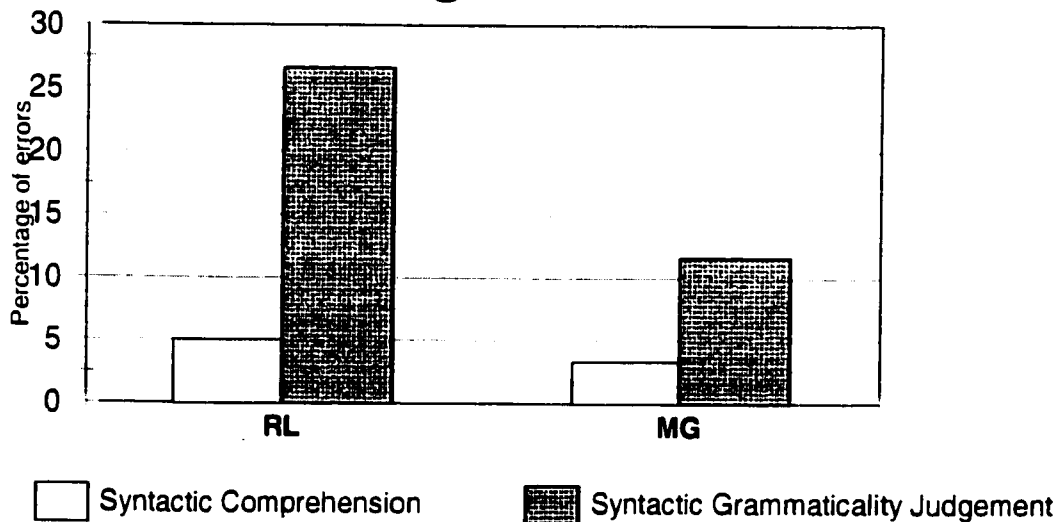
Patient: RL				
	Syntactic Comprehension		Syntactic Grammaticality Judgement	
Sentence Type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
Simple active	0.00%	0/12	16.66	3/18
Subject cleft	0.00%	0/12	38.09%	8/21
Object cleft	8.33%	1/12	25.00%	5/20
Subject relative	8.33%	1/12	38.09%	8/21
Object relative	8.33%	1/12	15.00%	3/20

Table 8
 Syntactic Comprehension versus Syntactic Grammaticality Judgement
 Number and percentage of errors by sentence type

Patient: MG				
	Syntactic Comprehension		Syntactic Grammaticality Judgement	
Sentence type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
Simple active	0.00%	0/12	11.11%	2/18
Subject cleft	0.00%	0/12	4.76%	1/21
Object cleft	8.33%	1/12	5.00%	1/20
Subject relative	0.00%	0/12	28.57%	6/21
Object relative	8.33%	1/12	15.00%	3/20

Figure 6 displays the subjects' performance on the Syntactic Comprehension and Syntactic Grammaticality Judgement Tasks. Note that both subjects have higher error rates on the Syntactic Grammaticality Judgement Task than on the Syntactic Comprehension Task. Our subjects' greater impairment in syntactic grammaticality judgement ability than comprehension ability is at odds with findings of earlier studies in which agrammatics had impaired comprehension but relatively preserved grammaticality judgement ability (Linebarger et al., 1983; Saffran et al., 1985; Crain et al., 1987; Shankweiler et al., 1989; Wulfeck, 1988).

Figure 6



Comparison of Error Rates for the Syntactic Comprehension and Syntactic Grammaticality Judgement Tasks

5.3. Results of the Morphological Experiment

In this section, we investigate the performance of the two Persian-speaking agrammatic subjects on the Morphological Experiment. As discussed in Chapters 3 and 4, the Morphological Experiment consists of three sub-experiments: a Morphological Comprehension Task, a Morphological Grammaticality Judgement Task and a Morphological Cloze Test.

As in the Syntactic Experiment (A and B), the subjects' responses are presented in terms of error rates. Responses were considered correct if the subjects could select the appropriate target picture in the sentence-picture matching task of the Comprehension Task (A). In the Grammaticality Judgement Task (B), the subjects' performance was judged to be successful if they could give an unequivocal and correct Yes/No answer to the sentences. And finally, in the third test, the Cloze Test, the subjects were required to correctly point to one of three forms to complete a sentence. The subjects were considered unsuccessful if they refused to provide any answer or they responded "I don't know". In some cases, the subjects attempted to correct their initial answer. In such cases, their scores were based on their second response, whether or not it was correct.

As the goal of the Morphological Experiment was to examine agrammatics' capacities to process various types of morpho-lexical items, the stimuli included sentences involving the DO clitic pronoun, the IDO clitic pronoun, the possessive clitic

pronoun, and the null subject pronoun. We set out to test the assumption that closed class and open-class words are differentially affected, and that morpho-lexical elements such as clitics are selectively subject to disruption in agrammatism. Hence, the results of the agrammatic patients' performance will be described in terms of the three morphological stimulus types.

5.3.1. Experiment A: Morphological Comprehension Task

The agrammatic subjects performed similarly to normals on the Morphological Comprehension Task. As is evidenced in Table 9, RL made just one error out of 60 sentences (1.66%). MG made only two errors overall, yielding an error rate of 3.33%. Moreover, one of MG's two errors was related to a simple distractor sentence which involved neither a clitic nor a null subject pronoun.

Table 9
 Morphological Comprehension Task
 Number and percentage of errors by morphological structure

Patients				
	MG		RL	
Pronoun type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
DO clitic	10.00%	1/10	0.00%	0/10
IDO clitic	0.00%	0/10	0.00%	0/10
Possessive clitic	0.00%	0/10	0.00%	0/10
Null subject	0.00%	0/10	10.00%	1/10
Distractors	5.00%	1/20	0.00%	1/20

These results indicate that both patients are strikingly similar and accurate in their comprehension of pronominal clitics and null subject pronoun. Their high accuracy rate (98.34% and 96.67%) suggests that they did not have fundamental morphological problems, and were capable of comprehending various morpho-syntactic structures. Both patients were virtually flawless in interpreting sentences that contained IDO and possessive clitic pronouns. Also, MG made no errors on sentences containing null subject pronoun and RL made no errors on DO clitic structures.

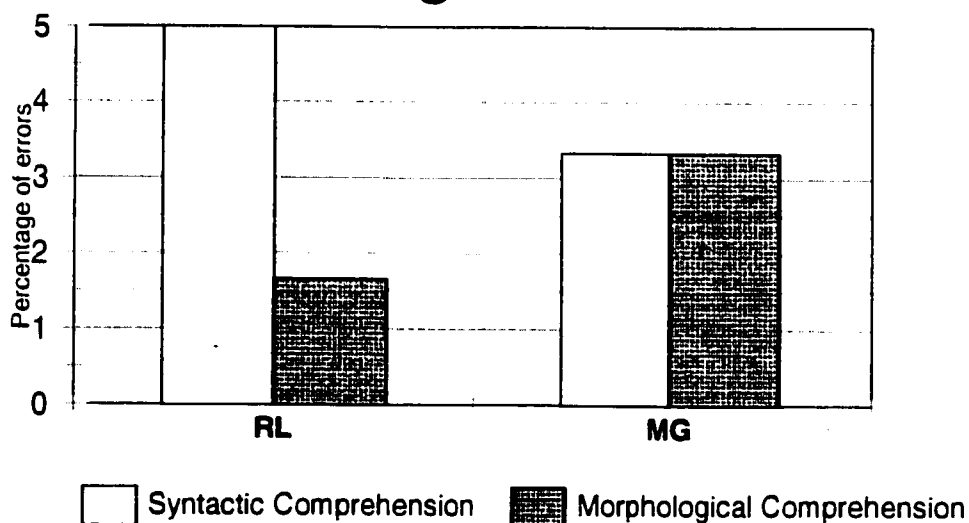
These findings appear to be at variance with those reported in the literature, as agrammatic aphasics are usually expected to exhibit more difficulty comprehending the morphological aspects of the grammar than do MG and RL (see, for example, Bradley

et al., 1980; Friederici et al., 1991; Kean, 1977, 1979; Zurif & Grodzinsky, 1983).

5.3.1.1. Morphological versus Syntactic Comprehension Tasks

Figure 7 compares the results of Syntactic Comprehension and Morphological Comprehension Tasks for both patients. As the shorter bar for fewer errors shows, RL performed somewhat better on the Morphological than on the Syntactic Comprehension Task, whereas MG demonstrated no difference in her performance on the two tasks. We must bear in mind, however, that in all cases we are dealing with fairly similar error rates.

Figure 7



Comparison of Error Rates for the Morphological Comprehension and Syntactic Comprehension Tasks

These findings indicate that agrammatism has not prevented our subjects from interpreting the various morpho-syntactic structures presented in Syntactic and Morphological Comprehension Tasks; their comprehension of various syntactic constructions and morphological features has been remarkably well-preserved. Nor can their performance be considered task-specific, as the Syntactic comprehension and Morphological Comprehension Tasks involved act-out and sentence-picture matching, respectively.

5.3.2. Experiment B: Morphological Grammaticality Judgement Task

MG was slightly more impaired than RL on the Morphological Grammaticality Judgement Task. However, both subjects were quite sensitive to the morphological information of clitic and null subject pronouns. RL made a total of 6 errors out of 80 sentences (7.50%), while MG made a total of 12 errors out of 80 sentences (15.00%). This result stands in contrast to the results of the Morphological Comprehension Task in which both patients performed more similarly to one another and with fewer errors. Again, as with the Syntactic Experiment, both patients performed better on the Comprehension Task than on the Grammaticality Judgement Task.

Table 10
Morphological Grammaticality Judgement Task
Number and percentage of errors by structure type

Patients				
	MG		RL	
Structure type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
DO clitic	20.00%	2/10	0.00%	0/10
IDO clitic	50.00%	5/10	30.00%	3/10
Possessive clitic	40.00%	4/10	20.00%	2/10
Null subject	0.00%	0/10	10.00%	1/10

A comparison of the subjects' performance shows the same hierarchy of difficulty for judging structures involving clitic pronouns (see, Table 10). Sentences containing IDO clitic pronouns were the most difficult ones for both agrammatics. MG performed at chance level on these structures (50.00% errors), while RL performed somewhat better and above-chance (30.00% errors). The patients' relatively weak performance on these structures may be evidence of some type of disturbance in the handling of morpho-syntactic operations. By contrast, sentences involving DO clitic pronouns proved to be the easiest for the two subjects: MG made only 2/10 errors and RL performed flawlessly. Both agrammatic subjects also showed problems with possessive clitic pronouns, although these structures were not equally difficult for them. With 40.00% errors, MG made twice as many errors as RL did on sentences

with possessive pronouns.

Both subjects performed better on judging null subject sentences than clitic pronoun ones. MG made no errors with null subjects, while RL was only mildly impaired (10.00% errors) on null subject structures. Thus, neither patient had particular trouble recognizing and interpreting relevant morphological and syntactic information in null subject structures.

Although inferior to normals in their grammaticality judgement ability, the two subjects demonstrated relatively well-preserved sensitivity to grammaticality. Their performance suggests that they maintain an ability to make systematic use of closed-class morphology for assigning thematic roles and achieving syntactic processing.

Further examination of the data revealed that the subjects reacted differentially to grammatical and ungrammatical sentences. As Table 11 illustrates, both MG and RL were more likely to give accurate judgements when presented with grammatical sentences. MG was able to detect grammatical sentences 97.50% of the time. In contrast, she rejected ungrammatical sentences only 70.00% of the time. RL had no problems whatsoever accepting grammatical sentences, whereas he rejected ungrammatical sentences only 85.00% of the time. This pattern is similar to the one obtained for grammatical and ungrammatical sentences in the Grammaticality Judgement Task of the Syntactic Experiment.

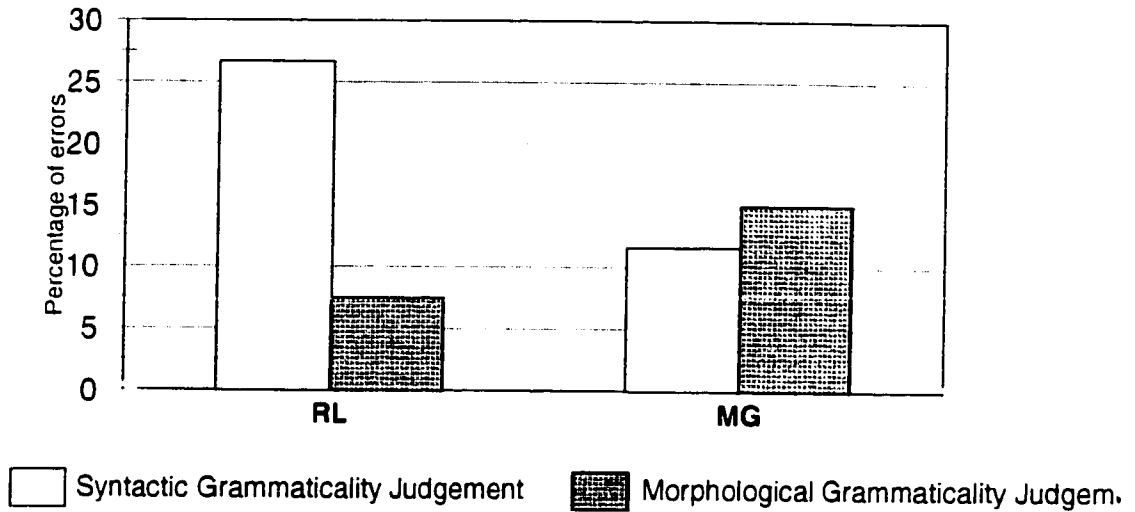
Table 11
Morphological Grammaticality Judgement Task
Number and percentage of errors for grammatical and ungrammatical sentences

Patients				
	MG		RL	
Sentence type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
Grammatical	2.50%	1/40	0.00%	0/40
Ungrammatical	30.00%	12/40	15.00%	6/40

5.3.2.1. Morphological versus Syntactic Grammaticality Judgement Tasks

As can be seen in Figure 8, the subjects' performance on the Morphological Grammaticality Judgement Task is not completely compatible with their performance on the Syntactic Grammaticality Judgement Task. In addition, the patients show reverse patterns of behaviour with respect to their relative strengths on the two tasks. MG performed slightly more accurately on the Syntactic than on the Morphological Judgement Task. Conversely, RL was found to be more deficient in the Syntactic than in the Morphological Grammaticality Judgement Task. Both patients nonetheless exhibited above-chance sensitivity to grammaticality in both tasks.

Figure 8



Comparison of Error Rates for the Syntactic and Morphological Grammaticality Judgement Tasks

5.3.3. Experiment C: Morphological Cloze Test

Although both agrammatic subjects performed at above-chance levels on this task, there was a marked difference in their levels of performance. RL did very well, producing only 3 errors out of 40 sentences (7.50%). MG, by contrast, performed rather poorly, making 11 errors out of 40 sentences (27.50%). The error rates of the two subjects on the four types of morphological structures are represented in Table 12.

Table 12
Morphological Cloze Test
Number and percentage of errors by morphological structure

Patients				
	MG		RL	
Pronoun type	Percentage of errors	Raw Number of errors	Percentage of errors	Raw Number of errors
DO clitic	30.00%	3/10	20.00%	2/10
IDO clitic	20.00%	2/10	10.00%	1/10
Possessive clitic	10.00%	1/10	0.00%	0/10
Null subject	50.00%	5/10	0.00%	0/10

For the constructions involving DO clitic pronouns, MG and RL chose the incorrect morphological form in only 30.00% and 20.00% of the items, respectively. They showed absolutely lower error rates on IDO clitic structures: MG made 20.00% errors and RL only 10.00% errors. Sentences containing possessive clitic pronouns were the least problematic ones for both agrammatics. While RL's performance was error-free, MG made only one error (10.00% error rate), yielding an accuracy rate of 90.00% on these items. The overall strong performance of the subjects on sentences containing clitic pronouns suggests that they exploited the semantic and structural properties of these morphemes for sentence interpretation, and that they were capable of assigning an appropriate syntactic representation to the sentences.

Null subject sentences produced the only major difference between the two

agrammatics' performance in terms of the number of errors. In contrast to RL, who obtained a perfect score, MG demonstrated a chance-level performance of 50.00% on these sentences. The fact that MG encountered more difficulties with null subject structures than with other structures seems surprising, as she successfully handled null subject morphological structures in the Comprehension and Grammaticality Judgement Tasks.

Tables 13 and 14 present a comparison of each subject's error rates across all three morphological tasks for each of the morphological structures tested. Although both MG and RL exhibit greater impairment on the Morphological Grammaticality Judgement Task and Morphological Cloze Test than on the Morphological Comprehension Task, there is no discernible hierarchy of difficulty for the various sentences across the three tasks.

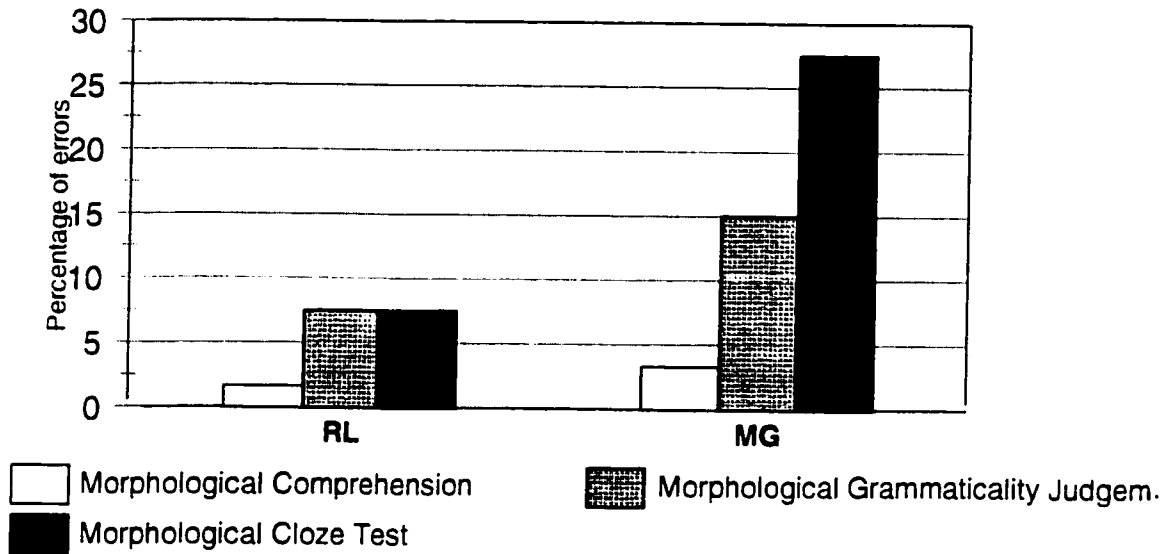
Table 13
Morphological Comprehension, Grammaticality Judgement and Cloze Test
Number and percentage of errors by item type

Patient: RL						
	Comprehension		Grammaticality Judgement		Cloze Test	
Item type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
DO clitic	0.00%	0/10	0.00%	0/10	20.00%	2/10
IDO clitic	0.00%	0/10	30.00%	3/10	10.00%	1/10
Possessive clitic	0.00%	0/10	20.00%	2/10	0.00%	0/10
Null subject	10.00%	1/10	10.00%	1/10	0.00%	0/10

Table 14
Morphological Comprehension, Grammaticality Judgement and Cloze Test
Number and percentage of errors by item type

Patient: MG						
	Comprehension		Grammaticality Judgement		Cloze Test	
Item type	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors	Percentage of errors	Raw number of errors
DO clitic	10.00%	1/10	20.00%	2/10	30.00%	3/10
IDO clitic	0.00%	0/10	50.00%	5/10	20.00%	2/10
Possessive clitic	0.00%	0/10	40.00%	4/10	10.00%	1/10
Null subject	0.00%	0/10	0.00%	0/10	50.00%	5/10

Figure 9



Comparison of Error Rates for the Morphological Comprehension, Morphological Grammaticality Judgement and Morphological Cloze Tests

The subjects' performance on the three sub-tests of the Morphological Experiment are displayed in Figure 9. RL did quite well and relatively uniformly on all three morphological sub-tests, experiencing the least difficulty with the morphological comprehension task. MG experienced more difficulty than RL with all the morphological tasks, performing especially poorly on the Morphological Cloze Test. MG's lower score on the Cloze Test cannot be attributed to a disruption in interpreting the functions of the morpho-lexical elements in sentences, as she obtained very high scores on the same sentence stimuli in the Morphological Comprehension and Grammaticality Judgement Tasks. Her difficulty with the Cloze Test, therefore, may be

attributable to a task-specific effect. We will discuss the factors that may have affected MG's performance on the Cloze Test in Chapter 6.

CHAPTER 6

DISCUSSION

6.1. Introduction

In this study, a detailed analysis of the performance of two Persian-speaking agrammatic aphasics on comprehension and grammaticality judgement tasks was carried out. Different tests were designed to examine the extent to which the patients were sensitive to certain structural and morphological aspects of Persian.

This final chapter summarizes the findings of this investigation, and discusses them in light of the issues raised in Chapter 3. Our discussion of the results of the two experiments, one on syntax and the other on morphology, will initially be presented separately, as they are related to separate hypotheses. This is followed by a general discussion of the mechanisms underlying the subjects' performance.

6.2. Discussion of the Syntactic Experiment

6.2.1. Syntactic Comprehension Task

One of the main goals of the Syntactic Experiment was to explore the possibility that agrammatic patients retain a well-preserved tacit knowledge of syntax in the face of impaired production. To determine whether or not agrammatism extends beyond the expressive level and involves other language modalities, we focussed on the ability of

the agrammatic subjects to comprehend different types of sentence structures in comprehension and grammaticality judgement tasks. By including the grammaticality judgement task, we could address the issue of whether or not comprehension deficits in agrammatism are accompanied by a parallel disturbance in grammaticality judgement of the same syntactic constructions.

The sentence structures tested included simple active, subject cleft and subject relative sentences in which the canonical word order reflects the underlying functional relationships of the sentence elements. The test also included non-canonical sentences, such as object clefts and object relatives, in which the grammatical functions of the sentence elements are not reflected by their surface word order. It is clear from the results that the agrammatic subjects of the present study had remarkably intact syntactic abilities, and exhibited near-perfect interpretation with respect to the syntactic structures tested (MG: 2/60 (3.33%) and RL: 3/60 (5.00%) error rate). Complicated sentences were predicted to be more difficult to evaluate than simple ones. This prediction was, in fact, borne out, although the percentage of errors of these patients, compared to the percentage of errors of most agrammatics reported in the literature, was very low. Both MG and RL demonstrated fairly identical patterns of performance in that they showed a very mild comprehension deficit on only more complicated structures such as relative clauses and object clefts.

Considering that both of these patients presented with expressive disturbances

characteristic of agrammatic aphasics, the relative intactness of their syntactic comprehension ability goes counter to the central syntactic deficit theory which predicts parallel manifestations in all language modalities for agrammatics (Zurif, Caramazza, & Myerson, 1972; Caramazza & Zurif, 1976; Zurif, Green, Caramazza, & Goodenough, 1976). Neither does it support the classical view that agrammatism syndrome follows from a global impairment to syntactic knowledge (Berndt & Caramazza, 1980). The comprehension data obtained from this investigation clearly suggest that syntactic abilities can remain unaffected and resilient to decrement in agrammatism.

A number of studies report that agrammatic aphasics demonstrate more problems with reversible sentences than non-reversible ones (Ansell & Flower, 1982; Friederici, 1983; Friederici & Graetz, 1987; Lukatela et al., 1988; Jarema & Kehayia, 1992). This, according to Zurif & Caramazza (1976), is due to agrammatics' use of a heuristic strategy based on semantic information in sentence comprehension. However, the two agrammatics in the present study comprehended reversible structures just as well as non-reversible ones. This suggests that the patients were capable of utilizing both syntactic and semantic cues for sentence comprehension and that they were successfully using syntactic cues to achieve thematic mapping.

The well-preserved ability of both MG and RL to process syntactic structures of various types, including those involving traces (e.g., object relatives and object clefts),

constitutes strong evidence against the Trace Deletion Hypothesis (Grodzinsky, 1986, 1989). According to this hypothesis, agrammatic aphasics should perform at chance-level on sentences in which the empty NP is in object position, and at above-chance level on sentences where the empty NP is in subject position. Contrary to this prediction, both patients showed excellent comprehension of all types of relative clauses and cleft sentences. This absence of subject-object asymmetry in the patients' comprehension shows that they were capable of linking traces with their antecedents in the syntactic analysis of sentences such as object relatives. These results also challenge the view that agrammatics' problems result from an inability to build structural hierarchies (Caplan & Futter, 1986). The fact that these patients demonstrated nearly normal comprehension ability indicates that they exploited syntactic and lexical features, and had the capacity to process functional and inflectional items for sentence analysis. Based on the performance of MG and RL, agrammatism cannot be interpreted as a central deficit resulting from an absence of syntax or from a severely diminished ability to process closed-class morphology.

6.2.2. Syntactic Grammaticality Judgement Task

There have been a number of studies in different languages showing that agrammatic subjects perform relatively well on grammaticality judgement tasks, while they experience more problems with comprehension (Linebarger et al., 1983; Saffran et

al., 1985; Shankweiler et al., 1989). Our patients demonstrated the reverse pattern: they exhibited better performance on the Syntactic Comprehension act-out Task than on the Syntactic Grammaticality Judgement Task, even though both tasks tested the same linguistic structures. This may suggest that comprehension and grammaticality judgement processes do not necessarily show similar patterns of deterioration across different patients, and are independently subject to disruption.

Although the patients performed better on the Syntactic Comprehension Task, both of them scored well above chance on the Grammaticality Judgement Task. This latter result replicates earlier findings of retained syntactic grammaticality judgement ability in agrammatics (Smith & Mimica, 1984; Lukatela et al., 1988; Wulfeck, 1988; Heeschen, 1990; Wulfeck et al., 1991). MG performed the Grammaticality Judgement Task more accurately than RL. Given MG's more severe agrammatic production, it appears that degree of impairment in grammaticality judgement ability does not co-vary with degree of severity of agrammatic production. More generally, these results suggest a lack of association between the degree of disruption in different language modalities.

The results of this study also run counter to the Mapping Hypothesis, which views agrammatism as a deficiency in mapping operations between syntactic and thematic roles (Linebarger et al., 1983; Saffran & Schwartz, 1988). Given the patients' well-preserved syntactic abilities in the Comprehension Task, we assume that they could access this syntactic ability in making grammaticality judgements. In addition, as

closed-class items played a crucial role in distinguishing the grammatical from the ungrammatical stimulus sentences, these results suggest that our subjects retained considerable sensitivity to closed-class items and could map the syntactic functions (e.g., subject, object) onto thematic roles (e.g., agent, theme). Furthermore, as Frazier & Friederici (1991) point out, evidence supporting the Mapping Hypothesis comes from agrammatics' superior performance on grammaticality judgement as compared to comprehension tasks. The fact that our patients exhibited a reversed pattern on these two tasks further questions the validity of this hypothesis.

Another goal of the Syntactic Experiment was to investigate the patients' sensitivity to morphological and word order characteristics of Persian. An analysis of their verbal agreement and sentential word order errors in the Syntactic Grammaticality Judgement Task indicates considerably degraded performance relative to control subjects. RL performed slightly above-chance, reacting similarly to violations of word order and verbal agreement. MG performed relatively well, demonstrating greater ability to recognize agreement violations than word order violations. Although their combined results indicate a clearly impaired capacity for word order recognition, they are equivocal with respect to their ability to make systematic use of agreement properties for sentence interpretation.

There is a suggestion, at least in the case of MG, that various aspects of syntax and morphology may be differentially disrupted in agrammatism and that word order

may be more subject to disruption than morphological agreement. Considering that Persian word order is quite variable, while its inflectional system is more categorical and invariant, diminished ability to detect word order violations relative to agreement violations is not totally unexpected. MG's performance pattern could have been influenced by the degree of syntactic weight that inflectional morphology carries in Persian. This would be compatible with the prediction of the Competition Model, as outlined by Bates & MacWhinney (1987, 1989), which maintains that the stronger a language-specific characteristic is in terms of cue validity/informational value, the more resistant it remains to brain damage. Thus, as inflectional morphemes in Persian are higher in cue validity than word order, they may remain less disturbed in the behaviour of this one agrammatic.

As discussed in Chapter 3, the cross-linguistic examination of word order and agreement violations in agrammatism has lately been the focus of considerable attention (Bates, Friederici, & Wulfeck, 1987a, b; Bates, Friederici, Wulfeck, & Juarez, 1988; Wulfeck, 1988, Wulfeck, Bates, & Capasso, 1991). MG's performance is at variance with that of subjects reported in these studies. Agrammatic aphasics in a variety of languages, including even Italian, in which morphology has greater cue validity than word order, have been reported to be more impaired with respect to agreement than to word order violations. In contrast to the present study, the results of these previous studies all support the view of a selective vulnerability of morphology in agrammatism,

regardless of its cue validity. The fact that the Persian-speaking agrammatic subjects of the present study showed greater ability to detect agreement violations than word order violations should thus be interpreted with caution, especially since our other subject, RL was equally impaired with respect to both word order and inflectional morphology.

In sum, the overall results of the Syntactic Experiment suggest that the Persian-speaking agrammatic subjects were able to carry out syntactic analyses in the act-out Comprehension and off-line Grammaticality Judgement Tasks, and showed remarkable preservation of syntactic and certain morphological aspects of Persian grammar. The fact that the subjects manifested only a very mild deficit in their comprehension of complicated structures is evidence that they have a preserved representation of Persian grammar. This suggestion is further strengthened by the patients' varying degrees of difficulty in the different language modalities of production, comprehension and grammaticality judgement. If the patients had fundamental linguistic difficulties, and suffered from the loss of specific portion(s) of syntax, we should have observed parallel manifestations of this syntactic loss in all language modalities. These two agrammatics, despite experiencing some degree of difficulty in utilizing closed-class morphology and word-order features, were highly sensitive to a wide range of linguistic information, and demonstrated a well-retained residual knowledge of syntax for assigning grammatical relations. We will argue below that the Persian patients' performance may be better explained in terms of a processing rather than a representational account.

6.3. Discussion of the Morphological Experiment: Morphological Comprehension and Morphological Grammaticality Judgement Tasks

The morphological component of the study focussed on subjects' ability to apprehend a specific set of closed-class morphemes, i.e. pronominal clitics and null subject. The three morphological tasks, Comprehension, Grammaticality Judgement and a Cloze Test, will be discussed in turn and compared with the results of the Syntactic Experiment.

Both patients displayed nearly normal performance on the Morphological Comprehension Task. Their performance indicated that they were fully aware of the structural cases (direct object, indirect object, possessive) of the pronominal clitics and null subject, and were able to properly discriminate the syntactic and semantic information encoded in these different homophonous clitics and strong pronouns. This stands in marked contrast to their typically agrammatic production.

Our results agree with earlier findings of agrammatics' ability to interpret closed-class items in different tasks (Zurif & Caramazza, 1976; Blumstein et al., 1983; Miceli et al., 1983; Bates et al., 1987; De Bleser & Bayer, 1988; Friederici et al., 1991; Slobin, 1991; Luzzatti & De Bleser, 1996). What is, however, striking in this study is that our agrammatic patients exhibited even better comprehension of closed-class items than did their counterparts in various languages reported in the literature. We will now consider several theories of and predictions regarding agrammatism in the light of our subjects'

high degree of comprehension of the morphological features of Persian.

The results of the Morphological Experiment provide further evidence against the validity of Grodzinsky's Trace-Deletion Hypothesis (1986, 1989), which assumes that traces are deleted in the syntactic representations of agrammatic aphasics. This would make chaining especially difficult for them. As discussed in Chapter 3, sentences containing DO clitic pronouns and null subject pronoun require the establishment of a chain whereby the clitic and the null element are co-indexed with their antecedents. Such sentences were predicted to be more difficult to interpret than sentences involving IDO clitic and possessive clitic pronouns. This prediction, however, was not borne out, as the agrammatics did almost equally well on all types of clitic and null subject pronouns, including structures involving syntactic chains.

Friederici et al. (1991, p. 292) argue that direct object pronouns, as compared to indirect object pronouns, are easier to process, as the syntactic relation between the direct object and the verb is more straightforward than the relation between the indirect object and the verb. Our data do not appear to support this prediction. Both MG and RL performed flawlessly on IDO clitic pronouns, while MG had one error on a DO clitic pronoun.

The pattern of morpho-syntactic performance of the two patients cannot be reconciled with Kean's Phonological Hypothesis (1977, 1981) either. Based on this hypothesis, agrammatics should have problems processing phonological clitics but not

phonological words. Contrary to Kean's prediction, the clitic and non-clitic pronouns were treated alike by our Persian-speaking patients. This finding is in agreement with the results of a study of French-speaking agrammatics (Friederici et al., 1991), which also indicated that the clitic/non-clitic distinction does not affect the comprehension performance of agrammatics.

The present findings suggest striking parallels between the patients' performance on the Syntactic and Morphological Comprehension Tasks, despite the use of an act-out task for syntax and a sentence-picture matching task for morphology. This indicates that the relatively intact morpho-syntactic abilities of the patients are not due to task-specific conditions, but rather reflect genuine linguistic knowledge.¹² Taken together, these results indicate that telegraphic agrammatic output may occur within a setting of well-retained comprehension capacity. Thus, we are inclined to agree with Smith and Bates (1987, p. 31) who maintain that "agrammatic Broca's syndrome may involve separate deficits in production and comprehension".

