

A LEXICAL–FUNCTIONAL GRAMMAR FOR TURKISH

A THESIS

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July, 1993

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ABSTRACT

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Natural language processing is a research area which is becoming increasingly popular each day for both academic and commercial reasons. Syntactic parsing underlies most of the applications in natural language processing. Although there have been comprehensive studies of Turkish syntax from a linguistic perspective, this is one of the first attempts for investigating it extensively from a computational point of view. In this thesis, a lexical-functional grammar for Turkish syntax is presented. Our current work deals with regular Turkish sentences that are structurally simple or complex.

Keywords: Natural language processing, computational linguistics, Turkish syntax, parsing, lexical-functional grammar.

ÖZET

TÜRKÇE İÇİN BİR SÖZCÜKSEL-İŞLEVSEL GRAMER

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Doğal dil işleme, hem akademik hem de ticari nedenlerden ötürü popülerliği her geçen gün daha da artan bir araştırma alanıdır. Tümcelerin sözdizimsel olarak çözümlenmesi, doğal dil işleme alanındaki birçok uygulamanın temelini oluşturmaktadır. Türkçe sözdizimi üzerine dilbilimsel açıdan kapsamlı çalışmalar yapılmıştır. Ancak, bunların hiçbiri bilgisayar ile çözümlenmeye yönelik değildir. Bu çalışma, Türkçe'nin sözdiziminin bilgisayar ile çözümlenmesi konusunu etraflıca inceleyen ilk çalışmalardan biridir. Bu tezde, Türkçe için bir sözcüksel-işlevsel gramer sunulmaktadır. Şu andaki çalışmamız, yapı olarak basit veya girişik olan düz Türkçe tümcelerini ele alıp, başarı ile çözümlenmektedir.

Anahtar Sözcükler: Doğal dil işleme, bilgisayarla dil işleme, Türkçe sözdizimi, çözümlenme, sözcüksel-işlevsel gramer.

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List of Abbreviations

1SG, 2SG, 3SG	first, second, third person singular
1PL, 2PL, 3PL	first, second, third person plural
1SP, 2SP, 3SP	first, second, third person singular possessive
1PP, 2PP, 3PP	first, second, third person plural possessive
ABL	ablative (<i>+dEn</i>)
ACC	accusative (<i>+yI</i>)
ACL	acceleration suffix (<i>+yIver</i>)
ADJ*	adjective conversion, adjective
ADV*	adverb conversion, adverb
AOR	aurist (positive: <i>+Er</i> and <i>+Ir</i> ; negative: <i>+z</i>)
APP	approximation suffix (<i>+yEyaz</i>)
BE	noun to verb conversion with null suffix
CAUS	causative (<i>+dIr</i> , <i>+t</i>)
CM	compound marker (<i>+sI</i>)
COMP	comparative
COND	conditional (<i>+sE</i>)
CONT	continuence suffix (<i>+yEdur</i> , <i>+yEkoy</i> , <i>+yEkal</i>)
COP	copula (<i>+dIr</i>)
DAT	dative (<i>+yE</i>)
FUT	future (<i>+yEcEk</i>)
GEN	genitive (<i>+nIn</i>)
GER*	gerund conversion, gerund
IMP	imperative
INF	infinitive (<i>+mEk</i>)
INS	instrumental (<i>+lE</i>)
LOC	locative (<i>+dE</i>)
NAR	narrative past (<i>+mI₅</i>)
NEC	necessitative (<i>+mElI</i>)
NEG	verbal negative (<i>+mE</i>)
OPT	optative (<i>+yE</i>)
PART	participle conversion
PASS	passive (<i>+In</i> , <i>+Il</i>)
PAST	past (<i>+dI</i>)

PLU	noun plural (<i>+lEr</i>)
POT	positive potential (<i>+yEbIl</i>)
POT:NEG	negative potential (<i>+yEmE</i>)
PRG	progressive (<i>+Iyor</i>)
Q	yes/no question (<i>mI</i>)
VN	verbal noun conversion

The abbreviations marked by ‘*’ have two functions: (i) in the examples, they are used to indicate conversions to the corresponding categories, and (ii) in the outputs, they indicate the lexical categories themselves.

Chapter 1

Introduction

Natural language processing (NLP) is a research area which is becoming more and more popular each day. Its popularity does not depend only on academic reasons but also on commercial ones. The following paragraph is taken from Gazdar and Mellish [2]:

“At the time of writing, almost every computing group and linguistic group in the world is urgently starting up courses in computational linguistics and natural language processing (NLP). In our view, the initiation of these courses is not a mere transitory whim of academic fashion: a 1985 industrial report predicted that the market for NLP products in the UK and US would expand by a factor of 100 over the ensuing decade. Many people with a training in NLP will be needed to develop, produce and maintain these products.”

NLP can be defined, in rather simplistic terms, as the construction of a computing system that processes and understands natural language. Obviously, the word ‘understand’ in this definition needs further qualification. One can argue that it may be possible to build a computing system which processes natural language; however, what it does cannot be described as ‘understanding’ unless what it does is in some way logically equivalent to what humans do. In other words, the observable behavior of the system must make us assume that it is doing internally the same, or very similar, things that we do when we understand language. Though it seems to be a very difficult task to develop such a system, considerable progress has been achieved as we describe below.

Today, machine translation (MT) is, without any doubt, the most popular application of NLP research. In fact, the mechanization of translation has

been one of humanity's oldest dreams. There is a sense in which MT is now a reality. What has been achieved is the development of programs which can produce raw translations of texts in relatively well-defined subject domains. These can then be revised to give good-quality translated texts, or directly read and understood by specialists in the subject for information purposes [4]. There have been studies by Sagay [12] and Özgüven [11] on machine translation between Turkish and English.

Another growing application of NLP research is natural language front ends to databases which aim to help the user by the familiarity and flexibility of a natural language, in the task of accessing a database.

A rather new application area of NLP techniques is explanation generation for expert systems. A user may want to know how an expert system arrived at a particular advice, and there may be several bases for it. So, it would be impractical to incorporate potted scripts for each of the possible explanations. By the help of a knowledge of the syntax and semantics of the fragment of a natural language relevant to its domain, the system can synthesize explanations from scratch [2].

Another application area for NLP techniques is spelling correction. Currently, spelling correctors are word-based. It is not so unrealistic to expect syntax-based spelling correctors replace the word-based systems very soon. Although no spelling corrector has been implemented for Turkish yet, we would like to point out a word-based spelling checker for Turkish developed by Solak [15].

Syntax is the structure of language. In natural languages, it deals with the word-order, and the relationships and connections between the constituents of a sentence. We can define a language as being a set whose membership is precisely specifiable by rules. The rules defining permissible word orders are part of the grammar of the language. Syntactic analysis is the process of determining the syntactic structure of a sentence according to the grammatical rules which define the forms of all permitted (grammatical) sentences. The set of compound linguistic expressions in a natural language is not finite, i.e., natural languages are infinite. Besides, understanding the meaning of a sentence depends on an ability, which is likely to be unconscious for a native speaker of the language, to recover its structure. Hence, what we need are formal systems that define the membership of the infinite sets of linguistic expressions, and

assign a structure to each member of these sets, i.e., syntactic analyzers [2].

The reason for us attacking the problem of syntactic analysis of Turkish sentences computationally is that syntactic parsing underlies most of the applications in natural language processing. Hence, any nontrivial natural language processing application involving Turkish has to use some form of syntactic analysis. Computational analysis of syntax has been thoroughly investigated for languages like English and Japanese. As a consequence, there are many commercial systems for these languages in several areas of natural language processing. Naturally, the same has to be done for Turkish if natural language processing applications involving Turkish are to be developed. There have been comprehensive studies of Turkish syntax from a linguistic perspective (e.g., [8]). However, this is one of the first attempts for investigating it extensively from a computational point of view.

This thesis presents the development of a lexical-functional grammar specification for a subset of Turkish. The outline of the thesis is as follows:

In Chapter 2, we give an overview of lexical-functional grammar formalism where we briefly describe the formal objects of the theory and their relationships. Chapter 3 presents an overview of Turkish syntax with special emphasis on the concepts that we make use of when presenting our grammar. The lexical-functional grammar specification that we have developed for Turkish syntax is presented in Chapter 4, together with a description of our system architecture. In Chapter 5, an evaluation of the grammar is presented by testing it on a large number of sentences. Finally, in Chapter 6 we state our conclusions and make some suggestions for solving some of the problems we have encountered in the development of the grammar.

Chapter 2

Lexical-Functional Grammar

Lexical-functional grammar (LFG) is a linguistic theory which fits nicely into computational approaches that use *unification* [14]. LFG was developed by Joan Bresnan and Ron Kaplan in the late 1970s. It has been devised as a formalism for representing the native speaker's syntactic knowledge. In this chapter, we briefly describe the formal objects of the theory and the relationships among them, summarizing them from Kaplan and Bresnan [5], and from Sells [13]. The most complete description of the formal principles of the theory can be found in the work of Kaplan and Bresnan [5].

2.1 Constituent Structures and Functional Structures

A lexical-functional grammar assigns two levels of syntactic description to every sentence of a language:

Constituent Structure: Constituent structures (c-structures) are used for representing phrase structure configurations. A c-structure is a conventional phrase structure tree, which is defined in terms of syntactic categories, terminal strings, and their dominance and precedence relationships.

Functional Structure: Functional structures (f-structures) encode information about the various functional relations between parts of sentences. F-structures are composed of grammatical function names, semantic forms and feature symbols.

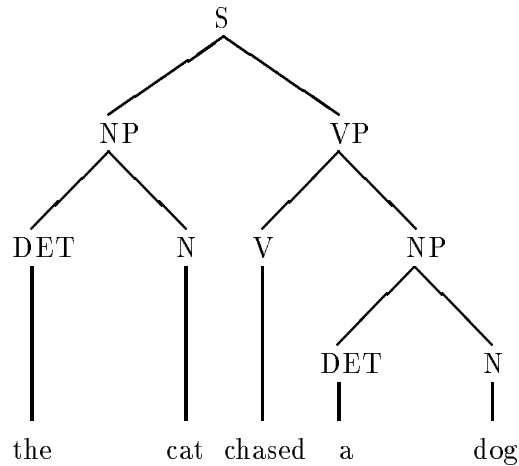


Figure 2.1. The c-structure for (2).

Given the conventional phrase structure rules (1a-c), the ordinary rewriting procedure for context-free grammars would assign the c-structure given in Figure 2.1 to the sentence (2):

- (1) a. $S \rightarrow NP VP$
 b. $NP \rightarrow DET N$
 c. $VP \rightarrow V NP$

(2) The cat chased a dog.

The f-structure for a sentence encodes its meaningful grammatical relations and provides sufficient information for the semantic component to determine the appropriate predicate-argument formulas. The f-structure represents this information as a set of ordered pairs each of which consists of an *attribute* and a specification of that attribute's *value* for this sentence. An attribute is the name of a grammatical function or feature, e.g., SUBJ (subject), OBJ (object), PRED (predicate), NUM (number), CASE (case). There are three types of values that these attributes may have:

1. **Simple (atomic) symbols:** Pairs with this kind of value represent *syntactic features*, e.g., tense, number, person, definiteness.
2. **Semantic forms:** Semantic forms, which are indicated as the value of *PRED*, govern the process of semantic interpretation.

3. Subsidiary f-structures: Subsidiary f-structures are sets of ordered pairs representing complexes of internal functions. They are used to represent *grammatical functions*, e.g., subject, object.

(3) is a plausible f-structure for (2):

(2) The cat chased a dog.

(3)

$$\left[\begin{array}{l} \text{SUBJ} \\ \text{TENSE} \\ \text{PRED} \\ \text{OBJ} \end{array} \left[\begin{array}{l} \left[\begin{array}{l} \text{SPEC} \quad \text{THE} \\ \text{NUM} \quad \text{SG} \\ \text{DEF} \quad + \\ \text{PRED} \quad \text{'CAT' } \end{array} \right] \\ \text{PAST} \\ \text{'CHASE } < (\uparrow \text{SUBJ})(\uparrow \text{OBJ}) > \text{' } \\ \left[\begin{array}{l} \text{SPEC} \quad \text{A} \\ \text{NUM} \quad \text{SG} \\ \text{DEF} \quad - \\ \text{PRED} \quad \text{'DOG' } \end{array} \right] \end{array} \right]$$

In this structure, the TENSE attribute has the simple symbol value PAST, and the subject and object functions have subsidiary f-structure values, the values of SUBJ and OBJ, respectively. Attributes SPEC (specifier), NUM (number) and DEF (definiteness) mark embedded features with symbol values. The quoted values of the PRED attributes are semantic forms. Semantic forms usually arise in the lexicon and are carried along by the syntactic component as unanalyzable atomic elements, just like simple symbols. When the f-structure is semantically interpreted, these forms are treated as patterns for composing the logical formulas encoding the meaning of the sentence.

2.2 Functional Descriptions

A string's c-structure is generated by a context-free c-structure grammar, which is augmented in order to produce a number of statements that specify various properties of the string's f-structure. The set of such statements is called the *functional description* (f-description) of the string, and it serves as an intermediary between the c-structure and the f-structure for the string.

The statements of an f-description can be used in two different ways:

1. In order to determine whether a particular f-structure is plausible for a string with respect to a given grammar, the statements of the f-description can be applied to the given f-structure to decide whether it has all the properties required by the grammar.
2. An f-structure may be synthesized for a string using a set of inferences which are supported by the statements of the f-description for that string.

The statements in an f-description and the inferences that may be drawn from them should satisfy the following condition:

Uniqueness Condition: In a given f-structure, a particular attribute may have at most one value.

This condition lets us describe an f-structure by specifying the values of the grammatical functions of which it is composed. For example, if we let f_1 and f_2 stand for the f-structures (3) and its subject, respectively, with a slightly modified version of the traditional function notation, we end up with the following equations:

- (4) a. $(f_1 \text{ SUBJ}) = f_2$
- b. $(f_2 \text{ SPEC}) = \text{THE}$
- c. $(f_2 \text{ NUM}) = \text{SG}$
- d. $(f_2 \text{ DEF}) = +$
- e. $(f_2 \text{ PRED}) = \text{'CAT'}$

The statements in an f-description come from functional specifications that are associated with particular elements on the righthand sides of c-structure rules, and with particular categories in the lexical entries. These specifications, which are called *functional schemata*, indicate how the functional information contained on a node in the c-structure participates in the f-structure. For example, the c-structure rules (5a-c) are versions of (1a-c) with schemata written underneath the rule elements that they are associated with:

- (5) a. $S \rightarrow \quad \text{NP} \quad \text{VP}$
 $(\uparrow \text{SUBJ})=\downarrow \quad \uparrow=\downarrow$

b. NP → DET N

c. VP → V NP
(↑ OBJ)=↓

The up and down arrows are called *metavariables*, and they correspond to the f-structures of the c-structure nodes. The up-arrow refers to the f-structure of the mother node and the down-arrow refers to the f-structure of the node itself. Hence, the annotations in (5a) indicate that (i) all the functional information carried by the NP (i.e., the NP's f-structure) goes into the SUBJ part of the mother's f-structure (i.e., the S's f-structure), and (ii) all the functional information carried by the VP (i.e., the VP's f-structure) is also direct information about the mother's f-structure. Similarly, the annotation in (5c) indicates that all the functional information carried by the NP goes into the OBJ part of the mother's f-structure. Note that there is no functional annotation on the DET, N and V nodes in (5b,c). This is because there is a general convention that all preterminals are associated with $\uparrow=\downarrow$ unless indicated otherwise. So, in the NP-rule both the DET and the N will be associated with $\uparrow=\downarrow$, and so will be the V in the VP-rule.

The syntactic features and semantic content of lexical items are determined by schemata in lexical entries. The entries for the vocabulary of (2) are listed in (6):

- (6) the: DET, (↑ SPEC) = THE
 (↑ DEF) = +
- cat: N, (↑ NUM) = SG
 (↑ PRED) = 'CAT'
- chased: V, (↑ TENSE) = PAST
 (↑ PRED) = 'CHASE<(↑ SUBJ) (↑ OBJ)>'
- a: DET, (↑ SPEC) = A
 (↑ NUM) = SG
 (↑ DEF) = -

dog: N, (↑ NUM) = SG
 (↑ PRED) = ‘DOG’

A lexical entry in LFG includes a categorial specification indicating the preterminal category under which the lexical item may be inserted, and a set of schemata to be instantiated. For example, in (6) the entry for *dog* indicates that *dog* is a noun (N), its number (NUM) feature has the value singular (SG), and its predicate (PRED) feature has the value ‘DOG’.

If a rule is applied to generate a c-structure node, or a lexical item is inserted under a preterminal category, the associated schemata are *instantiated* by replacing the metavariables with actual variables (f_1, f_2, \dots). Which actual variables are used depends on which metavariables are in the schemata and what the node’s relationship is to other nodes in the tree. Schemata originating in the lexicon and those coming from c-structure rules are treated uniformly by the instantiation procedure.

The f-description statements for (2) are illustrated in (7):

- (7) a. $(f_1 \text{ SUBJ}) = f_2$
 b. $f_1 = f_3$
 c. $(f_3 \text{ OBJ}) = f_4$
 d. $(f_2 \text{ SPEC}) = \text{THE}$ from *the*
 e. $(f_2 \text{ DEF}) = +$
 f. $(f_2 \text{ NUM}) = \text{SG}$ from *cat*
 g. $(f_2 \text{ PRED}) = \text{‘CAT’}$
 h. $(f_3 \text{ TENSE}) = \text{PAST}$ from *chased*
 i. $(f_3 \text{ PRED}) = \text{‘CHASE} < (\uparrow \text{SUBJ}) (\uparrow \text{OBJ}) > \text{’}$
 j. $(f_4 \text{ SPEC}) = \text{A}$ from *a*
 k. $(f_4 \text{ NUM}) = \text{SG}$
 l. $(f_4 \text{ DEF}) = -$

- m. (f_4 NUM) = SG from *dog*
 n. (f_4 PRED) = ‘DOG’

We won’t be concerned with the details of the instantiation procedure, which is used to produce the f-description statements from the c-structure rules and the lexical entries, and with the details of the synthesis algorithm, which is used to construct the f-structure from the f-description statements. (See Kaplan and Bresnan [5] for details.)

2.3 Well-formedness Conditions on F-Structures

Before stating the well-formedness conditions on f-structures, we discuss the notions of *subcategorization* and *governable grammatical functions*.