One source of additional evidence for the dissociation of language modalities in agrammatism comes from the results of the Morphological Grammaticality Judgement Task and the Cloze Test. These two tasks, in contrast to the Morphological Comprehension Task, provide a more disturbed picture of the agrammatic subjects'

¹²The performance of the Persian-speaking agrammatics contrasts with that of a Spanish-speaking Broca's aphasic reported in Reznik et al. (1995). The patient presented a marked syntactic deficit with respect to structures such as clitic pronouns and null subject, which are subject to chain formation process in Spanish.

morpho-syntactic abilities. Both MG and RL performed better on the Morphological Comprehension Task than on the Morphological Grammaticality Judgement Task, exhibiting a pattern strikingly similar to the one for the Syntactic Experiment. This pattern of task performance is not compatible with the well-accepted, traditional assumption that agrammatic aphasics retain preserved grammaticality judgement ability in the face of compromised comprehension. It should be noted that the level of the patients' performance in grammaticality judgement, despite its degraded quality, was very high (error rates: RL: 7.5% and MG: 15%). Despite being weaker than their comprehension ability, their grammaticality judgement performance was nonetheless comparable to that of agrammatics reported in other studies (Smith & Mimica, 1984; Lukatela et al., 1988; Wulfeck et al., 1991). In fact, they outperformed the subjects of several studies of grammaticality judgement ability (see, for example, Grossman & Haberman, 1982).

The Trace-Deletion Hypothesis (Grodzinsky, 1986, 1989) would predict that sentences involving syntactic chains, such as sentences with DO clitic and non-overt subject, are more difficult to process than sentences without syntactic chains. However, both subjects performed more accurate grammatical judgements on DO clitic and null subject pronoun items than on IDO and possessive clitic items. Thus, as with Morphological Comprehension, our data from the Morphological Grammaticality Judgement Task do not conform with the prediction of a chain disruption hypothesis.

Rather, our data indicate that the subjects recognize the syntactic attributes of different kinds of functional and inflectional elements, including clitic pronouns and null subject pronoun, and are able to generate complete syntactic representations. Recognizing closed-class morphemes is a prerequisite for an accurate structural analysis of sentences, as observed in our subjects' performance. In addition, in order to interpret more complicated structures involving syntactic chains, our agrammatics must have had the ability to retrieve the lexical items associated with different syntactic positions, and be able to fully appreciate the syntactic as well as semantic implications of the co-indexation process.

Zurif & Caramazza (1976), based on their study of English-speaking agrammatics, propose that agrammatic aphasics' preserved processing of pronouns has to do with the lexical-semantic status of these elements. They argue that pronouns carry a considerable amount of semantic information, making them easier to process. This proposal cannot, however, be considered as a convincing explanation for the satisfactory performance of the Persian-speaking agrammatics on pronominal elements. Although our patients' performance indicates that they are able to utilize the lexical semantics of different words, including closed-class morphemes, they cannot rely solely on lexical semantic and pragmatic information to assign syntactic relations. This is because, unlike their English counterparts, Persian pronouns do not represent semantic characteristics such as (\pm animate, \pm masculine). This evidence further demonstrates that our patients

used grammatical cues appropriately to discover the correct antecedent for pronominal elements in comprehension processing. If the agrammatics' normal syntactic parsing routine was disrupted, and they had merely used alternative strategies (semantic, heuristic, etc.) of arriving at an interpretation of the sentences, they could not have performed so well on all these tests.

As we saw in the preceding chapter, the two agrammatics differed markedly from one another with respect to their performance on the Cloze Test, with MG experiencing much greater difficulty than RL. Given MG's relatively poor performance on the Cloze Test, it might be assumed that she had lost the general ability to fully exploit the structural information of closed-class items. However, her superior performance on sentence stimuli of the same type in the Comprehension and Grammaticality Judgement Tasks eliminates the possibility that her grammatical knowledge base *per se* had broken down. She maintained a nearly spared ability to utilize the syntactic properties of bound and inflectional morphemes for assigning grammatical relations in the latter tests, even though her ability to access this structural information appears to be impaired to a considerable extent in the Cloze Test. This is best illustrated by her performance on structures involving null subject pronouns. MG's chance-level performance (50.00%) on null subject sentences in the Cloze Test contrasts sharply with her perfect performance on these structures in the Grammaticality Judgement Task. This indicates that although she was able to make optimum use of her morpho-syntactic knowledge to

interpret null subjects sentences in the Comprehension and Grammaticality Judgement Tasks, she was unable to use that same morpho-syntactic information in the Cloze Test.

MG's divergent performance on the Morphological Comprehension, Grammaticality Judgement and Cloze Tests suggests that linguistic abilities may be subject to differential degrees of disruption in agrammatism, depending on task conditions and demands. Smith & Bates (1987) put this another way, suggesting that agrammatics' capacity to employ their grammatical knowledge may vary depending on the specific task demands. Friederici's (1982) study of English-speaking agrammatic aphasics also revealed that agrammatic comprehension for prepositions varies with specific task demands. Thus, it is crucial to investigate agrammatic performance on different tasks in order to accurately assess each individual patient's linguistic and cognitive strengths and limitations. Furthermore, for reasons as yet to be understood, different agrammatics may not necessarily react in a uniform manner to different experimental tasks. This is certainly true of MG and RL. RL was equally proficient on all morphological tests, whereas MG encountered greater difficulty with the Cloze Test (error rate: 27.50%) than with the Morphological Comprehension and Grammaticality Judgement Tasks (error rates: 3.33% and 15.00%).

Let us turn now to the task-related factors that may account, at least in part, for MG's difficulty in performing the Cloze Test. In this task, the patient had to select a morphological form out of three alternatives for each target sentence. She therefore had

to parse each sentence three times and compare the outcome of each analysis in order to choose the final response. This imposes a computational overload that can exceed the patient's attentional and/or memory capacity. MG's weak performance on the Cloze Test may have been further exacerbated by her reading impairment. Given MG's severely impaired reading ability, she had to rely solely on her auditory memory to perform this task. Saddy (1992) has also considered reading impairment as a possible source of the deficit underlying his patient JA's weak performance in an insertion task. Note that RL, who was less impaired in reading, did not show a similar decrement in his performance on the Cloze Test relative to the other morphological tests.

In summary, despite MG's weaker performance in the Cloze Test relative to her performance on the Morphological Comprehension and Grammaticality Judgement Tasks, the overall high level of performance by both subjects suggests that agrammatics retain knowledge of and ability to access morphological elements in extracting the syntactic structure of a sentence. Although, as we have seen, access to this grammatical information may be somewhat disrupted, it is still possible for agrammatics to arrive at a satisfactory syntactic analysis under experimental circumstances that impose a minimum amount of processing load.

6.4. General Discussion and Conclusion

Although our two agrammatic subjects did not do as well as normal controls on the experimental measures employed in the present study, they performed relatively well. Despite their impoverished speech output, the patients' high level of awareness of Persian grammatical features, as well as their remarkable sensitivity to grammatical violations, may be taken as evidence for their preserved ability to recover syntactic and morphological structures and to construct phrasal constituents which observe appropriate grammatical constraints.

The performance of the agrammatic subjects on different sentence stimuli, including simple and complicated structures, indicates a preserved ability to make systematic use of word position for assigning thematic roles. Their striking performance is, therefore, incompatible with the hypothesis which holds that thematic role assignment in agrammatism occurs on the basis of a non-linguistic linear word order strategy, such as assigning agent role to a sentence-initial noun phrase or to the noun immediately preceding the verb. If agrammatics employ a heuristic strategy to interpret sentences, then, as Kolk & Weijts (1996) note, sentences with canonical word order (actives, subject clefts) should be better perceived than sentences with non-canonical order (object clefts, object relatives). Contrary to this assertion, our agrammatic subjects did very well on both canonical and non-canonical structures.

As we have seen, the results of this research strongly reject the doctrine of a

global loss of syntax in agrammatism. Nor do our results support the idea of agrammatism as a central syntactic deficit, as we could find no evidence for the selective impairment of any aspects of language across all modalities in our agrammatic patients' performance. Thus, the notion of a syntactic loss which is manifested in all language modalities appears to be too simplistic.

In contrast to Friederici (1985), who proposes that the mechanisms of comprehension and production are generally linked, we assume that linguistic problems in agrammatism do not affect all modalities of language in parallel, and that production and perception of speech draw upon different mechanisms. Agrammatism, at least in the two cases discussed here, appears to involve dissociable comprehension and production modalities. The dissociation patterns within the deficit displayed by our agrammatic subjects suggest the need for a more complex account of agrammatism than one which simply tries to capture all of the deficiencies in all language modalities within a single explanatory framework.

Another issue raised by the results of the current study is the nature of the relationship between comprehension and production. Our findings of an expressive/receptive dissociation, for which much support exists in the literature, lends further credence to the idea of the autonomy of expressive syntactic ability from perception ability, and hence to a multifaceted view of the agrammatism syndrome. Agrammatic aphasics have been reported to demonstrate great diversity as to both the

nature and degree of their linguistic impairments. For instance, there are reports of patients who exhibit agrammatic production but intact comprehension (Kolk et al., 1982; Miceli et al., 1983; Nespoulos et al., 1984). Conversely, a number of studies have discussed cases of receptive agrammatics whose spontaneous speech has been left intact (Smith & Bates, 1987; Bates et al., 1987a; Bates & Wulfeck, 1989b).

It has been argued (Zurif et al., 1972) that agrammatic aphasics' better performance on comprehension than on production is due to the fact that in comprehension they rely on their knowledge of lexical semantics as well as on their extralinguistic contextual knowledge. There is no doubt that the comprehension process is a multifaceted operation which depends not only on grammatical knowledge, but also on the strength and availability of extralinguistic information. It is important to note, however, that while contextual and lexical information may be necessary for arriving at a satisfactory interpretation of complex syntactic structures, they are not in themselves sufficient for that purpose. Thus, given the complex structures of some of the stimulus items employed in the present study, it is difficult to posit a solely contextual/lexical strategy for comprehending them at the near-normal level achieved by our subjects. They would certainly have also required access to their knowledge of syntactic relations to properly comprehend such complex stimuli. We would not, therefore, support Zurif et al.'s notion that combining a heuristic extralinguistic with a lexical strategy could adequately account for our subjects' excellent comprehension ability.

The claim of impoverished syntactic representations in agrammatics is difficult to reconcile with our finding that comprehension and grammaticality judgement abilities are well preserved in our subjects. We have seen that they performed very well on both tasks, albeit somewhat better on comprehension. As the pattern of disparity between comprehension and grammaticality judgement in our patients' performance does not, by and large, fit with previous observations of preserved grammaticality judgement and impaired comprehension in agrammatism, some researchers may be tempted to dismiss our subjects as atypical agrammatics. However, there are at least two other studies where grammaticality judgement ability was not markedly superior to comprehension ability in agrammatics. Wulfeck (1987) showed that although her agrammatic subjects performed slightly better on a grammaticality judgement task than on a comprehension task, their performance on the two tasks was actually very similar. In addition, in a reading study, Huber et al. (1990) showed that their patients performed equally well on comprehension and grammaticality judgement tasks which included the same language materials. Thus, a unidirectional performance dissociation between comprehension and grammaticality judgement is not an invariant feature of agrammatism.

Agrammatics' relative performance on comprehension versus grammaticality judgement tasks may be affected by the interaction of a variety of factors, such as task demands and procedures, linguistic materials tested, as well as patients' degrees of preservation of linguistic and cognitive abilities. As Frazier and Friederici (1991, p.58)

note, “the relative complexity of the grammaticality judgement and comprehension tasks is not absolutely invariant but may depend on both the sentences and the type of deficit of the patients tested”. Methodological factors could also affect patients’ performance. For example, the order of presentation of comprehension and grammaticality judgement tasks in the present study might have contributed to the poorer performance of our agrammatic subjects on the Grammaticality Judgement Task. Wulfeck (1988) argues that agrammatics are likely to find a grammaticality judgement task more confusing when it is preceded by a comprehension task. This is because the comprehension task may alter the patients’ interpretation of the grammaticality judgement task. That is, the patients may extract meanings of sentences in the grammaticality judgement task in the same way that they treat sentences in the comprehension task. In both of our experiments, the Comprehension Task was presented to both subjects first, followed by the Grammaticality Judgement Task. Although any effect of task order on our agrammatics’ performance is purely speculative, it would have been interesting to see how these patients might have performed if the tests were presented in the reverse order. As discussed in the preceding section, MG’s relatively weak performance on the Cloze Test might also be accounted for in terms of a task-specific effect.

6.4.1. A processing Account of Agrammatism

Despite MG and RL's typically agrammatic production, their relatively spared linguistic abilities observed in all receptive tasks indicate that they are capable of generating full morpho-syntactic representations. Thus, none of the representational accounts of agrammatism can provide an adequate characterization of the data obtained from this study. The receptive syntactic abilities of our Persian-speaking patients are simply far more preserved than a representational syntactic deficit theory would predict. Our results suggest that the deficit underlying agrammatism syndrome should instead be attributed to a reduction or disturbance in the efficiency of the language processing mechanism. Such processing/computational difficulties would result in disruption of the ability to gain access to or properly manipulate underlying knowledge associated with grammatical and lexical morphemes. While access to some aspects of the grammar may be entirely blocked, access to others might be limited or slowed down. As processing deficits and their effects would vary from patient to patient, a reduction in processing capacity may lead to variable and uneven performance disturbances both within and across agrammatics.

Processing capacity limitations may be attributed to several sources. Some researchers propose that agrammatics' degraded performance can be explained in terms of a memory reduction/overload (Ostrin & Schwartz, 1986; Martin, 1987; Lukatela et al., 1988; Romani, 1990; Lukatela & Shankweiler, 1990; Saffran, 1990). Others claim

that agrammatics' linguistic problems might be due to factors such as the speed with which syntactic representations are processed. Based on the latter view, agrammatic patients suffer either from a slow-down in syntactic processing (Gigley, 1983; Kolk & Van Grunsven, 1985; Friederici, 1988; Friederici & Kilborn, 1989; Haarmann & Kolk, 1991a; Friederici & Frazier, 1992; Zurif et al., 1993) or from a too rapid decay of syntactic information (Gigley, 1983; Kolk & Van Grunsven, 1985; Haarmann & Kolk, 1991a, 1994). Reduction in the speed of language processing, according to Friederici & Frazier (1992), gives rise to a loss of automaticity in syntactic parsing.¹³ In the absence of automatic syntactic processing, more resources would be required to carry out structural analysis in agrammatic language processing than in normal language processing. As a result, task demands and structural complexity of sentence stimuli will have more impact on the performance of agrammatics than on that of normals. This view has also been supported by Milberg & Blumstein (1981), who claim that anterior lesions have a selective effect on the automatic language processing system, whereas posterior lesions have a greater effect on the controlled processing system.

It is well-documented that the symptom-complexes of even a single patient may vary drastically depending on task demands. This is apparent in the differential performance patterns across tasks demonstrated by the agrammatic subjects of the present study. In fact, similar patterns of receptive agrammatism have also been

¹³An automatic process, based on Friederici & Frazier's (1992) definition, is a fast, well-coordinated and effortless process characteristic of normal language functioning.

demonstrated in normals who are working under capacity limiting circumstances. A number of reports illustrate that normal performance degrades under conditions of computational pressure/cognitive overload, such as time pressure from rapid input, noisy conditions, concurrent task performance, multiple centre embedded sentences, etc.. (Forster & Olbrei, 1973; Kolk & Van Grunsven, 1985; Kilborn, 1991; Miyake et al., 1994; Blackwell & Bates, 1995). For instance, Miyake et al. (1994) created processing limitations in their normal subjects during a comprehension task by rapid visual presentation of the individual words of the target sentences. They found that normals made many errors and exhibited a comprehension profile which was very similar to an agrammatic comprehension profile. Such findings suggest that both agrammatic and normal performance is affected by a limitation in processing capacity. Agrammatic language processing is different from normal language processing in terms of the degree of severity of the processing deficit, which controls the efficacy and accessibility of cognitive resources based on which a proper language parsing takes place. Given the strikingly variable patterns of performance exhibited by agrammatic aphasics and by normals, it is unlikely that a single impairment of the automatic processing system results in a single outcome. It is more likely the case that, depending on the task and the particular linguistic structure, processing limitations can lead to different outcomes.

Given the variable and relatively unusual behavioural patterns evidenced by MG and RL across the two experiments, it is difficult to ascertain the exact nature of their

processing impairment(s) in language comprehension. As we discussed earlier, one of the factors that may account for MG's errors in the Cloze Test is an increase in short-term memory load resulting from the presence of three alternative forms in each target sentence. However, if MG's weak performance on this test is a consequence of her impaired memory span, then we should be able to find further evidence of a limited short-term memory in her and possibly in RL's performance on other tasks. We would also need to explain both subjects' excellent performance on the act-out Syntactic Comprehension Task, as this task is assumed to impose a considerable load on short-term memory processes (Hamburger & Crain, 1984). Furthermore, the patients' accuracy in understanding complicated sentences whose length exceeds their memory span indicates that their storage of phonological sequences is adequate for syntactic processing. These findings suggest that the underlying cause of their deficit likely rests on other components of the processing system than short-term memory. This conclusion is further supported by other studies in which verbal memory span was shown not to play a role in aphasics' processing of syntactically complex materials (Martin & Feher, 1990; Friederici & Frazier, 1992). Only further research can determine the extent to which memory load, possibly in combination with other factors, affects the language comprehension of agrammatics.

Another issue that should be examined is the speed with which agrammatic aphasics process syntactic representations. Due to the off-line nature of the

Grammaticality Judgement Tasks in the two experiments, it was not possible to precisely evaluate the agrammatics' reaction time for processing different types of sentence structures. However, an informal timing of the patients' performance on the Grammaticality Judgement Tasks was carried out from the audio recordings of the test sessions. This analysis suggests that the agrammatic subjects' reaction time was relatively slower and more variable than that of the normal controls who participated in the development of the test. This contrasts with the agrammatics' remarkable, near-normal speed in recognizing and analyzing simple syntactic representations. In fact, the speed with which the patients recognized less complicated sentence constructions was indistinguishable from that of normals, indicating that they were not markedly deficient in their syntactic processing time. This also suggests that they did not delay assignment of theta roles to sentential arguments, at least not in simple canonical structures. Moreover, it further underscores their capacity to perform on-line analysis of the input strings in the Grammaticality Judgement Tasks.

The picture is less clear with respect to complicated structures. Relative to normals who participated in the study, both MG and RL process difficult sentences more slowly than simple sentences. This is not surprising, as the underlying representations of these sentences contain traces and co-indexations, and therefore entail increased processing demands and deeper and more intricate analysis than simple structures. The fact that the agrammatics encountered difficulty mainly in complicated constructions

across all the tasks could be an indication that syntactic complexity selectively influenced their performance. A similar slow-down in reaction time was also found in the agrammatics' grammaticality judgement of ungrammatical but not of grammatical sentences. This may suggest that their processing mechanisms are more heavily taxed by ungrammatical than by grammatical sentences. It is noteworthy that both patients showed evidence of correcting ungrammatical sentences in the two grammaticality judgement tasks. These corrections occurred both deliberately and at the request of the experimenters. Thus, the extra time required for judging ungrammatical sentences may have been due to the subjects' reanalyzing them. This reinforces the notion that the subjects retain a great deal of residual grammatical knowledge and are capable of the automatic processing of linguistic representations.

6.4.2. Other Relevant Factors

In addition to computational and linguistic factors, there are other psychological and cognitive factors which are of importance in the investigation of agrammatism. Factors such as stress, panic, lack of confidence, degree of motivation and attention may have affected our patients' performance patterns.¹⁴ Furthermore, agrammatics' social and family environments can contribute a great deal towards their degree of recovery

¹⁴Some researchers, such as Code and Müller (1983), have proposed that psychological factors should not be considered as "secondary" effects of aphasia, but central problems requiring the full attention of the aphasia therapist.

and their regaining of language skills. The investigation of psychological and emotional effects on agrammatic patients' language performance is an important area often overlooked in the study of agrammatism. Such factors may account, at least partially, for MG's poorer progress relative to RL's. Unlike RL, who has been enjoying a great deal of support from his sympathetic relatives, MG has been suffering from depression as a result of disturbing life events and the lack of a satisfactory family environment.

The type of medications the patient is taking might also affect an agrammatic's recovery. RL was on drug treatment for a short time, whereas MG has been taking several drugs since the onset of her illness.¹⁵ Slurred speech, abnormal involuntary movements, decreased behavioural co-ordination, mental confusion, disturbed concentration and anxiety are some of the most common side-effects associated with the use of these drugs. These side-effects may have contributed to MG's feelings of social isolation and depression, as well as to her slowness in recovery. Thus, the effects of various linguistic and non-linguistic factors should be taken into consideration to gain a deeper insight into the agrammatic's linguistic behaviours. Further investigations are warranted in order to clarify the nature and magnitude of these effects.

The results of the present study do not favour an impaired grammatical representation as the underlying mechanism in agrammatism. Rather, they support the view that both complexity of the test materials and slowness of the language processing

¹⁵These drugs include Elavil (Amitriptyline), Phenytoin (Diphenylhydantoin), Tegretol (Carbamazepine), Warfarine (Coumadin) and Lamictal (Lumotrigin).

mechanism have converged to diminish or reduce the linguistic performance of our two agrammatic subjects. The patients' patterns of disruption are taken as evidence of a processing/accessing deficit which possibly results from delayed integration of preserved morpho-syntactic information in the processing of complicated grammatical constructions.

6.5. Suggestions for Future Research

This study investigated the comprehension and grammaticality judgement performance of two Persian-speaking agrammatic aphasics on a limited set of morpho-syntactic constructions. Although the results obtained can undoubtedly be taken as an indication of remarkably preserved grammatical knowledge in agrammatics, it would be necessary to extend the scope of this investigation to a larger number of Persian-speaking agrammatic subjects before generalizing these findings. Future studies should include agrammatics with the same etiology, age and educational background as those in the present study, as well as other groups of neurologically-damaged aphasics, such as paragrammatics. Comparison of the performance of different aphasic populations on the same experimental materials and tasks might reveal additional mechanisms underlying language breakdown, aside from insufficient processing capacity, and may eventually lead us to accurately associate specific patterns of language breakdown with distinct cortical and subcortical areas of the brain.

Another question to pursue is whether patterns of performance similar to those observed in the present study can be obtained with other aspects of syntax and morphology. Thus, future studies should extend the test stimuli to include a wider variety of syntactic and morphological structures, such as different types of relative clauses and passives, as well as other inflectional and derivational elements and prepositions.

Also, to obtain a more comprehensive picture of the language processing difficulties experienced by agrammatic aphasics, further examination of their linguistic behaviours across other tasks and performance modalities, including on-line grammaticality judgement, repetition and repair tasks is warranted. Closer inspection of agrammatics' performance on a variety of tasks may reveal whether a uniform performance profile is exhibited both across and within patients. Such studies would also enhance our understanding of the methodological as well as processing factors contributing to patients' performance on various tasks. Furthermore, in order to determine whether agrammatics' behavioural patterns are influenced by task ordering, tasks should be administered in different orders across subjects and within subjects across testing sessions.

As was pointed out earlier, general cognitive factors such as a reduction in short-term memory could have affected the performance of our agrammatic patients on the language tasks. Although there was no direct way to assess this in the present study,

future studies should address the relationship between cognitive abilities/disabilities and syntactic and morphological abilities/disabilities.

And finally, future research in different languages is needed to confirm the findings of the present study. Studies of both comprehension and grammaticality judgement which assess the same syntactic and morphological structures across languages are relatively scarce. Furthermore, it would be interesting to find evidence of agrammatics' differential sensitivity to various grammatical categories, such as agreement and word order violations, in other languages. Further cross-linguistic exploration of the issues addressed by this research would add immeasurably to our understanding of universal and language-specific patterns in agrammatism. Such studies might lead us closer to determining whether agrammatism results in language specific performance or whether a universal syndrome-specific profile may be observed in this syndrome.

Appendix 1*

1. Syntactic Experiment

A. Syntactic Comprehension

Simple actives:

Reversibles:

1. Gorbe xarguš rā gāz migirad.
“The cat bites the rabbit.”
2. Doxtar mādaraš rā mibusad.
“The girl kisses her mother.”
3. Pedar doxtaraš rā baqal mikonad.
“The father is hugging her daughter.”
4. Pesar doxtar rā hol midehad.
“The boy is pushing the girl.”
5. Meymun qurbāqe rā donbāl mikonad.
“The monkey is chasing the frog.”
6. Asb xers rā lagad mizand.
“The horse is kicking the bear.”

Non-reversibles:

7. Mard divār rā rang mizand.
“The man is painting the wall.”
8. Doxtar kafšaš rā pāk mikonad.
“The girl is cleaning her shoes.”

* All Persian stimuli are presented in phonetic transcription. See Appendices 3 and 4 for the same stimuli in Persian script.

9. Mard māšin rā mišuyad.
“The man is washing the car.”
10. Mādar šam rā rošan mikonad.
“The mother is lighting the candle.”
11. Bačče asbāb bāzi rā mišekand.
“The child is breaking the toy.”
12. Bāqbān deraxt rā āb midehad.
“The gardener is watering the tree.”

Subject Clefts:

Reversibles:

13. In kāmiyun ast ke māšin rā mikesād.
“It is the truck that is pulling the car.”
14. In mādar ast ke doxtar rā baqal mikonad.
“It is the mother who is hugging the girl.”
15. In gorbeh ast ke muš rā gāz migirad.
“It is the cat that is biting the mouse.”
16. In zan ast ke mard rā mizanad.
“It is the woman who is beating the man.”
17. In pesar ast ke doxtar rā hol midehad.
“It is the boy who is pushing the girl.”
18. In sag ast ke parande rā donbāl mikonad.
“It is the dog that is chasing the bird.”

Non-reversibles:

19. In pesar ast ke šišē rā mišekanad.
“It is the boy who is breaking the window.”
20. In sag ast ke tup rā gāz migarad.
“It is the dog that is biting the ball.”
21. In mard ast ke māšin rā mišuyad.
“It is the man who is washing the car.”
22. In pesar ast ke māšin rā hol midehad.
“It is the boy who is pushing the car.”
23. In bačče ast ke gol rā negāh mikonad.
“It is the child who is looking at the flower.”
24. In moallem ast ke ketāb rā mixānad.
“It is the teacher who is reading the book.”

Object clefts

Reversibles:

25. In māšin ast ke kāmīyun mīkešadaš.
“It is the car that the truck is pulling.”
26. In pesar ast ke pedar baqalaš migirad.
“It is the boy whom the father is hugging.”
27. In gorbe ast ke xarguš gāzaš migirad.
“It is the cat that the rabbit is biting.”
28. In xers ast ke asb holaš midehad.
“It is the bear that the horse is pushing.”
29. In fil ast ke meymun donbālaš mikonad.
“It is the elephant that the monkey is chasing.”

30. In zan ast ke mard kotakaš mizanad.
“It is the woman whom the man is beating.”

Non-reversibles:

31. In tup ast ke pesar partābaš mikonad.
“It is the ball that the boy is throwing.”
32. In deraxt ast ke doxtar āb midehad.
“It is the tree that the girl is watering.”
33. In gorbe ast ke bačče nāzaš midehad.
“It is the cat that the child is patting.”
34. In māšin ast ke mard holaš midehad.
“It is the car that the man is pushing.”
35. In māšin ast ke pesar pākaš mikonad.
“It is the car that the boy is cleaning.”
36. In miz ast ke mard rangaš mizanad.
“It is the table that the man is painting.”

Subject Relatives

Reversibles:

37. Mādari ke bačče rā mibusad ruye sandali nešaste ast.
“The mother who is kissing the child is sitting on the chair.”
38. Pesari ke pedaraš rā baqal karde xošhāl ast.
“The boy who is hugging his father is happy.”
39. Doxtari ke pesar rā kotak mizanad asabāni ast.
“The girl who is beating the boy is angry.”

40. Mardi ke Qurbāqe rā mibinad farār mikonad.
“The snake that is seeing the frog is running away.”
41. Gorbei ke muš rā dide ast zire miz ast.
“The cat that has seen the mouse is under the table.”
42. Gāvi ke xers rā lagad mizanad bozorg ast.
“The cow that is kicking the bear is big.”

Non-reversibles:

43. Mardi ke ruznāme mixānad derāz kešide ast.
“The man who is reading the newspaper is lying down.”
44. Baččeī ke gorbe rā baqal karde nešaste ast.
“The child who is holding the cat is sitting.”
45. Zani ke lebās rā otu mikonad eynak zade ast.
“The woman who is ironing the dress is wearing glasses.”
46. Mardi ke divār rā rang mizanad qad boland ast.
“The man who is painting the wall is tall.”
47. Pesari ke bādkonak ra tarkānde gerye mikonad.
“The boy who has blown up the balloon is crying.”
48. Baččeī ke mard rā nešān midehad tarside ast.
“The child who is pointing at the snake is scared.”

Object Relatives

Reversibles:

49. Gorbei ke sag donbālaš mikonad ruye divār ast.
“The cat that the dog is chasing is on the wall.”
50. Muši ke gorbe negāhaš mikonad siyā ast.
“The mouse that the cat is looking at is black.”

51. Pesari ke zan nešānaš midehad dars mixānad.
 “The boy whom the woman is pointing at is studying.”
52. Doxtari ke pesar kotakaš mizanad kučak ast.
 “The girl whom the boy is beating is small.”
53. Asbi ke xers gāzaš migarad bozorg ast.
 “The horse that the bear is biting is big.”
54. Pedari ke pesar mibusadaš ruznāme mixānad.
 “The father whom the boy is kissing is reading a newspaper.”

Non-reversibles:

55. Ketābi ke pesar xaride ruye zamin oftāde ast.
 “The book that the boy has bought has fallen on the floor.”
56. Xersi ke mār nišaš mizanad bozorg ast.
 “The bear that the snake stings is big.”
57. Māšini ke mard mišurad sefid ast.
 “The car that the man is washing is white.”
58. Lebāsi ke zan otu mikonad qašang ast.
 “The dress that the woman is ironing is beautiful.”
59. Baččei ke pedar bolandash kardeh mixandad.
 “The child whom the father has lifted is laughing.”
60. Gorbei ke doxtar nāzaš midahad xābide ast.
 “The cat that the girl is patting is sleeping.”

B. Syntactic Grammaticality Judgement*

Word order violations:

1. Šekastand in panjere āšpazxāne ast ke baččehā.
“It is the kitchen window that the children broke.”
2. Minevisad in dānešāmuz ast ke mašqaš rā.
“It is the student who is doing his homework.”
3. Nešast doxtar baččei ke arusak rā baqal karde ast ruye sandali.
“The baby girl who was holding the doll sat on the chair.”
4. Mixandad pedari ke pesar baqalaš karde ast az tahe del.
“The father whom the boy is hugging is laughing from the bottom of his heart.”
5. Mizanad doxtar pesar rā bā čub mohkam.
“The girl is beating the boy hard with the stick.”
6. Lagadaš in xers ast ke asb mizanad.
“It is the bear that the horse is kicking.”
7. Hol in pesar ast ke doxtar rā midehad.
“It is the boy who is pushing the girl.”
8. Faryād doxtari ke muš ra dide mizanad.
“The girl who has seen the mouse is screaming.”
9. Gerye baččei ke doktor āmpulaš mizanad mikonad.
“The child whom the doctor is giving an injection is crying.”
10. Āb pesar deraxt rā midehad.
“The boy is watering the tree.”
11. Gorbeh xarguš rā migereft dāšt.
“The cat was catching the rabbit.”

*The English translations do not reflect the Persian ungrammatical structures involving word order and agreement violations.

12. Mard divār rā naqqāši bud karde.
“The man had painted the wall.”
13. In doxtar ast ke pesar rā hol bud dāde.
“It is the boy who had pushed the girl.”
14. In mard ast ke māšin rā mišuyad dārad.
“It is the man who is washing the car.”
15. In fil ast ke palang donbālaš mikard dāšt.
“It is the elephant that the leopard was chasing.”
16. In miz ast ke mard rangaš mizanad dārad.
“It is the table that the man is painting.”
17. Madari ke bačče rā mibusid ruye sandali bud nešaste.
“The mother who was kissing the child was sitting on the chair.”
18. Bačče ke arusak dust dārad mixābad dārad.
“The child who likes the doll is sleeping.”
19. Dānešāmuzi ke moallem dustaš dārad dars mixānad dāšt.
“The student whom the teacher likes was studying.”
20. Dozdi ke polis taqībaš mikard bud tir xorde.
“The thief whom the police was chasing had been shot.”
21. Parastār mariz baqal rā mikonad.
“The nurse hugs the patient.”
22. Mār qurbāqe dārad niš mizanad.
“The snake is stinging the frog.”
23. In kāmīyun ast ke māšin dāšt mikešid rā.
“It is the truck that was pulling the car.”
24. In mard ast ke māšin hol rā midehad.
“It is the man who is pushing the car.”