Subcategorization is a very important piece of information that some lexical items carry. Some categories (e.g., nouns, verbs) are divided into *subcategories*. Subcategories are grammatically significant subdivisions of categories. The simplest illustration of this is the difference between a transitive and an intransitive verb; a transitive verb must have an object in order to be grammatical, and an intransitive verb cannot have such an object. We say that the transitive verb *subcategorizes* for an object. For any given language, some function G is a member of the set of governable grammatical functions if and only if there is at least one semantic form that subcategorizes for it, i.e., G appears within the PRED value of some lexical form [13]. A given lexical entry mentions only a few of the governable functions, and that entry is said to *govern* the ones it mentions.

There are three well-formedness conditions on f-structures:

Uniqueness Condition: In a given f-structure, a particular attribute may have at most one value¹.

Completeness Condition: An f-structure is *locally complete* if and only if it contains all the governable grammatical functions that its predicate governs. An f-structure is *complete* if and only if it and all its subsidiary f-structures are locally complete.

¹Recall that this condition was stated also in Section 2.2.

Coherence Condition: An f-structure is *locally coherent* if and only if all the governable grammatical functions that it contains are governed by a local predicate. An f-structure is *coherent* if and only if it and all its subsidiary f-structures are locally coherent.

A string is grammatical only if its f-structure satisfies the uniqueness, completeness and coherence conditions. Let us make these conditions more clear by the use of examples. Consider the string (8), which is ungrammatical because the numbers of the final determiner and noun disagree:

(8) *The cat chased a dogs.

The only f-description difference between this and our previous example (2) is that the lexical entry for *dogs* produces the equation (9) instead of (7m):

(9) $(f_4 \text{ NUM}) = \text{PL}$

A conflict between the lexical specifications for *a* and *dogs* arises because their schemata are attached to daughters of the same NP node. Some of the properties of that node's f-structure are specified by the determiner's lexical schemata and some by the noun's. According to the Uniqueness Condition, all properties attributed to it must be compatible if that f-structure is to exist. Since SG and PL are incompatible with each other no f-structure can be assigned to that node.

(10a) is another ungrammatical string. The unacceptability of this string follows from the fact that the lexical entry for *chased* governs the grammatical function OBJ which does not appear in its f-structure (10b). Hence, the Completeness Condition does not hold:

(10) a. The cat chased.

b.

$$\left[\begin{array}{l} \text{SUBJ} \left[\begin{array}{l} \text{SPEC THE} \\ \text{NUM SG} \\ \text{DEF +} \\ \text{PRED 'CAT'} \end{array} \right] \\ \text{TENSE PAST} \\ \text{PRED 'CHASE < (\uparrow \text{SUBJ})(\uparrow \text{OBJ}) >'} \end{array} \right]$$

Also, (11a) is ungrammatical because the governable function OBJ2 appears in its f-structure (11b) but is not governed by the verb *chased*. So, the Coherence Condition is violated:

(11) a. *The cat chased a dog a bone.

b.

SUBJ	<table style="border-collapse: collapse;"> <tr><td style="padding-right: 10px;">SPEC</td><td>THE</td></tr> <tr><td>NUM</td><td>SG</td></tr> <tr><td>DEF</td><td>+</td></tr> <tr><td>PRED</td><td>'CAT'</td></tr> </table>	SPEC	THE	NUM	SG	DEF	+	PRED	'CAT'
SPEC	THE								
NUM	SG								
DEF	+								
PRED	'CAT'								
TENSE	PAST								
PRED	'CHASE < (↑ SUBJ)(↑ OBJ) >'								
OBJ	<table style="border-collapse: collapse;"> <tr><td style="padding-right: 10px;">SPEC</td><td>A</td></tr> <tr><td>NUM</td><td>SG</td></tr> <tr><td>DEF</td><td>–</td></tr> <tr><td>PRED</td><td>'DOG'</td></tr> </table>	SPEC	A	NUM	SG	DEF	–	PRED	'DOG'
SPEC	A								
NUM	SG								
DEF	–								
PRED	'DOG'								
OBJ2	<table style="border-collapse: collapse;"> <tr><td style="padding-right: 10px;">SPEC</td><td>A</td></tr> <tr><td>NUM</td><td>SG</td></tr> <tr><td>DEF</td><td>–</td></tr> <tr><td>PRED</td><td>'BONE'</td></tr> </table>	SPEC	A	NUM	SG	DEF	–	PRED	'BONE'
SPEC	A								
NUM	SG								
DEF	–								
PRED	'BONE'								

Chapter 3

Turkish Syntax

The subject of syntax, the most basic component of a grammar, consists of the relations among words that are used together in expressions. Syntax investigates the grammatical functions of words in a phrase, and phrases in a sentence. Formation of sentences, their structural properties and constituents, classification of sentences, structural properties and functions of phrases and dependent clauses all constitute the subject of syntax.

In this chapter, we present an overview of Turkish syntax with special emphasis on the concepts that we will refer when we describe our grammar in Section 4.2. We first present the distinctive characteristics of Turkish syntax, which is followed by a discussion of the structural characteristics of Turkish sentences. Then we begin investigating constituents of Turkish sentences one by one. We continue by describing the compound nouns in Turkish, their types and structural properties. We end the chapter with a discussion of the classification of Turkish sentences according to their structures.

3.1 Distinctive Characteristics of Turkish Syntax

We present the four distinctive characteristics of Turkish syntax below:

(1) The most prominent characteristic of Turkish expressions is that their constituents are generally ordered beginning from the secondary ones to the primary, i.e., the qualifiers precede the qualified (head). Hence, the adjective,

participle or qualifying noun precedes the noun; the adverb, object or complement precedes the verb; the modifying phrase or adverb precedes the adjective [16, 7]. Some examples are:

- (1) a. yeşil kitap ‘the green book’
 green book
- b. gülen yüz ‘the smiling face’
 smile+PART face
- c. kitabın kapağı ‘the cover of the book’
 book+GEN cover+CM
- d. Hızlı koşma! ‘Don’t run fast!’¹
 fast run+NEG+IMP+2SG
- e. Annemi seviyorum. ‘I love my mother.’
 mother+1SP+ACC love+PRG+1SG
- f. Okulda kal. ‘Stay at the school.’
 school+LOC stay+IMP+2SG
- g. senden yaşlı kadınlar ‘women older than you are’
 you+ABL old woman+PLU
- h. çok eski evler ‘very old houses’
 very old house+PLU

This is the most fundamental characteristic of Turkish syntax that distinguishes it from many other languages.

(2) In Turkish syntax, expressions that lack a number of constituents are especially important. Sentences with covert subjects, and compound nouns with covert modifiers are the most common ones of such constructs. This property lets us have one word constructs such as:

- (2) a. (benim) kitabım ‘my book’
 (my) book+1SP
- b. (Ben) Okudum. ‘I read.’
 (I) read+PAST+1SG.

Note that (2b) is a sentence with a single overt constituent, the verb.

¹Note that *hızlı koşma* also means *fast running*. Some of the examples we give may have ambiguous interpretations. We won’t, however, point out each of these interpretations.

(3) In Turkish syntax, most of the relations between words, such as those that are provided by some auxiliary words in English are accomplished using suffixes. For example, in English, certain cases (e.g., dative, locative and ablative) of noun phrases are formed using prepositions. Hence, prepositions are responsible for the binding of complements and objects (except for the accusative case-marked ones) to the verb, and the formation of a variety of phrases. On the other hand, in Turkish, the construction of most of the phrases, and all of the case information of noun phrases are provided using suffixes:

- | | | | |
|--------|------------|--------------|----------------------------------|
| (3) a. | kağıttan | ev | ‘house made of paper’ |
| | paper+ABL | house | |
| b. | evin | çatısı | ‘the roof of the house’ |
| | house+GEN | roof+3SP | |
| c. | Okula | gidiyoruz. | ‘We are going to the school.’ |
| | school+DAT | go+PRG+1PL | |
| d. | Okuldan | geliyoruz. | ‘We are coming from the school.’ |
| | school+ABL | come+PRG+1PL | |

(4) As stated above in item (3), the functions of some English prepositions (e.g., *of*, *to*, *from*) are performed in Turkish by the case-suffixes. Those of the rest (e.g., *for*, *against*, *before*) are performed by postpositions, which follow the word they govern. This is a consequence of the fact that secondary constituents come before primary ones as we stated in item (1). A postposition is the head of a postpositional phrase in Turkish just as a preposition is the head of a prepositional phrase in English:

- | | | | |
|--------|----------------|---------|---------------------|
| (4) a. | benim | için | ‘for me’ |
| | my | for | |
| b. | babama | karşı | ‘against my father’ |
| | father+1SP+DAT | against | |
| c. | geceyarısından | önce | ‘before midnight’ |
| | midnight+ABL | before | |

3.2 Structural Characteristics of Turkish Sentences

Structural characteristics of expressions play an important role in classifying languages. In the following sections, we summarize structural characteristics of Turkish sentences [16].

3.2.1 Order of Constituents in Turkish Sentences

Typical Order of Constituents

Every language has its own syntax which basically depends on the order of constituents in a syntactic category, i.e., word-order. In Turkish syntax, the cardinal rule is that the modifier precedes the modified (see page 13). The typical order of the constituents in a sentence is: (a) subject, (b) expression of time, (c) expression of place, (d) indirect object, (e) direct object, (f) modifier of the verb, (g) verb [7]. If any of these constituents is modified, the modifier precedes it. A definite constituent precedes an indefinite one. For example, if the indirect object is indefinite and the direct object is definite, (d) and (e) will change places:

- (5) a. Çocuğa kitabı verdim.
 child+DAT book+ACC give+PAST+1SG
 ‘I gave the child the book.’
- b. Kitabı bir çocuğa verdim.
 book+ACC a child+DAT give+PAST+1SG
 ‘I gave the book to a child.’

More generally, any indefinite constituent moves towards the verb:

- (6) a. Adam dün okula geldi
 man yesterday school+DAT come+PAST+3SG
 ‘The man came to the school yesterday’
- b. Dün okula bir adam geldi
 yesterday school+DAT a man come+PAST+3SG
 ‘A man came to the school yesterday.’

Modifier of the verb in position (f) may be:

1. an oblique object in the dative or ablative cases as *okula* in (6),
2. a noun complement in the locative case as *okulda* in (1f), or
3. an adverbial complement as *çok hızlı* (*very fast*) in (7):

(7) Arabasını çok hızlı sürüyor
 car+3SP+ACC very fast drive+PRG+3SG
 ‘He is driving very fast.’

The following is an example of the typical word-order:

(8) Mehmet dün evde bize şiirlerini
 Mehmet yesterday home+LOC we+DAT poem+PLU+3SP+ACC
 (a) (b) (c) (d) (e)
 ilk olarak okudu.
 for the first time read+PAST+3SG
 (f) (g)
 ‘Mehmet read his poems to us for the first time at home yesterday.’

Changes in Typical Word-Order

The typical order of constituents in a sentence may change due to a number of reasons. We can classify these reasons mainly in four categories:

1. An indefinite constituent moves towards the verb as exemplified in (5) and (6).
2. A constituent that is to be emphasized, for any reason, is generally placed immediately before the verb. This affects the places of all the constituents in a sentence except that of the verb. For example, if we want to emphasize the subject of (8), *Mehmet*, then we move it towards the verb, *okudu*:

(9) Dün evde bize şiirlerini Mehmet ilk olarak okudu.

‘It was Mehmet who read us his (Mehmet’s) poems for the first time at home yesterday.’

The primary constituent of a sentence is its verb. Hence, it is not unexpected that a constituent that is placed just in front of it gets more importance

and is emphasized. This, of course, relates also to the habits of the native speaker. Since the native speaker is accustomed to use every constituent in its own place, any change in the place of a constituent draws the attention to it and causes it to be emphasized [16].

3. As we stated before, in the typical order of constituents in a sentence, expression of time appears in the second position. It is somewhat peculiar that an expression of time, when it is to be emphasized, is placed at the beginning of a sentence whereas any other constituent is placed before the verb. In (10), for example, expression of time, *dün*, is emphasized:

(10) Dün Mehmet evde bize şiirlerini ilk olarak okudu.

‘Yesterday at home Mehmet read his poems to us for the first time.’

4. In daily conversations, it would not be realistic to expect the syntactic rules be always obeyed. That is because such conversations are typically directed by the natural flowing of emotions and thoughts. This frequently causes the verb of a sentence to move away from its typical place, i.e., the end of the sentence. Such sentences are called *inverted sentences*. That is, in an inverted sentence the verb may appear anywhere but the end as opposed to regular sentences in which the verb is always placed at the end. The reason behind using an inverted sentence is generally to emphasize the verb:

(11) a. Gelme buraya! ‘Don’t come here!’

come+NEG+IMP+2SG here+DAT

b. Üç beş kişiyiz böyle söyleyen, biliyoruz

we are a handful of people who talk like this we know

çoğunluğa bunu anlatamayacağımızı.²

that we could not make the majority understand it

‘We are a handful of people who talk like this; we know

that we could not make the majority understand it.’

Such sentences have been used in daily conversations and poetry for many years. Today they are also frequently used in prose especially in stories and novels in which conversations take place.

²This example is taken from Lewis [7].

3.2.2 Expressing Judgements Concisely

Another structural characteristic of Turkish sentences is the ability of expressing judgements concisely. This characteristic basically depends on four different concepts as will be discussed in the next four sections:

Formation of Expressions with Several Judgements

Languages vary in the way expressions with several judgements are formed. In Turkish, dependent judgements are generally constructed using verbal nouns, participles or gerunds, which have two basic functions:

1. They can be used as nouns, adjectives or adverbs.
2. They are non-finite verbs which can govern subjects, several objects and complements to form dependent clauses – which can then be used as noun, adjectival or adverbial phrases.

Hence, besides expressing dependent judgements, they can also take part in several phrases such as compound nouns or other dependent clauses. This leads to complex structures with concise and dense expressions:

- (12) Burada içilebilecek su bulamayacağımı zannetmek doğru olmazdı.
 ‘It wouldn’t have been right for me to think that I would’t be able to find drinkable water here.’

The subject of (12) *burada içilebilecek su bulamayacağımı zannetmek* (to think that I would’t be able to find drinkable water here) is a nominal dependent clause of which definite object *burada içilebilecek su bulamayacağımı* (that I would’t be able to find drinkable water here) is an adjectival dependent clause which acts as a nominal one. Its indefinite object *içilebilecek su* (drinkable water) is a compound noun of which modifier part is another adjectival dependent clause *içilebilecek* (drinkable), and modified part is a noun *su* (water).

Expressions That Lack Constituents

In Turkish, expressions that lack constituents are frequently used. There are mainly three types of such expressions:

1. Sentences with covert subjects: Since in a Turkish sentence the finite verb has a suffix that uniquely determines the agreement of the subject, in many circumstances we do not need to specify the subject explicitly. We call such a subject, which does not appear explicitly but can be determined by the person suffix at the end of the verb, an *implicit subject*:

- (13) a. Yarın Ankara'ya gideceğim.
 tomorrow Ankara+DAT go+FUT+1SG
 ‘I will go to Ankara tomorrow.’
- b. Senin buradaki kurallara
 your here+LOC+REL regulation+PLU+DAT
 uymanı bekliyoruz.
 obey+PART+ACC expect+PRG+1PL
 ‘We expect you to obey the regulations here.’

2. Nominal verbs without copula: In writing and formal speech, the copula is expressed by *+dIr*:

- (14) a. Çocuk hastadır. ‘The child is sick.’
 child sick+COP
- b. Sonuç iyi değildir. ‘The result is not good.’
 result good not+COP

In informal speech *+dIr* is frequently omitted, and use of it usually implies more than a simple predicate. *+dIr* is generally used as a copula in speech as well as in writing in the following four cases [7]:

1. When the predicate is a noun phrase where the omission of *+dIr* might lead to misunderstanding:

- (15) a. En çok özlediklerim yurdumun insanlarıdır.
 ‘Those that I miss the most are the people of my country.’

b. En çok özlediklerim, yurdumun insanları...

‘The people of my country, those that I miss the most...’

2. When the subject is a pronoun understood from the context as in (16a). One can as well use the third-person pronoun, *o*, instead of using *+dIr*, as in (16b) or in (16c):

(16) a. İyi bir insandır. ‘He is a good person.’

b. O, iyi bir insan. ‘He is a good person.’

c. İyi bir insan o. ‘He is a good person.’

3. When the subject is a noun phrase which follows the predicate:

(17) İyi bir insandır, sizin komşunuz.

he is a good person your neighbor

‘He is a good person, your neighbor.’

4. When two independent clauses are connected by the conjunction *ki*:

(18) Bana söylediğin yalanlardan dolayıdır ki

It is because of the lies that you have told me

sana güvenmiyorum.

I don’t trust you

‘It is because of the lies that you have told me that I don’t trust you.’

In other cases the use of *+dIr* in informal speech is either for emphasis, or - more generally - to indicate a supposition or certainty:

(19) a. Çocuk hastadır. ‘The child is sick.’ (in writing)

‘The child is surely sick.’,

‘The child must be sick.’, or

‘The child *is* sick.’ (in informal speech)

b. Çocuk hasta ‘The child is sick.’ (in informal speech)

The tendency is that *+dIr* is more and more frequently omitted also in writing when it expresses the copula.

3. Compound nouns with covert modifiers: The possessive suffixes decline nouns according to person. Hence, if the modifier of a noun is a personal pronoun in the genitive case, we can safely omit it in many cases:

- (20) a. (benim) kitabım ‘my book’
 (my) book+1SP
 b. (sizin) eviniz ‘your house’
 (your) house+2PP
 c. (onun) saati ‘his watch’
 (his) watch+3SP

However, we sometimes need to use the genitive of the third person pronouns explicitly in order to resolve ambiguities which might arise from the various possible senses of, for example *çocukları*:

- (21) a. onun çocukları ‘his children’
 his child+PLU+3SP
 b. onların çocukları ‘their child’
 their child+3PP
 c. onların çocukları ‘their children’
 their child+PLU+3PP
 d. çocukları ‘the children’
 child+PLU+ACC

Note that (21b) and (21c) are still ambiguous.

Reciprocal Verbs

A reciprocal verb shows that an action is done by more than one subject, one with another or one to another. For example, in (22) *bakışmak* (*to look at each other*) is the reciprocal form of the verb *bakmak* (*to look*) produced by the addition of the suffix *+Iş* to the root *bak-* (*look*):

- (22) a. Koray Onur’a baktı ve (aynı anda) Onur Koray’a baktı.
 ‘Koray looked at Onur and (contemporaneously) Onur looked at Koray.’
 b. Koray ve Onur birbirlerine baktılar.
 ‘Koray and Onur looked at each other.’
 c. Koray ve Onur baktılar.
 ‘Koray and Onur looked at each other.’