25. In pesar ast ke doxtar mizanad rā.
“It is the boy who is beating the girl.”
26. In sag ast ke tup gāz gerefte ast rā.
“It is the dog that has bitten the ball.”
27. Mādari ke bačče mibusad rā nešaste ast.
“The mother who is kissing the child is sitting.”
28. Baččeī ke arusak baqal karde rā mixandad.
“The child who is holding the doll is laughing.”
29. Pesari ke pedar dārad rā baqal mikonad xošhāl ast.
“The boy who is hugging the father is happy.”
30. Mardi ke divār dāšt naqqāši mikard rā qad boland ast.
“The man who was painting the wall is tall.”
31. In sag ast gorg ke rā donbāl mikonad.
“It is the dog that is chasing the wolf.”
32. In kāmīyun ast terāktor ke rā mikešad.
“It is the truck that is pulling the tractor.”
33. Ke in bačče ast gol rā mičīnad.
“It is the child that picks the flower.”
34. Ke in gorbe ast xarguš gāzaš migirad.
“It is the cat that the rabbit bites.”
35. In mariz ast doktor ke moāyeneaš mikonad.
“It is the patient whom the doctor is checking.”
36. Polisi dozd ke rā dastgir mikonad qavi ast.
“The police who arrests the thief is strong.”
37. Pesari mard ke rā hol midahad čāq ast.
“The boy who is pushing the man is fat.”

38. Ke bačcei dočarxe xaride xošhāl ast.
“The child who has bought a bicycle is happy.”
39. Ke gāvi xers lagadaš mizanad mitarsad.
“The cow that the bear is kicking is scared.”
40. Ke āhui šekārči šekār karde zibā ast.
“The dear that the hunter has hunted is beautiful.”

Agreement Violations:

41. Gorbe xarguš rā gāz migiri.
“The cat is biting the rabbit.”
42. In pesar ast ke doxtar rā hol midādam.
“It is the boy who was pushing the girl.”
43. In asb ast ke zarrāfe donbālaš mikonid.
“It is the horse that the giraffe is chasing.”
44. Bačcei ke bādkonak rā didi xošhāl ast.
“The child who has seen the balloon is happy.”
45. Ketābi ke dānešāmuzān xāndim ruye miz ast.
“The book the students read is on the table.”
46. Moallem dānešāmuz rā tanbih kardand.
“The teacher punished the student.”
47. In doxtarhā hastand ke golhā rā āb midehad.
“It is the girls that are watering the flowers.”
48. In deraxte kāj ast ke bačcehā šekast.
“It is the pine tree that the children broke.”
49. Doktorī ke mariz ra moāyene mikonad mixandand.
“The doctor who is checking the patient is laughing.”

50. Dānešāmuzāni ke moallem dustešān dārad darsxān hast.
“The students who the teacher likes are hard-working.”
51. In pesar ast ke pedaraš dāri baqalaš mikonad.
“It is the boy whom his father is hugging.”
52. Baččehāi ke šīše rā šekaste budim farār kardand.
“The children who had broken the window ran away.”
53. In zani ast ke dāram golhā rā āb midehad.
“It is the woman who is watering the flowers.”
54. Parastār mariz rā dāšti baqal mikard.
“The nurse was hugging the patient.”
55. Dozdi ke polishā dastgiraš karde budid farār kard.
“The thief whom the police had arrested ran away.”
56. Bāqbān dārand gol mikārad.
“The gardener is planting flowers.”
57. In bačče ast ke asbāb bāzi rā šekaste budand.
“It is the child who had broken the toys.”
58. In majruh ast ke sarbāzha dāšt hamlaš mikardand.
“It is the injured whom the soldiers were carrying.”
59. Mardi ke ketāb mixānad nešasteand.
“The man who is reading the book is sitting.”
60. Ketabi ke baččehā dāšt mixāndand Šāhnāme bud.
“The book that the children were reading was Šahname.”

Grammatical Sentences:

61. Doxtar gorbe rā nāz midehad.
“The girl is petting the cat.”

62. In gorbe ast ke muš rā donbāl mikonad.
“It is the cat that is chasing the mouse.”
63. In māšin ast ke pedar xaride ast.
“It is the car that the father has bought.”
64. Baččei ke asbāb bāzi rā šekast gerye mikonad.
“The child that broke the toy is crying.”
65. Lebāsi ke doxtar otu mikonad qašang ast.
“The dress that the girl is ironing is beautiful.”
66. In xalabān ast ke havāpeymā rā mirānad.
“It is the pilot that is controlling the plane.”
67. Šekārči āhu rā āzād kard.
“The hunter released the dear.”
68. Xersi ke asb lagadaš zad oftād.
“The bear that the horse kicked collapsed.”
69. Pesar dārad šokolāt mixorad.
“The boy is eating chocolate.”
70. In doxtari ast ke dustaš rā dāšt hol midād.
“It is the girl who was pushing her friend.”
71. In xānei ast ke pedar xaride bud.
“It is the house that the father had bought.”
72. Mardi ke golhā rā dāšt āb midād hamsāye mā ast.
“The man who was watering the flowers is our neighbour.”
73. Qazāi ke mādar dārad mipazad xošmaze ast.
“The food that the mother is cooking is delicious.”
74. Doktor mariz rā dāšt moāyene mikard.
“The doctor was checking the patient.”

75. In āhui ast ke šekārči šekār karde ast.
“It is the deer that the hunter has hunted.”
76. Polisi ke dārad dozd rā taqīb mikonad šojā ast.
“The cop that is chasing the thief is brave.”
77. Pedar baččehā rā be sinamā bord.
“The father took the children to the cinema.”
78. In mādar bozorg ast ke qazā mipazad.
“It is the grandmother who is cooking food.”
79. In māšin ast ke mard holaš dād.
“It is the car that the man pushed.”
80. Mādari ke bačče rā mibusad xošhāl ast.
“The mother who is kissing the child is happy.”
81. Nevisandei ke ketāb rā nevešte ast soxanrāni mikonad.
“The writer who has written the book is giving a speech.”
82. In doxtar ast ke pesar ra masxare mikonad.
“It is the girl who is humiliating the boy.”
83. Doxtar muhāyaš rā šāne mikonad.
“The girl is combing her hair.”
84. In āšpaz ast ke kabāb rā mipazad.
“It is the cook who cooks the kebab.”
85. In pesar bud ke gol rā čid.
“It was the boy who picked the flower.”
86. Marizi ke doktor moāyenešaš mikonad pir ast.
“The patient whom the doctor is checking is old.”
87. In sag ast ke gorg gāzaš gereft.
“It is the dog that the wolf bit.”

88. Dānešāmuzi ke jāyze gereft darsxān ast.
“The student received an award is hard-working.”
89. Xarguši ke sag gāzaš gerft farār kard.
“The rabbit that the dog bit scaped.”
90. Zani ke lebās miduxt ruye sandali nešaste bud.
“The woman who was sewing was sitting on the chair.”
91. Pesar kifaš rā dar madreseh gom kard.
“The boy lost his bag in the school.”
92. In pedar ast ke baččehā rā dārad da?vā mikonad.
“It is the father who is yelling at the children.”
93. In motor siklet bud ke mard tamiraš mikard.
“It is the motor cycle that the man was fixing.”
94. Ketābi ke pedarbozorg dust dārad Šāhnāme ast.
“The book that the grandfather likes is Šahname.”
95. Filmi ke baččehā dāštand tamāša mikardand kārton bud.
“The film that the children were watching was a cartoon.”
96. Pesari ke mard rā hol midehad čāq ast.
“The boy who is pushing the man is fat.”
97. In bače ast ke asbāb bāzi rā mišekanad.
“It is the boy who is breaking the toy.”
98. In āhu ast ke šir dārad šekāraš mikonad.
“It is the dear that the lion is chasing.”
99. Gāvi ke xers rā lagad mizanad bozorg ast.
“The cow that is kicking the bear is big.”
100. Mādar bačče rā dārad šir midehad.
“The mother is nursing the baby.”

Distractors (Grammatical sentences):

101. Pedar diruz be edāreh naraft barāye inke sarmā xorde bud.
“The father did not go to work yesterdays because he had a cold.”
102. Naqqāš čand tāblo zibā kešid va be qeymate xubi foruxt.
“The painter drew several beautiful paintings and sold them for a good price.”
103. Moallem az dānešāmuzān xāst ke dars bexānand tā dar emtehān movaffaq shavand.
“The teacher asked the students to study in order to be successful.”
104. Polis sā’athā dozd rā taqib kard tā tavānest u rā dastgir konad.
“The cop chased the thief for hours until they were able to arrest him.”
105. Čon dānešāmuz taklifaš rā anjām nadāde bud moallem u rā jarime kard.
“The teacher punished the student because he had not done his homework.”
106. Gorbe bā didane sag tarsid va be sor’at farār kard.
“The cat got scared by seeing the dog and escaped quickly.”
107. Mādar baččehā rā be bāzār bord tā barāyešān lebās bexarad.
“The mother took the children to the mall to buy them clothes.”
108. Čon havā sard bud baččehā az raftan be sinamā monsaref šodand.
“The children changed their mind about going to the movies because of the cold weather.”
109. Dustāne mā natavānestand be mosāferat beravand barāye inke barfe ziyādi bāride bud.
“Our friends could not go on vacation because there was a lot of snow.”
110. Pedar tasmim gereft ke pesaraš rā barāye tamāšaye mosābeqye futbāl bebarad.
“The father decided to take his son to the soccer game.”

Distractors (Ungrammatical sentences):

111. Čon pesar sāgerde momtāz bud xarid pedar barāyaš jāyze.
“Because the boy was a smart student, his father bought him a present.”

112. Mādar mašqule qazā poxtan ast va doxtaraš be u komak mikonad dārad.
“The mother is busy cooking and her daughter is helping her.”
113. Pesar natavānest az qannādi širini bexarad barāye inke kife pulaš gom karde bud rā.
“The boy could not buy pastries from the confectionary because he had lost his wallet.”
114. Dandānpezeš be baččehā tosiye kard dandānhāye xod ke rā ruzi se bār mesvāk bezanand.
“The dentist advised the children to brush their teeth three times a day.”
115. Mahigirān sobhe zud be daryā raftand tā māhi seyd konim.
“The fisher men went to sea early in the morning to catch some fish.”
116. Polis doz d rā natavānest dastgir konad barāye inke kard u farār.
“The police could not arrest the thief because he ran away.”
117. Doxtar bā mādaraš be mehmāni naraft čon mašqaš rā bud nanevešte.
“The girl did not go to the party with her mother because she had not finished her homework.”
118. Pesar pule tujibiaš pasandāz mikonad rā tā yek dočarxe bexarad.
“The boy is saving his money to buy a bicycle.”
119. Baččehā dust dārand be juje qazā ke bedahand.
“The children like to feed the chickens.”
120. Asb gāv rā lagad zad va u rā be zamin andāxtand.
“The horse kicked the cow and dropped him on the floor.”

Appendix 2 *

2. Morphological Experiment

A. Morphological Comprehension

DO clitics:

1. Pesar bolandaš karde ast.
“The boy has lifted it.”
2. Doxtar dārad nešānaš midehad.
“The girl is point at it.”
3. Mard dārad moʔarrefīt mikonad.
“The man is introducing you.”
4. Pesar dārad holam midehad.
“The boy is pushing me.”
5. Zan dārad sedāyaš mikonad.
“The woman is calling him.”
6. Bačče dārad donbālešan mikonad.
“The child is chasing them.”
7. Polis dārad taqibešan mikonad.
“The cop is chasing them.”
8. Sag dārad negāhešān mikonad.
“The dog is looking at them.”
9. Pedar dārad navāzešemān mikonad.
“The father is patting us.”

*All Persian stimuli are presented in phonetic transcription. See Appendices 3 and 4 for the same stimuli in Persian script.

10. Doxtar xeyli dustešān dārad.
“The girl likes them very much.”

IDO clitics:

11. Moallem dārad behet dars midehad.
“The teacher is teaching you.”
12. Šekārçi beheš tirandāzi mikonad.
“The hunter is shooting at it.”
13. Pesar azaš mitarsad.
“The boy is scared of it.”
14. Pedar barāyam ketāb dāstān mixānad.
“Father is reading a story book for me.”
15. Pesar dārad azat xodāhāfezi mikonad.
“The boy is saying goodbye to you.”
16. Pesar dārd behešān negāh mikonad.
“The boy is looking at them.”
17. Mard bāhāmān sohbat mikonad.
“The man is talking to us.”
18. Bačče behešān alaf midehad.
“The boy is giving them grass.”
19. Madar barayetān qazā mipazad.
“Mother is cooking for you.”
20. Pesar tup rā barāyemān part mikonad.
“The boy is throwing the ball at us.”

Possessive clitics:

21. Sagaš xābide ast.
“His dog is sleeping.”
22. Mādarat dārad āš mipazad.
“Your mother is cooking soup.”
23. Pesaraš dārad xodāhāfezi mikonad.
“Her son is saying goodbye.”
24. Barādaram dārad xub midavad.
“My brother is running well.”
25. Moallemaš dārad nāme minevisad.
“His teacher is writing a letter.”
26. Morqhāyešān dārand dāne mixorand.
“Their hens are eating seeds.”
27. Pedaretān ketāb mixānad.
“Your father is reading a book.”
28. Moallemetān dārad dars midehad.
“Your teacher is teaching.”
29. Gusfandānšān dārand čera mikonand.
“Their sheep are eating.”
30. Tupešān bālāye deraxt oftāde ast.
“Their ball fell on a tree.”

Null subject:

31. Dārad sag rā bā čub mizanad.
“He is beating the dog with a stick.”
32. Be māšin negāh mikoni.
“You’re looking at the car.”

33. Lāneye parandegān rā nešān midaham.
“I am pointing at the birds’ nest.”
34. Dāri dočarxe rā tamir mikoni.
“You’re fixing the bicycle.”
35. Dārad be morqhā dāne midehad.
“He is feeding the chickens.”
36. Bā parastārkhā sohbat mikonad.
“She’s talking to nurses.”
37. Mušhā rā donbāl mikonand.
“They are chasing the mice.”
38. Be darse moallem guš midahim.
“We are listening to the teacher’s lesson.”
39. Dārid be golhā āb midahid.
“You are watering the flowers.”
40. Dārand mesvāk mizanand.
“They are brushing their teeth.”

Grammatical active sentences:

41. Gorbe sag rā donbāl mikonad.
“The cat is chasing the dog.”
42. In doxtar ast ke be pesar āb mipāšad.
“It is the girl who is spraying water on the boy.”
43. Pesar lāne parande rā nešan midehad.
“The boy is pointing at the birds’ nest.”
44. Kāmiyun māšin rā mikesād.
“The tractor pulls the car.”

45. Zan mard rā mibusad.
“The woman kisses the man.”
46. In mard ast ke gol mikārad.
“It is the man who is planting the flowers.”
47. Pesarhā taxte siya rā pāk mikonand.
“The boys are cleaning the blackboard.”
48. In doxtar ast ke be morqhā dāne midehad.
“It is the girl who feeds the chicken.”
49. Xorus darad kabutar rā tamāšā mikonad.
“The rooster is watching the pigeon.”
50. Pesar hediyeye xod rā be doxtar nešān midahad.
“The boy shows his present to the girl.”
51. In gorg ast ke dārad farār mikonad.
“It is the wolf that is running away.”
52. In pesarhā hastand ke donbāle doxtarhā midavand.
“It is the boys who are running after the girls.”
53. In doxtar ast ke kif be dast gerefte ast.
“It is the girl who is holding a bag.”
54. Pesar be pedar sib taārof mikonad.
“The boy offers his father an apple.”
55. Šekārči dārad be āhuhā tir andāzy mikonad.
“The hunter is shooting at the dears.”
56. Mariz bā parstārḥā sohbat mikonad.
“The patient is talking to nurses.”
57. Sag dārad pāye pesar rā gāz migirad.
“The dog is biting the boy’s leg.”

58. Roftegarān dārand zamin rā jāru mikonand.
“The janitors are sweeping the floors.”
59. In pedar ast ke pesar rā baqal gerefte ast.
“It is the father who is holding the boy.”
60. Parande barāye juhēhāyaš qazā miāvarad.
“The bird is bringing food for the chicks.”

B. Morphological Grammaticality Judgement:

Agreement violations of DO clitics:

1. In pesar ast ke sag gāzat gereft.
“It is the boy whom the dog bit.”
2. Čon mā šoluq mikardim moallem davāš kard.
“Because we were noisy, the teacher punished us.”
3. Dozd farār kard va polis natavānest dastgiraš konad.
“The thief ran away and the police could not catch him.”
4. To doxtare darsxāni hasti va moallem dustam dārad.
“You are a hard-working girl and the teacher likes you.”
5. Pesar do qanāri dārad ke dar qafas negahetān midārad.
“The boy has two canaries that he keeps in a cage.”
6. Čon čamedān sangin bud, zan natavānest bolandešān konad.
“The woman could not lift the suitcase because it was heavy.”
7. Hamin ke oqāb parandeye kučak rā did šekārat kard.
“As soon as the eagle saw the little bird he hunted it.”
8. In haman ketābi ast ke doxtar gometān karde bud.
“This is the book that the girl had lost.”
9. Man mariz budam vali mitarsidam ke doktor moāyeneat konad.
“I was sick but I was scared of being checked by the doctor.”

10. Čon to dar tārīki nešaste budi natavānestam bebinamaš.
“I could not see you because you were sitting in the dark.”

Agreement violations of IDO clitic pronouns:

11. Ān mār xeyly tarsnāk ast va bačče azašān mitarsad.
“That snake is very scary and the child is scared of it.”
12. Čon šomā gorosneid madar barāyaš keyk poxte ast.
“Mother has baked a cake for you because you are hungry.”
13. In hamān marde faqiri ast ke zan behet komak mikard.
“This is the same poor man who the woman helps.”
14. In lebāsi ast ke to dust dāšti va pedar barāyeman xarid.
“This is the dress that you liked and the father bought it for you.”
15. Vaqti pedar dar mazrae kār mikonad pesar behetān komak mikonad.
“When the father works in the farm the boy helps him.”
16. To dānešāmuze darsxāni hasti va moallem azam rāzi ast.
“You are a smart student and the teacher is satisfied.”
17. Moallemān delsuz hastand va mā bāyad beheš ehterām begozārim.
“The teachers are kind and we should respect them.”
18. In gorbei ast ke doxtar azašān negahdāri mikard.
“It’s the cat that the girl was taking care of.”
19. Vaqti ke dar bimarestān bastari budam dustān azat didār kardand.
“When I was in the hospital my friends visited me.”
20. Mehmānān be xāneye mā āmadand va mādar azatān pazirāyi kard.
“The visitors came to our house and the mother served them.”

Agreement violations of possessive clitic pronoun:

21. Šomā bāzi mikonid va mādaraš qazā mipazad.
“You are playing and the mother is cooking.”
22. Man zamin xordam va pāyat zaxmi šod.
“I fell down and injured my leg.”
23. Doxtar gerye mikonad čon arusakešān rā gom karde ast.
“The girl is crying because she has lost her doll.”
24. Pedar va mādar movāzeb hastand ke baččeaš az dočarxe nayoftand.
“The parents are careful that their child does not fall off the bicycle.”
25. Dānešāmuzān sāket nešasteand čon moallemetān dārad dars midehad.
“The students are sitting quietly because the teacher is teaching.”
26. Šomā xeyly xošhāl budid be tori ke sedāye xandeyetān hame ja rā por karde bud.
“You were so happy that your laughter filled the room.”
27. Mā moallemān dust dārand ke dānešāmuzānaš movafaq shavand.
“We teachers like that our students to be successful.”
28. Dandānpezešk be baččehā tosiye kard ke dandānhāyemān rā xub mesvāk bezanand.
“The dentist advised the children to brush their teeth well.”
29. Mādarbozorg mehrāban ast va navehayešān u rā dust dārand.
“The grandmother is kind and her grandchildren like her.”
30. Vaqti ke gāv be gorg hamleh kard šāxat šekast.
“When the cow attacked the wolf, his horn broke.”

Agreement violations of the null subject:

31. Be pesar čand ketāb dāram midahi.
“You are giving a few books to the boy.”

32. Dāšt xāne rā naqqāši mikardand.
“They were painting the house.”
33. Dārad be bačče qazā mideham.
“I am feeding the baby.”
34. Dārand dozd rā taqib mikonand.
“They are chasing the thief.”
35. Be darse moallem dārim guš midahid.
“You are listening to the teacher.”
36. Yek keyke xošmaze dārad mipazi.
“She’s baking a delicious cake.”
37. Ba barādarš dāšt bāzi mikardand.
“They were playing with their brother.”
38. Dāštam doxtar rā donbāl mikard.
“He was chasing the girl.”
39. Dārad lebāshāyaš rā otu mikonid.
“You are ironing your clothes.”
40. Dāšti barāye bačče qesse tarif mikardam.
“I was telling a story to the children.”

Grammatical sentences:

41. U doxtare bā adaby ast va pedar dustaš dārad.
“She is a polite girl and her father likes her.”
42. In gorbe ast ke pesar donbālaš mikonad.
“It is the cat that the boy is chasing.”
43. Āhu farār kard va šekārči natavānest šekāraš konad.
“The dear escaped and the hunter couldn’t hunt it.”

44. Ćon dānešāmuzān bienzebāti budand moallem tanbihešān kard.
“The teacher punished the students, because they were rude.”
45. Vaqti be madrese mirafti didamat.
“I saw you when you were going to school.”
46. Ćon mariz budam doktor moāyeneam kard.
“The doctor checked me because I was sick.”
47. Dar pārk bāzi mikardid ke sag gāzetan gereft.
“You were playing in the park when the dog bit you.”
48. Ćon az ĉerāq qermez rad šody polis jarimeat kard.
“The police gave you a ticket, because you passed the red light.”
49. In hamān zani ast ke mard azaš mitarsad.
“This is the woman whom the man is scared of.”
50. Ketābi ke to mixāsti mādar barāyat peydā kard.
“Mother found the book that you wanted.”
51. Ānhā dustān xubi hastand va mā behešān ehterām migozārim.
“They are good friends and we respect them.”
52. Qessei ke dust dātštīd mādar bozorg barāyetān tarif kard.
“Grandmother told the story that you liked.”
53. Pesar kabutarhā rā dust dārad va behešān dāneh midehad.
“The boy likes the pigeons and is feeding them.”
54. Mādar be šomā qol dād ke barāyetān širini bepazad.
“Mother promised you to bake some cookies.”
55. Vaqti ke mariz budi azat morāqebāt mikardam.
“When you were sick I was taking care of you.”
56. In mardī ast ke to rānandegī behesh yād dādi.
“This is the man whom you gave driving lessons.”

57. Doxtar dars mixānad va barādaraš be u komak mikonad.
“The girl is studying and her brother is helping her.”
58. Pesar yek ketāb xaride ast va dārd akshayāš rā negāh mikonad.
“The boy has bought a book and is looking at its pictures.”
59. To movāzeb hasti ke lebāsāt kasif našavad.
“You are careful not to stain your shirt.”
60. Be mādar qol dadam ke otāqam rā tamiz konam.
“I promised my mother to clean my room.”
61. Pedar va mādar xošhāland ke pesarešān xub dars mixānd.
“The parents are happy that their son is studying well.”
62. Vaqti ke be xāne āmadid taklifetān rā anjām bedahid.
“When you come home do your homework.”
63. Ma irāni hastim va zabānemān fārsi ast.
“We are Iranian and our language is Persian.”
64. Baččehā gerye mikardand čon asbāb baziešān šekasteh bud.
“The children were crying because their toy had broken.”
65. Dārad zamin rā jāru mikonad.
“She is sweeping the floor.”
66. Dāštand filme kārtoni tamašā mikardand.
“They were watching a cartoon.”
67. Dārim takalife darsi xod rā anjām midahim.
“We are doing our homework.”
68. Barāye baččehā dāštam dāstān mixāndam.
“I was reading a story to the children.”
69. Barāye pedar bozorg dāried name minevisid.
“You are writing a letter to your grandfather.”

70. Be jujehā dāšti negāh mikardi.
“You were looking at the chickens.”

Distractors:

71. In doxtar ast ke har ruz be golhā ab midehad.
“It is the girl who waters the flowers ever day.”
72. Xalabāni ke in havāpeymā rā mirānd besyār māher ast.
“The pilot who was controlling the plane is very experienced.”
73. Bāqbān dar bāq kār mikonad va šaxehāyeh xoške deraxtān rā miborad.
“The gardener works in the garden and cuts the dead branches.”
74. Moallem be dānešāmuzān qol dāde ke ānhā rā be safare elmi bebarad.
“The teacher has promised the students to take them on a field trip.”
75. Gorg be galle hamle kard va čand gusfand rā dārid.
“The wolf attacked the cattle and killed few lambs.”
76. Man natavānestam be mehmāni beravam čon sarmā xorde budam.
“I could not go the party because I had a cold.”
77. In meymun ast ke fil rā azyat mikonad.
“It is the monkey that is bugging the elephant.”
78. Anhā be ketābxāne raftand ta ketāb qarz begirand.
“They went to the library to borrow some books.”
79. Bāyad be mādar va pedar ehterām begozārid va be ānāh niki konid.
“You should respect your parents and be kind to them.”
80. Mardi ke divār rā rang mizanad duste pedaram ast.
“The man who is painting the wall is my father’s friend.”

C. Morphological Cloze Test

1. In pesar ast ke sag gāzam/gāzešan/gāzaš gereft.
“This is the boy whom the dog bit me/them/him.”
2. An mār xeyly tarsnāk ast va bačče azaš/azat/azatān mitarsad.
“That snake is very scary and the child is scared of him/you sg./you pl.”
3. Šomā bāzi mikonid va mādaretān/mādarat/mādarešān qazā mipazad.
“You are playing and your pl./your sg./their mother is cooking.”
4. Be pesar čand ketāb dāram mideham/midehad/midahim.
“I am/he is/we are giving few books to the boy.”
5. Čon mā šoluq mikardim moallem davāšān/davāt/davāmān kard.
“The teacher punished them/you/us because we were noisy.”
6. Dāšt xāne rā naqqāši mikardi/mikard/mikardam.
“You were/he was/I was painting the house.”
7. In hamān marde faqiri ast ke zan beheš/behem/behešān komak mikard.
“This is the poor man whom the woman helped him/me/them.”
8. Man zamin xordam va pāyaš/pāyam/pāyešan zaxmi šod.
“I fell down and his/my/their leg was injured.”
9. Čon šomā gorosneid mādar barāyemān/barāyetan/barāyešān keyk poxte ast.
“Because you are hungry, the mother has baked cake a for us/you/them.”
10. Doxtar gerye mikonad čon arusakaš/arusaketān/arusakam rā gom kardeh ast.
“The girl is crying because she has lost her/your/my doll.”
11. Dārad be bačče qazā midehad/midehi/midehand.
“She/you/they are feeding the baby.”
12. “In lebāsi ast ke to dust dāšti va pedar barāyam/barāyat/barāyaš xarid.
“This is the dress that you liked and the father bought it for me/you/her.”
13. Dozd farār kard va polis natavānest dastgiram/dastgirat/dastgiraš konad.
“The thief escaped and the cop could not arrest me/you/him.”

14. To doxtare darsxāni hasti va moallem dustaš/dustat/dustemān dārad.
“You are a hard-working girl and the teacher likes her/you/us.”
15. Dārand dozd rā taqib mikonand/mikonim/mikonad.
“They/we/her are chasing the thief.”
16. Pedar va mādar movāzeb hastand ke baččešān/baččetān/baččeam az dočarxe nayoftad.
“The parents are careful that their/your/my child does not fall off the bike.”
17. Dānešāmuzān sāket nešasteand čon moallemaš/moallemeshān/moallemat dārad dars midehad.
“The students are quiet because his/their/your teacher is teaching.”
18. Pesar do qanāri dārad. Ke dar qafas negahaš/hegaheshān/negahat midārad.
“The boy has two canaries that he keeps him/them/you in the cage.”
19. Be darse moallem dārim guš midehand/midahim/mideham.
“They/we/I are listening to the teacher.”
20. Pedar dar mazrae kār mikonad va pesar behešān/behem/beheš komak mikonad.
“The father is working in the farm and his son is helping them/me/him.”
21. Šomā xeyli xošhāl budid va sedāye xandeaš/xandetān/xandeshān hameh jā rā por karde bud.
“You were very happy and his/your/their laughter had filled the whole room.”
22. To dānešāmuze darsxāni hasti va moallem azat/azaš/azatān rāzi ast.
“you are a hard working student and the teacher is satisfied with you sg./him/you pl.”
23. Čon čamedān sangin bud zan natavānest bolandam/bolandaš/bolandemān konad.
“As the suitcase was heavy, the woman could not lift me/it/us.”
24. Yek keyke xošmaze dārad mipazand/mipazam/mipazad.
“They/I/she is baking a delicious cake.”
25. Ma moallemān dust dārim ke dānešāmuzānat/dānešāmuzānemān/dāneš-āmuzānešān movafaq šavand.
“We teachers wish your/our/their students be successful.”

26. Ba barādaraš dāšt bāzi mikardam/mikardi/mikard.
“I/you/he was playing with his borhter.”
27. Moalleman delsuz hastand va mā bāyad behešān/behemān/behetān ehterām begozārim.
“The teachers are kind and we must respect them/us/you.”
28. Dandānpezešk be baččehā tosiye kard ke dandānhāyešān/dandānhāyetān/dandānhāyaš rā xub mesvāk bezanand.
“The dentist advised the children to brush thier/your/his teeth.”
29. Haminke oqāb parandeye kučak rā did šekāram/šekārešān/šekāraš kard.
“The eagle hunted me/them/it once he saw the bird.”
30. Dāštam doxtar ra donbāl mikardam/mikardi/mikardand.
“I/you/they was chasing the girl.”
31. In hamān ketābi ast ke doxtar gomaš/gomam/gomešān karde bud.
“It is the book that the girl had lost it/me/them.”
32. In gorbei ast ke doxtar azatān/azaš/azat negahdāri mikard.
“It is the cat that the girl was taking care of you pl./it /you sg..”
33. Man mariz budam vali mitarsidam ke doktor moāyeneāš/moāyeneat/moāyeneam konad.
“I was sick but I was scared that the doctor checks him/you/me.”
34. Dārad lebāshāyaš rā otu mikonam/mikonad/mikonim.
“I/she/we is ironing her clothes.”
35. Vaqti ke dar bimarestān bastari budam dustān azatān/azat/azam didār kardand.
“When I was hospitalized my friends visited you pl./you sg./me.”
36. Mādar bozorg mehrabān ast va navehāyetān/navehāyaš/navehāyam u rā dust darand.
“The grandmother is kind and your/her/my grandchildren love her.”
37. Čon to dar tārīki nešaste budi natavānestam bebinametān/bebinamat/bebinamešān.
“As you were sitting in the dark, I could not see you pl./you sg./them.”

38. Mehmānān be xāneye mā āmadand va mādar azašān/azamān/azaš pazirāyi kard.
“The guests came to our house and the mother served them/us/her.”
39. Dāšti barāye bačče qesse tarif mikardi/mikard/mikardid.
“You sg./she/you pl. were reading a story to the child.”
40. Vaqti ke gāve be gorg hamle kard šāxaš/šāxešān/šāxam šekast.
“When the cow attacked the wolf his/their/my horn broke.”

Appendix 3

۱. آزمون دستوری
الف: درک دستوری

۱. گربه خرگوش را گاز میگیرد.
۲. دختر مادرش را میبوسد.
۳. پدر دخترش را بغل میکند.
۴. پسر دختر را هل می‌دهد.
۵. میمون قورباغه را دنبال می‌کند.
۶. اسب خرس را لگد میزند.
۷. مرد دیوار را رنگ می‌زند.
۸. دختر کفشش را پاک می‌کند.
۹. مرد ماشین را می‌شوید.
۱۰. مادر شمع را روشن می‌کند.
۱۱. بچه اسباب‌بازی را می‌شکند.
۱۲. باغبان درخت را آب می‌دهد.
۱۳. این کامیون است که ماشین را می‌کشد.
۱۴. این مادر است که دختر را بغل می‌کند.
۱۵. این گربه است که موش را گاز می‌گیرد.
۱۶. این زن است که مرد را می‌زند.
۱۷. این پسر است که دختر را هل می‌دهد.
۱۸. این سگ است که پرنده را دنبال می‌کند.
۱۹. این پسر است که شیشه را می‌شکند.
۲۰. این سگ است که توپ را گاز می‌گیرد.
۲۱. این مرد است که ماشین را می‌شوید.
۲۲. این پسر است که ماشین را هل می‌دهد.
۲۳. این بچه است که گل را نگاه می‌کند.
۲۴. این معلم است که کتاب را می‌خواند.
۲۵. این ماشین است که کامیون را می‌کشد.
۲۶. این پسر است که پدر بغلش می‌گیرد.
۲۷. این گربه است که خرگوش گازش می‌گیرد.
۲۸. این خرس است که اسب هلش می‌دهد.
۲۹. این فیل است که میمون دنبالش می‌کند.
۳۰. این زن است که مرد کتکش می‌زند.

۳۱. این توپ است که پسر پرتایش می‌کند.
۳۲. این درخت است که دختر آبش می‌دهد.
۳۳. این گریه است که بچه نازش می‌دهد.
۳۴. این ماشین است که مرد هلش می‌دهد.
۳۵. این ماشین است که پسر پاکش می‌کند.
۳۶. این میز است که مرد رنگش می‌زند.
۳۷. مادری که بچه را میبوسد روی صندلی نشسته است.
۳۸. پسری که پدرش را بغل کرده خوشحال است.
۳۹. دختری که پسر را کتک می‌زند عصبانی است.
۴۰. ماری که قورباغه را می‌بیند فرار می‌کند.
۴۱. گریه‌ای که موش را دیده است زیر میز است.
۴۲. گاوی که خرس را لگد می‌زند بزرگ است.
۴۳. مردی که روزنامه می‌خواند دراز کشیده است.
۴۴. بچه‌ای که گریه را بغل کرده نشسته است.
۴۵. زنی که لباس را اتو می‌کند عینک رده است.
۴۶. مردی که دیوار را رنگ می‌زند قد بلند است.
۴۷. پسری که بادکنک را ترکانده گریه می‌کند.
۴۸. بچه‌ای که مار را نشان می‌دهد ترسیده است.
۴۹. گریه‌ای که سگ دنبالش میکند روی دیوار است.
۵۰. موشی که گریه نگاهش می‌کند سیاه است.
۵۱. پسری که زن نشانش می‌دهد درس می‌خواند.
۵۲. دختری که پسر کتکش می‌زند کوچک است.
۵۳. اسبی که خرس گازش می‌گیرد بزرگ است.
۵۴. پدري که پسر می‌بوسدش روزنامه می‌خواند.
۵۵. کتابی که پسر خریده روی زمین افتاده است.
۵۶. خرسی که مار نیشش می‌زند بزرگ است.
۵۷. ماشینی که مرد می‌شوید سفید رنگ است.
۵۸. لباسی که زن اتو می‌کند قشنگ است.
۵۹. بچه‌ای که پدر بلندش کرده می‌خندد.
۶۰. گریه‌ای که دختر نازش می‌دهد خوابیده است.

۱. شکسته این پنجره آشپزخانه است که بچه‌ها.
۲. می‌نویسد این دانش‌آموز است که مشقش را.
۳. نشست دختر بچه‌ای که عروسک را بغل کرده است روی صندلی.
۴. می‌خندد پدری که پسر بغلش کرده است از ته دل.
۵. می‌زند دختر پسر را با چوب محکم.
۶. لگدش این خرس است که اسب می‌زند.
۷. هل این پسر است که دختر را می‌دهد.
۸. فریاد دختری که موش را دیده می‌زند.
۹. گریه بچه‌ای که دکتر آمپولش می‌زند می‌کند.
۱۰. آب پسر درخت را می‌دهد.
۱۱. گربه خرگوش را می‌گرفت داشت.
۱۲. مرد دیوار را نقاشی بود کرده.
۱۳. این دختر است که پسر را هل بود ناده.
۱۴. این مرد است که ماشین را می‌شوید نارد.
۱۵. این فیل است که پلنگ دنبالش می‌کرد داشت.
۱۶. این میز است که مرد رنگش می‌زند نارد.
۱۷. مادری که بچه را می‌بوسید روی صندلی بود نشسته.
۱۸. بچه‌ای که عروسک دوست نارد می‌خواهد نارد.
۱۹. دانش‌آموزی که معلم دوستش نارد درس می‌خواند داشت.
۲۰. دزدی که پلیس تعقیبش می‌کرد بود تیر خورده.
۲۱. پرستار مریض بغل را می‌کند.
۲۲. مار قورباغه نارد را نیش می‌زند.
۲۳. این کامیون است که ماشین داشت می‌کشید را.
۲۴. این مرد است که ماشین هل را می‌دهد.
۲۵. این پسر است که دختر می‌زند را.
۲۶. این سگ است که توپ گاز گرفته است را.
۲۷. مادری که بچه می‌بوسد را نشسته است.
۲۸. بچه‌ای که عروسک بغل کرده را می‌خندد.
۲۹. پسری که پدر نارد را بغل می‌کند خوشحال است.
۳۰. مردی که دیوار داشت نقاشی می‌کرد را قد بلند است.
۳۱. این سگ است گرگ که را دنبال می‌کند.
۳۲. این کامیون است تراکتور که را می‌کشد.

۳۳. که این بچه است گل را می‌چیند.
۳۴. که این گربه است خرگوش گازش می‌گیرد.
۳۵. این مریض است دکتر که معاینه‌اش می‌کند.
۳۶. پلیسی دزد که را دستگیر می‌کند قوی است.
۳۷. پسری مرد که را هل می‌دهد چاق است.
۳۸. که بچه‌ای دوچرخه خریده خوشحال است.
۳۹. که گاوی خرس لگدش می‌زنند می‌ترسد.
۴۰. که آهوئی شکارچی شکار کرده زیبا است.
۴۱. گربه خرگوش را گاز می‌گیری.
۴۲. این پسر است که دختر را هل می‌دادم.
۴۳. این اسب است که زرافه دنبالش می‌کنید.
۴۴. بچه‌ای که بادکنک را دیدی خوشحال است.
۴۵. کتابی که دانش‌آموزان خواندیم روی میز است.
۴۶. معلم دانش‌آموز را تنبیه کردند.
۴۷. این دخترها هستند که گلها را آب می‌دهد.
۴۸. این درخت کاج است که بچه‌ها شکست.
۴۹. دکتری که مریض را معاینه می‌کند می‌خندند.
۵۰. دانش‌آموزانی که معلم دوستشان دارد درسخوان هست.
۵۱. این پسر است که پدرش باری بفلش می‌کند.
۵۲. بچه‌هایی که شیشه را شکسته بودیم فرار کردند.
۵۳. این زنی است که دارم گلها را آب می‌دهد.
۵۴. پرستار مریض را ناشتی بفل می‌کرد.
۵۵. دزدی که پلیسها دستگیرش کرده بودید فرار کرد.
۵۶. باغبان دارند گل می‌کارد.
۵۷. این بچه است که اسباب بازی را شکسته بودند.
۵۸. این مجروح است که سربازها ناشت حملش می‌کردند.
۵۹. مردی که کتاب می‌خواند نشسته‌اند.
۶۰. کتابی که بچه‌ها ناشت می‌خواندند شاهنامه بود.
۶۱. دختر گربه را ناز می‌دهد.
۶۲. این گربه است که موش را دنبال می‌کند.
۶۳. این ماشین است که پدر خریده است.
۶۴. بچه‌ای که اسباب‌بازی را شکست گربه می‌کند.
۶۵. لباسی که دختر اتو می‌کند قشنگ است.
۶۶. این خلبان است که هواپیما را می‌راند.

۶۷. شکارچی آهو را آزاد کرد.
۶۸. خرسی که اسب لگدش زد افتاد.
۶۹. پسر دارد شکلات می‌خورد.
۷۰. این دختری است که دوستش را داشت هل می‌داد.
۷۱. این خانه‌ای است که پدر خریده بود.
۷۲. مردی که گلها را داشت آب می‌داد همسایه ما است.
۷۳. غذایی که مادر دارد می‌پزد خوشمزه است.
۷۴. دکتر مریض را داشت معاینه می‌کرد.
۷۵. این آهوئی است که شکارچی شکار کرده است.
۷۶. پلیسی که دارد دزد را تعقیب می‌کند شجاع است.
۷۷. پدر بچه‌ها را به سینما برد.
۷۸. این مادر بزرگ است که غذا می‌پزد.
۷۹. این ماشین است که مرد هلش داد.
۸۰. مادری که بچه را می‌بوسد خوشحال است.
۸۱. نویسنده‌ای که کتاب را نوشته است سخنرانی می‌کند.
۸۲. این دختر است که پسر را مسخره می‌کند.
۸۳. دختر موهایش را شانه می‌کند.
۸۴. این آشپز است که کباب را می‌پزد.
۸۵. این پسر بود که گل را چیند.
۸۶. مریضی که دکتر معاینه‌اش می‌کند پیر است.
۸۷. این سگ است که گرگ گازش گرفت.
۸۸. دانش‌آموزی که جایزه گرفت درسخوان است.
۸۹. خرگوشی که سگ گازش گرفت فرار کرد.
۹۰. زنی که لباس می‌دوخت روی صندلی نشسته بود.
۹۱. پسر کیفش را در مدرسه گم کرد.
۹۲. این پدر است که بچه‌ها را دارد دعوا می‌کند.
۹۳. این موتور سیکلت بود که مرد تعمیرش می‌کرد.
۹۴. کتابی که پدر بزرگ دوست دارد شاهنامه است.
۹۵. فیلمی که بچه‌ها داشتند تماشا می‌کردند کارتون بود.
۹۶. پسری که مرد را هل می‌دهد چاق است.
۹۷. این بچه است که اسباب‌بازی را می‌شکند.
۹۸. این آهو است که شیر دارد شکارش می‌کند.
۹۹. گاوی که خرس را لگد می‌زند بزرگ است.
۱۰۰. مادر بچه را دارد شیر می‌دهد.

۱۰۱. پدر دیروز به اداره نرفت برای اینکه سرما خورده بود.
۱۰۲. نقاش چند تابلو زیبا کشید و به قیمت خوبی فروخت.
۱۰۳. معلم از دانش‌آموزان خواست که درس بخوانند تا در امتحان موفق شوند.
۱۰۴. پلیس ساعتها دزد را تعقیب کرد تا توانست او را دستگیر کند.
۱۰۵. چون دانش‌آموز تکلیفش را انجام نداده بود معلم او را جریمه کرد.
۱۰۶. گربه با دیدن سگ ترسید و به سرعت فرار کرد.
۱۰۷. مادر بچه‌ها را به بازار برد تا برایشان لباس بخرد.
۱۰۸. چون هوا سرد بود بچه‌ها از رفتن به سینما منصرف شدند.
۱۰۹. دوستان نمی‌توانستند به مسافرت بروند برای اینکه برف زیادی باریده بود.
۱۱۰. پدر تصمیم گرفت که پسرش را برای تماشای مسابقه فوتبال ببرد.
۱۱۱. چون پسر شاگرد ممتاز بود خرید پدر برایش جایزه.
۱۱۲. مادر مشغول غذا پختن است و دخترش به او کمک می‌کند دارد.
۱۱۳. پسر نتوانست از قنادی شیرینی بخرد برای اینکه کیف پولش گم کرده بود را.
۱۱۴. دندانپزشک به بچه‌ها توصیه کرد دندانهای خود که را روزی سه بار مسواک بزنند.
۱۱۵. ماهیگیران صبح زود به دریا رفتند تا ماهی صید کنیم.
۱۱۶. پلیس دزد را نتوانست دستگیر کند برای اینکه کرد او فرار.
۱۱۷. دختر با مادرش به مهمانی نرفت چون مشقش را بود ننوشته.
۱۱۸. پسر پول توجیبی‌اش پس‌انداز می‌کند را تا یک دوچرخه بخرد.
۱۱۹. بچه‌ها دوست دارند به جوجه غذا که بدهند.
۱۲۰. اسب گاو را لگد زد و او را به زمین انداختند.

Appendix 4

۱. آزمون واژگانی
الف: درک واژگانی

۱. پسر بلندش کرده است.
۲. دختر دارد نشانش می‌دهد.
۳. مرد دارد معرفیت می‌کند.
۴. پسر دارد هلم می‌دهد.
۵. زن دارد صدایش می‌کند.
۶. بچه دارد دنبالشان می‌کند.
۷. پلیس دارد تعقیبشان می‌کند.
۸. سگ دارد نگاهشان می‌کند.
۹. پدر دارد نوازشان می‌کند.
۱۰. دختر خیلی دوستشان دارد.
۱۱. معلم دارد بهت درس می‌دهد.
۱۲. شکارچی بهش تیراندازی می‌کند.
۱۳. پسر آتش می‌ترسد.
۱۴. پدر برایم کتاب داستان می‌خواند.
۱۵. پسر دارد ازت خداحافظی می‌کند.
۱۶. پسر دارد بهشان نگاه می‌کند.
۱۷. مرد باهامان صحبت می‌کند.
۱۸. بچه بهشان علف می‌دهد.
۱۹. مادر برایتان غذا می‌پزد.
۲۰. پسر توپ را برایمان پرت می‌کند.
۲۱. سگش خوابیده است.
۲۲. مادرت دارد آتش می‌پزد.
۲۳. پسرش دارد خداحافظی می‌کند.
۲۴. برادرم دارد خوب می‌دود.
۲۵. معلمش دارد نامه می‌نویسد.
۳۶. مرغهایشان دارند نانه می‌خورند.
۲۷. پدرتان کتاب می‌خواند.
۲۸. معلمتان دارد درس می‌دهد.
۲۹. گوسفندانشان دارند چرا می‌کنند.
۳۰. توپشان بالای درخت افتاده است.

- ۳۱. دارد سگ را با چوب می‌زند.
- ۳۲. به ماشین نگاه می‌کند.
- ۳۳. لانه پرندگان را نشان می‌دهم.
- ۳۴. داری دوچرخه را تعمیر می‌کنی.
- ۳۵. دارد به مرغها نانه می‌دهد.
- ۳۶. با پرستارها صحبت می‌کند.
- ۳۷. موشها را دنبال می‌کنند.
- ۳۸. به درس معلم گوش می‌دهید.
- ۳۹. نارید به گنجا آب می‌دهید.
- ۴۰. دارند مسواک می‌زنند.

جمله‌های دستوری:

- ۴۱. گربه سگ را دنبال می‌کند.
- ۴۲. این دختر است که به پسر آب می‌پاشد.
- ۴۳. پسر پرنده را نشان می‌دهد.
- ۴۴. کامیون ماشین را می‌کشد.
- ۴۵. زن مرد را می‌بوسد.
- ۴۶. این مرد است که گل می‌کارد.
- ۴۷. پسرها تخته‌سیاه را پاک می‌کنند.
- ۴۸. این دختر است که به مرغها نانه می‌دهد.
- ۴۹. خروس دارد کبوتر را تماشا می‌کند.
- ۵۰. پسر هدیه خود را به دختر نشان می‌دهد.
- ۵۱. این گرگ است که دارد فرار می‌کند.
- ۵۲. این پسرها هستند که دنبال دخترها می‌دوند.
- ۵۳. این دختر است که کیف به دست گرفته است.
- ۵۴. پسر به پدر سیب تعارف می‌کند.
- ۵۵. شکارچی دارد به آهو تیراندازی می‌کند.
- ۵۶. مریض با پرستارها صحبت می‌کند.
- ۵۷. سگ دارد پسر را گاز می‌گیرد.
- ۵۸. رفتگران دارند زمین را جارو می‌کنند.
- ۵۹. این پدر است که پسر را بغل گرفته است.
- ۶۰. پرنده برای جوجه‌ها غذا می‌آورد.

۱. این پسر است که سگ گازت گرفته است.
۲. چون شلوغ می‌کردیم معلم دعواش کرد.
۳. دزد فرار کرد و پلیس نتوانست دستگیرشان کند.
۴. تو دختر درسخوانی هستی و معلم دوستم دارد.
۵. پسر دو قناری دارد که در قفس نگاهتان می‌دارد.
۶. چون چمدان سنگین بود زن نتوانست بلندشان کند.
۷. همین که عقاب پرنده کوچک را دید شکارت کرد.
۸. این همان کتابی است که دختر گمتان کرده بود.
۹. من مریض بودم ولی می‌ترسیدم دکتر معاینه‌ات کند.
۱۰. چون تو در تاریکی نشسته بودی نتوانستم ببینمش.
۱۱. آن مار خیلی ترسناک است و بچه ازشان می‌ترسد.
۱۲. چون شما گرسنه‌اید مادر برایش کیک پخته است.
۱۳. این همان مرد فقیری است که زن بهت کمک می‌کرد.
۱۴. این لباسی است که تو دوست ناشتی و پدر برایمان خرید.
۱۵. وقتی پدر در مزرعه کار می‌کند پسر بهتان کمک می‌کند.
۱۶. تو دانش‌آموز درسخوانی هستی و معلم ازم راضی است.
۱۷. معلمان دلسوز هستند و ما باید بهش احترام بگذاریم.
۱۸. این گربه است که دختر ازشان نگهداری می‌کرد.
۱۹. وقتی که در بیمارستان بستری بودم دوستان ازت دیدار می‌کردند.
۲۰. مهمانان به خانه ما آمدند و مادر ازتان پذیرایی کرد.
۲۱. شما بازی می‌کنید و مادرش غذا می‌پزد.
۲۲. من زمین خوردم و پایت شکست.
۲۳. دختر گریه می‌کند چون عروسکشان را گم کرده است.
۲۴. پدر و مادر مواظب هستند که بچه‌اش از دوچرخه نیفتد.
۲۵. دانش‌آموزان ساکت نشسته‌اند چون معلمتان دارد درس می‌دهد.
۲۶. شما خیلی خوشحال بودید بطوری که صدای خنده‌مان همه جا را پر کرده بود.
۲۷. معلمان دوست دارند که دانش‌آموزان موفق شدند.
۲۸. دندانپزشک به بچه‌ها توصیه کرد که دندانهایمان را خوب مسواک بزنند.
۲۹. مادربزرگ مهربان است و نوه‌هایشان او را دوست دارند.
۳۰. وقتی که گاو به گرگ حمله کرد ساخت شکست.
۳۱. به پسر چند کتاب دارم می‌دهی.
۳۲. داشت خانه را نقاشی می‌کردند.

۳۳. دارد به بچه غذا می‌دهم.
۳۴. دارند دزد را تعقیب می‌کنید.
۳۵. به درس معلم ناریم گوش می‌دهید.
۳۶. یک کیک خوشمزه دارد می‌پزی.
۳۷. با برادرش داشت بازی می‌کردند.
۳۸. داشتم دختر را دنبال می‌کرد.
۳۹. دارد لباسهایش را اتو می‌کنید.
۴۰. داشتی برای بچه قصه تعریف می‌کردم.
۴۱. او دختر بالایی است و پدر دوستش دارد.
۴۲. این گربه است که پسر دنبالش می‌کند.
۴۳. آهو فرار کرد و شکارچی نتوانست شکارش کند.
۴۴. چون دانش‌آموز بی‌انضباطی بودند معلم تنبیهشان کرد.
۴۵. وقتی به مدرسه می‌رفتی دیدمت.
۴۶. چون مریض بودم دکتر معاینه‌ام کرد.
۴۷. در پارک بازی می‌کردید که سگ گازتان گرفت.
۴۸. چون از چراغ قرمز رد شدی پلیس جریمه‌ات کرد.
۴۹. این همان زنی است که مرد ازش می‌ترسد.
۵۰. کتابی که تو می‌خواستی مادر برایت خرید.
۵۱. آنها دوستان خوبی هستند و ما بهشان احترام می‌گذاریم.
۵۲. قصه‌ای که دوست داشتید مادر بزرگ برایتان تعریف کرده است.
۵۳. پسر کبوترها را دوست دارد و بهشان نانه می‌دهد.
۵۴. مادر به شما قول داد که برایتان شیرینی بپزد.
۵۵. وقتی که مریض بودی ازت مراقبت می‌کردم.
۵۶. این مردی است که تو بهش رانندگی یاد دادی.
۵۷. دختر درس می‌خواند و برادرش به او کمک می‌کند.
۵۸. پسر یک کتاب خریده است و دارد عکسهایش را نگاه می‌کند.
۵۹. تو مواظب هستی که لباست کثیف نشود.
۶۰. به مادر قول دادم که اتاقم را تمیز کنم.
۶۱. پدر و مادر خوشحالند که پسرشان خوب درس می‌خواند.
۶۲. وقتی که به خانه آمدید تکلیفتان را انجام بدهید.
۶۳. ما ایرانی هستیم و زبانمان فارسی است.
۶۴. بچه‌ها گریه می‌کردند چون اسباب‌بازی‌شان شکسته بود.
۶۵. دارد زمین را جارو می‌کند.
۶۶. داشتند فیلم کارتونی تماشا می‌کردند.

۶۷. داریم تکالیف درسی خود را انجام می‌دهیم.
۶۸. برای بچه‌ها داشتم داستان می‌خواندم.
۶۹. برای پدر بزرگ نارید نامه می‌نویسید.
۷۰. به جوجه‌ها داشتی نگاه می‌کردی.
۷۱. این دختر است که هر روز به گلها آب می‌دهد.
۷۲. خلبانی که هواپیما را می‌راند بسیار ماهر است.
۷۳. باغبان در باغ کار می‌کند و شاخه‌های خشک درختان را می‌برد.
۷۴. معلم به دانش‌آموزان قول داد که آنها را به سفر علمی ببرد.
۷۵. گرگ به گله حمله کرد و چند گوسفند را درید.
۷۶. من نتوانستم به مهمانی بروم چون سرما خورده بودم.
۷۷. این میمون است که فیل را اذیت می‌کند.
۷۸. آنها به کتابخانه رفتند تا کتاب قرض بگیرند.
۷۹. باید به پدر و مادر احترام بگذارید و به آنها نیکی کنید.
۸۰. مردی که دیوار را رنگ می‌زند دوست پدرم است.

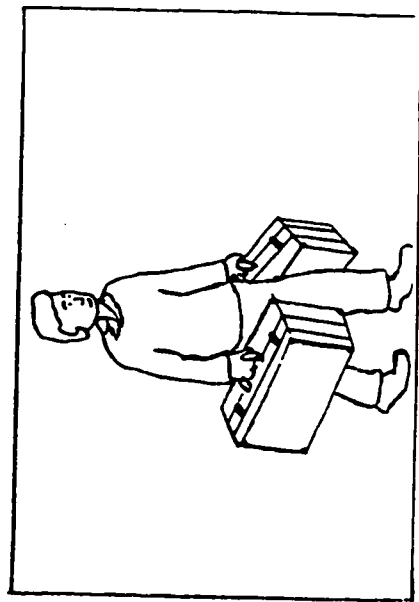
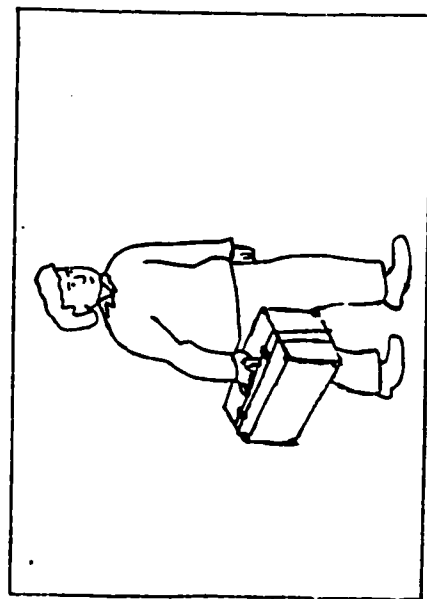
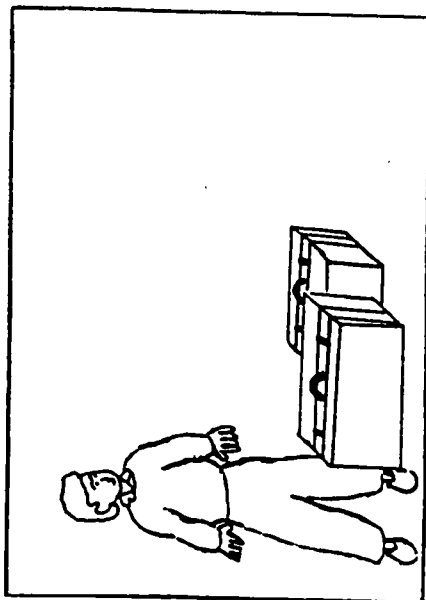
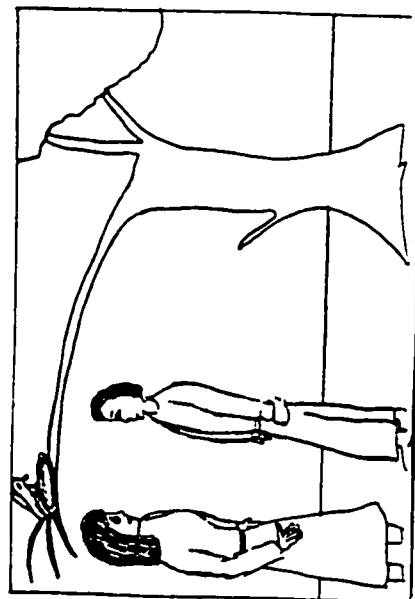
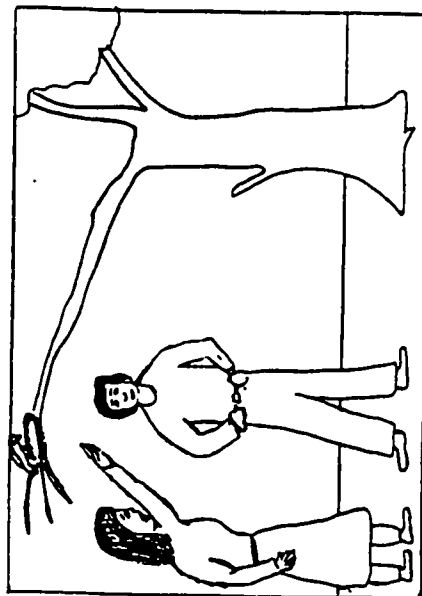
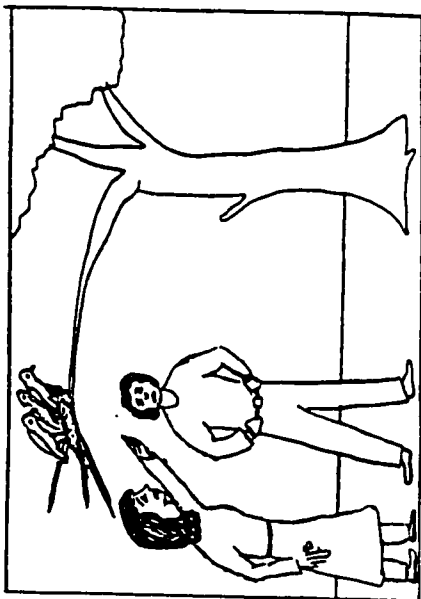
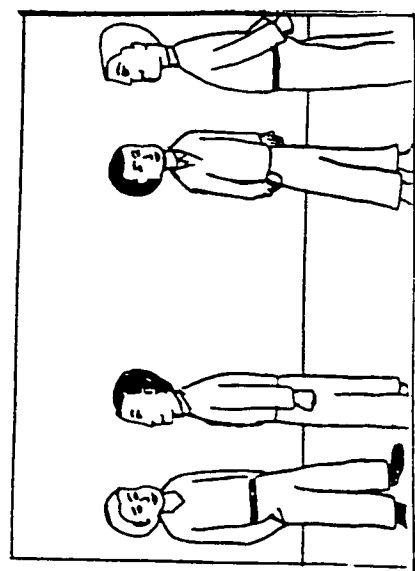
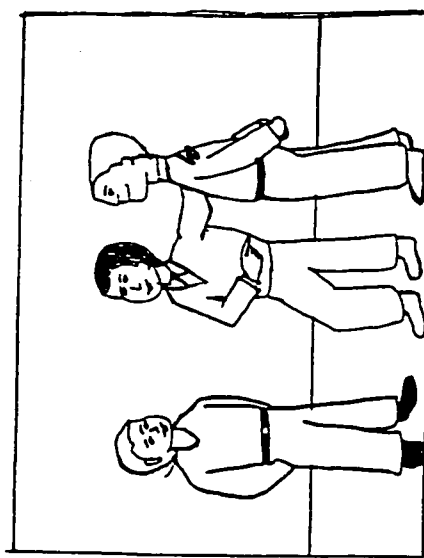
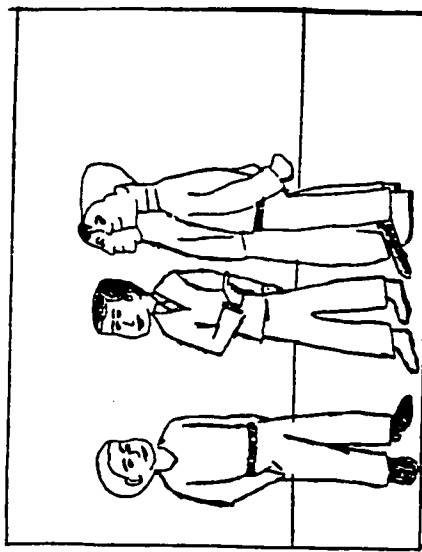
ج. انتخاب واژگانی

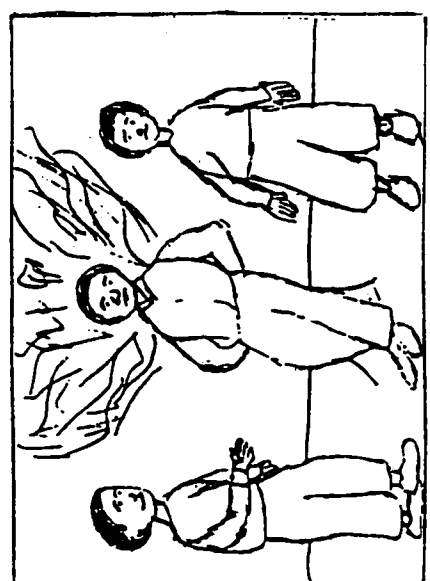
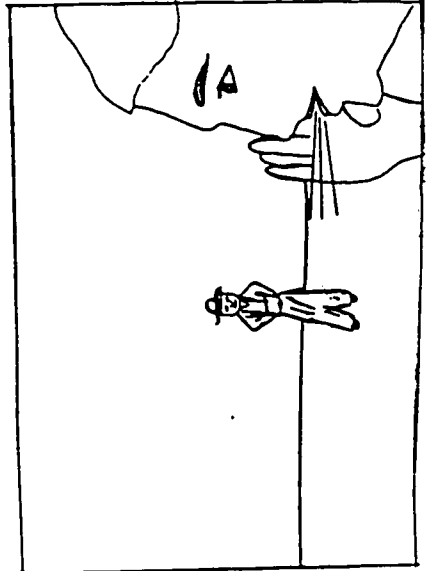
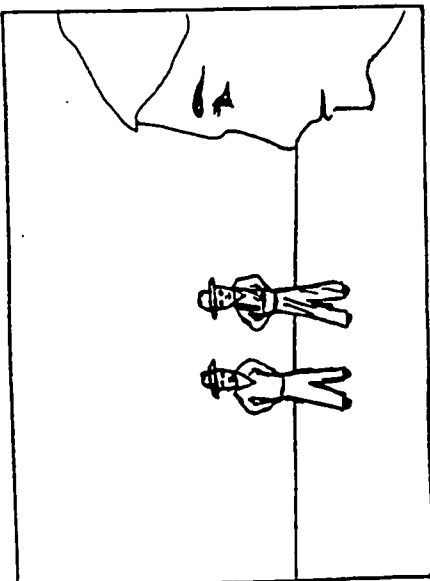
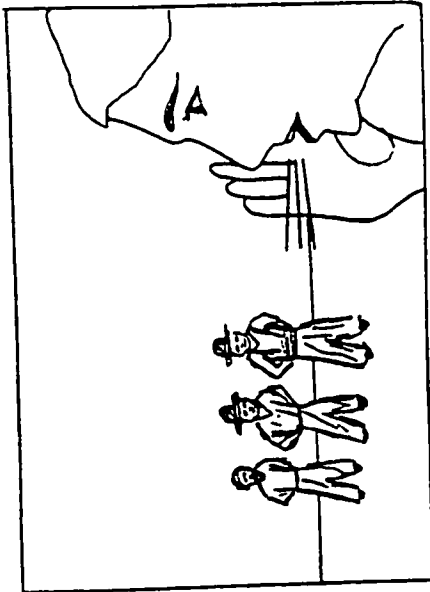
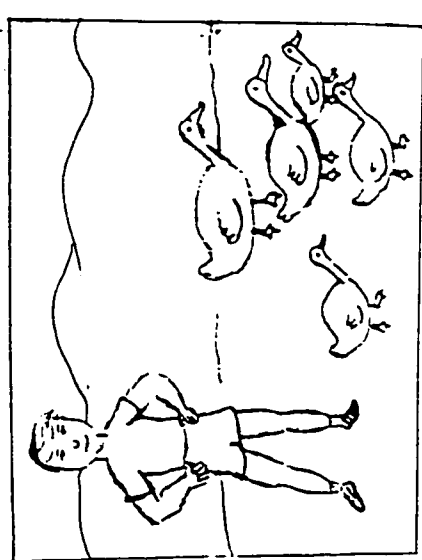
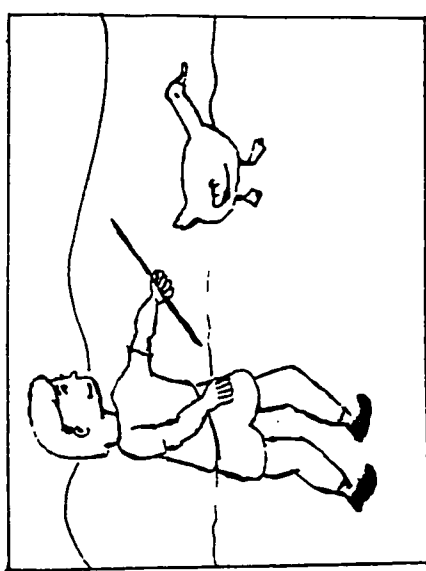
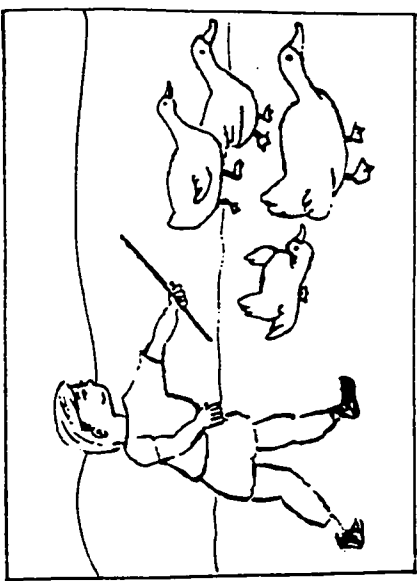
۱. این پسر است که سگ گازم/گازشان/گازش گرفت.
۲. آن مار خیلی ترسناک است و بچه ازش/ازت/ازتان می‌ترسد.
۳. شما بازی می‌کنید و مادرتان/مادرت/مادرشان غذا می‌پزد.
۴. به پسر چند کتاب دارم می‌دهم/می‌دهد/می‌دهیم.
۵. چون ما شلوغ می‌کردیم معلم دعواشان/دعوات/دعوامان کرد.
۶. داشت خانه را نقاشی می‌کردی/می‌کرد/می‌کردم.
۷. این همان مرد فقیری است که زن بهش/بهم/بهشان کمک می‌کرد.
۸. من زمین خوردم و پایش/پایم/پایشان زخمی شد.
۹. چون شما گرسنه‌اید مادر برایمان/برایتان/برایشان کیک پخته است.
۱۰. دختر گریه می‌کند چون عروسکش/عروسکتان/عروسکم را گم کرده است.
۱۱. دارد به بچه غذا می‌دهد/می‌دهی/می‌دهند.
۱۲. این لباسی است که تو دوست داشتی و پدر برایم/بریت/برایش خرید.
۱۳. دزد فرار کرد و پلیس نتوانست دستگیرم/دستگیرت/دستگیرش کند.
۱۴. تو دختر درسخوانی هستی و معلم دوستش/دوستت/دوستمان دارد.
۱۵. دارند دزد را تعقیب می‌کنند/می‌کنیم/می‌کند.
۱۶. پدر و مادر مواظب هستند که بچه‌شان/بچه‌تان/بچه‌ام از دوچرخه نیفتد.
۱۷. دانش‌آموزان ساکت نشسته‌اند چون معلمش/معلمشان/معلمت دارد درس می‌دهد.