All three sentences in (22) have the same meaning and, as one can easily recognize, in (22c) the number of words used is the least.

Pronomial Suffix

The pronomial suffix *+ki* is another way of expressing judgements concisely. Added to the genitive case of a noun or pronoun, it makes a possessive pronoun, and causes the modified noun of a compound noun to be omitted:

- (23) a. öğrencinin kitabı – öğrencininki
 student+GEN book+3SP student+GEN+REL
 ‘the student’s book’ ‘the student’s’
- b. benim saatim – benimki
 my watch+1SP my+REL
 ‘my watch’ ‘mine’

Added to an expression of time or place which may be an adverb or a noun in the locative case, *+ki* makes a pronoun or adjective:

- (24) a. bugün – bugünkü randevu – bugünkü
 today today+REL appointment today+REL
 ‘today’ ‘the appointment today’ ‘the one today’
- b. bahçede – bahçedeki çiçekler –
 garden+LOC garden+LOC+REL flower+PLU
 ‘in the garden’ ‘the flowers in the garden’
 bahçedekiler
 garden+LOC+REL+PLU
 ‘those in the garden’

3.3 Constituents of Turkish Sentences

3.3.1 Overview

A sentence is formed by a number of parts with different functions, which come together and function in integrity, i.e., the constituents of the sentence.

The number and type of constituents that take part in a sentence depends on the judgement to be expressed by that sentence. In the simplest case, a sentence consists of two primary constituents, the verb and the subject:

- | | | |
|------|---------------------|------------------------|
| (25) | a. Güneş batıyor. | ‘The sun is setting.’ |
| | b. Savaş sona erdi. | ‘The war is over.’ |
| | c. Hava güzel. | ‘The weather is fine.’ |

If the judgement is to be expressed in a complex structure with its several aspects, then the sentence contains, besides the primary ones, a number of secondary constituents such as objects and complements. In the following sections, we briefly mention these constituents beginning with the primary ones.

3.3.2 Verb

In Turkish, the verb is the primary constituent of a sentence. It is subject to inflection regardless of its origin and type. We won't be concerned with the inflection process here. Rather, we will concern ourselves with argument structures of verbs, and with phrases that can be used as a verb phrase in a sentence.

Argument Structures of Verbs

Here, we are concerned with only the objects that verbs subcategorize for. Since any verb root subcategorizes for a subject, we do not specify it explicitly for each verb. Turkish verbs are classified in two categories depending on whether they subcategorize for direct objects:

1. Transitive verbs: Transitive verbs are those that take direct objects. Direct objects are generally case-marked accusative or are unmarked (i.e., nominative). Actually, accusative and nominative objects are replacable in this respect, that is, a verb that takes an accusative case-marked direct object can also take a nominative one as in (26). The function of accusative case-marking is to indicate that the object refers a particular definite entity:

- (26) a. Kitabı okuyorum. 'I am reading the book.'
 book+ACC read+PRG+1SG
 b. Kitap okuyorum. 'I am reading a book.'
 book+NOM read+PRG+1SG

Some verbs take dative, ablative or, very rarely, locative case-marked direct objects. They are called *oblique transitive verbs*. For example, *tap-* (*worship*), *şüphelen-* (*doubt, suspect*) and *ısrarlı ol-* (*be insistent*) are oblique transitive verbs which take dative, ablative and locative marked direct objects, respectively:

- (27) a. Bu insanlar sana tapıyorlar.
 these people you+DAT worship+PRG+3PL
 'These people worship you.'
 b. Herkes adamdan şüphelendi.
 everyone man+ABL suspect+PAST+3SG
 'Everyone suspected the man.'
 c. Bu konuda ısrarlıyım.
 this subject+LOC be insistent+1SG
 'I am insistent on this subject.'

There are some verbs, such as *konuş-* (*talk*), of which direct object can be nominative, accusative or ablative. Hence, (a), (b) and (c) of (28) are all grammatical.

- (28) a. Birşey konuşmalıyız.
 something+NOM talk+NEC+1PL
 'We have to talk about something.'
 b. Bu konuyu konuşmalıyız.

this subject+ACC talk+NEC+1PL

‘We have to talk about this subject.’

c. Bu konudan konuşmayalım.

this subject+ABL talk+NEG+OPT+1PL

‘Let’s not talk about this subject.’

Some verbs can also take a second object, which we call an *indirect object*, in addition to the direct object. Such verbs are called *ditransitive verbs*. Indirect objects are marked dative, ablative or, very rarely, locative. For example, *ver-* (*give*) and *sat-* (*sell*) take dative indirect objects, *al-* (*take*) takes an ablative indirect object, and *hak ver-* (*agree with*) takes a locative indirect object:

(29) a. Kitabı çocuğa verdim. ‘I gave the book to the child.’

book+ACC child+DAT give+PAST+1SG

b. Kitabı çocuğa sattım. ‘I sold the book to the child.’

book+ACC child+DAT sell+PAST+1SG

c. Kitabı çocuktan aldım.

book+ACC child+ABL take+PAST+1SG

‘I took the book from the child.’

d. Sana bu konuda hak veriyorum.

you+DAT this subject+LOC agree with+PRG+1SG

‘I agree with you on this subject.’

2. Intransitive verbs: Intransitive verbs do not subcategorize for a direct object:

(30) Bugün çok üşüyorum. ‘Today I feel very cold.’

today very feel-cold+PRG+1SG

Verbs that express a motion can optionally take oblique objects. Oblique objects are marked either dative (goal) or ablative (source):

(31) a. Karşı kıyıya yüzelim.

opposite shore+DAT swim+OPT+1PL

‘Let’s swim to the opposite shore.’

- b. Her sabah annesi küçük kızı
 every morning mother+3SP little girl+ACC
 evden okula götürüyordu.
 home+ABL school+DAT take+PRG+PAST
 ‘Every morning her mother used to take the little girl from home to school.’

Note that *yüz-* (*swim*) is intransitive, and *götür-* (*take with*) is transitive.

There are two operations which change the valence of a verb:

1. Passivization: When an active sentence containing an accusative case-marked direct object is passivized, (i) the noun phrase which corresponds to the direct object of the active functions as subject, (ii) the noun phrase which corresponds to the subject of the active, functions as a non-subject (most frequently appearing as the object of the postposition *tarafından* (*by*)), and (iii) the verb is suffixed by a passive morpheme [6]. That is, the accusative case-marked direct object of a transitive verb advances to become the subject of the corresponding passive verb:

- (32) a. Küçük kız oyuncasını buldu.
 little girl toy+3SP+ACC find+PAST
 ‘The little girl found her toy.’
 b. Oyuncayı bulundu.
 toy+3SP find+PASS+PAST+3SG
 ‘Her toy was found.’

Dative and ablative case-marked direct objects do not undergo such a conversion:

- (33) a. Annesi küçük kıza kızdı.
 mother+3SP little girl+DAT get angry+PAST+3SG
 ‘Her mother got angry with the little girl.’
- Küçük kıza annesi tarafından
 little girl+DAT mother+3SP by

kızıldı.

get angry+PASS+PAST+3SG

‘The little girl was scolded by her mother.’

b. Herkes adamdan şüphelendi.

everyone man+ABL suspect+PAST+3SG

‘Everyone suspected the man.’

Adamdan şüphelenildi.

adam+ABL suspect+PASS+PAST+3SG

‘The man was suspected.’

2. Causativization: Causative formation is an operation that increases the valence of a verb by one: causativizing an intransitive verb creates a transitive verb, causativizing a transitive verb creates a ditransitive one [6]:

(34) a. Küçük kız ağladı. ‘The little girl cried.’
 little girl cry+PAST+3SG

Annesi küçük kızını ağlattı.

mother+3SP little girl+ACC cry+CAUS+PAST+3SG

‘Her mother made the little girl cry.’

b. Herkes adama inandı.

everyone man+DAT believe+PAST+3SG

‘Everyone believed in the man.’

Çocuk herkesi adama inandırdı.

child everyone+ACC man+DAT believe+CAUS+PAST+3SG

‘The child made everyone believe in the man.’

c. Kitabı aldım. ‘I took the book.’

book+ACC take+PAST+1SG

Kitabı çocuğa aldırđım.

book+ACC child+DAT take+CAUS+PAST+1SG

‘I made the child take the book.’

d. Uçurtma uçtu. ‘The kite fled.’
kite fly+PAST+3SG

Çocuk uçurtmayı uçurdu.
child kite+ACC fly+CAUS+PAST+3SG
‘The child fled the kite.’

Ben çocuğa uçurtmayı uçurttum.
I child+DAT kite+ACC fly+CAUS+CAUS+PAST+1SG
‘I made the child fly the kite.’

Types of Verb Phrases

Verb phrases are classified as either nominal or verbal, the former being those that correspond to ‘to be’ not formed from the stem *ol-* (*be, become*); the latter, those formed from *ol-* or any other normal stem [7].

Below we investigate types of phrases, with either nominal or verbal origin, that can be used as a verb phrase in a sentence:

Phrases with verbal origin are structurally classified as simple, derived or compound [16]:

- **Simple verbs** are mostly unisyllabic roots such as *al-* (*take*), *bil-* (*know*), *dök-* (*pour*), *ol-* (*be, become*) and *it-* (*push*). There are also some polysyllabic roots like *ara-* (*look for*), *acı-* (*hurt, pity*), *kavra-* (*seize, comprehend*) and *oku-* (*read*).
- **Derived verbs** are those that are derived from nominal or verbal roots using suffixes, e.g., *azal-* (*decrease*) from *az* (*little, few*), *oyna-* (*play*) from *oyun* (*game, play*), *susa-* (*get thirsty*) from *su* (*water*) and *acık-* (*get hungry*) from *aç* (*hungry*).
- **Compound verbs** are formed by a combination of two or more words. Some compound verbs are named according to the concepts they express, e.g., verbs of potentiality/possibility or falsity, whereas others are named according to their constituents, e.g., compound verbs that are formed by auxiliary verbs, compound verbs that are semantically coalesced:

– **Compound verbs that express potentiality/possibility:**

When the potentiality/possibility suffix *+yEbil* is affixed to a verb, the verb expresses a physical or mental ability or capability, or permission or possibility. For example, in (35a) it expresses physical capability, and in (35b) possibility:

- (35) a. Bu ufacık çocuk o kocaman çantayı
 this tiny child that huge luggage+ACC
 taşıyabilir mi?
 carry+POT Q+3SG
 ‘Can this tiny child carry that huge luggage?’
- b. Bugün yağmur yağabilir.
 today rain rain+POT+3SG
 ‘It may rain today.’

– **Compound verbs that express acceleration/quickness:**

When the acceleration suffix *+yIver* is affixed to a verb, it expresses acceleration or quickness in an action, or a request:

- (36) a. İki dakika içinde bütün işlerini
 two minute within all duty+PLU+3SP+ACC
 bitiriverdi.
 complete+ACL+PAST+3SG
 ‘He completed all his duties within two minutes.’
- b. Kapıyı açiver. ‘Please open the door.’
 door+ACC open+ACL+IMP+2SG

– **Compound verbs that express continuence:**

To express continuence in an action the continuence suffixes *+yEdur*, *+yEkoy*, or *+yEkal* are used. Continuence can also be expressed with finite verbs followed explicitly by the roots *dur-* (*keep*), *koy-* (*keep*) and *kal-* (*keep*):

- (37) a. Küçük kız annesinin arkasından
 little girl mother+3SP+GEN behind
 bakakaldı.
 look+CONT+3SG
 ‘The little girl kept on looking behind her mother.’
- b. Kadın bu korkunç manzara karşısında

woman this terrifying sight facing
 dondu kaldı.
 be petrified+PAST+3SG keep+PAST+3SG
 ‘The woman was petrified by this terrifying sight.’

– **Compound verbs that express approximation:**

The approximation suffix *+yEyaz* indicates approximation to a state or situation without the state or situation really occurring:

(38) Ateşin içine düşeyazdım.
 fire+GEN into fall+APP+PAST+3SG
 ‘I almost fell into the fire.’

– **Compound verbs that express necessity:**

A participle formed by one of the suffixes *+yEsI*, *+yEcEk* followed by a possessive suffix, or an infinitive, and the root *gel-* (*come*) together form a compound verb which expresses necessity:

(39) a. Aklımdan geçenleri
 mind+1SP+ABL cross+PART+PLU+ACC
 söyleyesim geliyor.
 tell+PART+1SP come+PRG+3SG
 ‘I want to tell the things that cross my mind.’
 b. Bu konuda ona hak vereceğim
 this matter+LOC him agree with+PART+1SP
 geldi.
 come+PAST+3SG
 ‘I would almost agree with him on this matter.’
 c. İçimden küçük kızını kucaklamak
 heart+1SP+ABL little girl+ACC embrace+INF
 geldi.
 come+PAST+3SG
 ‘I felt like embracing the little girl.’

– **Compound verbs that express unexpectedness:**

A participle formed by the suffix *+yEcEk* followed by a possessive suffix and the root *tut-* (*hold*) together form a compound verb which expresses unexpectedness:

(40) Bu saatte uyuyacağı tutmuş.

this time+LOC sleep+PART+3SP hold+NAR+3SG

‘He happened to be asleep at that time.’

– **Compound verbs that express falsity:**

When a participle formed by one of the suffixes *+Er*, *+Ir*, *+z*, *+mİş* is followed by the root *görün-* (*seem*), or a verbal noun formed by one of the suffixes *+mEzllk*, *+mEmEzllk* is followed by the ablative case suffix and the root *gel-* (*come*), or followed by the dative case suffix *+{y}{a}* and the root *vur-* (*hit*), they together form a compound verb which expresses falsity:

(41) a. Küçük kız öğretmeni can kulağıyla
 little girl teacher+ACC soul ear+3SP+INS
 dinler göründü.
 listen+PART seem+PAST+3SG
 ‘The little girl pretended to listen to the teacher with great interest.’

b. Küçük kız öğretmeni duymazlıktan
 little girl teacher+ACC hear+VN+ABL
 geldi.
 come+PAST+3SG
 ‘The little girl pretended not to hear the teacher.’

– **Compound verbs that express intention:**

When a participle formed by the suffix *+yEcEk* is followed by the root *ol-* (*be*, *become*) they form a compound verb which expresses intention:

(42) Ne kadar karşı çıkacak olsam
 how much oppose+PART be+COND+1SG
 sözümü dinletemem.
 word+1SP+ACC hear+CAUS+POT:NEG+1SG
 ‘No matter how much I argue I can’t make them listen to what I say.’

– **Compound verbs that are formed by auxiliary verbs:**

Some auxiliary verbs like *et-* (*do*, *make*) and *ol-* (*be*, *become*) form compound verbs with a preceding nominal word:

(43) a. Neden pişman oldun?
 why sorry be+PAST+2SG

question suffix	mI	
tense suffixes	+dI	
	+mİş	
	+sE	
person suffixes	+m	+yIm
	+n	+sIn
	+Φ	(+dIr)
	+k	+yIz
	+nIz	+sInIz
	+lEr	+(dIr)lEr

Figure 3.1. The suffixes that are affixed to nominal verbs

‘Why did you feel sorry?’

b. Bana yardım etmelisin!

I+DAT help do+NEC+2SG

‘You have to help me!’

– **Compound verbs that are semantically coalesced:**

There are some idiomatic expressions which are syntactically compound verbs, e.g., *içi içine sığmamak* (to be unable to contain oneself), *içine kurt düşmek* (to feel suspicious), *içini dökmek* (to open one’s heart), *etekleri tutuşmak* (to be extremely alarmed), *etekleri zil çalmak* (to walk on air).

Phrases with nominal origin can be derived from nominal words and phrases, e.g., nouns, adjectives, pronouns, adverbs, noun phrases, adjectival phrases, and nominal, adjectival and adverbial dependent clauses [16]. The ones that are most frequently used are nouns, adjectives and noun phrases; others are rarely used. Some suffixes, which play the role of the verb ‘to be’ in English, are affixed to these nominal words and phrases, as shown in Figure 3.1, *person suffix* being the only obligatory one. The third person suffix *-dIr* is placed in parenthesis to remind that it can be omitted in many instances (see Section 3.2.2, page 20).

var (existent) and *yok* (non-existent) are special words which form nominal verb phrases:

- (44) a. Yapacak çok işim vardı.
do+PART many work+1SP existent+PAST+3SG
‘I had many things to do.’
b. Hiç zamanı yok.
no time+3SP non-existent+BE+3SG
‘He has no time.’

değil (*not*) is another special word which is used in negating nominal verb phrases:

- (45) a. Hastayım. ‘I am ill.’
ill+BE+1SG
Hasta değilim. ‘I am not ill.’
ill not+BE+1SG
b. Sen gerçeklerin farkındasın.
you fact+PLU+GEN aware+BE+2SG
‘You are aware of the facts.’
Sen gerçeklerin farkında değilsin.
you fact+PLU+GEN aware not+BE+2SG
‘You are unaware of the facts.’

3.3.3 Subject

In Turkish, the case of subject is nominative. There are however some dependent clauses where subject is genitive case-marked. This is not related to its subjecthood, but is a consequence of the fact that in such clauses the subject and the non-finite verb may be considered as forming a definite compound noun where the subject is the modifier. Since in a definite compound noun the modifier is genitive case-marked, the subject of such a clause is genitive marked, too:

- (46) a. Senin buraya geldiğini bilmiyorlar.
your here+DAT come+PART+2SP+ACC know+NEG+PRG+3PL
(‘They don’t know of your coming here.’)
‘They don’t know that you came here.’

- b. Senin bunu söylemeni
 your this+ACC say+VN+2SP+ACC
 beklemiyordum.
 expect+NEG+PRG+PAST+1SG
 ‘I didn’t expect you to say this.’

The subject is one of the most important constituents of a sentence. Yet, there are some sentences which grammatically do not have subjects. For example, a sentence whose verb is intransitive and in passive voice doesn’t have a grammatical subject. Such sentences are called *impersonal passives* by Knecht [6]:

- (47) a. Girilmez. ‘It is not entered.’ or ‘Do not enter.’
 enter+PASS+NEG+PRS
 b. Okuldan kaçıldı. ‘The school was run away from.’
 school+ABL run away+PASS+PAST

Note that the negative present of a passive verb, as in (47a), has the effect of a negative imperative. Also, in some idiomatic expressions there seems to be no subject, e.g., *geçmiş olsun* (*may you recover soon*) and *afiyet olsun* (*bon appetit*). Recall also that the subject can safely be omitted in many circumstances since it is implicit in the person suffix of the verb (see Section 3.2.2 page 20).

If there are two or more joint subjects in a sentence, then the number feature of the subject is plural, and the person feature is determined according to the following rules, in the given order:

- if one of the constituents is first person, then the person feature of the subject is first person,

- (48) a. Ben ve sen gitmeliyiz. ‘I and you have to go.’
 I and you go+NEC+1PL
 b. Ben de ev sahibi de şaşırıyoruz.
 I also host also be confused+PRG+1PL
 ‘Both I and the host are confused.’

- if one of the constituents is second person, then the person feature of the subject is second person,

- (49) Sen ve kardeşin burada kalacaksınız.
 you and sister+2SP here+LOC stay+FUT+2PL
 ‘You and your sister will stay here.’

- otherwise, it is third person.

- (50) Mehmet ve annesi parka gittiler.
 Mehmet and mother+3SP park+DAT go+PAST+3PL
 ‘Mehmet and his mother went to the park.’

3.3.4 Concordance of Subject and Verb

In a Turkish sentence, person features of the subject and the verb should be the same. This is true also for the number features with one exception: third person plural subjects may sometimes take third person singular verbs. This is because inanimate plural subjects generally take a singular verb, plural verbs being used with animate subjects, or with inanimates personified or considered as individuals [7]:

- (51) Ağaçlar yüzümüze konfeti atıyorlar.³
 tree+PLU face+1PP+DAT confetti throw+PRG+3PL
 ‘The trees are throwing confetti on our faces.’

Conversely, an animate plural subject can take a singular verb if it represents a number of people acting as one:

- (52) Çocuklar annelerini bekliyor.
 child+PLU mother+3PP+ACC wait+PRG+3SG
 ‘The children are waiting for their mother.’

3.3.5 Object

There are three types of objects in Turkish:

³This example is taken from Lewis [7].

Direct objects are governed by transitive verbs. A direct object is *directly* affected by the action that the verb describes. They are mostly case-marked accusative or unmarked (i.e., nominative), but can also be dative, ablative or locative (cf. transitive verbs on page 25). A nominative direct object is indefinite and should be placed immediately before the verb. On the other hand, some noun phrases, such as pronouns, proper nouns, possessive phrases and any noun that occurs with a demonstrative, are always marked accusative when they function as the direct object of an active transitive verb. This is because such noun phrases refer to particular entities, i.e., they are already definite:

- (53) a. Seni aradım. ‘I looked for you.’
 you+ACC look for+PAST+1SG
 *Sen aradım.
 you+NOM look for+PAST+1SG
- b. Ankara’yı seviyorum. ‘I like Ankara.’
 Ankara+ACC like+PRG+1SG
 *Ankara seviyorum.
 Ankara+NOM like+PRG+1SG
- c. Bu binayı görmüştük.
 this building+ACC see+NAR+PAST+1PL
 ‘We had seen this building.’
 *Bu bina görmüştük.
 this building+NOM see+NAR+PAST+1PL

Indirect objects are governed by ditransitive verbs. Indirect objects are generally marked dative, ablative or locative (cf. ditransitive verbs on page 26).

Oblique objects are optionally taken by verbs that express motion. They are marked either dative (goal) or ablative (source), as illustrated in (31).

3.3.6 Indirect Complement

An indirect complement is a locative case-marked noun phrase which indicates the place where the action takes place:

- (54) Zamanının büyük bir kısmını denizde
 time+3SP+GEN great a portion+3SP+ACC sea+LOC
 geçiriyordu.
 spend+PRG+PAST+3SG
 ‘He used to spend a great portion of his time in the sea.’

3.3.7 Adverbial Complements

Adverbial complements modify the verb in many respects such as time, direction, quality and quantity. They are, in general, not subject to inflection. Some case-suffixes are used to derive adverbs:

- (55) a. Pazara düğünümüz var.
 sunday+DAT wedding feast+1PP existent
 ‘We have a wedding feast on Sunday.’
 b. Geçende seni gördüm.
 past+LOC you+ACC see+PAST+1SG
 ‘I saw you the other day.’
 c. Akşamdan herşeyi bitirmiştım.
 evening+ABL everything+ACC complete+NAR+PAST+1SG
 ‘I had completed everything in the evening.’

One should not confuse these adverbs with oblique objects or indirect complements because they don’t really express direction or location. On the other hand, some adverbs, when affixed case suffixes, should be treated as oblique objects or indirect complements:

- (56) a. Dışarıya çıkalım. ‘Let’s go outside.’
 outside+DAT go out+OPT+1PL
 b. İçeride misafir var. ‘There is a guest inside.’
 inside+LOC guest existent

In (56a), *dışarıya* is no more an adverb, but an oblique object, and *içeride* in (56b) is an indirect complement.

In the following sections we will briefly mention kinds of adverbial complements:

Temporal Adverbial Complements

Temporal adverbial complements modify the verb in respects of beginning, end, period, continuence, time and frequency:

- beginning:

- (57) a. Bir haftadan beri sana yazamadım.
 a week+ABL for you+DAT write+NEG:POT+PAST+1SG
 ‘I couldn’t write to you for a week.’
- b. Haziran başlayalı havalar iyice
 june begin+GER weather+PLU pretty
 ısındı.
 get warm+PAST+3SG
 ‘The weather got pretty warm since the beginning of June.’
- c. Haziran başladı başlayalı havalar iyice
 june begin+PAST+3SG begin+GER weather+PLU pretty
 ısındı.
 get warm+PAST+3SG
 ‘The weather got pretty warm since the beginning of June.’
- d. İki senedir onu görmedim.
 two year+ADV him see+NEG+PAST+1SG
 ‘I haven’t seen him for two years.’
- e. Haziran başlayalı beri havalar iyice
 june begin+GER since weather+PLU pretty
 ısındı.
 get warm+PAST+3SG
 ‘The weather got pretty warm since the beginning of June.’

- end:

- (58) a. Ben gelinceye kadar/dek bir yere
 I come+GER+DAT till a place+DAT

gitme.

go+IMP+2SG

‘Don’t go anywhere till I come.’

- b. Sabaha kadar/dek çalıştım.
 morning+DAT till work+PAST+1SG
 ‘I worked till the morning.’

- period:

- (59) a. İki gün evde kaldım.
 two day home+LOC stay+PAST+1SG
 ‘I stayed at home for two days.’
 b. Eve üç saatte ulaştım.
 home+DAT three hour+LOC reach+PAST+1SG
 ‘I reached home in three hours.’
 c. Yıllar yılı burada yaşadım.
 year+PLU year+3SP here+LOC live+PAST+1SG
 ‘I lived here for many years.’

- continuence:

- (60) a. Sen çalıştıkça o yatıyor.
 you work+GER he lie+PRG+3SG
 ‘He doesn’t do anything as you continue to work.’
 b. Yemeklerimizi hep bu lokantada
 meal+PLU+1PP+ACC always this restaurant+LOC
 yeriz.
 eat+AOR+1PL
 ‘We always eat in this restaurant.’
 c. Yıllarca burada yaşadım.
 year+PLU+ADV here+LOC live+PAST+1SG
 ‘I lived here for many years.’
 d. Dersler günden güne zorlaşıyor.
 course+PLU day+ABL day+DAT get harder+PRG+3SG
 ‘The courses get harder from day to day.’

- time:

- (61) a. Eve gittiğin zaman beni ara.
 home+DAT go+PART+2SP time me call+IMP+2SG
 ‘Call me when you go home.’
- b. İşin bitince çok oyalanma.
 job+2SP finish+ADV too much waste time+NEG+IMP+2SG
 ‘Don’t waste too much time when you finish your job.’
- c. Sabaha doğru eve ulaştım.
 morning+DAT about home+DAT reach+PAST+1SG
 ‘I reached home by morning.’
- d. Dün okula gittin mi?
 yesterday school+DAT go+PAST+2SG Q
 ‘Did you go to the school yesterday?’
- e. Yazın dinleneceğim.
 summer+ADV rest+FUT+1SG
 ‘I will rest in summer.’

- frequency:

- (62) a. Üç saatte bir mola verdik.
 three hour+LOC one take break+PAST+1PL
 ‘We took a break every three hours.’
- b. Her hafta burada buluşalım.
 every week here+LOC meet+OPT+1PL
 ‘Let’s meet here every week.’

Adverbial Complements of Direction

Adverbial complements of direction indicate the direction of the action expressed by the verb:

- (63) a. Hemen aşağı gelmelisin.
 immediately downstairs come+NEC+2SG
 ‘You have to come downstairs immediately.’
- b. Yol, oradan öte bozuktü.
 road there+ABL beyond rough+PAST+3SG

‘The road was rough beyond there.’

- c. Merdivene doğru yürüdüm.
 stairs+DAT towards walk+PAST+1SG
 ‘I walked towards the stairs.’

- d. Evin köşesine kadar koştu.
 house+GEN corner+3SP+DAT up to run+PAST+3SG
 ‘He ran up to the corner of the house.’

Adverbial Complements of Quality

Adverbial complements of quality modify the verb in respects of quality/manner or reason:

- Adverbial complements of quality/manner consist mostly of qualitative adjectives, reduplications, some postpositional phrases and adverbial dependent clauses. Also adverbs that are derived with the suffixes *+ce*, *+cene* and *+cesine* describe manner:

- (64) a. İyi konuştun. ‘You spoke well.’
 good speak+PAST+2SG
 b. Ev ev dolaştık.
 home home walk about+PAST+1PL
 ‘We walked about home by home.’
 c. Kar taneleri gibi hemen eridiler.
 snowflake+PLU like at once melt+PAST+3PL
 ‘They melted at once just like snowflakes.’
 d. Koşa koşa eve gittim.
 run+OPT run+OPT home+DAT go+PAST+1SG
 ‘I went home running.’
 e. Askerler kahramanca ilerlediler.
 soldier+PLU heroically advance+PAST+3PL
 ‘The soldiers advanced heroically.’

- Adverbial complements of reason are in general postpositional phrases and adverbial dependent clauses:

- (65) a. Geldiği için mutlu olmalısın.
 come+PART+3SP as happy be+NEC+2SG
 ‘You must be happy because he came.’
- b. Onun hakkında böyle konuşmamalısın.
 his about like this talk+NEG+NEC+2SG
 ‘You shouldn’t talk like this about him.’
- c. Seni gördükçe mutlu oluyorum.
 you+ACC see+GER happy become+PRG+1SG
 ‘I feel happy when I see you.’

Adverbial Complements of Confirmation

Adverbial complements of confirmation modify the verb in respects of certainty, limitation, wish, condition, repetition, answer, likelihood/supposition, designation and means:

- certainty:

- (66) a. Elbet hür olacaksın.
 certainly free be+FUT+2SG
 ‘You will certainly be free.’
- b. Mutlaka gelmelisin.
 certainly come+NEC+2SG
 ‘You should certainly come.’
- c. Katiyen korkmuyorum karanlıktan.
 never be afraid+NEG+PRG+1SG darkness+ABL
 ‘I am never afraid of darkness.’
- d. Asla şüphem yok.
 never doubt+1SP non-existent
 ‘I have no doubts.’

- limitation:

- (67) a. Bana ancak sen yardım edebilirsin.
 me only you help+POT+AOR+2SG
 ‘Only you can help me.’

- b. Yalnız burada mutlu oluyor.
 only here+LOC happy be+PRG+3SG
 ‘He is happy only here.’

- wish:

- (68) a. Keşke sen de orada olsaydın.
 I wish you too there+LOC be+COND+PAST+2SG
 ‘I wish you were there, too.’
 b. İnşallah pişman olmazsın.
 I hope feel sorry+NEG+AOR+2SG
 ‘I hope you don’t feel sorry.’

- condition:

- (69) a. Eğer gitmek istemiyorsan
 if go+INF want+NEG+PRG+COND+2SG
 lütfen söyle.
 please say+IMP+2SG
 ‘If you don’t want to go, please say so.’
 b. Şayet geç kalırsam
 if be late+AOR+COND+1SG
 beni bekleme.
 me wait for+NEG+IMP+2SG
 ‘If I am late, don’t wait for me.’

- repetition:

- (70) a. Yine/gene/tekrar gel. ‘Come again.’
 again come
 b. Bir daha denemelisin. ‘You have to try once more.’
 once more try+NEC+2SG

- answer:

- (71) a. Evet/Peki gidelim. ‘Yes/O.K., let’s go.’
 yes/O.K. go+OPT+1PL

b. Hayır/Yok, bu senin işin değil.
 no this your job+2SP not
 ‘No, this is not your job.’

- likelihood/supposition:

(72) a. Belki hâlâ oradadırlar. ‘Maybe, they are still there.’
 maybe still there+3PL
 b. Olsa olsa, yirmi beş yaşındadır.
 be+COND be+COND twenty five years old+3SG
 ‘She is at most (at the very most) 25 years old.’

- designation:

(73) İşte yazıyorum. ‘Here, I am writing.’
 here write+PRG+1SG

- means:

(74) a. Bu akisle duvarda şekiller beliriyor.
 this reflection+INS wall+LOC figure+PLU appear+PRG+3SG
 ‘Figures appear on the wall with this reflection.’
 b. Eve yayan gittik.
 home+DAT on foot go+PAST+1PL
 ‘We went home on foot.’

Adverbial Complements of Quantity

Adverbial complements of quantity modify the verb in respects of count-able/uncountable quantity, proportion, scarcity/abundance:

(75) a. Bir buldu iki ister.
 one find+PAST two want+AOR+3SG
 (‘He found one, but wants two.’)
 ‘He always wants more than what he gets.’
 b. Onu ben de çok severim.

- him I too very much like+AOR+1SG
 ‘I like him very much, too.’
- c. Trafik kazaları yüzde iki arttı.
 traffic accident+PLU+3SP percent two increase+PAST+3SG
 ‘Traffic accidents have increased by two percent.’
- d. Ayağa kalkamayacak kadar yorgundum.
 stand up+POT:NEG+PART as much as tired+BE+PAST+1SG
 ‘I was so tired that I couldn’t even stand up.’
- e. En çok annemi seviyorum.
 the most mother+1SP+ACC love+PRG+1SG
 ‘I love my mother the most.’

Adverbial Complements of Question

Adverbial complements of question modify the verb in respect of question. The most common ones are *ne/neden/niçin/neye/niye/ne diye* (*why*), *nasıl* (*how*), *ne biçim* (*what kind of*), *ne zaman/ne vakit* (*when*), *ne zamandan beri* (*since when*), *ne zamana dek* (*till when*), *ne ile* (*with what*), *kim için/kimin için* (*for whom*), *kim gibi/kimin gibi* (*like whom*):

- (76) a. Ne dolaşıyorsunuz burada?
 why walk about here+LOC
 ‘Why are you walking about here?’
- b. Ne zaman gördün onları?
 when see+PAST+2SG them
 ‘When did you see them?’
- c. Kimin için bu gözyaşları?
 for whom these tear+PLU
 ‘For whom are these tears?’

3.4 Compound Nouns

Compound nouns are formed by two nominal constituents one of which qualifies the other. The modifier precedes the modified. This is consistent with the

cardinal rule of word-order in Turkish⁴.

There are two types of compound nouns:

1. Definite Compound Nouns: In a definite compound noun the modifier is marked genitive and the modified has a possessive suffix, which is consistent with the agreement of the modifier⁵. They are also called *possessive compound nouns* because the modifier is a definite person or thing to which or within which the modified belongs:

- (77) a. lokantanın bahçesi ‘the garden of the restaurant’
 restaurant+GEN garden+3SP
- b. uzmanın raporu ‘the expert’s report’
 expert+GEN report+3SP
- c. haftanın günleri ‘the days of the week’
 week+GEN day+PLU+3SP

A number of words may come between the two constituents of a definite compound noun. These are usually adjectives or participles that modify the modified part, and, if the modified is a verbal noun or participle, objects or complements that are governed by the modified⁶:

- (78) a. İstanbul’un tarihi camileri
 İstanbul+GEN historic mosque+PLU+3SP
 ‘the historic mosques of İstanbul’
- b. mavi göklerin beyaz ve kızıl süsü⁷
 blue sky+PLU+GEN white and red trimming+3SP
 ‘the white and red trimming of the blue skies’
- c. mahkemenin bu kararı
 court+GEN this decision+3SP
 ‘this decision of the court’

⁴The cardinal rule is that in any syntactic category, the modifier precedes the modified (see Section 3.2.1).

⁵The agreement of the modifier must be the same as the possessive of the modified with the exception that if the modifier is third person plural the possessive of the modified may be third person singular.

⁶In most of the nominal and adjectival dependent clauses the subject and the non-finite verb may be considered as forming a definite compound noun where the subject is the modifier and the non-finite verb is the modified (see Section 3.3.3).

- d. annemin mektubu yollaması
 mother+1SP+GEN letter+ACC send+VN+3SP
 ‘my mother’s sending of the letter’
- e. adamın aniden ölmesi
 man+GEN unexpectedly die+VN+3SP
 ‘the unexpected dying of the man’

As stated above, in compound nouns the modifier precedes the modified. In an ‘inverted sentence’, however, the modifier in a definite compound noun may follow the word it qualifies since the grammatical suffixes still show the relationship between the two words and the meaning is unaltered⁸:

- (79) a. çiftçinin evi ‘the farmer’s house’
 farmer+GEN house+3SP
 evi çiftçinin ‘the farmer’s house’
 house+3SP farmer+GEN
- b. Biri bendedir bu üç nehirin.⁹
 one+3SP I+LOC+3SG this three river+GEN
 ‘I have one of these three rivers.’

In (79b) the verb *bendedir* appears between the modified *biri* and the modifier *bu üç nehirin*.

In definite compound nouns, the modifier can sometimes be marked ablative, when the modified is a word that expresses quantity. It may be a number, or an adjective which expresses uncountable (e.g., *biraz* (*little, some*)) or countable (e.g., *birkaç* (*some, a few*)) quantity:

- (80) a. bunlardan ikisi ‘two of these’
 these+ABL two+3SP
- b. yolculardan birkaçı ‘some of the passengers’
 passenger+PLU+ABL some+3SP

⁷This example is taken from Şimşek [16].

⁸Note that though *evi çiftçinin* also means ‘his house is the farmer’s’, in context, when this phrase is part of a longer sentence, there will be no ambiguity.

⁹This example is taken from Şimşek [16].