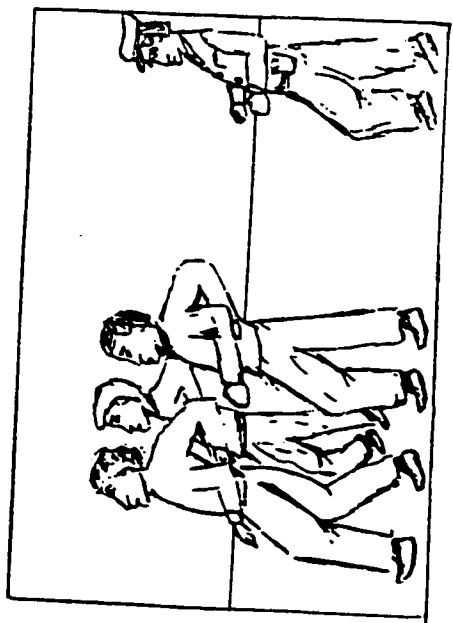
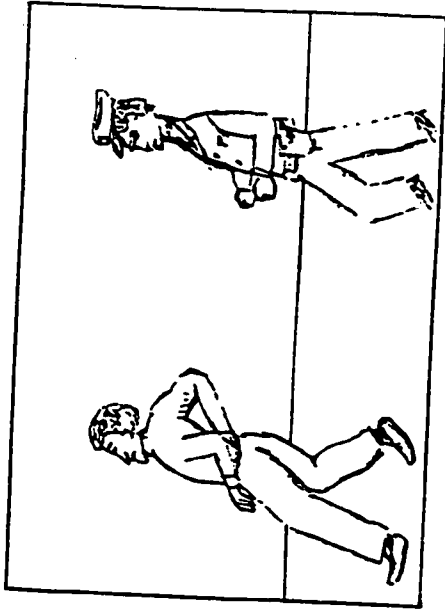
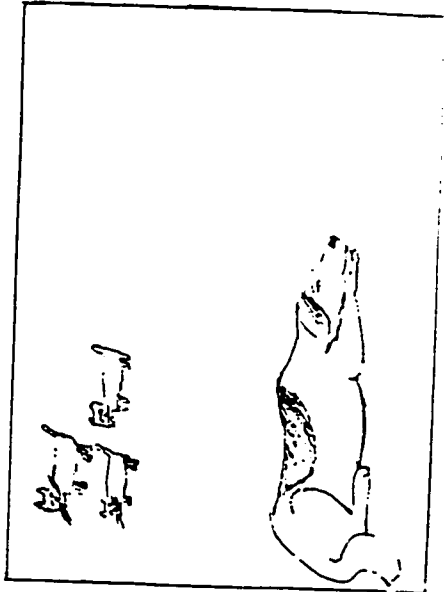
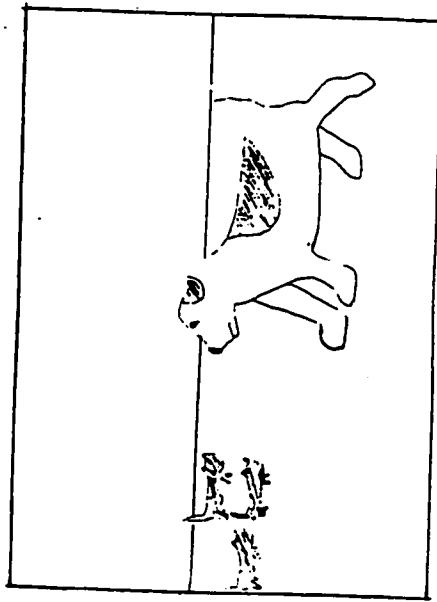
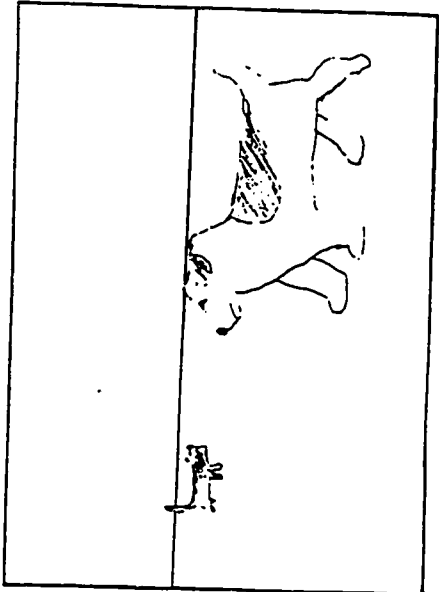
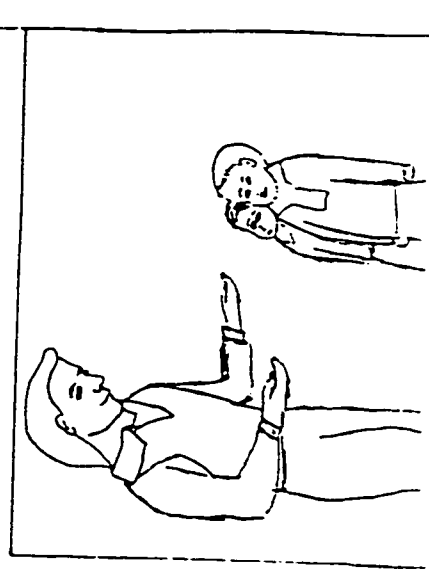
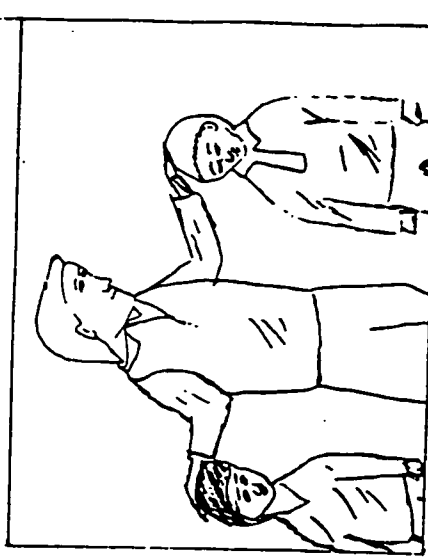
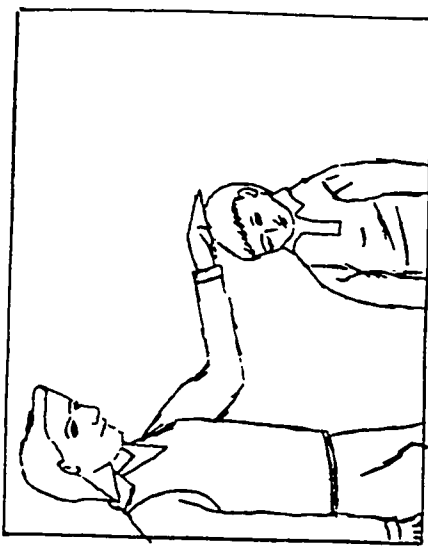
۱۸. پسر دو قناری دارد که در قفس نگاهش/نگاهشان/نگاهت می‌دارد.
۱۹. به درس معلم داریم گوش می‌دهند/می‌دهیم/می‌دهم.
۲۰. پدر در مزرعه کار می‌کند و پسر بهشان/بهم/بهمش کمک می‌کند.
۲۱. شما خیلی خوشحال بودید و صدای خنده‌اش/خنده‌تان/خنده‌شان همه جا را پر کرده بود.
۲۲. تو دانش‌آموز درسخوانی هستی و معلم ازت/ازش/ازتان راضی است.
۲۳. چون چمدان سنگین بود زن نتوانست بلندم/بلندش/بلندمان کند.
۲۴. یک کیک خوشمزه دارد می‌پزد/می‌پزم/می‌پزد.
۲۵. ما معلمان دوست داریم که دانش‌آموزانت/دانش‌آموزنمان/دانشان موفق شوند.
۲۶. با برادرش داشت بازی می‌کردم/می‌کردی/می‌کرد.
۲۷. معلمان دلسوز هستند و ما باید بهشان/بهمان/بهتان احترام بگذاریم.
۲۸. دندانپزشک به بچه‌ها توصیه کرد که دندانهایشان/دندانهایتان/دندانهایش را خوب مسواک بزنند.
۲۹. همین که عقاب پرنده کوچک را دید شکارم/شکارشان/شکارش کرد.
۳۰. داشتم دختر را دنبال می‌کردم/می‌کردی/می‌کردند.
۳۱. این همان کتابی است که دختر گمش/گمم/گمشان کرده بود.
۳۲. این گریه‌ای است که دختر ازتان/ازش/ازت نگهداری می‌کرد.
۳۳. من مریض بودم ولی می‌ترسیدم که دکتر معاینه‌اش/معاینه‌ات/معاینه‌ام کند.
۳۴. وارد لبسهایش را اتو می‌کنم/می‌کنند/می‌کنیم.
۳۵. وقتی که در بیمارستان بستری بودم دوستان ازتان/ازت/ازم دیدار کردند.
۳۶. مادربزرگ مهربان است و نوه‌هایتان/نوه‌هایش/نوه‌هایم او را دوست دارند.
۳۷. چون تو در تاریکی نشسته بودی نتوانستم ببینمتان/ببینمت/ببینمشان.
۳۸. مهمانان به خانه ما آمدند و مادر ازشان/ازمان/ازش پذیرایی کرد.
۳۹. داشتی برای بچه قصه تعریف می‌کردی/می‌کرد/می‌کردید.
۴۰. وقتی که گاو به گرگ حمله کرد شاخش/شاخشان/شاخم شکست.

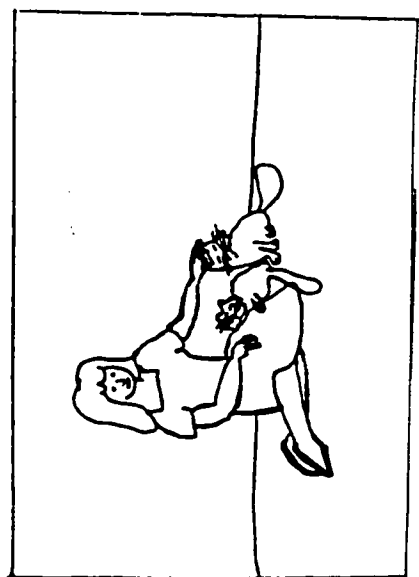
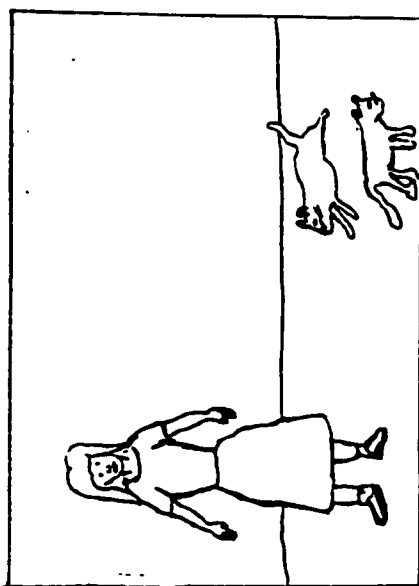
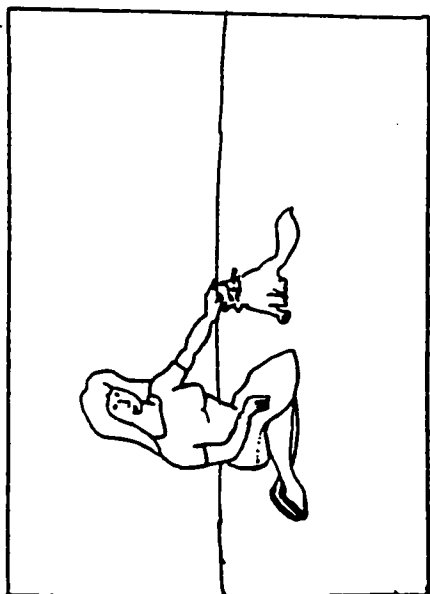
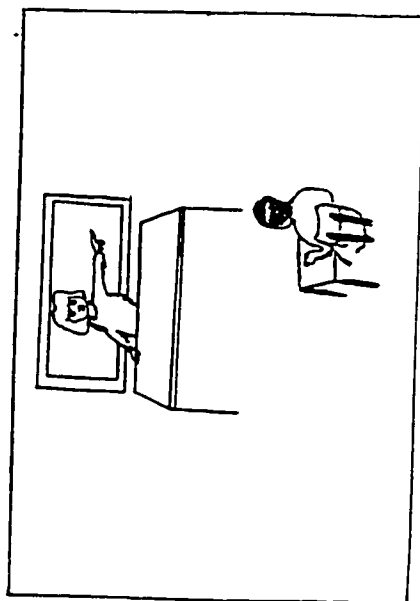
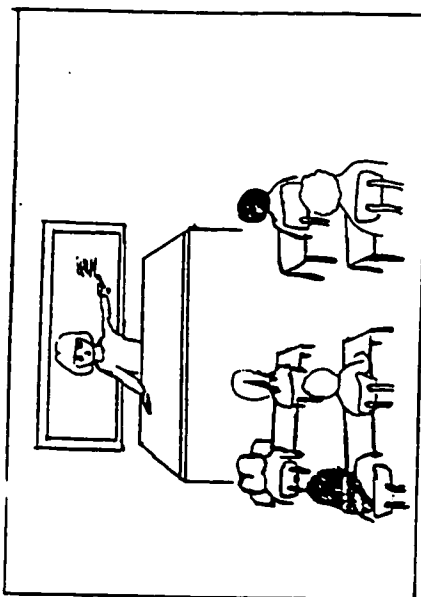
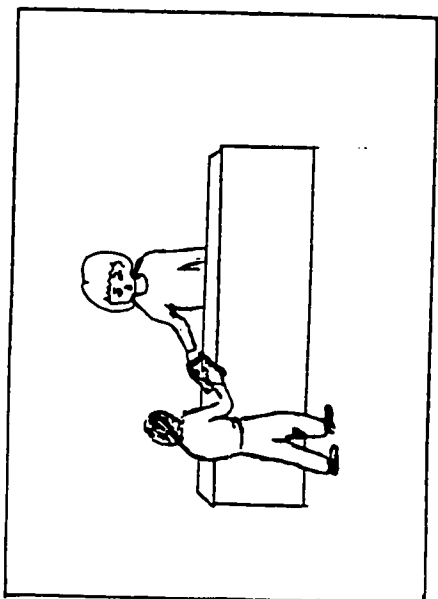
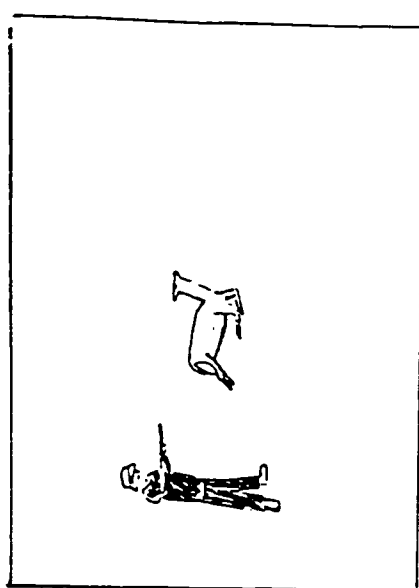
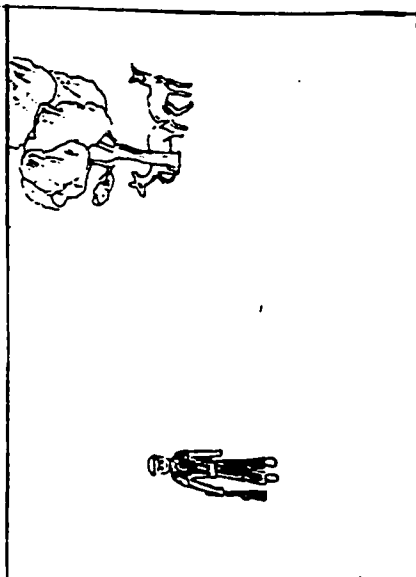
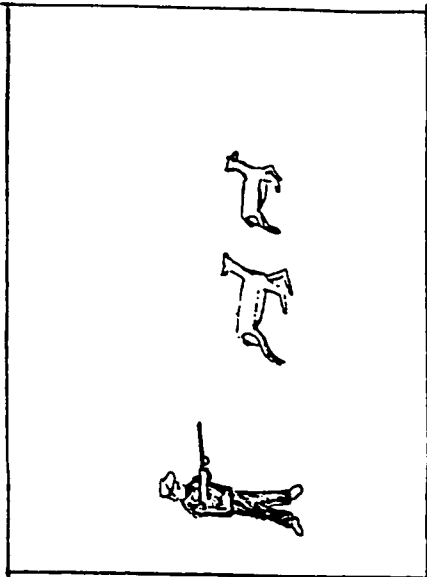
Appendix 5

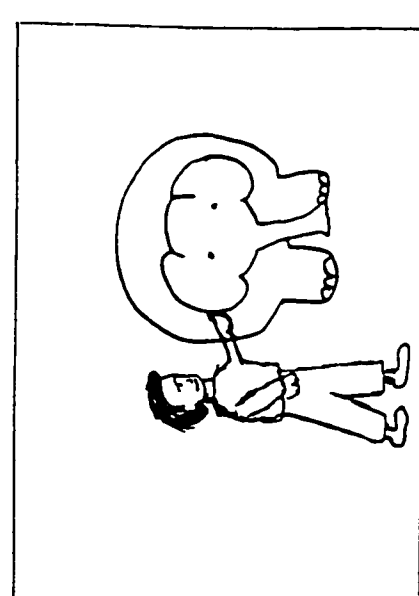
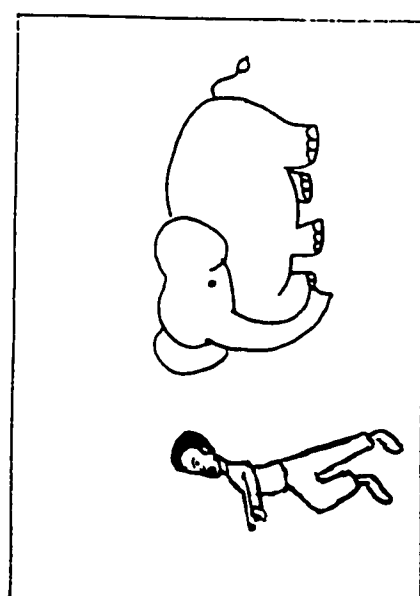
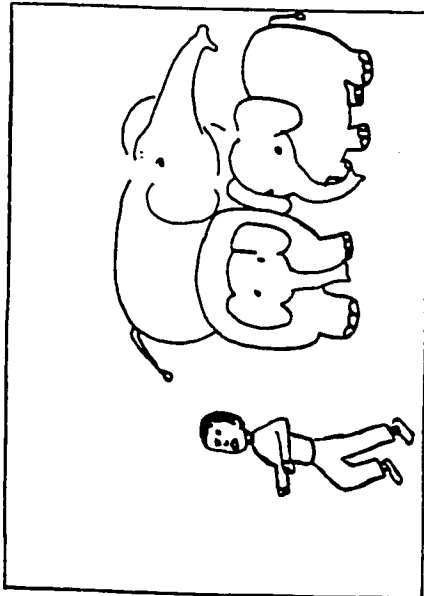
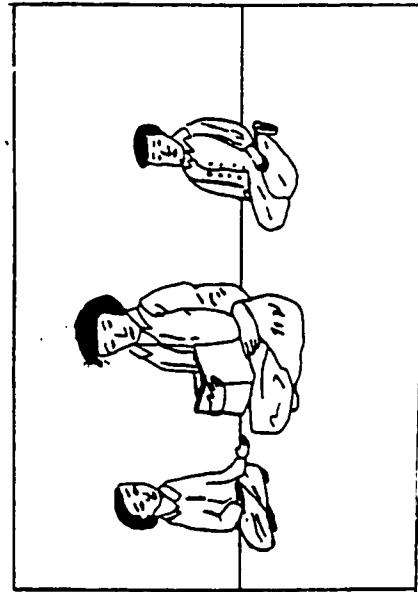
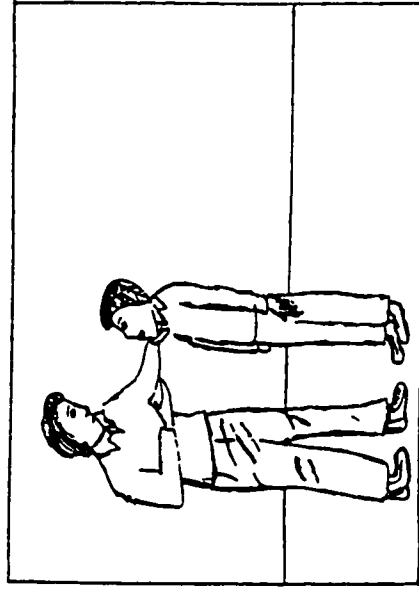
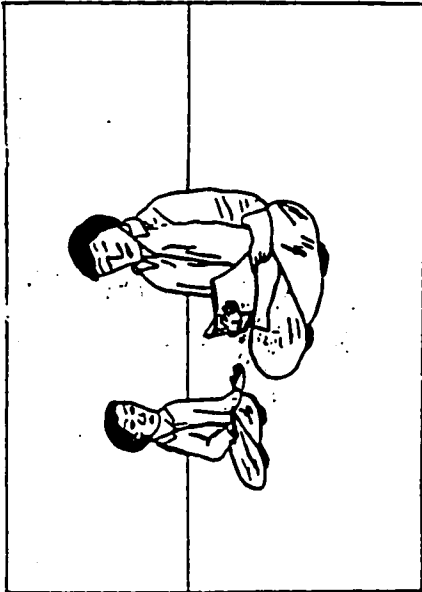
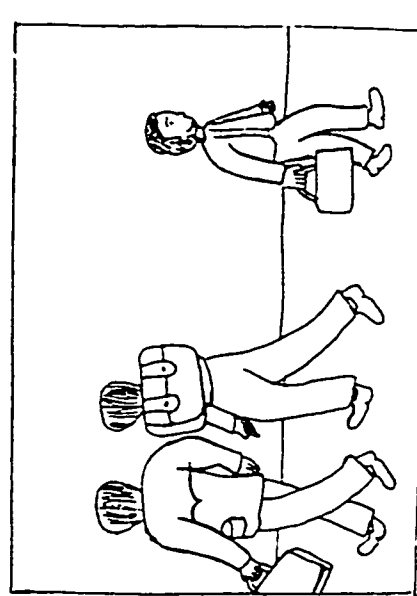
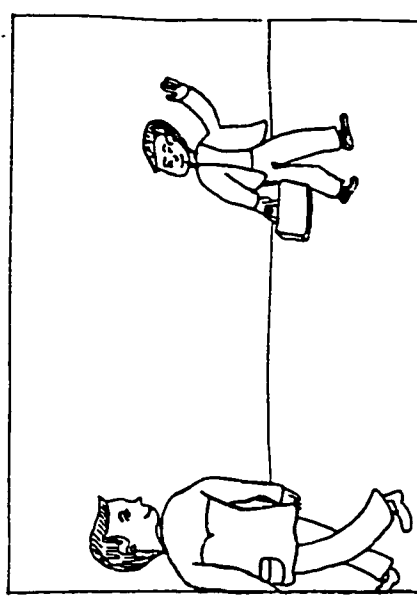
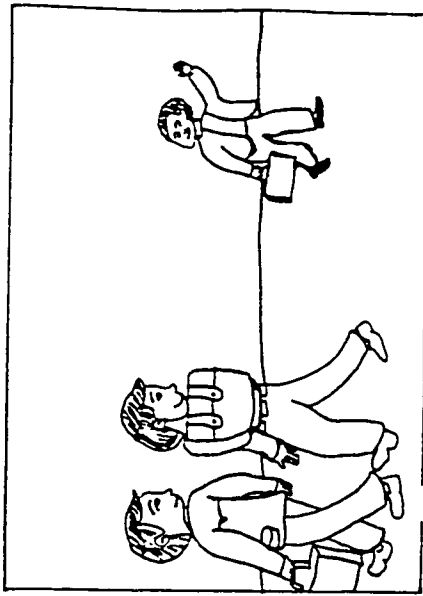
Pictures of Morphological Comprehension Task

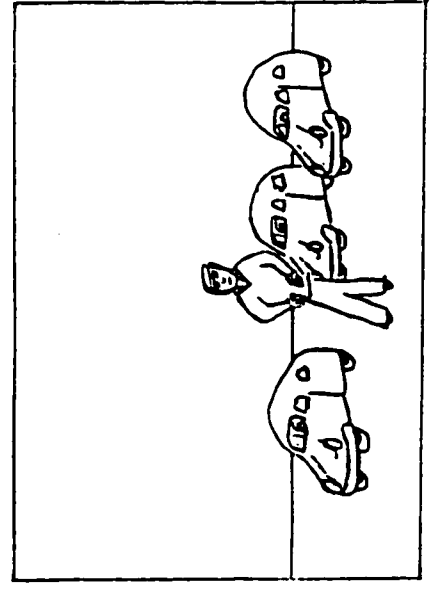
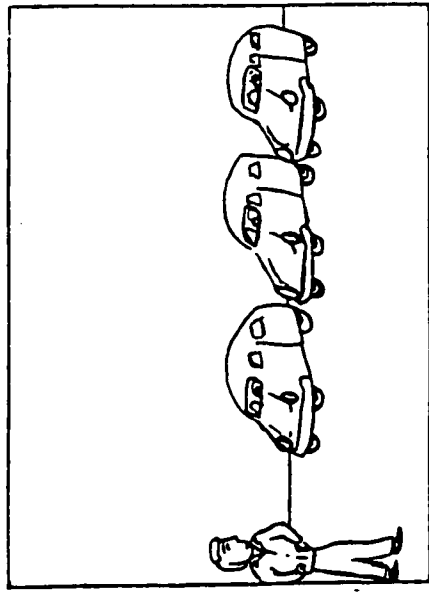
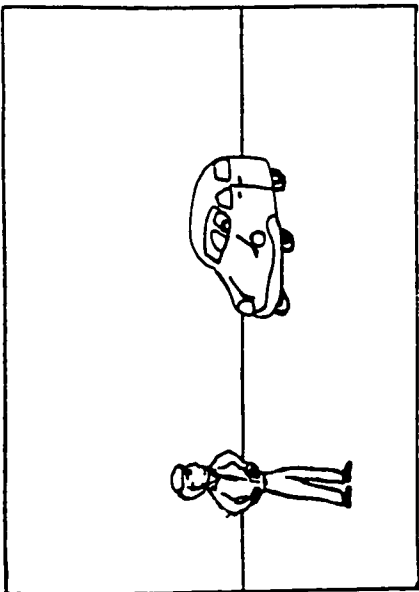
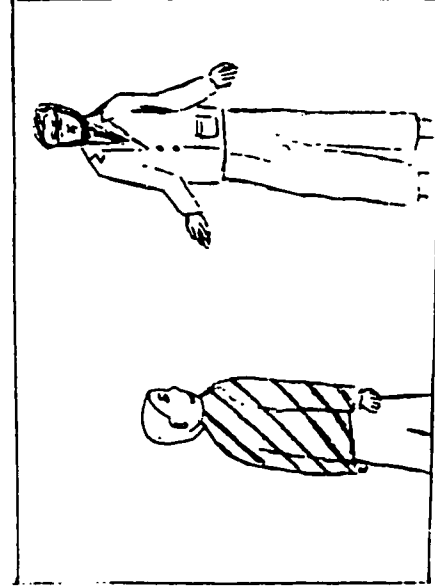
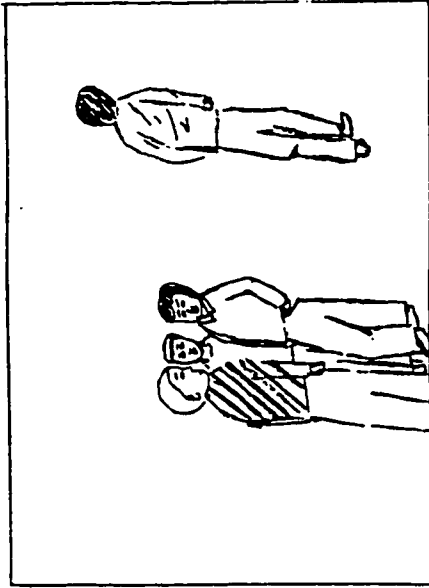
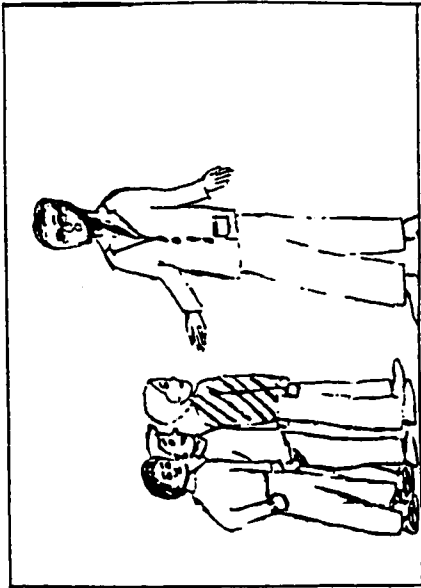
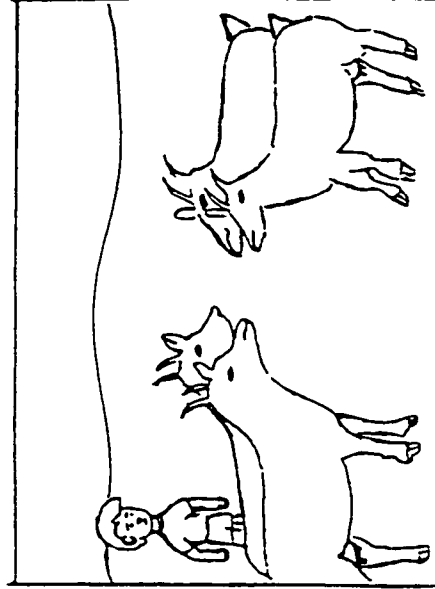
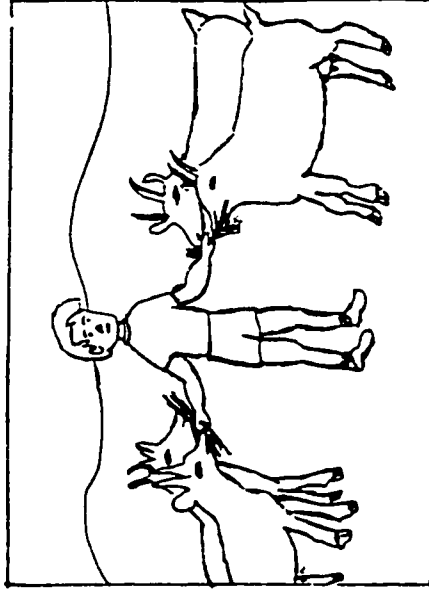
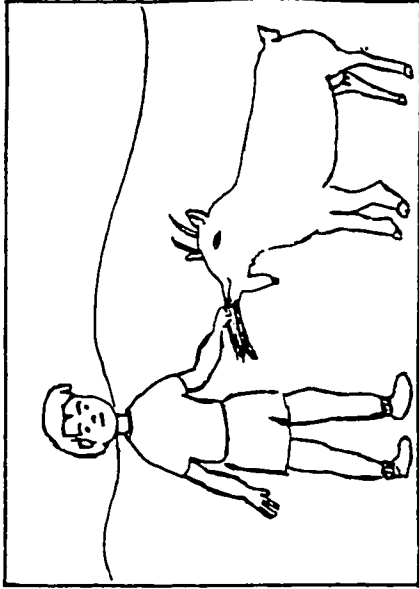