Indefinite Compound Nouns: The indefinite compound noun is used when the relationship between the two constituents is merely qualificatory and not so intimate or possessive as that indicated by the definite compound noun. In an indefinite compound noun the modifier is unmarked (i.e., nominative) and the modified has the third person possessive suffix, which we denote as the *compound marker* (CM). The reason why we prefer not to use the term ‘possessive suffix’ is that it doesn’t really indicate a possessor:

- (81) a. yaz tatili ‘summer holiday’
 summer holiday+CM
 b. oturma odası ‘living room’
 sit+VN room+CM

When a third person possessor is to be indicated, the CM gives way to the third person possessive suffix, yet the surface form of the word doesn’t change. This leads to ambiguity: *yaz tatili*, for example, means both *summer holiday* and *his summer holiday*. Note that *summer holiday* is not definite whereas *his summer holiday* is. When a first or second person is the possessor, the CM gives way to the possessive suffix of the first or second person: *yaz tatilim* (*my summer holiday*), *oturma odan* (*your living room*).

An indefinite compound noun refers, in general, to a common entity as in (81). However, if the modifier is a proper noun, it may refer to a particular entity, i.e., it may be definite: *Ankara Kalesi* (*Ankara Castle*), *Türk Dili* (*Turkish Language*). Yet, there are such compounds which are not definite: *Ankara gezileri* (*Ankara tours*), *İstanbul manzaraları* (*İstanbul views*).

In an indefinite compound noun, no words may come between the two constituents. The adjectives and participles that modify the modified precede the modifier, and this leads to ambiguous interpretations. If we represent the modification relation in compound nouns by a binary tree where the left child modifies the right child at each level, we end up with the three ambiguous interpretations shown in Figure 3.2 for (82).

- (82) siyah kömür kamyonu şoförü
 siyah kömür kamyon+CM şoför+CM
 ‘the black coal truck driver’

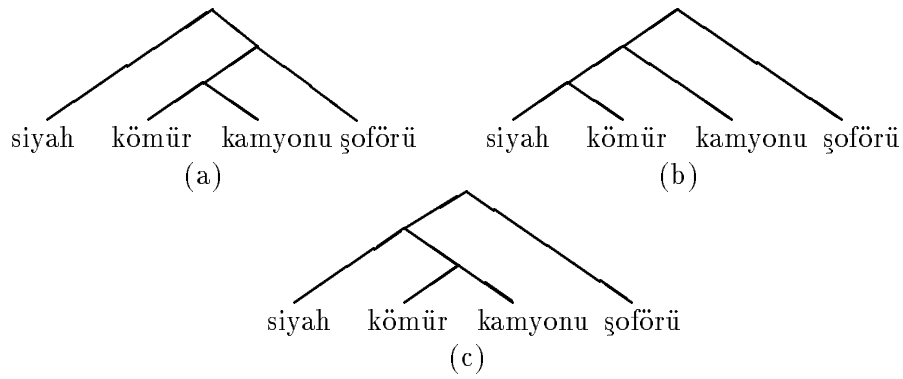


Figure 3.2. Three ambiguous interpretations of (82)

Compound nouns may themselves contain compound nouns. For example, (83a) is a definite compound noun of which modifier *masa örtüsünün* (*of the tablecloth*) is an indefinite compound noun that is marked genitive. (83b) is an indefinite compound noun of which modified *Dil Kurumu* (*Language Society*) is another indefinite compound noun. Note that, here the CM at the end of *kurum* functions as the CM of both of the compound nouns. In fact, the CM of the inner one has given way to the CM of the whole compound noun. One can observe this more clearly in (83c) which is a definite compound noun with a modified which is an indefinite compound noun, i.e., *masa örtüm* (*my tablecloth*). The CM of the inner compound *masa örtüsü* (*tablecloth*) has been dropped and the possessive suffix of the outer one survives. (83d) is a more complex example of embedded compound nouns: the modifier *edebiyat tarihçisinin* (*of the literary historian*) is a genitive marked indefinite compound, and the modified *başlıca görevlerinden biri* (*one of the main missions*) consists of an adjective *başlıca* (*main*) which modifies a definite compound noun *görevlerinden biri* (*one of his missions*).

- (83) a. masa örtüsünün rengi ‘the color of the tablecloth’
 table cloth+CM+GEN color+3SP
- b. Türk Dil Kurumu ‘Turkish Language Society’
 Turkish Language Society+CM
- c. benim masa örtüm ‘my tablecloth’
 my table cloth+1SP
- d. edebiyat tarihçisinin başlıca görevlerinden
 literary historian+CM+GEN main mission+PLU+3SP+ABL
 biri¹⁰

one+3SP

‘one of the main missions of the literary historian’

3.5 Classification of Turkish Sentences According to Structure

Sentences are means of expressing ideas and emotions. Ideas and emotions can be expressed as independent or dependent judgements. Hence, when classifying sentences according to structure, it is necessary to consider both the number of judgements expressed and the way they are combined. Some sentences express only one judgement. Some others express a number of dependent judgements in an embedded structure. Still some others are formed by combining structurally independent judgements using punctuation marks or conjunctions.

3.5.1 Simple Sentences

A simple sentence contains only one independent judgement. (5), (6), (7) and (8) are examples of simple sentences (see pages 16-17). Note that the word “simple” doesn’t lead to any limitation on the number of words or constituents in a sentence. What it suggests is that there should be only one finite verb and no infinitivals in the sentence.

3.5.2 Compound Sentences

Compound sentences integrate two or more functionally related judgements. In a compound sentence there may be one main clause and several dependent clauses. They are further divided into three subclasses according to their dependent clauses:

¹⁰This example is taken from Şimşek [16].

Complex Sentences

In Turkish, a sentence can be transformed into a noun, adjective, or adverb clause by affixing certain suffixes to the verb of the sentence [15]. Complex sentences are those that include such dependent (subordinate) clauses as their constituents, or as modifier or determiners of their constituents. (12), (13b) and (15) are examples of complex sentences (see pages 19-20). Dependent clauses may themselves contain other dependent clauses. So, we may have embedded structures as (12).

Substantival Sentences

A substantival sentence is a complete sentence, which can be used independently, that functions as a noun or adjectival clause within a longer sentence. In (84a), for instance, the direct object *yaşam güzeldir* (*life is beautiful*) is itself an independent sentence. The adjectival modifier of *bir sonuç* (*a result*) in (84b) is the complete conditional sentence *olmasa da olur* (*even if it were non-existent, that would be all right.*) The complete question sentence *niçin geldiniz?* (*why did you come?*) in (84c) qualifies the noun *soru* (*question*), and they form together a compound noun *niçin geldiniz sorusu* (*the question “why did you come?”.*)

- (84) a. Sen, yaşam güzeldir, dersin.
 ‘You say “life is beautiful.”’
- b. Niçin uğraştık bunca yıl? Olmasa da olur bir sonuç için mi?
 ‘Why did we struggle so many years? For a result that we could well do without?’
- c. Niçin geldiniz sorusu hepimizi sarstı.
 ‘The question “why did you come?” shocked all of us.’

Conditional Sentences

A conditional sentence is a compound sentence in which the dependent clause and the main clause are integrated by a condition, reason or result relation. For example, in (85a) the main clause *pikniğe gidemeyiz* (*we can not go to a picnic*) is the result of the dependent clause *yağmur yağarsa* (*if it rains*) whereas in

(85b) the dependent clause *bu kadar çok para harcarsan* (if you spend so much money) expresses the reason of the main clause *hiçbirşey biriktiremezsin* (you can't save up anything.)

- (85) a. Yağmur yağarsa pikniğe gidemeyiz.
 'If it rains, we can not go to a picnic.'
 b. Bu kadar çok para harcarsan hiçbir şey biriktiremezsin.
 'If you spend so much money, you can't save anything.'

3.5.3 Ordered Sentences

A sentence which is a combination of two or more complete sentences is called an ordered sentence. These complete sentences are structurally independent from each other, and they may or may not be semantically related to each other. They are combined by commas, semicolons or conjunctions. (11b) is an example of an ordered sentence (see page 18). Each complete sentence that takes part in an ordered sentence is called an *independent clause*. In (11b), for example, there are two independent sentences combined by a comma: *üç beş kişiyiz böyle söyleyen* (we are a handful of people who talk like this), and *biliyoruz çoğunluğa bunu anlatamayacağımızı* (we know that we could not make the majority understand it). Ordered sentences are further divided into three subclasses depending on whether their independent sentences are semantically related or not:

Independent Ordered Sentences

There is no definite semantic relation among the independent clauses of an *independent ordered sentence*. They are generally combined by commas or semicolons, and they usually don't have common constituents except for implicit subjects. (86) is an example of independent ordered sentences.

- (86) Çakallar çığlık çığlık burnumuzun dibine sokulur,
 şosedden vızır vızır otomobiller geçirdi.¹¹
 'The jackals used to sidle up to us shrieking,
 the cars used to whiz on the highway.'

Dependent Ordered Sentences

The independent clauses in a *dependent ordered sentence* are definitely semantically related. This relation is generally expressed by the use of a conjunction as in (87a), or a common constituent as in (87b), where the two clauses have a common direct object.

- (87) a. Çok iyi bir besteciydi; ama ünlü olamadı.
 ‘He was a very good composer; but he couldn’t be famous.’
 b. Kendi hikayelerini çok beğenir; her önüne gelene okurdu.
 ‘He used to like his own tales very much;
 he used to read them to everyone he met.’

Mixed Ordered Sentences

In a *mixed ordered sentence* the characteristics of both dependent and independent ordered sentences show up. For example, in (88) the first and the second independent clauses are not semantically related whereas the second and the third are.

- (88) Salih yatağına uzandı, güneş yüzüne geliyordu, fakat hava yine soğuktu.¹²
 ‘Salih laid himself onto his bed, the sun was shining in his face, but the weather was still cold.’

In this chapter, we presented an overview of Turkish syntax. The concepts that we described here in detail will be referred in the next chapter, when we present the LFG specification that we have developed for Turkish syntax.

¹¹This example is taken from Şimşek [16].

¹²This example is taken from Şimşek [16].

Chapter 4

LFG for Turkish Syntax

4.1 General Structure

The scope of our current work is the development of a lexical-functional grammar for Turkish syntax.

Our domain includes regular Turkish sentences which are structurally simple or complex (see Section 3.5). We have implemented our grammar on the Generalized LR Parser/Compiler which is the syntactic part of the Universal Parser used in the CMU Machine Translation project. No attempt has been made to include morphological rules since it would be a duplication of the contributions of Hankamer [3], Solak [15], and Oflazer [10]. The parser/compiler lets us incorporate our own morphological analyzer, and we use a full two-level specification of Turkish morphology based on a lexicon of about 24,000 root words, for morphological analysis of words [1, 10].

A Turkish sentence is given as input to the program, and the program outputs the functional structure for this sentence, if it is grammatical, or nothing, if it is not. No suggestion is made for an ungrammatical sentence, only the parser indicates where it failed. We are not concerned with the semantics. For example, both (1b) and (1c) are plausible interpretations of (1a) according to our grammar, though the second one is not semantically plausible:

- (1) a. Ben gelmeden hiçbir yere gitme.
I/mole come+VN+ABL anywhere+DAT go+NEG+IMP+2SG
b. ‘Don’t go anywhere before I come.’

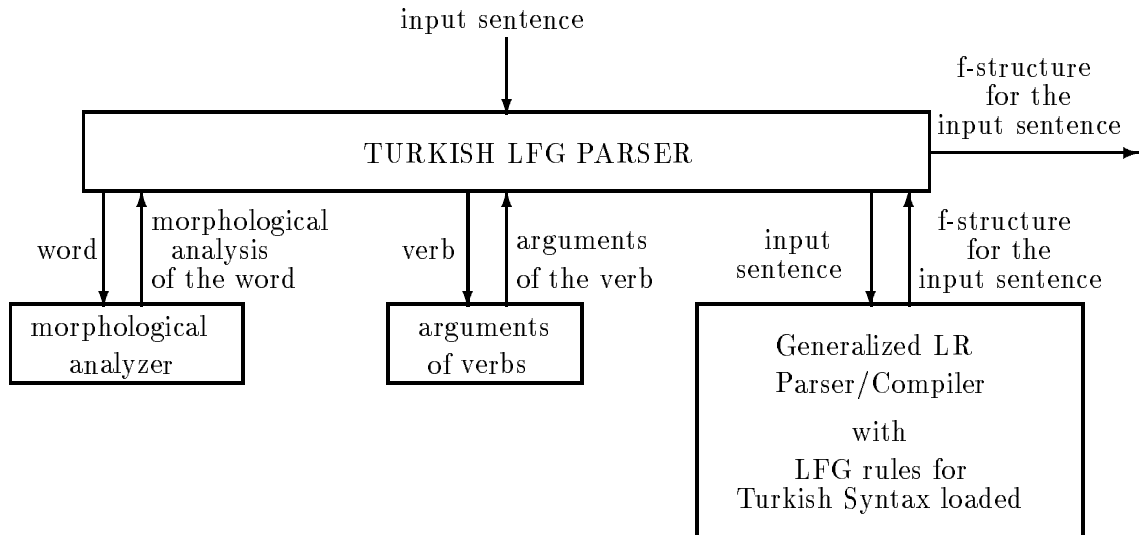


Figure 4.1. The system architecture.

c. ‘Don’t go anywhere before the mole comes.’

Figure 4.1 shows the architecture of our system. When a sentence is given as input to the program, the program first calls the morphological analyzer once for each word in the sentence, and keeps the results of these calls in a list to be used later by the parser/compiler. If the morphological analyzer fails to return a structure for a word for any reason (e.g., the lexicon may lack the word or the word may be misspelled), the program halts immediately giving a message which says that that word is unknown. After the morphological analysis is completed, the LR parser/compiler is called to check whether the sentence is grammatical. The parser/compiler performs bottom-up parsing. During this analysis, whenever it consumes a new word from the sentence it picks up the morphological structure of this word from the list, which keeps the morphological structures of the words in the sentence. If the word is a finite verb or an infinitival, the parser is also provided a list of the objects that the word may take, from a list which keeps the argument structures of verbs. At the end of the analysis, if the sentence is grammatical, the f-structure for it is output by the parser/compiler.

Turkish alphabet contains some special letters (shown by the symbols ζ , \mathcal{C} , \check{g} , \check{G} , \imath , \dot{I} , \ddot{o} , \ddot{O} , \mathfrak{s} , \mathfrak{S} , \ddot{u} , \ddot{U}) that do not exist on the standard character set of most of the computers, and on most of the keyboards. We handle this problem by using the letter set shown in Table 4.1, all other letters are represented by

Table 4.1. The representation of special Turkish letters.

Letters	Representation
ç, Ç	C
ğ, Ğ	G
ı, İ	I
î, İ̇	i
ö, Ö	O
ş, Ş	S
ü, Ü	U

their corresponding lowercase equivalences.

In the rest of this section we will mention the basic parts of our architecture except for the morphological analyzer, i.e., the Generalized LR Parser/Compiler and the list of arguments of verbs. We won't be concerned with the morphological analyzer since it is not really necessary to understand the LFG specification for Turkish which we will present in the next section.

4.1.1 Generalized LR Parser/Compiler

The Generalized LR Parser/Compiler is the syntactic part of the Universal Parser used in the CMU Machine Translation project. It is based on Tomita's Generalized LR Parsing Algorithm [18, 17], and is implemented in Common Lisp. Tomita's Generalized LR Parsing Algorithm is an efficient context-free parsing algorithm and emphasizes its practical value in natural language processing. It produces all possible parse trees in an efficient representation, and seems more efficient than any of the existing algorithms as far as practical natural language parsing is concerned.

Below, we describe fundamental points of the formalism of the Generalized LR Parser/Compiler so that the reader can easily understand the grammar rules that we will give at the end of the chapter [9].

General Format of Grammar Rules

A grammar rule for the Generalized LR Parser/Compiler consists of a context-free phrase structure rule followed by a list of equations. The list of equations is enclosed in parentheses and the entire grammar rule is enclosed in parentheses:

```
( context-free phrase structure rule
  ( list of equations ))
```

Equations

Equations for the Generalized LR Parser/Compiler are very similar to LFG equations. In the equations for the parser/compiler, variables x_0 , x_1 , x_2 , x_3 , etc. are used in place of the up-arrow and down-arrows. The up-arrow is replaced by x_0 . Hence, x_0 refers to the functional structure corresponding to the left hand side non-terminal of the phrase structure rule. x_1 takes the place of the down-arrow referring to the first element of the right hand side of the phrase structure rule. x_2 takes the place of the down-arrow referring to the second element, and so on [9]. (2a) is an example FLG rule and (2b) is the corresponding Generalized LR Parser/Compiler rule:

(2) a. $S \rightarrow \quad NP \quad VP$
 $(\uparrow \text{SUBJ})=\downarrow \quad \uparrow=\downarrow$

b. $\langle S \rangle \langle == \rangle (\langle NP \rangle \langle VP \rangle)$
 $((x_0 \text{SUBJ}) = x_1)$
 $(x_0 = x_2))$

The left hand side of an equation is a *path*. A path is:

- A variable (e.g., x_0 , x_1 , x_2).
- A variable followed by any number of character strings separated by spaces (e.g., $(x_1 \text{SUBJ})$, $(x_1 \text{SUBJ AGR})$).

The right hand side of an equation is:

- A path.
- A character string (e.g., 1SG, PAST, ACC).
- A list consisting of the word *OR* (inclusive or) followed by any number of character strings (e.g., (*OR* NOM ACC), (*OR* 3SG 3PL)).

Each equation is enclosed in parenthesis. For example, the equation below says that the value of the CASE feature in the functional structure corresponding to the first element of the right hand side of the phrase structure rule may be NOM or ACC:

```
((x1 CASE) = (*OR* NOM ACC))
```

Disjunctive Equations

The user is allowed to specify a disjunction over a set of equations:

```
(*OR*
 ( list-of-equations )
 ( list-of-equations )
 .....)
```

All lists of equations are evaluated disjunctively. This is an inclusive OR, as oppose to exclusive OR. Even if one of the lists of equations is evaluated successfully, the rest of lists will also be evaluated. For example, the disjunction below says that either *x1*'s CAT feature has the value PN *and* its CASE feature has the value NOM or GEN, or *x1*'s CASE feature has the value NOM:

```
(*OR*
 (((x1 CAT) = PN)
 ((x1 CASE) = (*OR* NOM GEN)))
 (((x1 CASE) = NOM)))
```

Exclusive OR, *EOR*

This is the same as disjunctive equations, except that an exclusive OR is used. That is, as soon as one of the elements is evaluated successfully, the rest of

lists will be ignored:

```
(*EOR*
 ( list-of-equations )
 ( list-of-equations )
 .....)
```

Constraint Equations

The symbol ‘=c’ in place of the plain equal sign expresses a *constraint equation* (e.g., ((x1 CASE) =c NOM), ((x2 AGR) =c 3SG)). A regular equation causes unification or assignment of a value to a function, while a constraint equation only checks to make sure that the function has the intended value. If the function does not already have the intended value, the parse will fail.