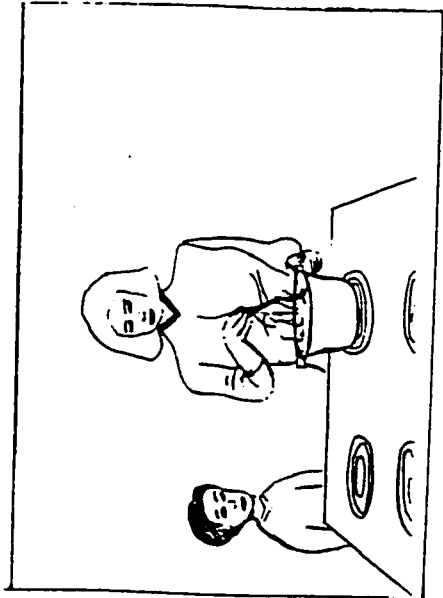
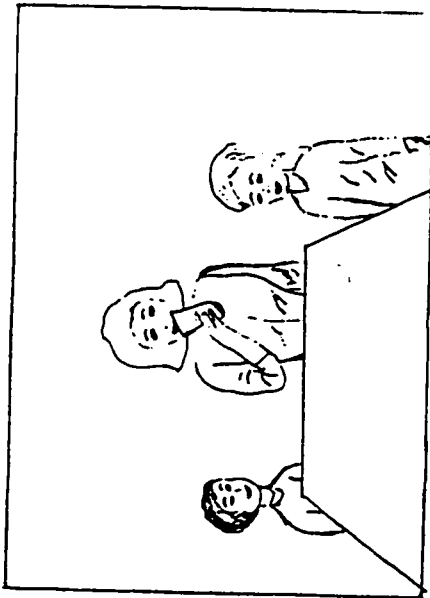
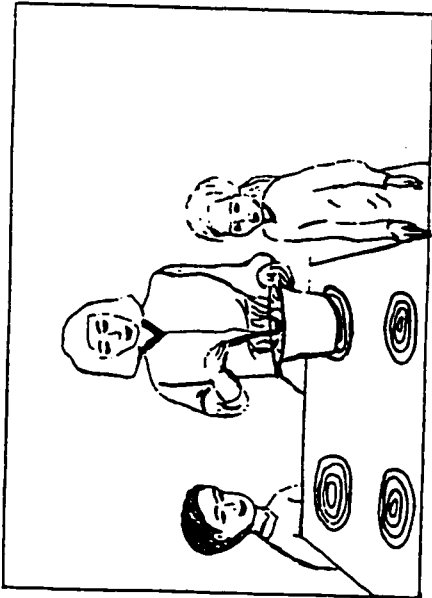
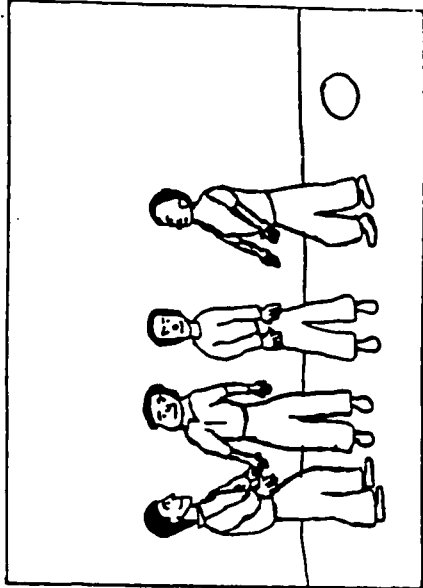
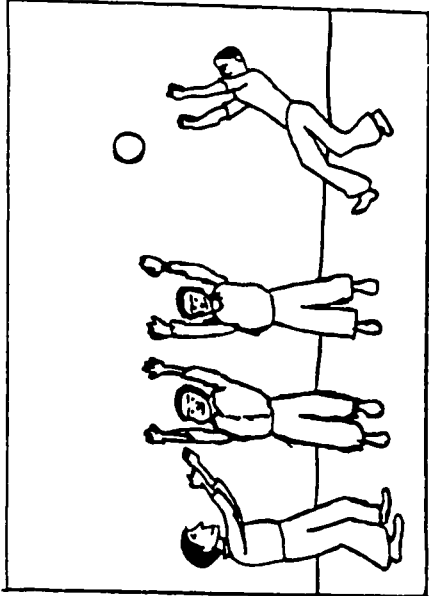
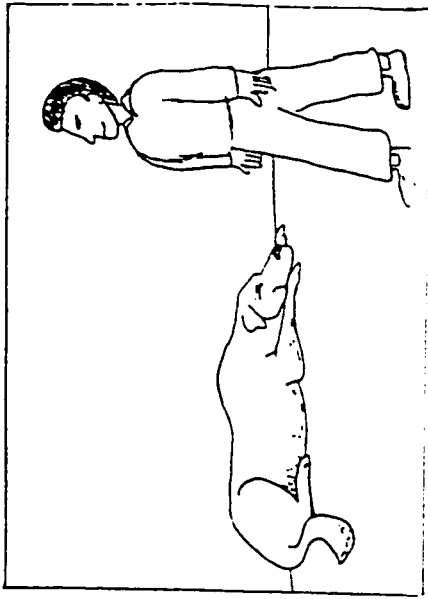
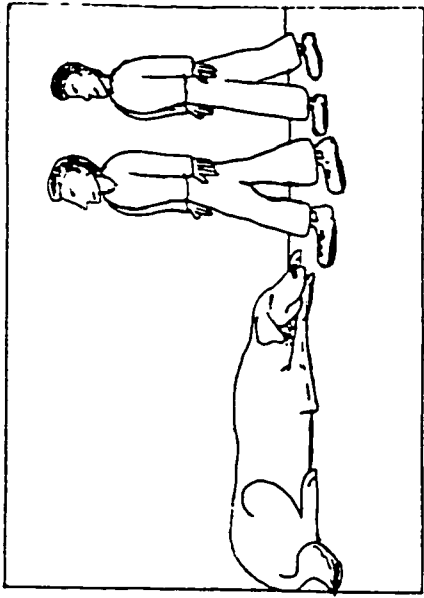
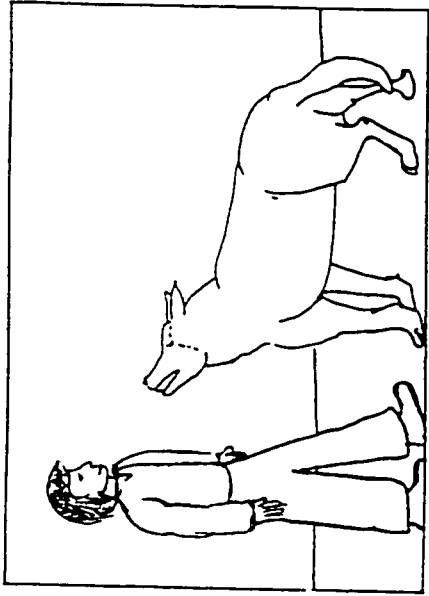


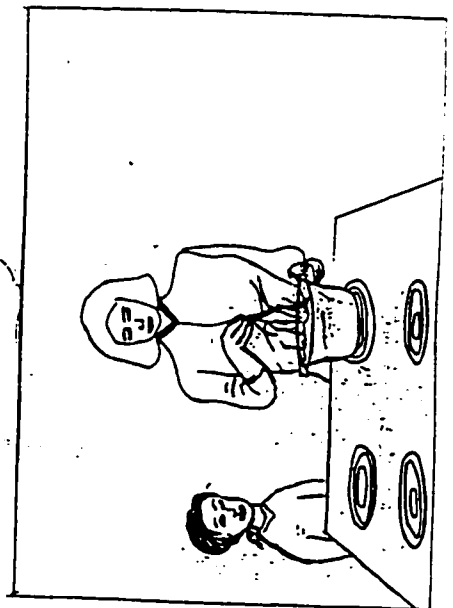
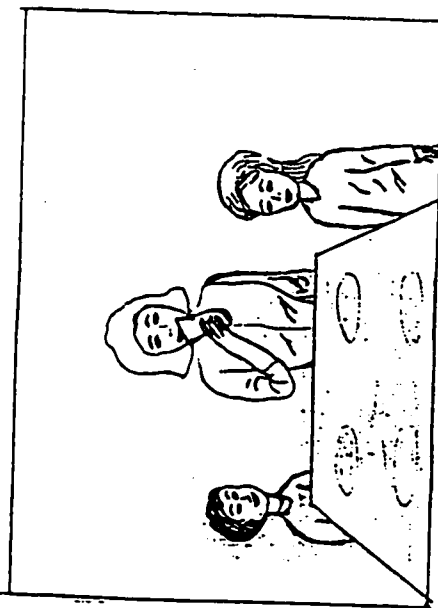
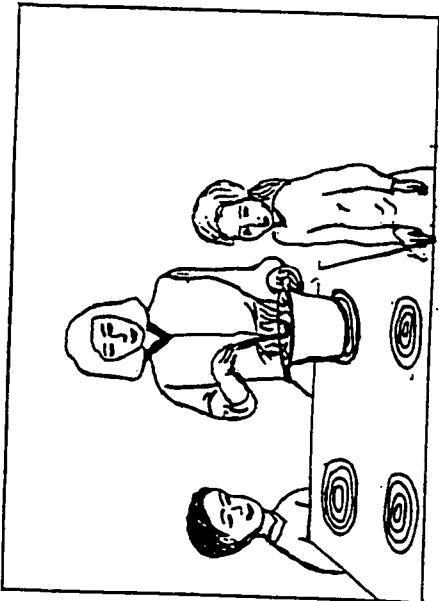
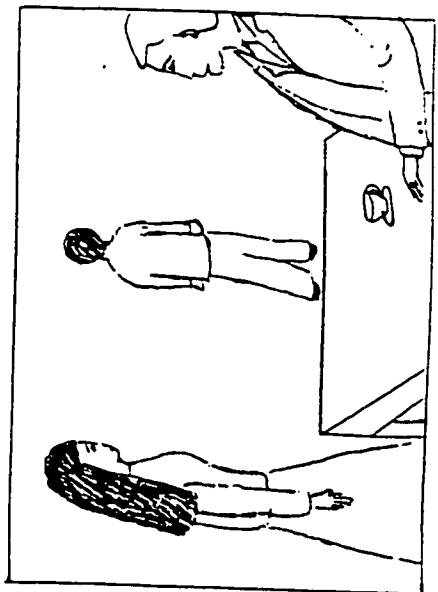
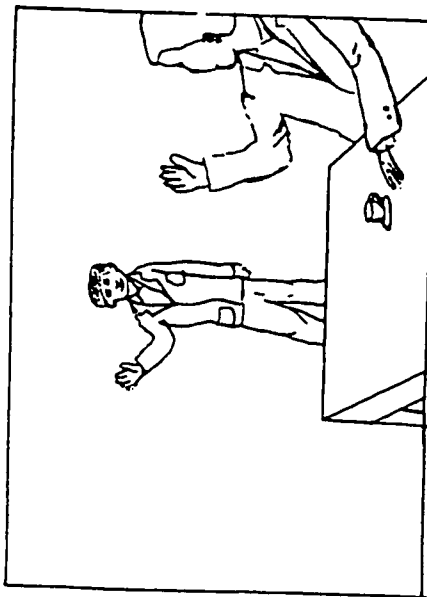
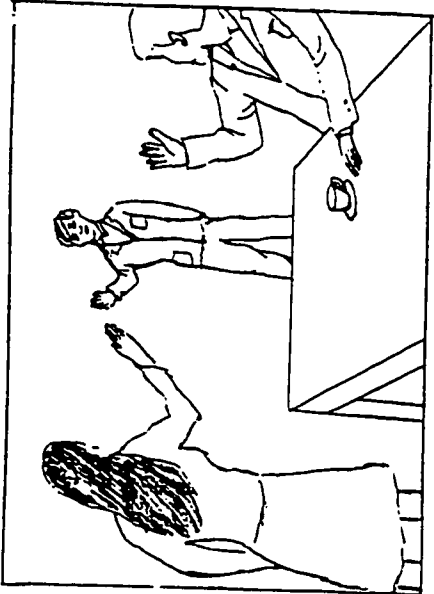
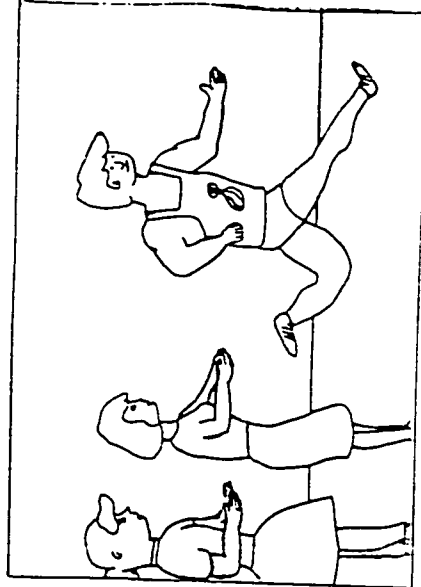
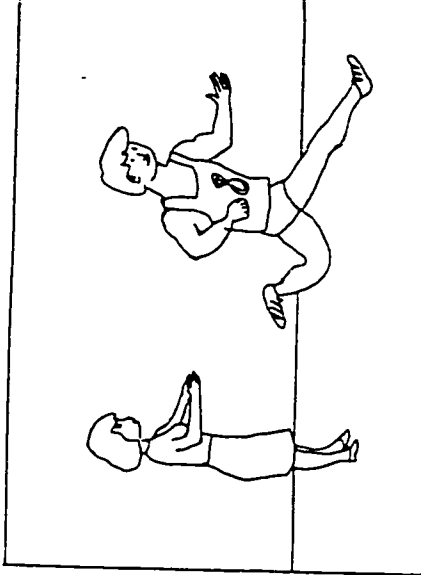
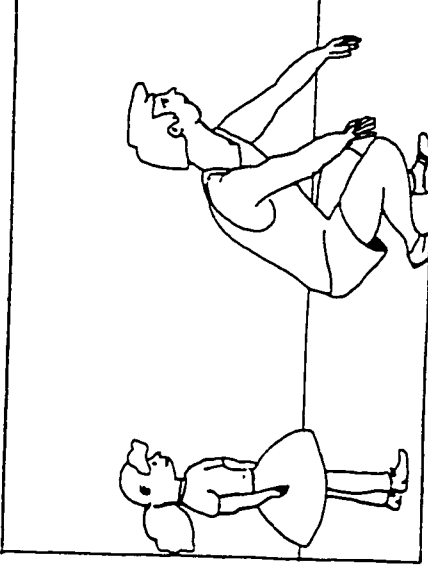


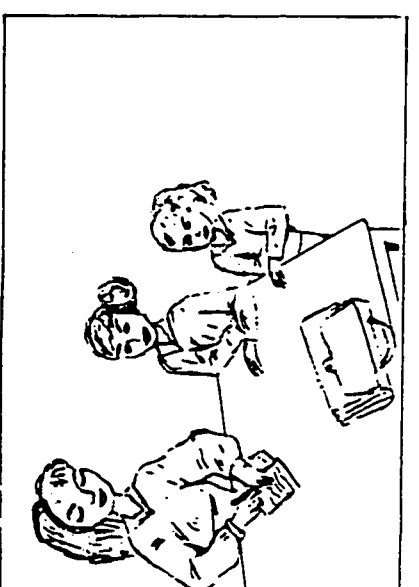
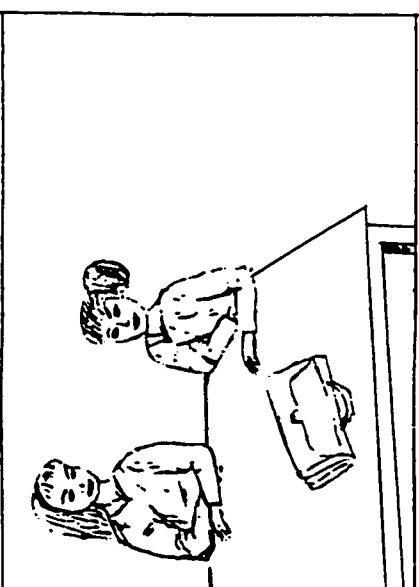
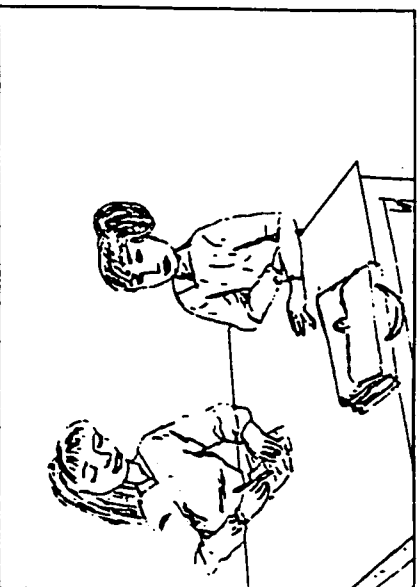
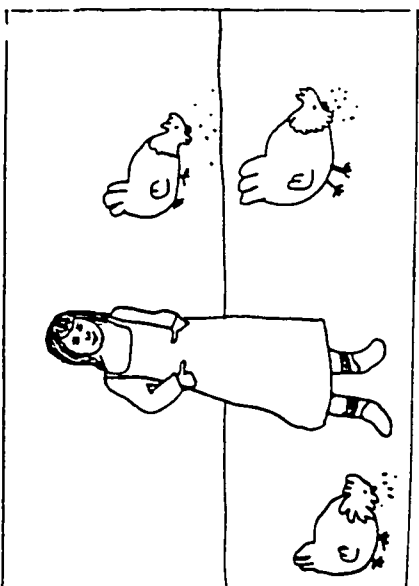
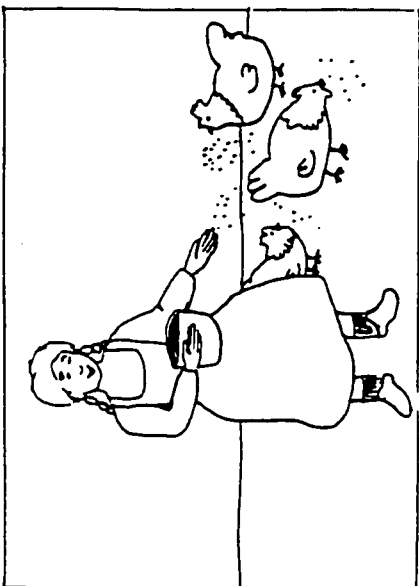
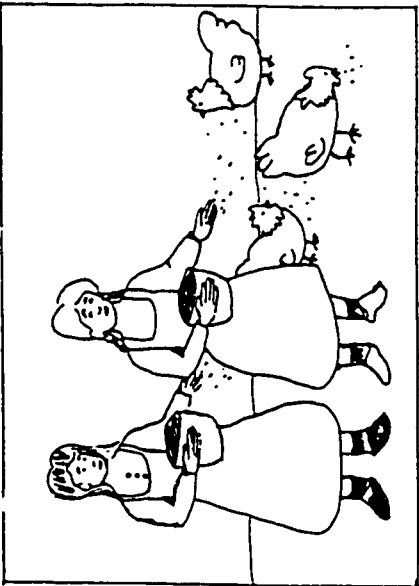
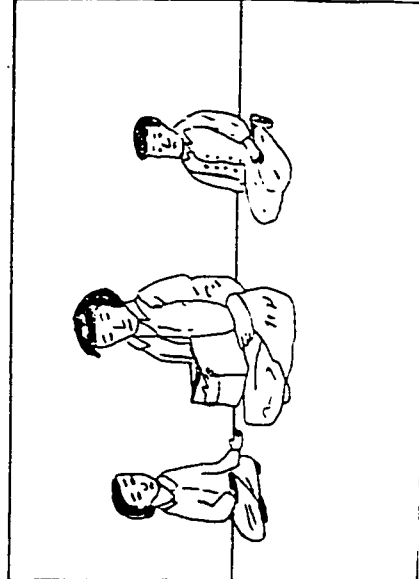
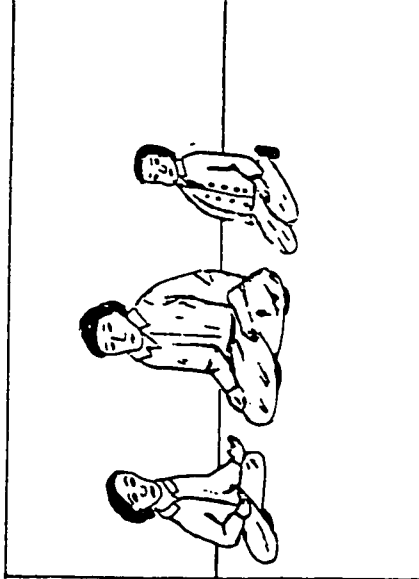
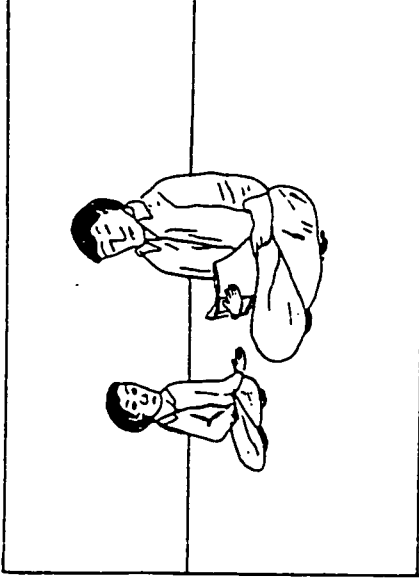


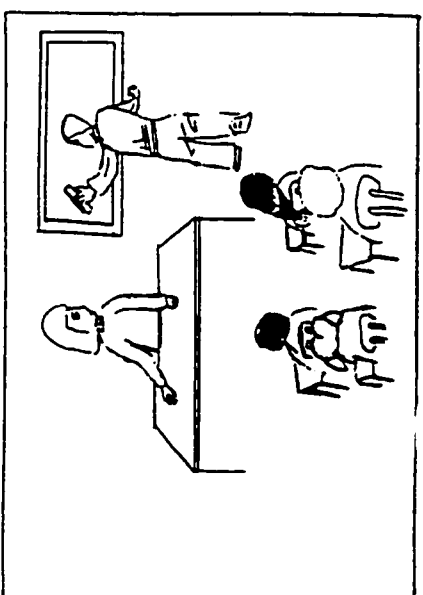
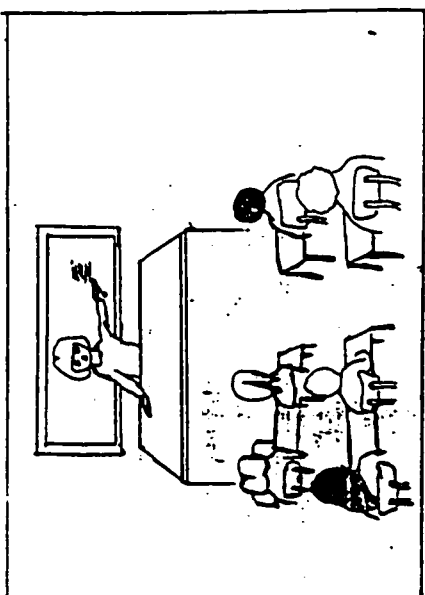
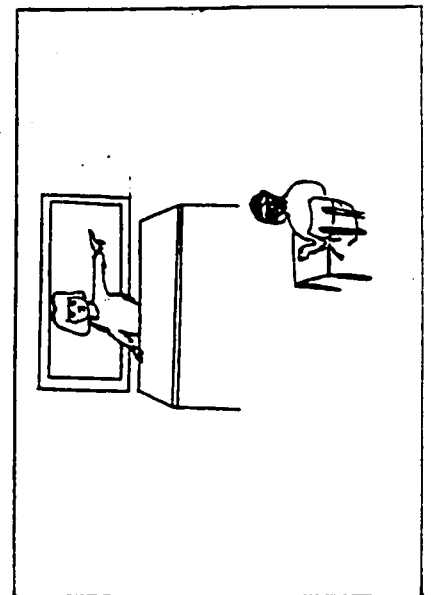
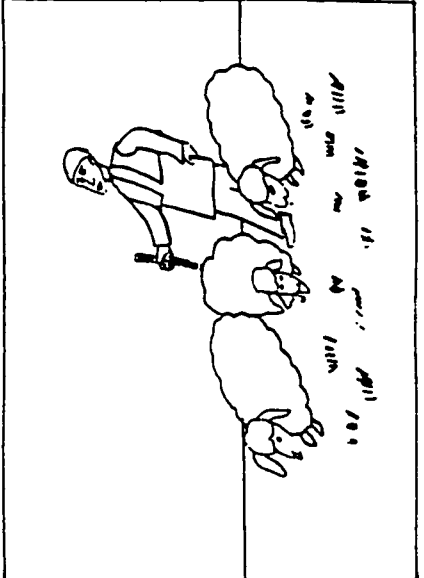
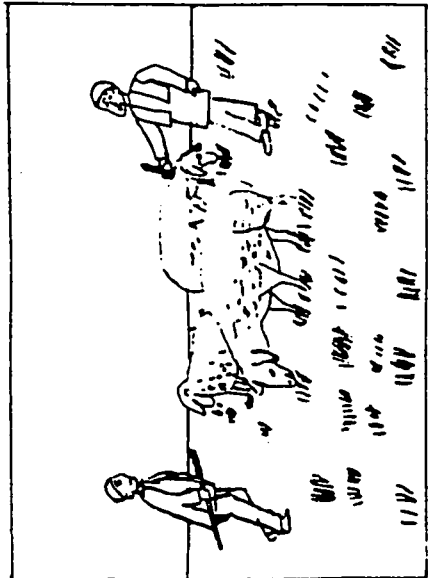
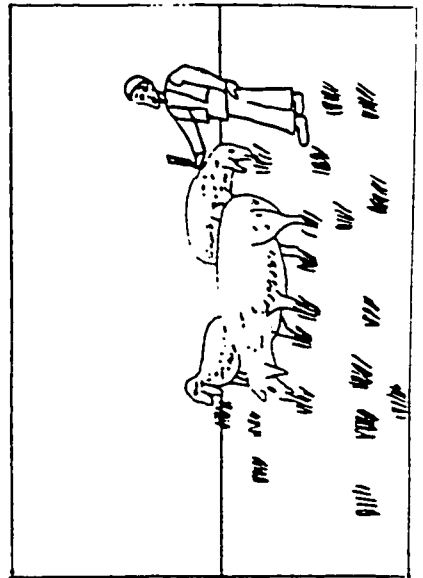
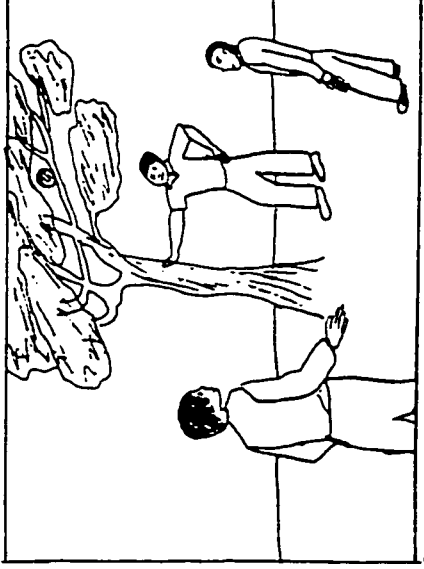
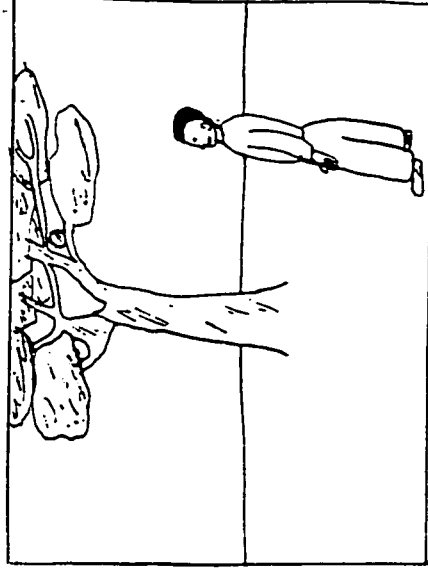
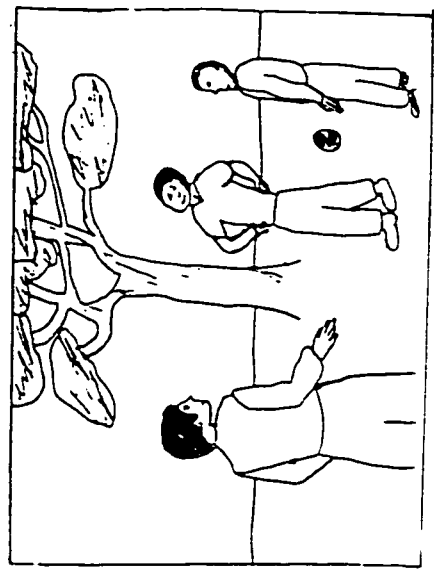


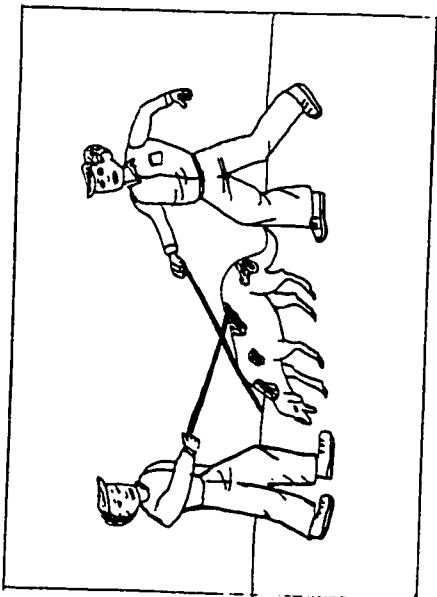
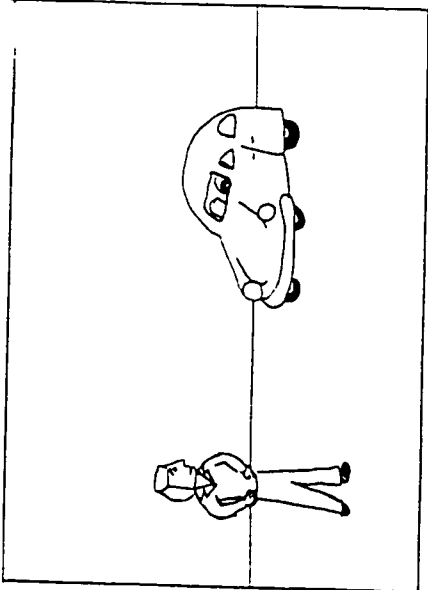
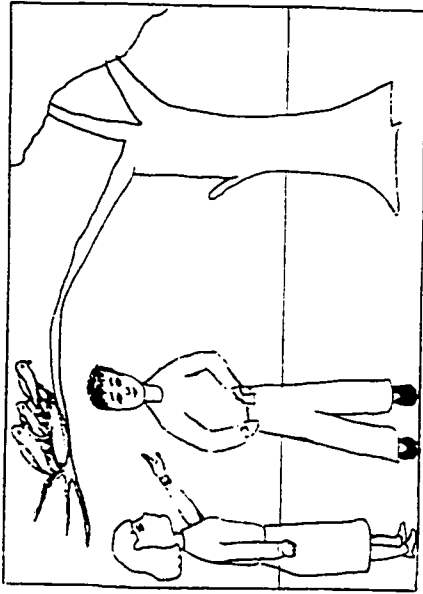
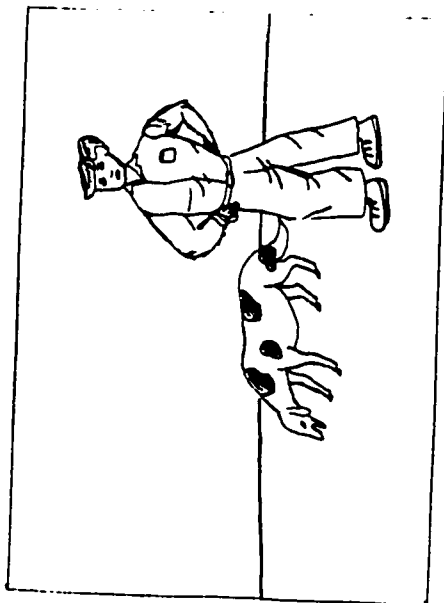
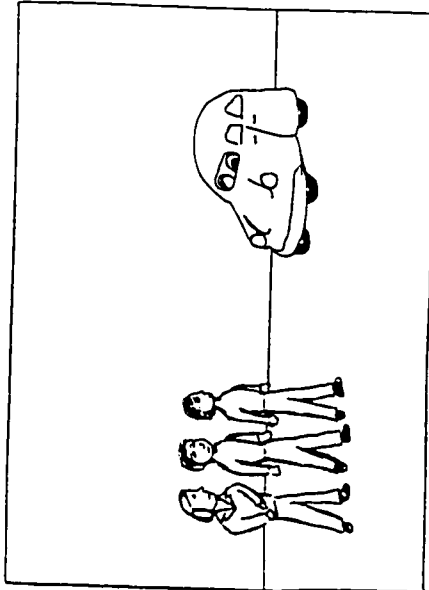
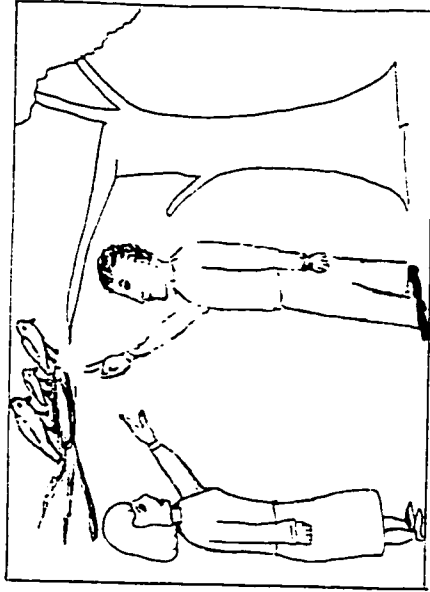
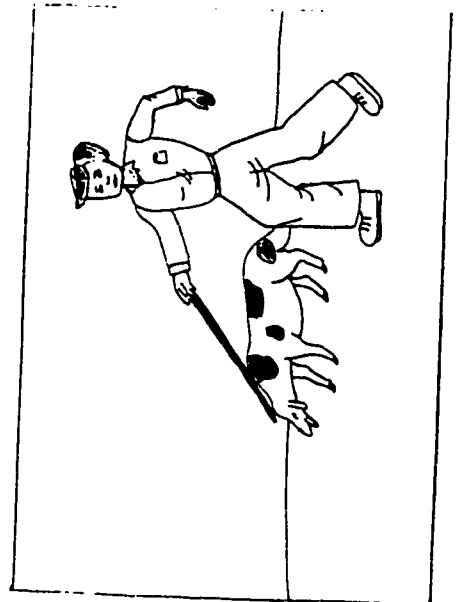
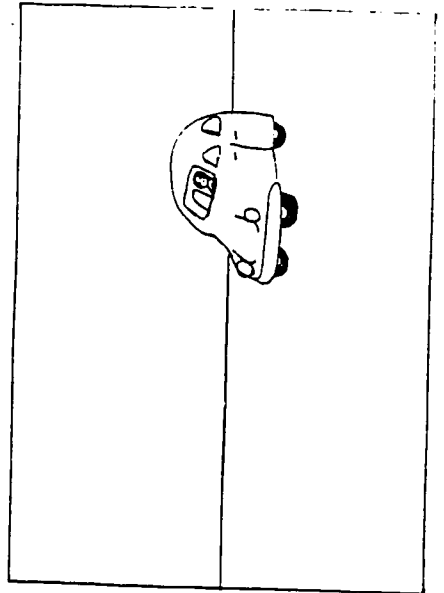
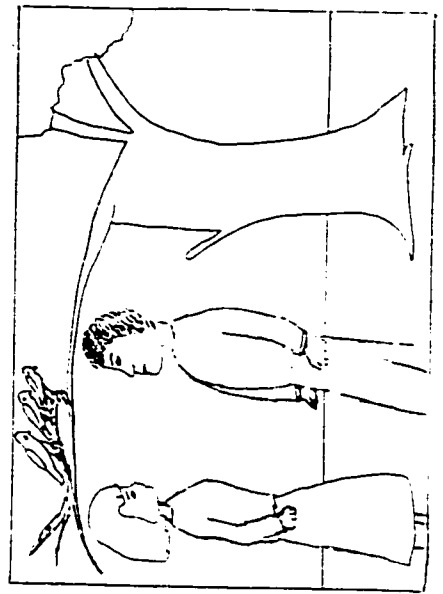