Negative Constraint Equations

The word **NOT** can be used on the right hand side of an equation to check if the value specified in the equation does not exist. For example, the equation below says that the value of the CASE feature of **x1** should be something other than NOM; otherwise, the parse will fail:

```
((x1 CASE) = (*NOT* NOM))
```

UNDEFINED and **DEFINED**

The special words **UNDEFINED** and **DEFINED** can be used on the right hand side of an equation. **UNDEFINED** makes sure that the left hand side of the equation has *no* value, and **DEFINED** makes sure that it has a value (no matter what it is). In the first equation below, for instance, the parse will fail if the CASE feature of **x1** has a value, and in the second equation it will fail if the AGR feature of **x2** has no value:

```
((x1 CASE) = *UNDEFINED*)
((x2 AGR) = *DEFINED*)
```

Assigning Multiple Values

Multiple values can be assigned to a feature by using the greater-than sign in place of the equal sign. Such a feature is specified by the keyword *MULTIPLE* followed by its values, in the f-structure. If the following rule applies recursively, the pp-adjunct function will have several different values (i.e., a list of values) at the same time:

```
(<S> <==> (<S> <PP>)
  ((x0 = x1)
   ((x0 pp-adjunct) > x2)))
```

LISP Code in the Grammar Rules

Arbitrary LISP code can be written on the right hand side of an equation, using the arrow ‘ \Leftarrow ’. The LISP function call is evaluated and the returned value is assigned to the left hand side of the equation (if it already has a value, the old value is simply overwritten). For example, the following equation calls the LISP function ‘requires-objects’ with two arguments, namely the ARGS and VOICE features of x1, and assigns the result to the NECC feature of x1:

```
((x1 NECC) <= (requires-objects (x1 ARGS) (x1 VOICE)))
```

Test with Arbitrary LISP Function

The statement (*TEST* *lisp-function-call*) has the following effect: The *lisp-function-call* is evaluated, and if the function returns nil, it fails. If the function returns a non-nil value, it does nothing.

4.1.2 Argument Structures of Verbs

Recall that we are only concerned with the objects that verbs subcategorize for since any verb root subcategorizes for a subject. Turkish verbs may subcategorize for direct and indirect objects, and some verbs (those that indicate a motion) may also take oblique objects (see Section 3.3.2).

Our system has an argument structure database that specifies the objects that may be, or ought to be taken. Each entry in the list is composed of one or more senses. For each of these senses an explanation of the meaning and the objects to be taken are indicated. Each object is specified by its case, type (direct, indirect or oblique), a flag that indicates whether the verb optionally or obligatorily subcategorizes for it, and its thematic role in the sentence.

Figure 4.2 illustrates the argument structures of some verbs¹:

- The root *al-* (*take*) is ditransitive. It obligatorily subcategorizes for a nominative or accusative marked direct object, and optionally subcategorizes for an ablative marked indirect object. The thematic role of the direct object is theme, and that of the indirect object is source.
- *Gel-* (*come*) is intransitive. So, it doesn't subcategorize for a direct or an indirect object. However, since it expresses motion, it can optionally take two oblique objects, one of them being marked dative (with thematic role goal), and the other one being marked ablative (with thematic role source).
- We have included two senses of *konus-* : *communicate* and *talk about*. The first one takes no objects, so the argument structure is nil. The second sense is transitive and obligatorily subcategorizes for a nominative, accusative or ablative marked direct object of which thematic role is theme.
- *Mutlu et-* (*make happy*) is a compound verb which obligatorily takes a nominative or accusative marked direct object of which thematic role is patient.

4.2 The Grammar

In this section, we present the LFG specification that we have developed for Turkish syntax. Our grammar includes rules for sentences, dependent clauses, noun phrases, adjectival phrases, adverbial phrases, verb phrases, and a number of lexical rules². Table 4.2 illustrates a statistics which shows the number of

¹Note that we haven't included all the senses of the verbs we have in the database.

²Recall that no morphological rules are included. The lexical rules are used just to call the morphological analyzer.

```

("al"
  (SENS ("to take"
    (ARGS (((*CASE* (NOM ACC))
      (*TYPE* DIRECT)
      (*OCC* OBLIGATORY)
      (*ROLE* THEME))
    ((*CASE* ABL)
      (*TYPE* INDIRECT)
      (*OCC* OPTIONAL)
      (*ROLE* SOURCE))))))))

("gel"
  (SENS ("to come"
    (ARGS (((*CASE* DAT)
      (*TYPE* OBLIQUE)
      (*OCC* OPTIONAL)
      (*ROLE* GOAL))
    ((*CASE* ABL)
      (*TYPE* OBLIQUE)
      (*OCC* OPTIONAL)
      (*ROLE* SOURCE))))))))

("konuS"
  (SENS ("to communicate"
    (ARGS ()))
    ("to talk about stg"
      (ARGS (((*CASE* (NOM ACC ABL))
        (*TYPE* DIRECT)
        (*OCC* OBLIGATORY)
        (*ROLE* THEME))))))))

("mutlu et"
  (SENS ("to make happy"
    (ARGS (((*CASE* (NOM ACC))
      (*TYPE* DIRECT)
      (*OCC* OBLIGATORY)
      (*ROLE* PATIENT))))))))

```

Figure 4.2. Argument structures of some verbs.

Table 4.2. The number of rules for each category in the grammar.

Category	Number of Rules
Noun phrases	17
Adjectival phrases	10
Adverbial phrases	74
Verb phrases	21
Dependent clauses	53
Sentences	19
Lexical rules	11

rules for each category in the grammar. There are also some intermediary rules. In the next sections, we present a number of rules for each category beginning with phrases.

4.2.1 Noun Phrases

Consider the first rule in Figure 4.3. When a noun phrase is followed by the question suffix *mI* we add a question (QUESTION) feature, of which value is equal to the f-structure of the node for the question suffix, to the f-structure of the final noun phrase. We don't want this rule apply recursively since only one question suffix can follow a noun phrase. The first equation in the rule guarantees that no question suffix precedes this one.

A noun phrase can also be followed by the postposition *bile* (*even*) or the conjunction *de/da* (*too*). These two words don't affect the original noun phrase grammatically. They rather have semantic influences on the f-structure of the final noun phrase. So, we just indicate these influences as illustrated in the second and third rules in Figure 4.3, respectively.

The most important of the rules for noun phrases is the rule for compound nouns (Figures 4.4–4.7). Though it is well-commented, we would like to clarify a few points further:

- In a definite compound noun of which modifier is marked genitive, if the modifier is the first or the second person, then the possessive of the modified can be omitted:

```

(<NP> <==> (<NP> <Q>))
  (((x1 QUESTION) = *UNDEFINED*)
   ((x0 QUESTION) = x2)
   (x0 = x1)))

(<NP> <==> (<NP> <POSTP>))
  (((x1 QUESTION) = *UNDEFINED*)
   (*TEST* (if (equal (x2 *R*) "bile") t))
   ((x0 *SEMANTIC-MODIFIER*) = x2)
   ((x0 *SEMANTIC-MODIFIER* *MODIFICATION*) = EVEN)
   (x0 = x1)))

(<NP> <==> (<NP> <CON>))
  (((x1 QUESTION) = *UNDEFINED*)
   (*TEST* (if (member (x2 *R*) '("de" "da") :test #'equal) t))
   ((x0 *SEMANTIC-MODIFIER*) = x2)
   ((x0 *SEMANTIC-MODIFIER* *MODIFICATION*) = TOO)
   (x0 = x1)))

```

Figure 4.3. The grammar rules for noun phrases which handle the question suffix, the postposition *bile* and the conjunction *de/da*.

(3) a.	senin	ev	‘your home’
	your	house	
b.	bizim	raporlar	‘our reports’
	our	report+PLU	

- In a definite compound noun of which modifier is marked genitive, the agreement of the modifier must be the same as the possessive of the modified with the exception that if the modifier is third-person plural the possessive of the modified may be third person singular (see Section 3.4, page 47).
- In a definite compound noun, the modified cannot be a definite compound noun. For example, there is only one interpretation of (4a): the modifier is *evin bahçesinin*, which is another definite compound noun, and the modified is *kapısı*. Similarly, in (4b) the modifier is *bahçelerden birinin* and the modified is *kapısı*, and in (4c) the modifier is *evin kapılarından* and the modified is *ikisi*:

(4) a.	evin	bahçesinin	kapısı
--------	------	------------	--------

- house+GEN garden+3SP+GEN door+3SP
 ‘the door of the garden of the house’
- b. bahçelerden birinin kapısı
 garden+PLU+ABL one+3SP+GEN door+3SP
 ‘the door of one of the gardens’
- c. evin kapılarından ikisi
 house+GEN door+PLU+3SP+ABL two+3SP
 ‘two of the doors of the house’

- In a definite compound noun of which modifier is marked ablative, the modified is a word that expresses quantity. It may be a number, or an adjective which expresses an uncountable (e.g., *biraz* (*little, some*)) or a countable (e.g., *birkaç* (*some, a few*)) quantity (see Section 3.4, page 48).
- In an indefinite compound noun, the modified cannot normally be a compound noun. For example, there is only one interpretation of (5a): *masa örtüsünün* is the modifier and *renği* is the modified. Compound nouns like (5b) are artificially formed proper nouns³. We don’t deal with such compounds for the time being:

- (5) a. masa örtüsünün rengi ‘the color of the tablecloth’
 table cloth+CM+GEN color+3SP
- b. Türk Dil Kurumu ‘Turkish Language Society’
 Turkish Language Society+CM

- In an indefinite compound noun, the modifier cannot have a possessive suffix. Hence, (6b) is the only interpretation of (6a), and (6c) is not valid:

- (6) a. masa örtüsü rengi ‘a color of a tablecloth’
 b. table cloth+CM color+CM
 c. *table cloth+3SP color+CM

The rule given in Figures 4.8–4.10 deals with compounds in which the first constituent is an adjectival phrase which modifies the second. We would like to make a few remarks about such compounds:

³It can be argued that *Türk* functions as an adjective here.


```

;This rule deals with definite and indefinite compound nouns.
(<NP> <==> (<NP> <NP>)
  ((*OR*
    ;This part is for definite compound nouns with genitive
    ;marked modifier.
    (((x1 *CASE*) =c GEN)
      (*OR*
        ;If the modifier is the first or the second person,
        ;the possessive suffix of the modified may be omitted.
        (((x1 *AGR*) = (*OR* 1SG 2SG 1PL 2PL))
          ((x2 *POSS*) = *UNDEFINED*))

        ;If the modified has a possessive suffix, then it must
        ;be consistent with the agreement of the modifier.
        (((x2 *POSS*) = *DEFINED*)
          (*OR*
            (((x1 *AGR*) =c 3PL)
              ((x2 *POSS*) = (*OR* 3SG 3PL)))
            (((x1 *AGR*) = (*NOT* 3PL))
              ((x1 *AGR*) = (x2 *POSS*))))))

    ;The modified cannot be a definite compound noun.
    (*EOR*
      (((x2 MODIFIER) = *UNDEFINED*))
      (((x2 MODIFIER *CASE*) = (*NOT* GEN))
        ((x2 MODIFIER *CASE*) = (*NOT* ABL))))

    ;Assign '+' to the definiteness feature.
    ((x0 *DEF*) = +))
  )

```

Figure 4.4. The grammar rule for compound nouns.

```

;This part is for definite compound nouns with ablative
;marked modifier.
(((x1 *CASE*) =c ABL)

;The modifier must be plural.
((x1 *AGR*) = (*OR* 1PL 2PL 3PL))

;The possessive of the modified is third person singular.
((x2 *POSS*) =c 3SG)

;The modified is a word that expresses quantity.
((x2 *SUB*) = *DEFINED*)
((x2 *SUB*) = (*OR* NUM QTY-U QTY-C)))

;The modified cannot be a definite compound noun.
(*EOR*
  (((x2 MODIFIER) = *UNDEFINED*))
  (((x2 MODIFIER *CASE*) = (*NOT* GEN))
  ((x2 MODIFIER *CASE*) = (*NOT* ABL))))

;Assign '+' to the definiteness feature.
((x0 *DEF*) = +))

;This part is for indefinite compound nouns.
;The modifier must be nominative.
(((x1 *CASE*) =c NOM)

;The modified cannot be a compound noun.
((x2 MODIFIER) = *UNDEFINED*)

;The modifier can be definite only if it is a proper noun.
(*OR*
  (((x1 *DEF*) = *UNDEFINED*))
  (((x1 *DEF*) =c -))
  (((x1 *DEF*) =c +)
  ((x1 *SUB*) =c PROP)))

```

Figure 4.5. The grammar rule for compound nouns continued.

```

;The possessive of the modifier must be undefined.
((x1 *POSS*) = *UNDEFINED*)

(*OR*
;If the modified is not a compound noun, and its
;possessive is third person plural or singular, this
;possessive can be replaced by a compound marker (CM).
(((x2 MODIFIED) = *UNDEFINED*)
((x2 *POSS*) = *DEFINED*)
(*OR*
(((x2 *POSS*) =c 3SG)
((x2 *AGR*) =c 3SG))
(((x2 *POSS*) =c 3PL)
((x2 *AGR*) =c 3PL)))
((x2 *POSS*) = *remove*)
((x2 *DEF*) = *remove*)
((x0 *CM*) = +)

;If the modifier is a proper noun then the compound
;noun refers to a particular entity, i.e., it is definite.
;Do not replace the possessive by CM.
(*OR*
(((x1 *SUB*) = *DEFINED*)
((x1 *SUB*) = (*NOT* PROP)))
(((x1 *SUB*) = *UNDEFINED*)))

;Assign '-' to the definiteness feature of the compound
;noun.
((x0 *DEF*) = -))

;If the modified has a possessive suffix, then the
;compound noun is definite.
(((x2 *POSS*) = *DEFINED*)
((x0 *DEF*) = +))))

```

Figure 4.6. The grammar rule for compound nouns continued.

```

;The modified is the head of the compound noun. So, the compound
;noun takes the possessive, compound marker, subcategory, case,
;and agreement features of the modified.
((x0 *POSS*) = (x2 *POSS*))
((x0 *CM*) = (x2 *CM*))
((x0 *SUB*) = (x2 *SUB*))
((x0 *CASE*) = (x2 *CASE*))
((x0 *AGR*) = (x2 *AGR*))

;If this is a definite compound noun with an ablative marked
;modifier, and the modified is a number of which value is
;greater than 1 or if it is an adjective which expresses
;countable quantity, then assign third person plural to the
;agreement feature of the compound noun.
(*EOR*
  (((x1 *CASE*) =c ABL)
    (*EOR*
      (((x2 *SUB*) =c NUM)
        ((x2 *VALUE*) = (*NOT* 1)))
        (((x2 *SUB*) =c QTY-C)))
      ((x0 *AGR*) = *remove*)
      ((x0 *AGR*) = 3PL))
    (((x0 *AGR*) = *DEFINED*)))

;The first constituent is the modifier, and the second one
;is the modified.
((x0 MODIFIER) = x1)
((x0 MODIFIED) = x2)))

```

Figure 4.7. The grammar rule for compound nouns continued.

- Some nominative or ablative nouns, those that are names of materials, indicate what an object is made of when it modifies the name of that object. We argue that such a noun functions as an adjective:

- (7) a. kağıt ev ‘a house made of paper’
 paper house
 b. kağıttan ev ‘a house made of paper’
 paper+ABL house

- When the pronomial suffix *+ki* is affixed to an expression of time or place which may be an adverb or a noun in the locative case, it makes a pronoun or adjective (see Section 3.2.2, page 23).
- In a definite compound noun the adjectives or participles that modify the modified follow the modifier (see Section 3.4, page 47). Hence, in a compound with an adjectival modifier, the modified cannot be a definite compound noun. For example, there is only one interpretation of (8a): the modifier is *yeşil kitabın* and the modified is *sayfası*, i.e., it is the book that is specified to be green. If we want to declare that the page is green, then (8b) is the right way of expressing that:

- (8) a. yeşil kitabın sayfası ‘the page of the green book’
 green book+GEN page+3SP
 b. kitabın yeşil sayfası ‘the green page of the book’
 book+GEN green page+3SP

The rule given in Figure 4.11 handles noun phrases that express a number. There are two types of such noun phrases:

- In the first type, the first constituent modifies the second one. The value of the first constituent is greater than that of the second, and the value of the whole phrase is equal to the product of the values of its constituents, e.g., *iki (two) yüz (hundred) (two hundred)*, *dört (four) bin (thousand) (four thousand)*.
- In the second type, the constituents do not modify each other. The value of the first constituent is smaller than that of the second, and the value of the whole phrase is equal to the sum of the values of its constituents, e.g., *yirmi (twenty) üç (three) (twenty three)*.

```

;This rule handles compounds in which the modifier is an
;adjectival phrase.
(<NP> <==> (<ADJP> <NP>))
  ((*OR*
    ;If the modifier indicates what the modified is made of,
    ;it may be marked ablative; otherwise it must be nominative.
    (((x1 *CASE*) =c ABL)
     ((x1 *ROLE*) =c MAT))
     (((x1 *CASE*) =c NOM)))

    (*EOR*
      ;The modifier can have a possessive suffix only if it is
      ;a participle formed by the suffixes -ecek and -dik, or an
      ;adjectival dependent clause of which infinitival is such a
      ;participle; otherwise it cannot have a possessive suffix.
      (((x1 INFINITIVAL) = *DEFINED*)
       (*TEST* (if (member (x1 INFINITIVAL *CONV* *WITH-SUFFIX*)
                           '("dik" "yacak") :test #'equal) t))
              ((x1 *POSS*) = *DEFINED*))

        (((x1 *CONV*) = *DEFINED*)
         (*TEST* (if (member (x1 *CONV* *WITH-SUFFIX*)
                             '("dik" "yacak") :test #'equal) t))
                ((x1 *POSS*) = *DEFINED*))

          (((x1 *POSS*) = *UNDEFINED*)))

    (*OR*
      ;If the modifier has a possessive suffix, the compound
      ;is definite.
      (((x1 *POSS*) = *DEFINED*)
       ((x0 *DEF*) = +))

      ;If the modifier is formed from a noun phrase with the
      ;suffix -ki, then the compound is definite.
      (((x1 *POSS*) = *UNDEFINED*)
       ((x1 *RELATIVE*) = *DEFINED*)
       ((x0 *DEF*) = +))
  ))

```

Figure 4.8. The grammar rule for nominal compounds with an adjectival modifier.

```

(*OR*
;If the modified has a possessive suffix, the compound
;is definite.
(((x1 *POSS*) = *UNDEFINED*)
 (x1 *RELATIVE*) = *UNDEFINED*)
 (x2 *POSS*) = *DEFINED*)
 (x0 *DEF*) = +))

;If the modifier is a demonstrator, then the compound
;is definite.
(((x1 *POSS*) = *UNDEFINED*)
 (x1 *RELATIVE*) = *UNDEFINED*)
 (x2 *POSS*) = *UNDEFINED*)
 (x1 *SUB*) =c DEMO)
 (x0 *DEF*) = +))

;If the modified is a proper noun, then the compound
;is definite.
(((x1 *POSS*) = *UNDEFINED*)
 (x1 *RELATIVE*) = *UNDEFINED*)
 (x2 *POSS*) = *UNDEFINED*)
(*EOR*
 (((x1 *SUB*) = *UNDEFINED*))
 (((x1 *SUB*) = (*NOT* DEMO))))
 (x2 *SUB*) =c PROP)
 (x0 *DEF*) = +))

;If none of the above conditions holds, then the compound
;is indefinite.
(((x1 *POSS*) = *UNDEFINED*)
 (x1 *RELATIVE*) = *UNDEFINED*)
 (x2 *POSS*) = *UNDEFINED*)
(*EOR*
 (((x1 *SUB*) = *UNDEFINED*))
 (((x1 *SUB*) = (*NOT* DEMO))))
(*EOR*
 (((x2 *SUB*) = *UNDEFINED*))
 (((x2 *SUB*) = (*NOT* PROP))))
 (x0 *DEF*) = -))

```

Figure 4.9. The grammar rule for nominal compounds with an adjectival modifier continued.

```

;The modified cannot be a definite compound noun.
(*EOR*
  (((x2 MODIFIER) = *UNDEFINED*))
  (((x2 MODIFIER *CASE*) = (*NOT* GEN))
  ((x2 MODIFIER *CASE*) = (*NOT* ABL))))

;The modified is the head of the compound noun. So, the
;compound takes the possessive, compound marker, subcategory,
;category, case, and agreement features of the modified.
((x0 *POSS*) = (x2 *POSS*))
((x0 *CM*) = (x2 *CM*))
((x0 *SUB*) = (x2 *SUB*))
((x0 *CASE*) = (x2 *CASE*))
((x0 *AGR*) = (x2 *AGR*))

;If the modifier is a number of which value is greater
;than 1, or if it is an adjective which expresses countable
;quantity, then assign third person plural to the agreement
;feature of the compound.
(*EOR*
  ((*EOR*
    (((x1 *SUB*) =c NUM)
    ((x1 *VALUE*) = (*NOT* 1)))
    (((x1 *SUB*) =c QTY-C)))
    ((x0 *AGR*) = *remove*)
    ((x0 *AGR*) = 3PL))
  (((x0 *AGR*) = *DEFINED*)))

;The first constituent is the modifier, and the second one
;is the modified.
((x0 MODIFIER) = x1)
((x0 MODIFIED) = x2)))

```

Figure 4.10. The grammar rule for nominal compounds with an adjectival modifier continued.


```

;This rule handles noun phrases that express a number.
(<NP> <==> (<NP> <NP>

;The first noun phrase must be nominative, and its possessive
;feature must be undefined.
(((x1 *CASE*) =c NOM)
 ((x1 *POSS*) = *UNDEFINED*))

;The subcategories of both of the constituents must be number.
((x1 *SUB*) =c NUM)
((x2 *SUB*) =c NUM)

;There are two types of such noun phrases:
(*EOR*
;The value of the first constituent is greater than that of
;the second.
((*TEST* (if (< (x1 *VALUE*) (x2 *VALUE*)) 't))
 ((x0 *VALUE*) <= (* (x1 *VALUE*) (x2 *VALUE*)))
 ((x0 MODIFIER) = x1)
 ((x0 MODIFIED) = x2))
;The value of the first constituent is smaller than that of
;the second.
((*TEST* (if (> (x1 *VALUE*) (x2 *VALUE*)) 't))
 ((x0 *VALUE*) <= (+ (x1 *VALUE*) (x2 *VALUE*)))
 ((x0 NUM-ONE) = x1)
 ((x0 NUM-TWO) = x2)))

;In both of the types, the noun phrase takes the possessive,
;subcategory, case, and agreement features of the modified.
((x0 *POSS*) = (x2 *POSS*))
((x0 *SUB*) = (x2 *SUB*))
((x0 *CASE*) = (x2 *CASE*))
((x0 *AGR*) = (x2 *AGR*)))

```

Figure 4.11. The grammar rule for noun phrases that express a number.

```

;This rule handles noun phrases of which constituents are combined
;by a conjunction or a comma.
(<NP> <==> (<NP> <C> <NP>))

```

```

;If the case of the first constituent is not nominative, then
;it must be the same as that of the second constituent.

```

```

((*EOR*
  (((x1 *CASE*) =c NOM))
  (((x1 *CASE*) = (x3 *CASE*)))))

```

```

(*EOR*
  ;If the first constituent has constituents which are combined
  ;by a comma, or a conjunction which is the same as the present
  ;conjunction, then the second constituent is simply added
  ;among the constituents of the first (see examples (10a-b)).

```

```

  (((x1 CONSTITUENTS) = *DEFINED*)
  (*EOR*
    (((x1 CONJUNCT) = *UNDEFINED*))
    (((x1 CONJUNCT *R*) = (x2 *R*)))))
  ((x0 CONSTITUENTS) = (x1 CONSTITUENTS))
  ((x0 CONSTITUENTS) > x3))

```

```

((*EOR*
  ;If the constituents of the first constituent are combined
  ;by a conjunction which is different from the present one,
  ;or if the first constituent has no constituents:
  (((x1 CONJUNCT) = *DEFINED*)
  ((x2 *R*) = *DEFINED*)
  (*TEST* (if (not (equal (x1 CONJUNCT *R*) (x2 *R*))) t)))
  (((x1 CONSTITUENTS) = *UNDEFINED*)))

```

```

(*EOR*
  ;OR, if the constituents of the second constituent are combined
  ;by a conjunction which is different from the present one, or
  ;if the second constituent has no constituents:
  (((x3 CONJUNCT) = *DEFINED*)
  ((x2 *R*) = *DEFINED*)
  (*TEST* (if (not (equal (x3 CONJUNCT *R*) (x2 *R*))) t)))
  (((x3 CONSTITUENTS) = *UNDEFINED*)))

```

Figure 4.12. The grammar rule for noun phrases with a conjunction or a comma.

```

;Then the first and the second constituents are combined
;(see examples (10c-e)):
((x0 CONSTITUENTS) > x3)
((x0 CONSTITUENTS) > x1)))
;The case of the noun phrase is the same as that of the second
;constituent.
((x0 *CASE*) = (x3 *CASE*))

(*OR*
;If one of the constituents is first person, then the agreement
;of the noun phrase is first person plural.
((*EOR*
(((x1 *AGR*) = (*OR* 1SG 1PL)))
(((x3 *AGR*) = (*OR* 1SG 1PL))))
((x0 *AGR*) = 1PL))
;If none of the constituents is first person, and one of them
;is second person, then the agreement of the noun phrase is
;second person plural.
((*EOR*
(((x1 *AGR*) = (*OR* 2SG 2PL))
((x3 *AGR*) = (*NOT* 1SG))
((x3 *AGR*) = (*NOT* 1PL)))
(((x3 *AGR*) = (*OR* 2SG 2PL))
((x1 *AGR*) = (*NOT* 1SG))
((x1 *AGR*) = (*NOT* 1PL))))
((x0 *AGR*) = 2PL))
;Otherwise, the agreement of the phrase is third person plural.
(((x1 *AGR*) = (*OR* 3SG 3PL))
((x3 *AGR*) = (*OR* 3SG 3PL))
((x0 *AGR*) = 3PL)))

;If the constituents are combined by a conjunction, then save
;it in the CONJUNCT feature.
(*EOR*
(((x2 *R*) = *DEFINED*)
((x0 CONJUNCT) = x2))
(((x2 *R*) = *UNDEFINED*))))))

```

Figure 4.13. The grammar rule for noun phrases with a conjunction or a comma continued.

4.2.2 Adjectival Phrases

Here, we present some of the rules for the adjectival phrases.

Figure 4.14 illustrates a rule which deals with the adjectival phrases such as:

- | | | | | |
|---------|----------|-------------|-------|----------------------------------|
| (11) a. | kanadı | kırık | kuş | ‘the bird whose wing is broken’ |
| | wing+3SP | broken | bird | |
| b. | kafası | bozuk | adam | ‘the man whose head is deranged’ |
| | head+3SP | deranged | man | |
| c. | güneş | gözlüklü | kadın | ‘the woman with sunglasses’ |
| | sun | glasses+ADJ | woman | |
| d. | evrak | çantasız | adam | ‘the man without portfolio’ |
| | papers | case+ADJ | man | |

Adjectival phrases such as (11c,d) are formed by the affixation of one the suffixes *+lI* and *+sIz*, which derive adjectives from nouns, to an indefinite compound noun. During this process, the compound marker of the indefinite compound noun is dropped. For example, (11c) is formed from the indefinite compound noun *güneş gözlüğü* (*sunglasses*), and (11d) is formed from *evrak çantası* (*portfolio*).

A noun phrase that expresses a number, and a measure (e.g., *kilo* (*kilo*), *metre* (*meter*)) form an adjectival phrase which expresses quantity, e.g., *bir* (*one*) *metre* (*meter*) (*one meter*) in *bir metre kumaş* (*one meter of cloth*) and *on* (*ten*) *iki* (*two*) *kilo* (*kilo*) in *on iki kilo elma* (*twelve kilos of apple*). The rule given in Figure 4.15 deals with such phrases.

A compound noun which satisfies the following conditions can function as an adjectival phrase:

- Its modified constituent must be a noun which expresses a physical property like *boy* (*height*, *length*), *uzunluk* (*length*), *ağırlık* (*weight*), *genişlik* (*width*), *kütle* (*mass*), *uzaklık* (*distance*) *koku* (*smell*), *renk* (*color*) and *yaş* (*age*).
- Its case must be locative.

```

(<ADJP> <==> (<NP> <ADJP>)
;The case of the noun phrase must be nominative.
(((x1 *CASE*) =c NOM)
(*EOR*
;When an adjectival phrase follows a noun phrase with a third
;possessive suffix, it modifies the noun phrase, and they
;together form an adjectival phrase (see examples (11a-b)).
(((x1 *POSS*) = *DEFINED*)
((x1 *POSS*) = (*OR* 3SG 3PL))
((x0 MODIFIED) = x1)
((x0 MODIFIER) = x2))

;When a nominative noun phrase follows an adjective derived
;from a noun by one of the suffixs "-li" and "-siz", the noun
;phrase modifies the adjective, and they together form an
;adjectival phrase (see examples (11c-d)).
(((x2 *CONV*) = *DEFINED*)
(*TEST* (if (member (x2 *CONV* *WITH-SUFFIX*)
                    '("li" "siz") :test #'equal) t))
((x1 *POSS*) = *UNDEFINED*)
((x0 MODIFIER) = x1)
((x0 MODIFIED) = x2)))

((x0 *POSS*) = (x2 *POSS*))
((x0 *CASE*) = (x2 *CASE*))
((x0 *AGR*) = (x2 *AGR*)))

```

Figure 4.14. An example of the grammar rules for adjectival phrases.

```

(<ADJP> <==> (<NP> <N>))
;The case of the first constituent must be nominative, its
;possessive must be undefined, and its subcategory must be
;number.
(((x1 *CASE*) =c NOM)
 (x1 *POSS*) = *UNDEFINED*)
 (x1 *SUB*) =c NUM)

;The subcategory of the second constituent must be measure.
((x2 *SUB*) =c MEASURE)

;The first constituent is the modifier, and the second one
;is the modified.
((x0 MODIFIER) = x1)
((x0 MODIFIED) = x2)))

```

Figure 4.15. An example of the grammar rules for adjectival phrases.

Below we give some examples of such adjectival phrases which we hadle using the rule in Figure 4.16:

- (12) a. bir metre uzunluğunda boru
 one meter length+CM⁴+LOC pipe
 ‘one-meter long pipe’
- b. insan boyunda ağaçlar
 human height+CM+LOC tree+PLU
 ‘trees with the height of a human’
- c. çukulata renginde yaprak
 chocolate color+CM+LOC leaf
 ‘chocolate leaf’
- d. benim yaşımda çocuklar
 my age+1SP+LOC child+PLU
 ‘children at my age’

⁴Note that here a third person singular suffix is also syntactically plausible though a compound marker is more reasonable.

```

(<ADJP> <==> (<NPR>))
(((x1 MODIFIED *ROLE*) =c PROPERTY)
 (*OR*
  (((x1 *POSS*) = *DEFINED*))
  (((x1 *POSS*) = *UNDEFINED*)
   ((x1 *CM*) = *DEFINED*)))
 ((x1 *CASE*) =c LOC)
 (x0 = x1)))

```

Figure 4.16. An example of the grammar rules for adjectival phrases.

4.2.3 Adverbial Phrases

We handle all the examples of adverbial phrases given in Section 3.3.7 except for the following ones:

- (13) a. İki senedir onu görmedim.
 two year+ADV him see+NEG+PAST+1SG
 ‘I haven’t seen him for two years.’
- b. Yıllar yılı burada yaşadım.
 year+PLU year+3SP here+LOC live+PAST+1SG
 ‘I lived here for many years.’
- c. Eğer gitmek istemiyorsan
 if go+INF want+NEG+PRG+COND+2SG
 lütfen söyle.
 please say+IMP+2SG
 ‘If you don’t want to go, please say so.’
- d. Şayet geç kalırsam
 if be late+AOR+COND+1SG
 beni bekleme.
 me wait for+NEG+IMP+2SG
 ‘If I am late, don’t wait for me.’

(13b) is an idiomatic expression with no general syntactic rule. Note that (13c,d) are (structurally) *conditional sentences* (see Section 3.5.2). Hence, they are beyond our scope.

There are rules for handling the question suffix, the postposition *bile* (*even*) and the conjunction *de/da* (*too*) in the adverbial phrases, too. These rules are very similar to those for noun phrases (see Figure 4.3). So, we will skip them here. We also have a recursive rule which lets an adverbial phrase be composed of more than one adverbial phrases. This allows us handle successive adverbial complements in a sentence with only one adverbial phrase in the phrase structure. Below we present some examples of the rules for adverbial phrases.

Consider the rule in Figures 4.17–4.18. This rule deals with the noun phrases that can be used as temporal adverbial complements which specify directly the time of the event or the action indicated by the verb. Such a phrase is either a noun that has a temporal feature, or it contains such a noun as a modified constituent. There are several types of such phrases. Examples for each type are given just above the part for that type in the rule. Note that we classify nouns with temporal features into a number of classes in order to handle all types:

- **TEMP-DAYTIME:** *akşam* (*evening*), *gece* (*night*), *gündüz* (*daytime*), *sabah* (*morning*)
- **TEMP-MONTH:** *ocak* (*january*), *şubat* (*february*), *mart* (*march*), etc.
- **TEMP-SEASON1:** *kış* (*winter*), *yaz* (*summer*)
- **TEMP-SEASON2:** *bahar*, *ilkbahar* (*spring*), *sonbahar* (*fall, autumn*)
- **TEMP-POINT:** *an* (*moment, instant*), *saat* (*hour*), *zaman* (*time*)
- **TEMP-UNIT:** *ay* (*month*), *gün* (*day*), *hafta* (*week*), *yıl* (*year*)
- **TEMP-WEEK:** *pazartesi* (*monday*), *salı* (*tuesday*), *çarşamba* (*wednesday*), etc.

The rule given in Figures 4.19–4.20 deals with temporal adverbial complements and adverbial complements of direction that are formed by a noun phrase followed by a postposition, i.e., a postpositional phrase. Again examples are given just above each part.