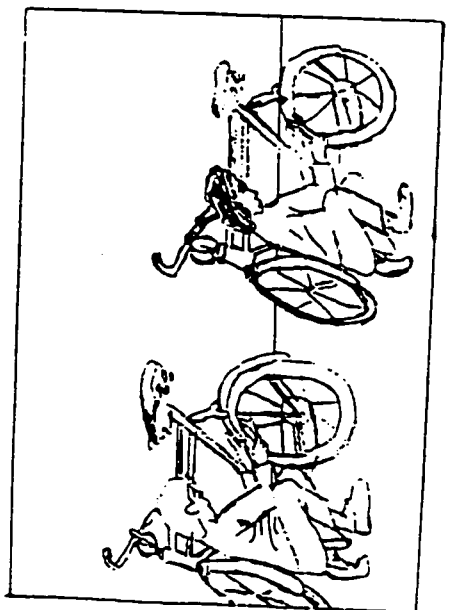
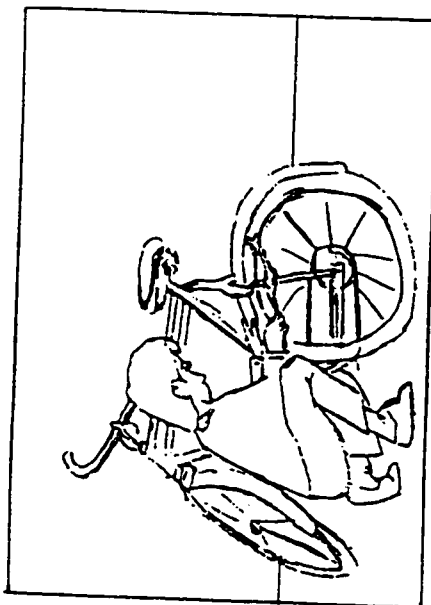
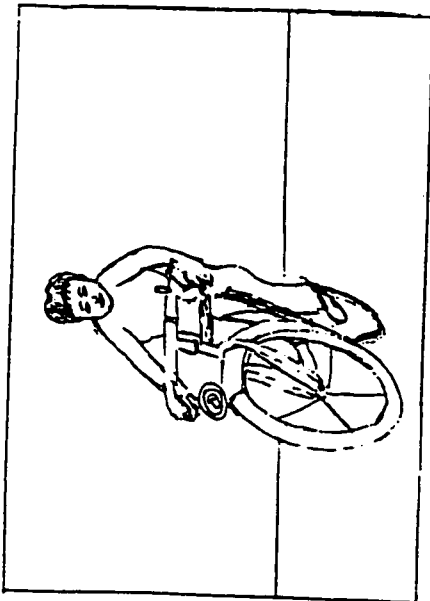
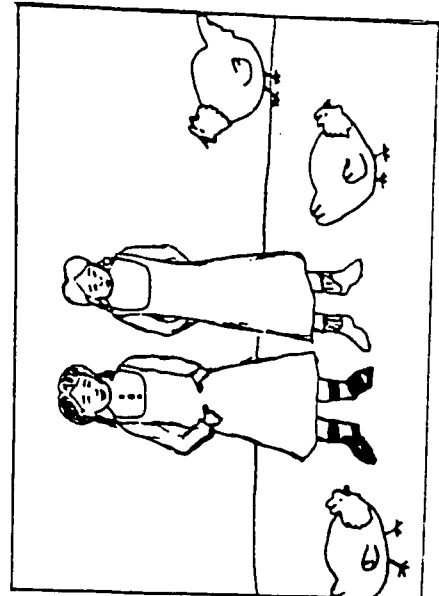
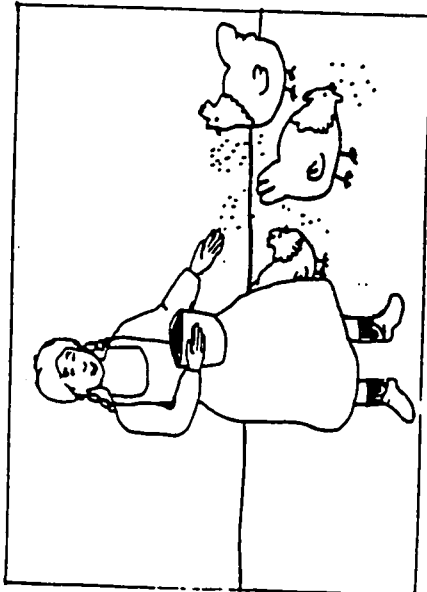
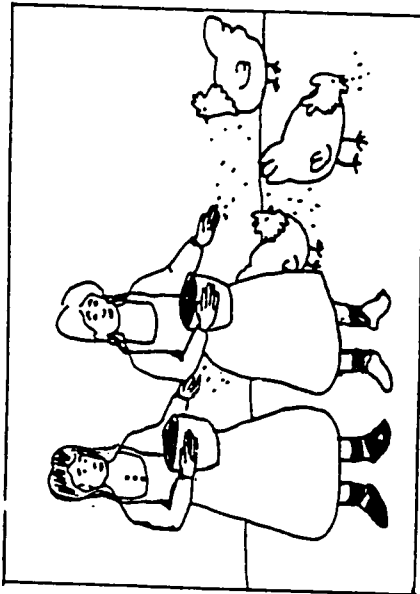
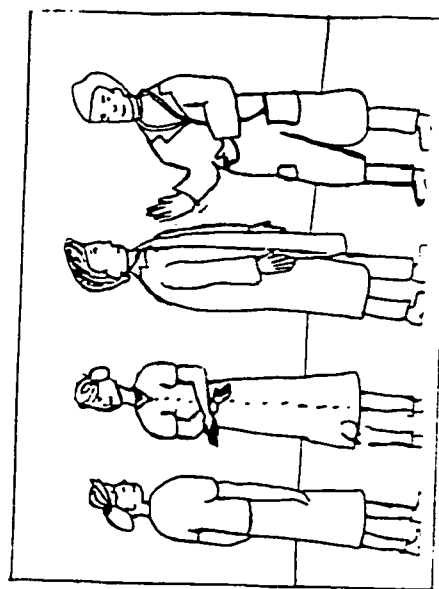
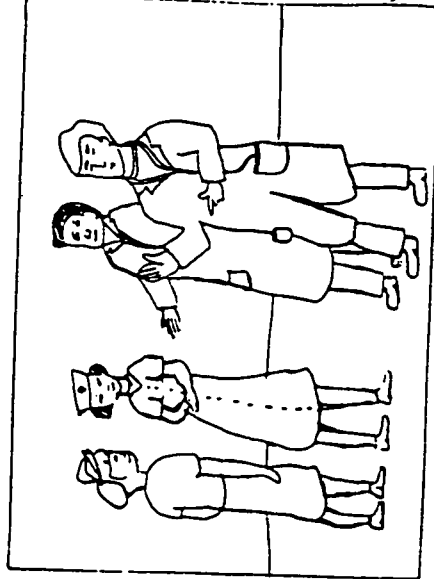
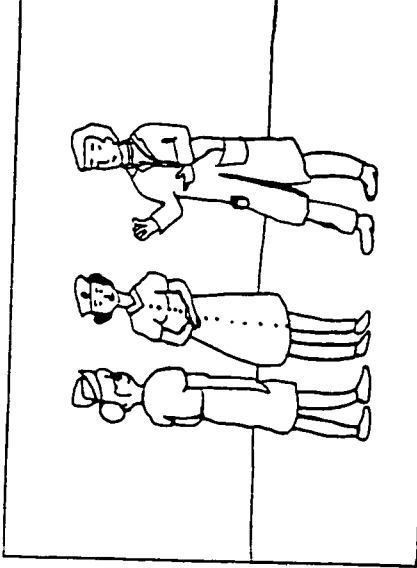


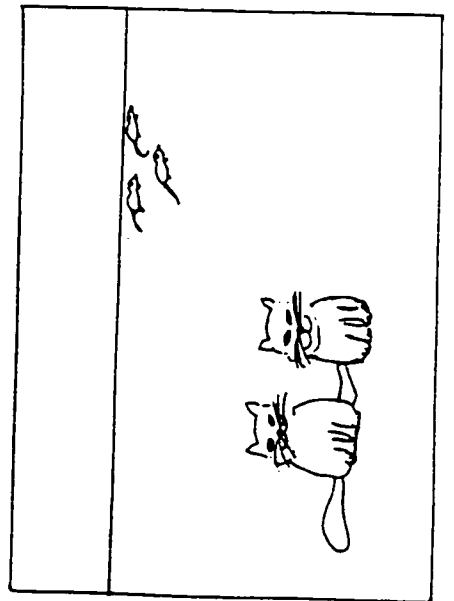
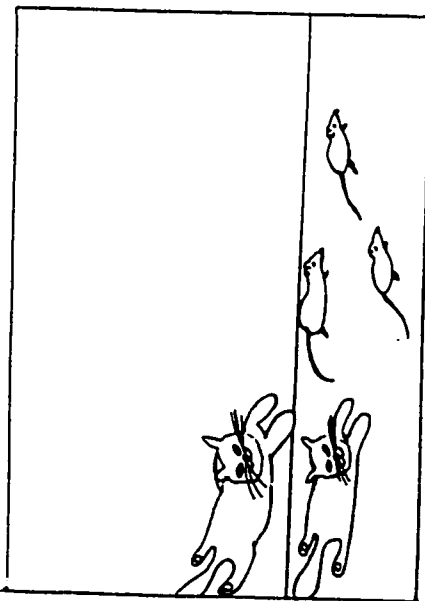
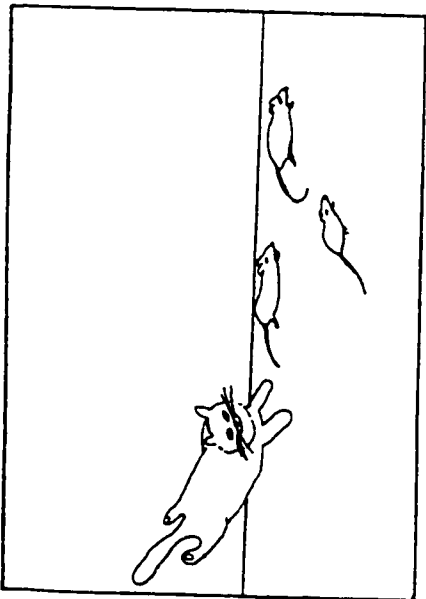
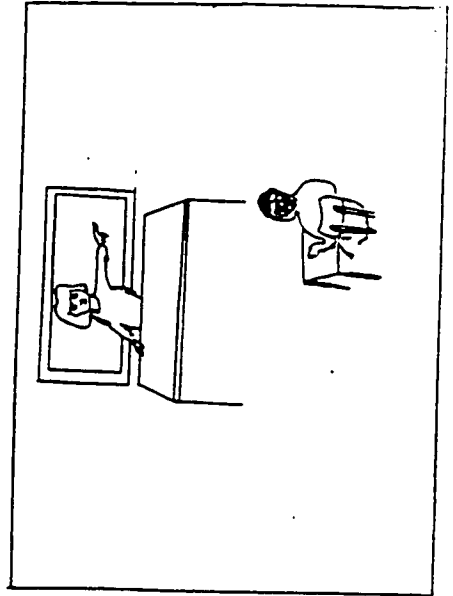
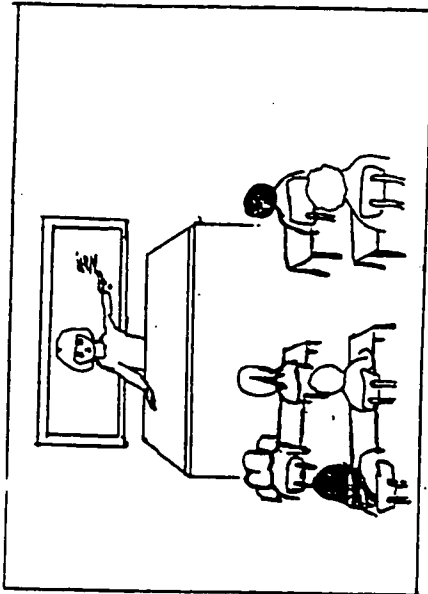
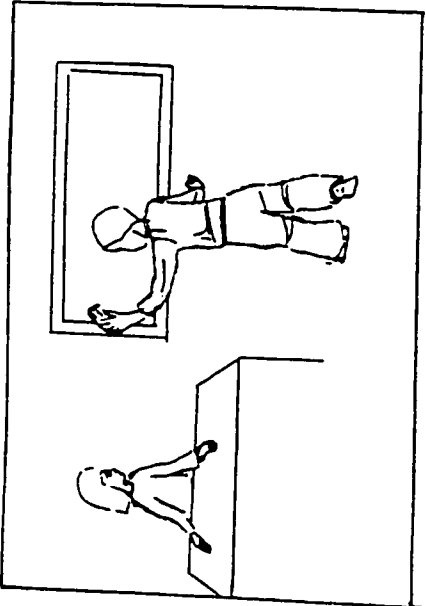
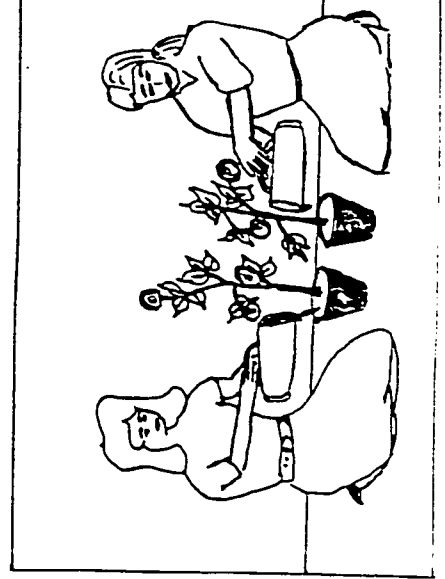
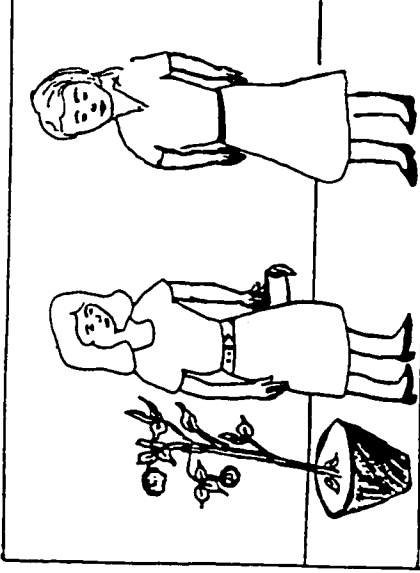


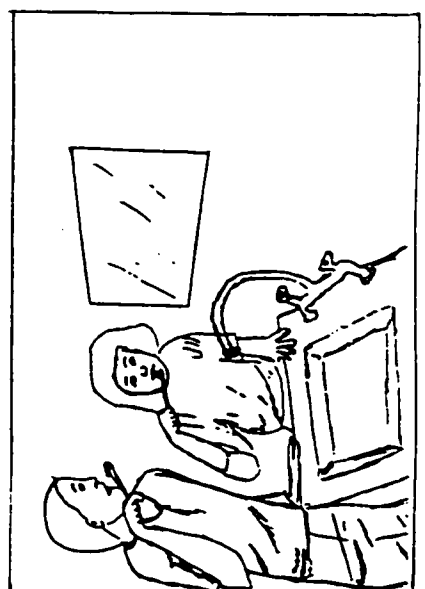
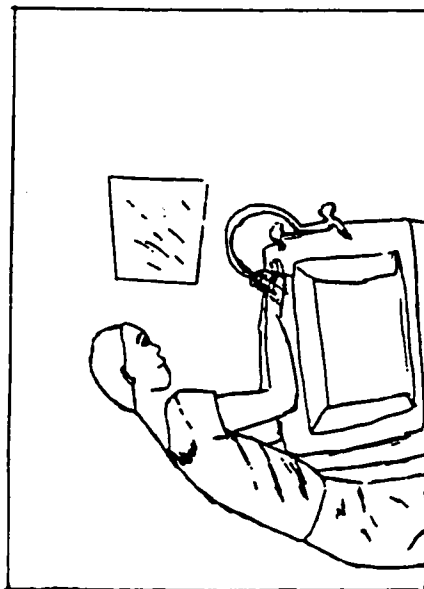
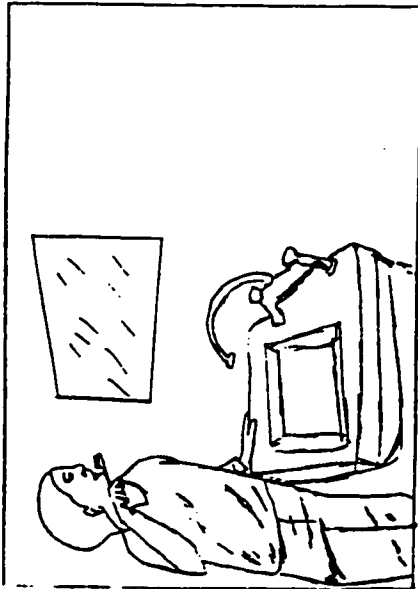
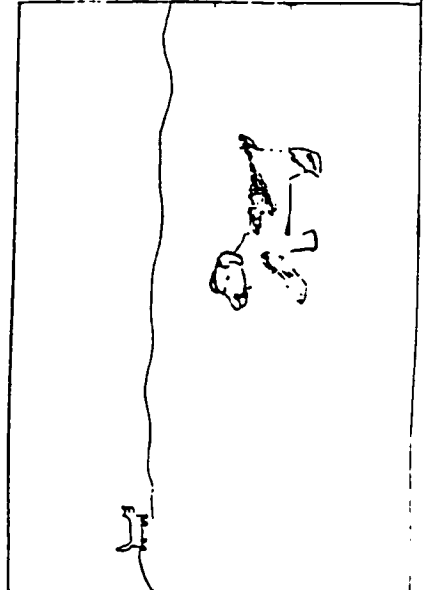
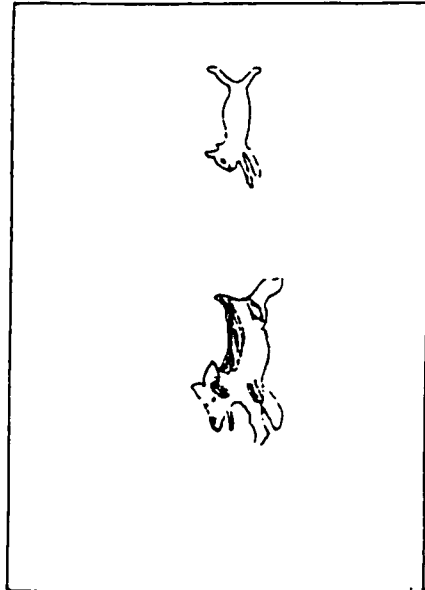
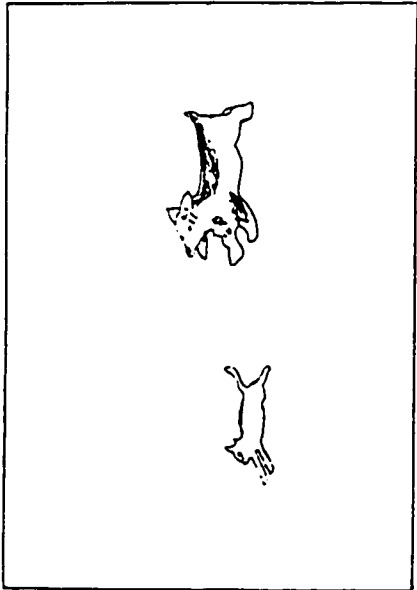
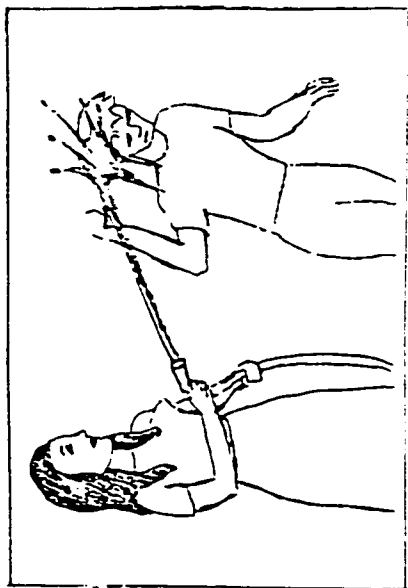
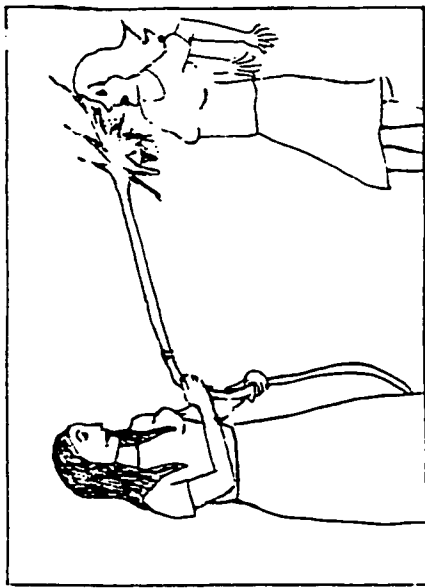
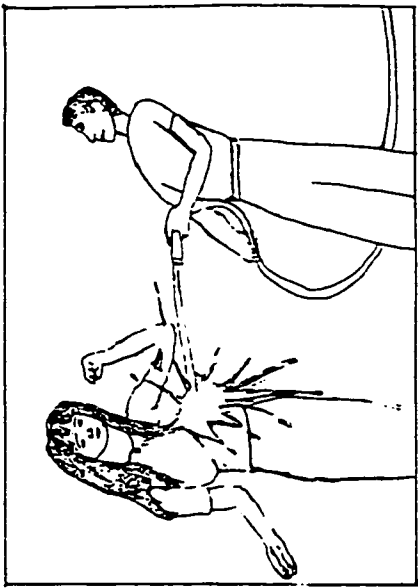


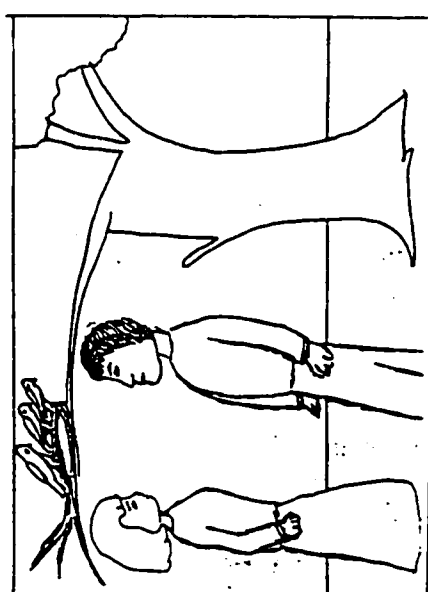
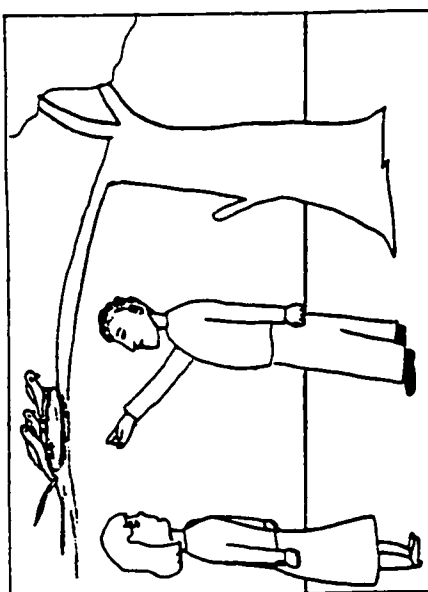
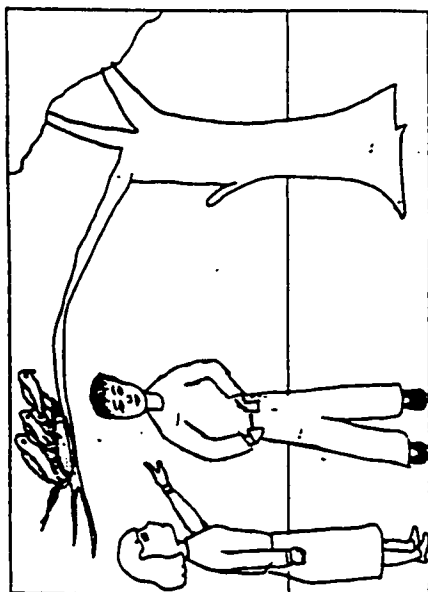
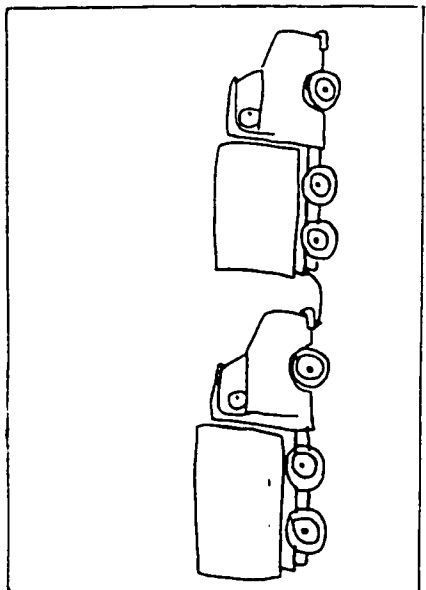
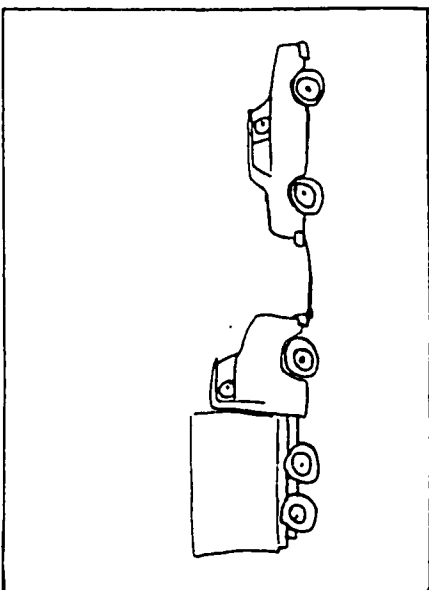
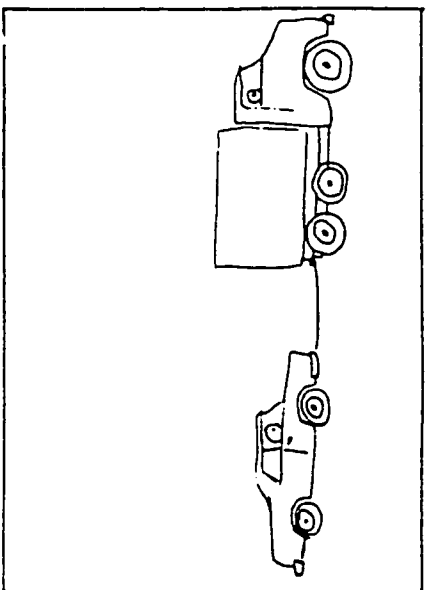
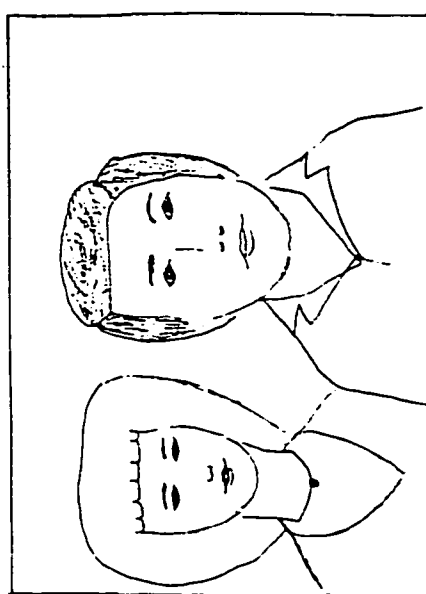
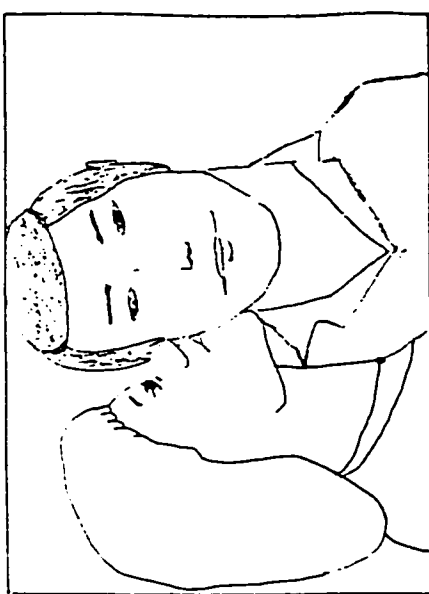
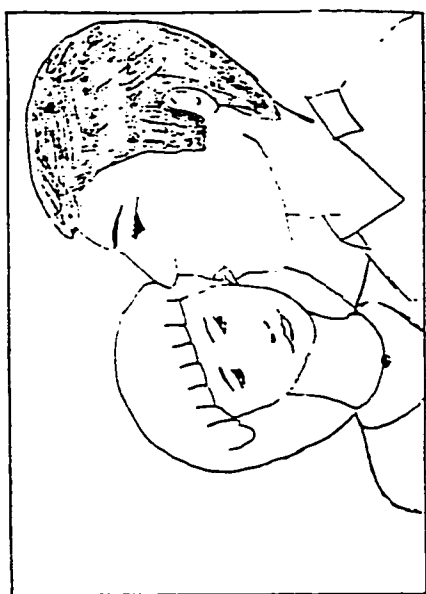


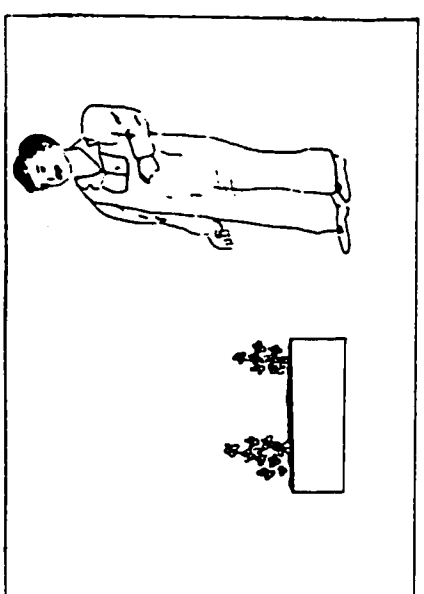
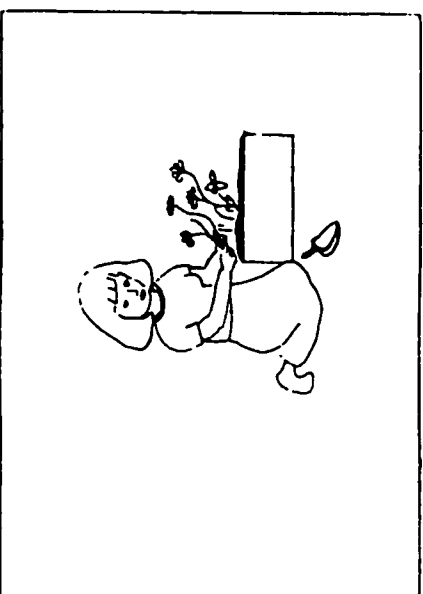
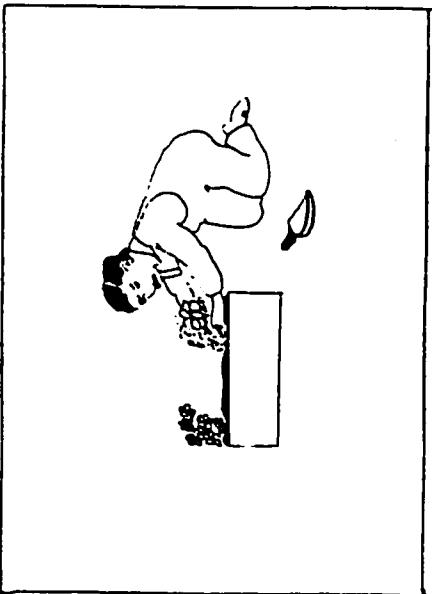
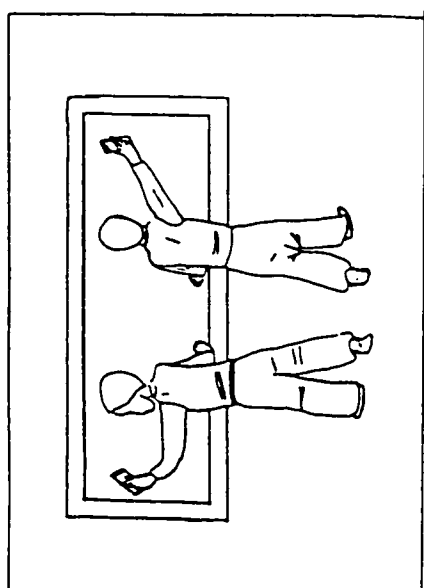
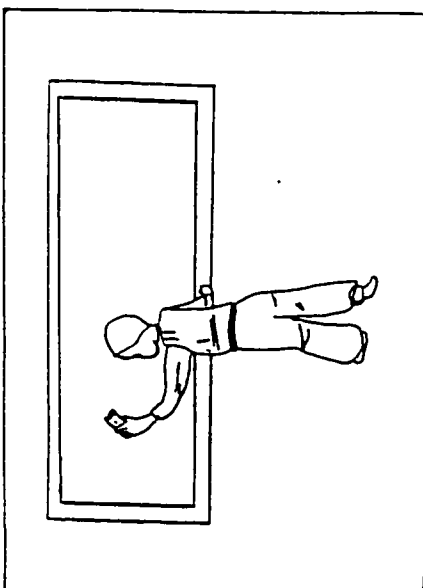
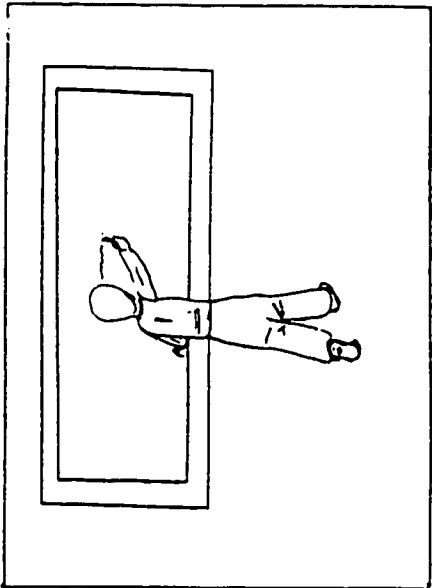
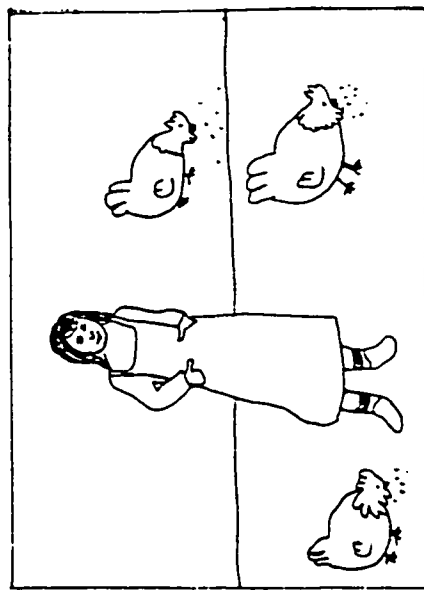
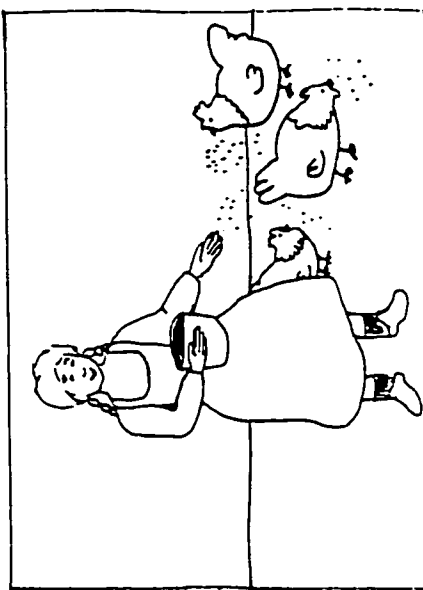
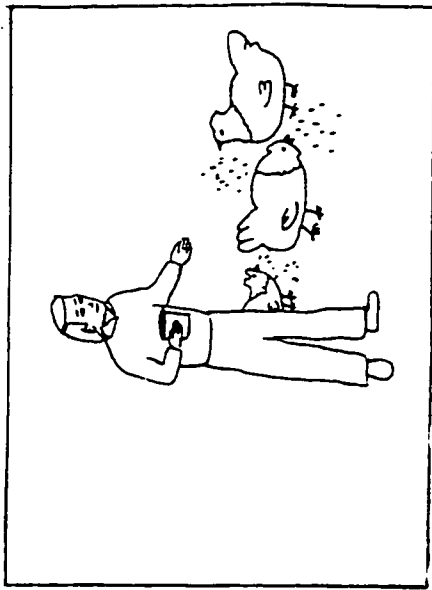


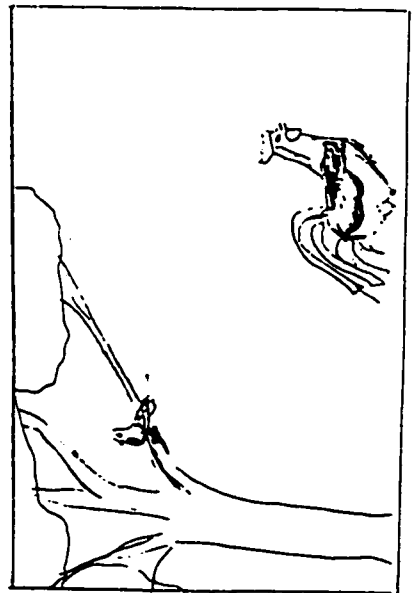
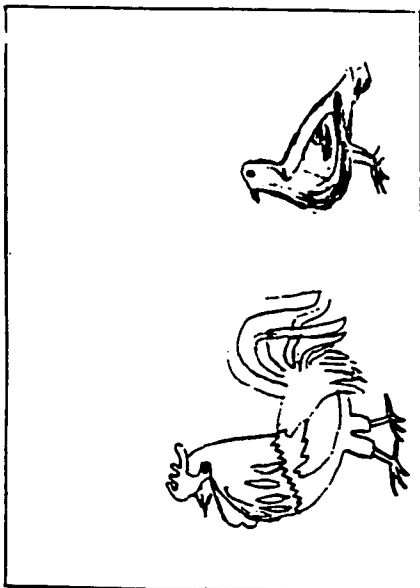
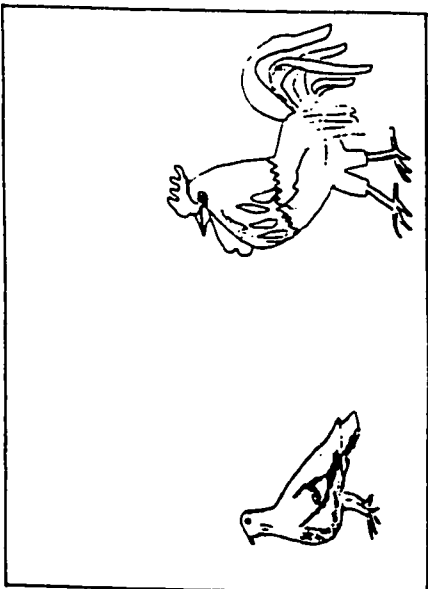
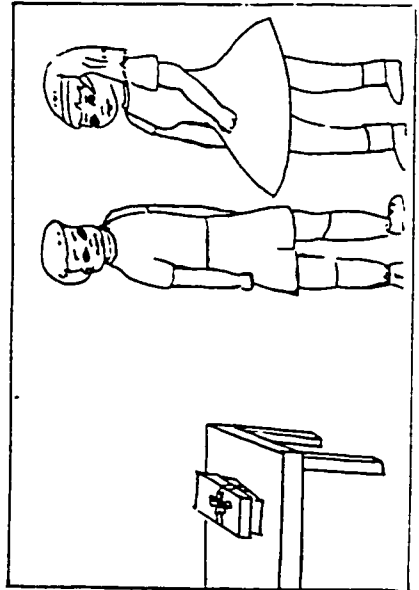
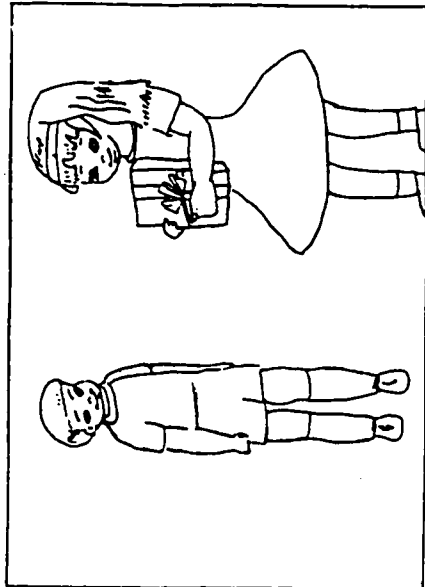
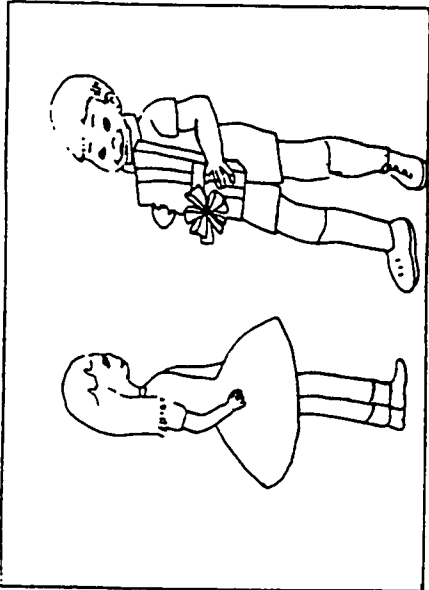
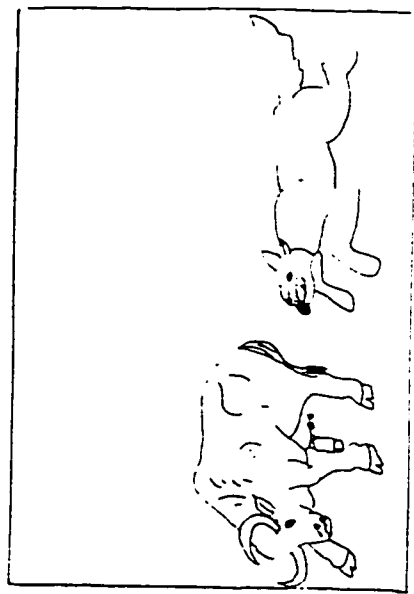
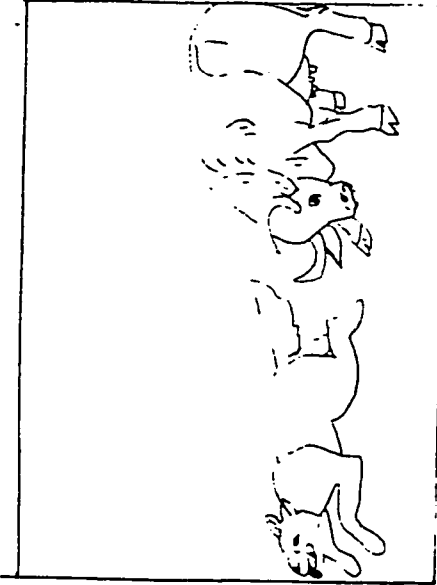
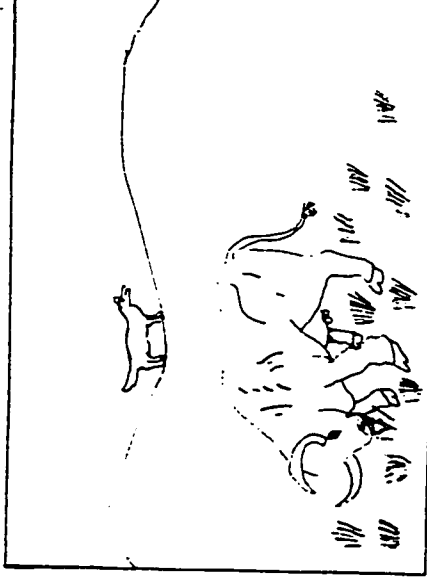


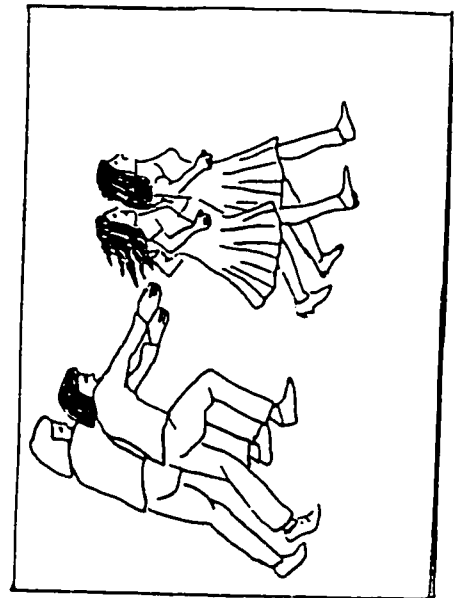
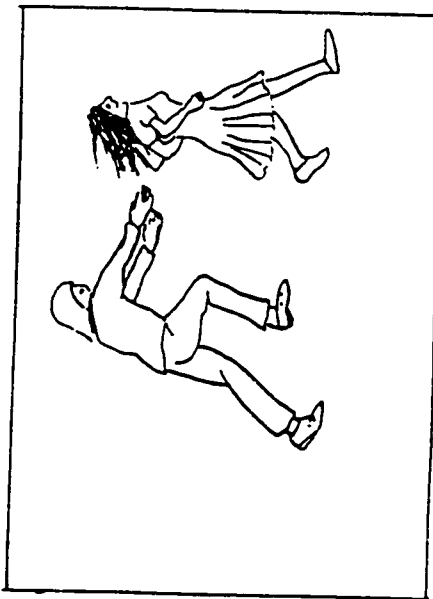
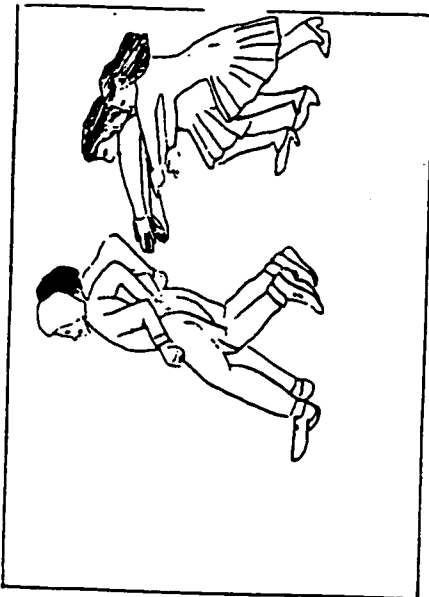
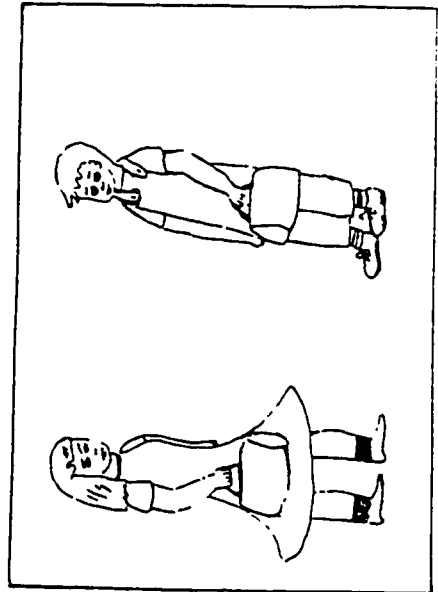
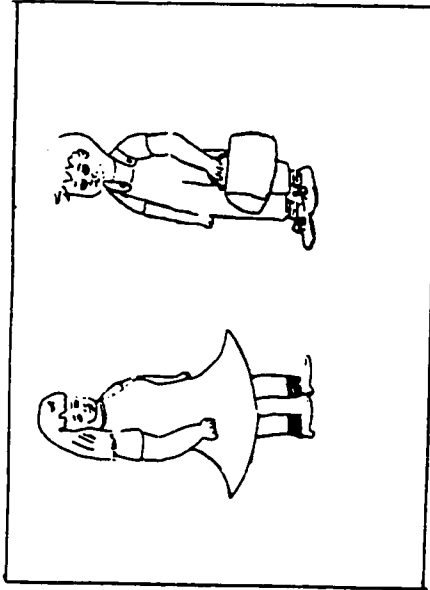
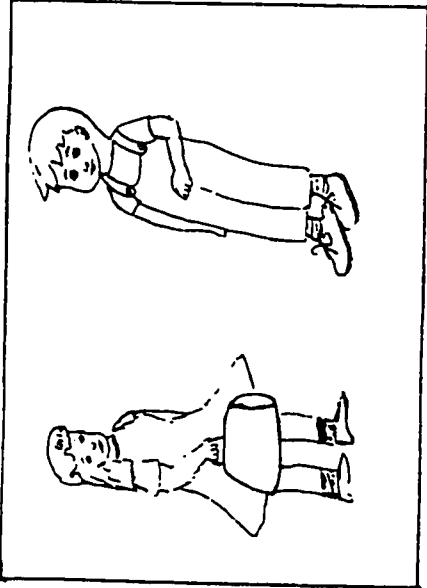
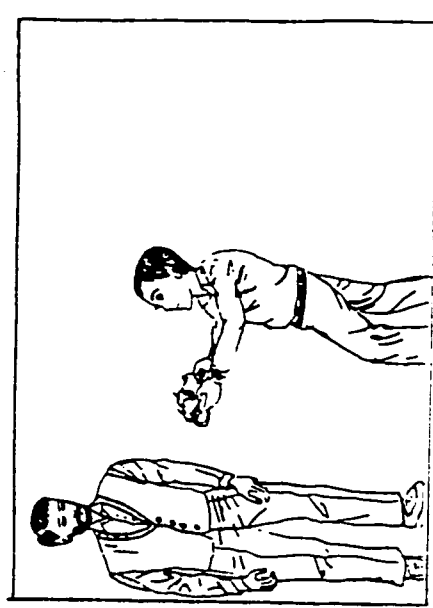
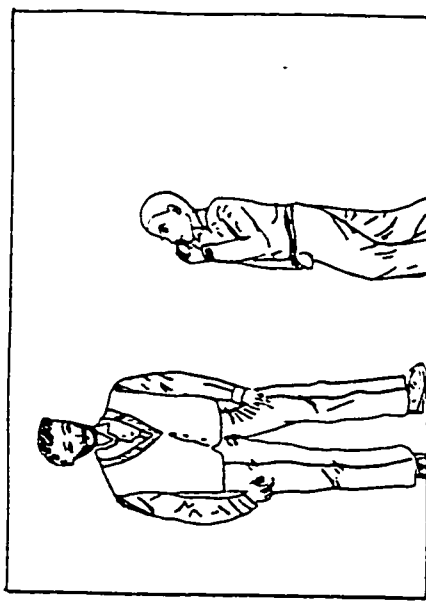
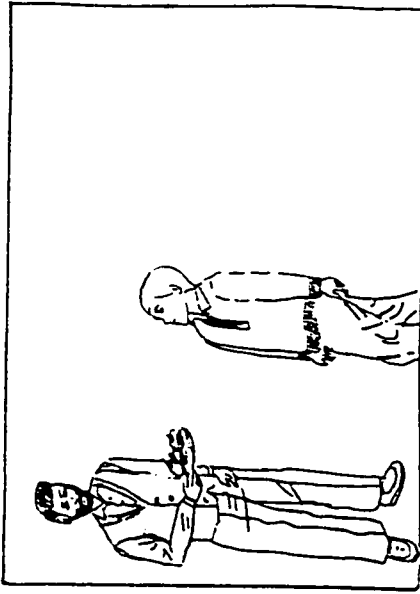


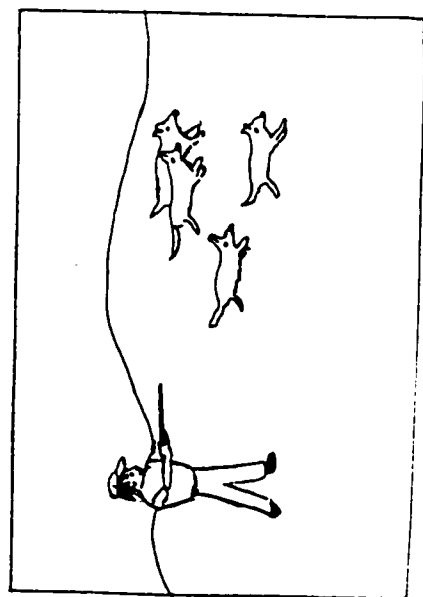
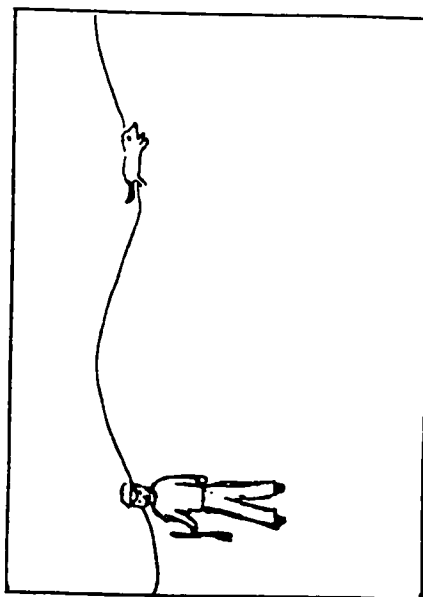
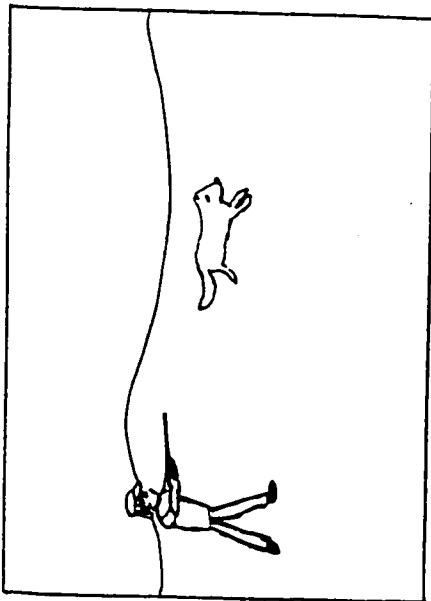
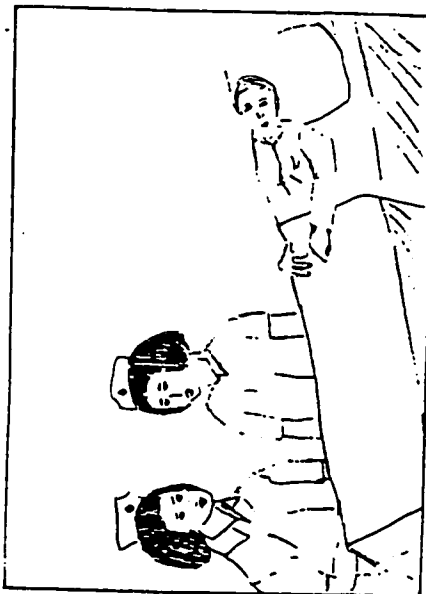
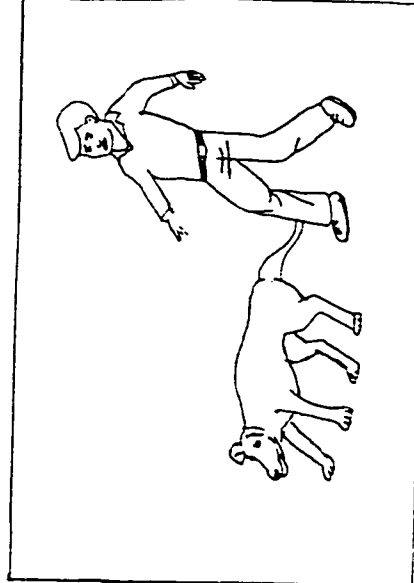
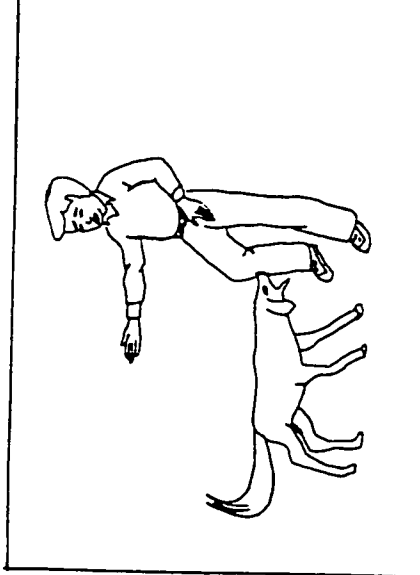
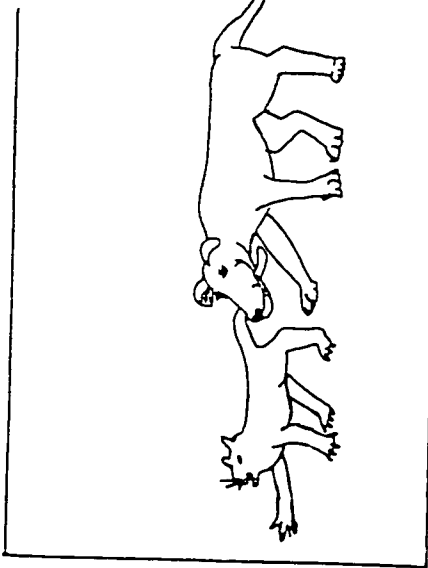


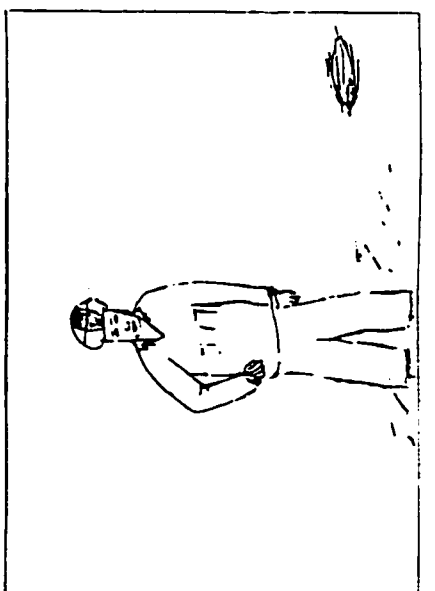
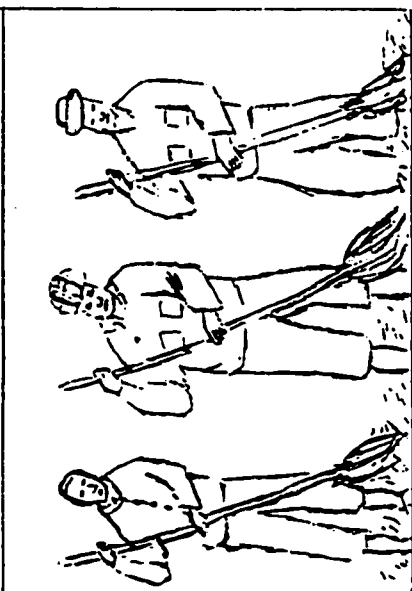
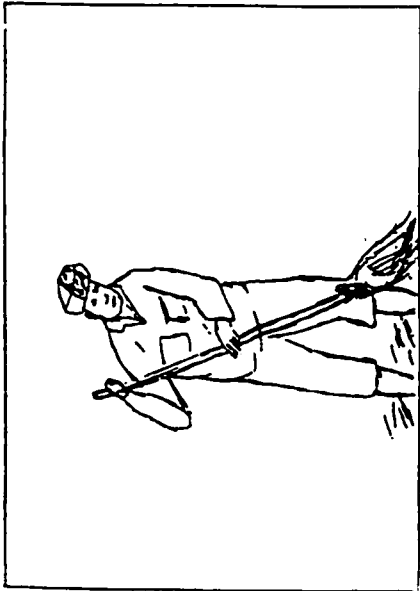
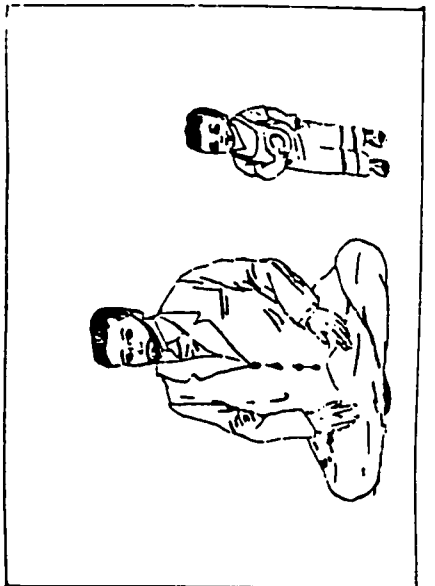
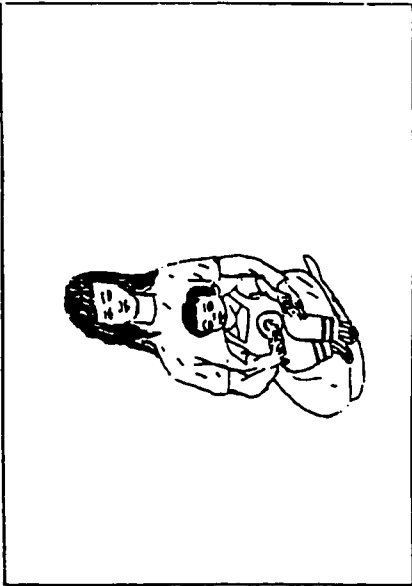
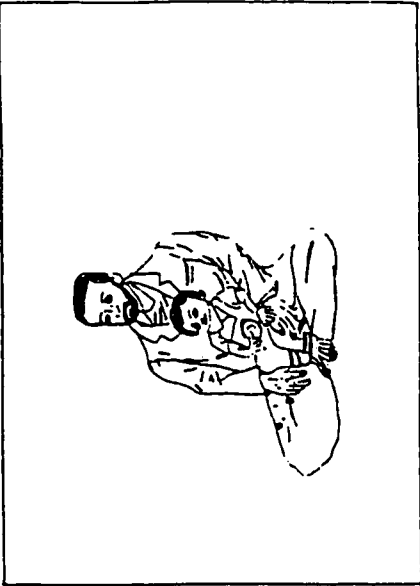
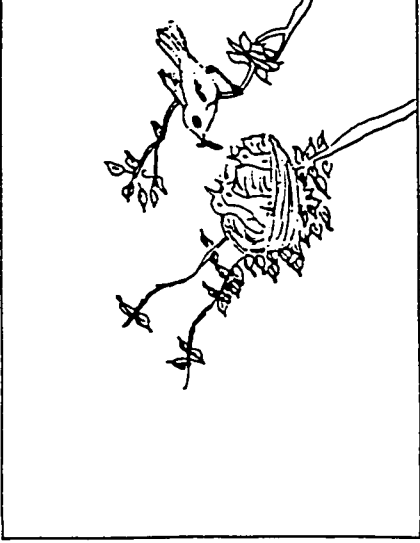












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