Consider the rule given in Figure 4.21. It deals with the noun phrases that can be used as temporal adverbial complements which specify the period of

```

(<ADVP> <==> (<NP>)
  ((*EOR*
    ;"akSama" "bu sabah" "bu geceye"
    (((x1 *SUB*) =c TEMP-DAYTIME)
      (*OR*
        (((x1 *CASE*) =c NOM)
          ((x1 *AGR*) =c 3SG))
          (((x1 *CASE*) =c DAT))))))

    ;"bu Subata" "ocakta"
    (((x1 *SUB*) =c TEMP-MONTH)
      ((x1 *CASE*) = (*OR* DAT LOC)))

    (((x1 *SUB*) = *DEFINED*)
      ((x1 *SUB*) = (*OR* TEMP-SEASON1 TEMP-SEASON2))
      (*EOR*
        ;"bu yaz" "o bahar"
        (((x1 MODIFIER) = *DEFINED*)
          ((x1 *CASE*) =c NOM))
        ;"bu yaza" "kISa"
        (((x1 *CASE*) =c DAT))))))

    ;"bu baharda" "sonbaharda"
    (((x1 *SUB*) =c TEMP-SEASON2)
      ((x1 *CASE*) =c LOC))

    ;"o anda" "bu saatte" "bu zamanda"
    (((x1 *SUB*) =c TEMP-POINT)
      ((x1 MODIFIER) = *DEFINED*)
      ((x1 *CASE*) = (*OR* NOM LOC)))

    ;"bu gUn" "o hafta" "gelecek ay"
    (((x1 *SUB*) =c TEMP-UNIT)
      ((x1 MODIFIER) = *DEFINED*)
      (*OR*
        (((x1 *CASE*) =c NOM)
          ((x1 *AGR*) =c 3SG))
          (((x1 *CASE*) =c DAT))))))

```

Figure 4.17. An example rule for temporal adverbial phrases.

```

; "bu CarSamba" "pazartesi"
(((x1 *SUB*) =c TEMP-WEEK)
 (*OR*
  (((x1 *CASE*) =c NOM)
   ((x1 *AGR*) =c 3SG))
  (((x1 *CASE*) =c DAT))))))

((x0 *TEMP-TYPE*) = TIME)
(x0 = x1))

```

Figure 4.18. An example rule for temporal adverbial phrases continued.

```

(<ADVP> <==> (<NP> <POSTP>))
 ((*EOR*
  ; "sabahtan beri" "evden beri"
  (((x1 *CASE*) =c ABL)
   (*TEST* (if (equal (x2 *R*) "beri") t))
   ((x0 *SUB*) = TEMP)
   ((x0 *TEMP-TYPE*) = BEGINNING))

  ; "yarIna kadar" "akSama dek" "sabaha deGin"
  (((x1 *CASE*) =c DAT)
   ((x1 *SUB*) = *DEFINED*)
   ((x1 *SUB*) = (*OR* TEMP TEMP-DAYTIME TEMP-MONTH TEMP-SEASON1
                      TEMP-SEASON2 TEMP-POINT TEMP-UNIT TEMP-WEEK))
   (*TEST* (if (member (x2 *R*) '("kadar" "dek" "deGin")
                    :test #'equal) t))
   ((x0 *SUB*) = TEMP)
   ((x0 *TEMP-TYPE*) = END))

```

Figure 4.19. An example rule for temporal adverbial phrases and adverbial complements of direction.

```

;"benim kadar" "sen kadar" "oda kadar"
(((*EOR*
  ((x1 *CAT*) =c PN)
  ((x1 *CASE*) = (*OR* NOM GEN)))
  ((x1 *CASE*) =c NOM)))
(*TEST* (if (equal (x2 *R*) "kadar") t))
((x0 *SUB*) = EQUALITY))

;"yaza doGru" "sabaha karSI"
(((x1 *CASE*) =c DAT)
  ((x1 *SUB*) = *DEFINED*)
  ((x1 *SUB*) = (*OR* TEMP TEMP-DAYTIME TEMP-MONTH TEMP-SEASON1
                 TEMP-SEASON2 TEMP-POINT TEMP-UNIT TEMP-WEEK))
  (*TEST* (if (member (x2 *R*) '("doGru" "karSI") :test #'equal) t))
  ((x0 *SUB*) = TEMP)
  ((x0 *TEMP-TYPE*) = TIME))

;"yokuStan aSaGI" "evden iCeri" "buradan Ote"
(((x1 *CASE*) =c ABL)
  (*TEST* (if (member (x2 *R*) '("aSaGI" "yukarI" "iCeri" "dISarI"
                                "Ote") :test #'equal) t))
  ((x0 *SUB*) = DIR))

;"kOye doGru" "okula kadar"
(((x1 *CASE*) =c DAT)
  (*TEST* (if (member (x2 *R*) '("doGru" "karSI" "kadar")
                      :test #'equal) t))
  ((x0 *SUB*) = DIR)))
((x0 OBJ) = x1)
(x0 = x2))

```

Figure 4.20. An example rule for temporal adverbial phrases and adverbial complements of direction continued.

```

(<ADVP> <==> (<NP>))
  (((x1 *TEMP-ADV*) = *UNDEFINED*)
   ((x1 MODIFIER *SUB*) = *DEFINED*)
   ((x1 MODIFIER *SUB*) = (*OR* NUM QTY-C))
   ((x1 *SUB*) = *DEFINED*)
   ((x1 *SUB*) = (*OR* TEMP-DAYTIME TEMP-MONTH TEMP-SEASON1
                  TEMP-SEASON2 TEMP-POINT TEMP-UNIT TEMP-WEEK)))
  ((x1 *CASE*) = (*OR* NOM LOC))
  ((x0 *TEMP-TYPE*) = PERIOD)
  (x0 = x1)))

```

Figure 4.21. An example rule for temporal adverbial complements of period.

the event or the action indicated by the verb, e.g., *iki (two) gece (night) (two nights)*, *üç (three) ay (month) (three months)*, *birkaç (a few) günde (day+LOC) (in a few days)*.

The rule in Figure 4.22 deals with adverbial phrases that are formed by reduplication of noun phrases. The first noun phrase must be marked ablative, and the second dative. If the noun phrases have temporal features then the adverbial phrase they form can be used as a temporal adverbial complement which expresses continuence, e.g., *sabahtan (morning+ABL) akşama (evening+DAT) (from morning till evening)*. Otherwise, the adverbial phrase can be used as an adverbial complement of quality which modifies the verb in respect of manner, e.g., *evden (home+ABL) eve (home+DAT) (from home to home, home by home)*.

Figure 4.23 illustrates a rule for temporal adverbial complements which modify the verb in respect of frequency. Such a phrase is formed by a locative marked noun phrase with a temporal feature (TEMP-POINT or TEMP-UNIT) followed by the noun *bir (a)*, e.g., *yilda (year+LOC) bir (a) (once a year)*, *saatte (hour+LOC) bir (a) (once an hour)*.

The rules in Figure 4.24 deal with adverbial phrases that are formed by reduplication of adjectives. Such adverbial phrases can be used as adverbial complements of quality which modify the verb in respect of manner. In the first rule, the adjectives that form the phrase are derived from nouns using the suffixes *+lı*, *+sız*, e.g., *ilgili (interest+ADJ) ilgisiz (interest+ADJ) (interested uninterested)*, *hızlı (speed+ADJ) hızlı (speed+ADJ) (fast)*. The second rule handles the reduplication of qualitative adjectives, e.g., *güzel (good) güzel*

```

(<ADVP> <==> (<NP> <NP>))
  (((x1 *CASE*) =c ABL)
   ((x2 *CASE*) =c DAT)

  (*EOR*
   ;If the noun phrases have temporal features then the adverbial
   ;phrase can be used as a temporal adverbial complement of continuence.
   (((x1 *SUB*) = *DEFINED*)
    ((x2 *SUB*) = *DEFINED*)
    ((x1 *SUB*) = (*OR* TEMP TEMP-DAYTIME TEMP-MONTH TEMP-SEASON1
                    TEMP-SEASON2 TEMP-POINT TEMP-UNIT TEMP-WEEK))
    ((x2 *SUB*) = (*OR* TEMP TEMP-DAYTIME TEMP-MONTH TEMP-SEASON1
                    TEMP-SEASON2 TEMP-POINT TEMP-UNIT TEMP-WEEK))
    ((x0 *SUB*) = TEMP)
    ((x0 *TEMP-TYPE*) = CONTINUENCE))

   ;Otherwise, the adverbial phrase can be used as an adverbial
   ;complement of quality which modifies the verb in respect of manner.
   (((x1 *R*) <= (if (equal (x1 *R*) (x2 *R*)) (x1 *R*)))
    ((x1 *R*) = *DEFINED*)
    ((x0 *SUB*) = QUALITY)
    ((x0 *QUALITY-TYPE*) = MANNER)))

  ((x0 *FROM*) = x1)
  ((x0 *TO*) = x2)))

```

Figure 4.22. An example rule which deals with temporal adverbial complements and adverbial complements of quality.

```

(<ADVP> <==> (<NP> <N>))
  (((x1 *CASE*) =c LOC)
   ((x1 *SUB*) = *DEFINED*)
   ((x1 *SUB*) = (*OR* TEMP-POINT TEMP-UNIT))
   (*TEST* (if (equal (x2 *R*) "bir") t))
   ((x0 *SUB*) = TEMP)
   ((x0 *TEMP-TYPE*) = FREQUENCY)
   ((x0 *ONCE-A*) = x1)))

```

Figure 4.23. An example rule which deals with temporal adverbial complements of frequency.

```

;"hIzli hIzli" "ilgili ilgisiz"
(<ADVP> <=> (<ADJ> <ADJ>
  (((x1 *CONV*) = *DEFINED*)
   (*TEST* (if (member (x1 *CONV* *WITH-SUFFIX*)
                       '("li" "siz") :test #'equal) t))
  ((x2 *CONV*) = *DEFINED*)
  (*TEST* (if (member (x2 *CONV* *WITH-SUFFIX*)
                       '("li" "siz") :test #'equal) t))
  (*TEST* (if (equal (x1 *R*) (x2 *R*)) t))
  ((x0 *SUB*) = QUALITY)
  ((x0 *QUALITY-TYPE*) = MANNER)
  ((x0 PART1) = x1)
  ((x0 PART2) = x2)))

;"gUzel gUzel"
(<ADVP> <=> (<ADJ> <ADJ>
  ((*TEST* (if (equal (x1 *R*) (x2 *R*)) t))
   ((x1 *LEX*) = (*NOT* n))
   ((x1 *SUB*) =c QUAL)
   ((x2 *SUB*) =c QUAL)
   ((x0 PART1) = x1)
   ((x0 PART2) = x2)
   ((x0 *SUB*) = QUALITY)))

```

Figure 4.24. Rules which deal with adverbial complements of quality formed by reduplication of adjectives.

(*good*) (*calmly*, *meekly*).

The rule in Figure 4.25 is for adverbial phrases that are formed by a noun phrase followed by one of the postpositions *için* (*for*) or *dolayı* (*because of*). When the postposition is *için*, if the noun phrase is a pronoun its case must be genitive, e.g., *benim* (*my*) *için* (*for*) (*for me*); otherwise, its case must be nominative, e.g., *annem* (*mother+1SP*) *için* (*for*) (*for my mother*). When the postposition is *dolayı*, the noun phrase must be marked ablative, e.g., *bundan* (*this+ABL*) *dolayı* (*because of*) (*because of this*), *seçimden* (*election+ABL*) *dolayı* (*because of*) (*because of the election*). Such phrases can be used as adverbial complements of quality that specify the reason of the event or the action indicated by the verb.

The rules in Figure 4.26 are for adverbial complements which indicate that the event or the action expressed by the verb is repeated several times. The

```

(<ADVP> <==> (<NP> <POSTP>)
  ((*EOR*
    ((*EOR*
      ((x1 *CAT*) =c PN)
      ((x1 *CASE*) =c GEN))
      ((x1 *CASE*) =c NOM)))
    (*TEST* (if (equal (x2 *R*) "iCin") t)))
    ((x1 *CASE*) =c ABL)
    (*TEST* (if (equal (x2 *R*) "dolayI") t))))
  ((x0 *SUB*) = QUALITY)
  ((x0 *QUALITY-TYPE*) = REASON)
  ((x0 OBJ) = x1)
  (x0 = x2)))

```

Figure 4.25. An example rule which deals with adverbial complements of quality that specify the reason of the verb.

first rule says that a noun phrase of which modified constituent is one of the nouns *sefer*, *defa*, *kez*, *kere* (*time*) can be used as an adverbial complement of repetition, e.g., *bir (one) defa (time) (once)*, *çok (many) kere (time) (many times)*. What the second rule suggests is that when such an adverbial phrase (one formed by the first rule) is followed by the adverb *daha* (*more, again*), they together form another adverbial phrase which can be used as an adverbial complement which expresses repetition, e.g., *iki (two) sefer (time) daha (more) (two times more)*.

In Turkish, there are a number of nouns which sometimes function as postpositions, e.g., *hak* (*due*), *uğur* (*aim, goal*), *saye* (*favour*), *taraf* (*side, part*). When one of these nouns takes part as the modified constituent in a compound noun, it grammatically functions as a postposition, and the compound noun can be treated as a postpositional phrase, e.g., *senin (your) hakkında (about), (about you)*, *kitabın (kitap+GEN/2SP) uğruna (for the sake of) (for the sake of the/your book)*, *onun (his) sayesinde (due to, owing to) (due to him, thanks to him)*, *annem (mother+1SP) tarafından (by) (by my mother)*. Such phrases formed by *hak*, *uğur* and *saye* can be used as adverbial complements of reason (see the first rule in Figure 4.27). Those formed by *taraf* are used as adverbial complements that indicate the agent of the action in passive sentences (see the second rule in Figure 4.27).


```

(<ADVP> <==> (<NP>))
  ((*TEST* (if (member (x1 MODIFIED *R*) '("sefer" "defa" "kez"
                                          "kere") :test #'equal) t))
    ((x0 *SUB*) = REPETITION)
    (x0 = x1)))

(<ADVP> <==> (<ADVP> <ADV>))
  ((*TEST* (if (equal (x2 *R*) "daha") t))
    ((x2 *SUB*) = *UNDEFINED*)
    ((x1 *SUB*) =c REPETITION)
    ((x0 *SUB*) = REPETITION)
    ((x0 MODIFIER) = x1)
    (x0 = x2)))

```

Figure 4.26. Rule which deal with adverbial complements of repetition.

```

(<ADVP> <==> (<NP>))
  ((*TEST* (if (member (x1 MODIFIED *R*) '("hak" "uGur" "saye")
                                          :test #'equal) t))
    ((x0 *SUB*) = REASON)
    (x0 = x1)))

(<ADVP> <==> (<NP>))
  ((*TEST* (if (equal (x1 MODIFIED *R*) "taraf") t))
    ((x0 *SUB*) = AGENT)
    (x0 = x1)))

```

Figure 4.27. Rules which deal with adverbial complements formed with *hak*, *uğur*, *saye* and *taraf*.

4.2.4 Verb Phrases

There are rules for handling the question suffix, the postposition *bile* (*even*) and the conjunction *de* (*too*) in the verb phrases, too. We will skip them since they are very similar to those for noun phrases (see Figure 4.3).

In Turkish, a nominative marked (indefinite) direct object always precedes the verb (see Section 3.3.5). We argue that such an object should be treated as a part of the verb phrase. The first rule in Figure 4.28 says that a nominative noun phrase and a verb phrase, which has no objects or adverbial complements, form a new verb phrase. The function *find-object-type* is an ordinary LISP function which checks whether the verb can take an object with the case of the noun phrase in question (here nominative). The voice of the verb should also be considered since it can change the valence of the verb (see Section 3.3.2). If the verb can take such an object the function returns the type of the object (direct, indirect, oblique), and its thematic role.

Another limitation on the order of constituents in Turkish sentences is that some adverbial complements of quality (those that are actually qualitative adjectives) always precede the verb if there is no indefinite direct object:

- (14) a. Yemeği iyi pişirdin.
 meal+ACC good cook+PAST+2SG
 ‘You cooked the meal well.’
 b. İyi yemeği pişirdin.
 good meal+ACC cook+PAST+2SG
 ‘You cooked the good meal.’

Note that although (14b) is grammatical *iyi* is no more an adverbial complement, but is an adjective that modifies *yemek* (*yemek*). We argue that such an adverbial complement should be treated as a part of the verb phrase, too. The second rule in Figure 4.28 serves for this purpose.

In principle, any noun phrase can be used as a (nominal) verb phrase. The argument structure of such a verb phrase is the same as that of the compound verb which is formed by this noun phrase and the auxiliary verb *ol-* (*be*, *become*):

- (15) a. Seni gördüğüne memnun oldu.

```

(<VP> <==> (<NP> <VP>)
  (((x2 OBJS) = *UNDEFINED*)
   ((x2 ADVADJUNCT) = *UNDEFINED*)
   ((x1 *CASE*) =c NOM)
   ((x1 FLAG) <= (find-object-type (x1 *CASE*) (x1 *SUB*)
                                   (x2 ARGS) (x2 *VOICE*)))

   ((x1 FLAG) = *DEFINED*)
   (x1 = (x1 FLAG))
   ((x0 ROLES) > (x1 FLAG *ROLE*))
   ((x1 FLAG) = *remove*)
   ((x1 *DEF*) = -)
   ((x2 OBJS) > x1)
   (x0 = x2)))

(<VP> <==> (<ADV> <VP>)
  (((x2 ADVADJUNCT) = *UNDEFINED*)
   ((x1 *SUB*) =c QUAL)
   ((x2 ADVADJUNCT) = x1)
   (x0 = x2)))

```

Figure 4.28. Rules for verb phrases which deal with indefinite direct object and qualitative adjectives used as adverbial complements of quality, respectively.

```

(<VP> <==> (<NP>))
  (((x0 *TYPE*) = NOMINAL)
   ((x0 ARGS) <= (add-compound-args (x1 *R*) "ol"))
   (x0 = x1)))

```

Figure 4.29. The rule for using any noun verb phrase as a verb phrase.

you see+PART+DAT pleased be+PAST+3SG
 ‘He was pleased to see you.’
 b. Seni gördüğüne memnun.
 you see+PART+DAT pleased
 ‘He is pleased to see you.’

The rule in Figure 4.29 handles such verb phrases.

We handle all the compound verbs described in Section 3.3.2 except the ones that are semantically coalesced. The reason is that such compound verbs are idiomatic expressions, and there are no general syntactic rules for them. We present some examples of the rules for compound verbs below. Examples of the compound verbs they deal with are given above each rule. Note that the objects that a compound verb can take are generally determined by the argument structure of the first constituent. So, we remove the argument structure of the second constituent, and assign that of the first to the argument structure of the whole compound verb in most of the rules.

The rules in Figure 4.30 are for compound verbs that express continuence in an action.

The rule in Figure 4.31 is for compound verbs that express intension.

The rule in Figure 4.32 deals with compound verbs that are formed from auxiliary verbs. Note that the argument structures of such compound verbs are determined by both of the constituents. For example, *memnun ol-* (*be happy*) takes a dative marked direct object whereas *memnun et-* (*make happy*) takes one which is marked either nominative or accusative:

(16) a. Seni gördüğüne memnun oldu.
 you see+PART+DAT pleased be+PAST+3SG

```

;"uzar giderdi", "dondu kaldI", "devam etti durdu"
(<VP> <==> (<VP> <V>)
  (((x1 *AGR*) =c 3SG)
   ((x1 *TYPE*) =c VERBAL)
   ((x1 *ASPECT*) = (x2 *ASPECT*))
   (*TEST* (if (member (x2 *R*) '("git" "kal" "dur")
                    :test #'equal) t))

  ((x2 ARGS) = *remove*)
  ((x0 ARGS) = (x1 ARGS))
  ((x1 ARGS) = *remove*)
  ((x0 PART1) = x1)
  ((x0 COMPOUND-TYPE) = CONTINUENCE)
  (x0 = x2)))

;"arayIp duruyordum", "sUrdUrUp gidecek miyiz", "soGuyup gitmiStir"
(<VP> <==> (<EYS> <V>)
  (((x1 TTYPE) = GERUND)
   ((x1 TTYPE) = *remove*)
   ((x1 *CONV*) = *DEFINED*)
   (*TEST* (if (equal (x1 *CONV* *WITH-SUFFIX*) "yip") t))
   (*TEST* (if (member (x2 *R*) '("git" "kal" "dur")
                    :test #'equal) t))

  ((x2 ARGS) = *remove*)
  ((x0 ARGS) = (x1 ARGS))
  ((x1 ARGS) = *remove*)
  ((x0 PART1) = x1)
  ((x0 COMPOUND-TYPE) = CONTINUENCE)
  (x0 = x2)))

```

Figure 4.30. Compound verbs that express continuence in an action.

```

;"soracak oldular", "diyecek oldular"
(<VP> <==> (<EYS> <V>))
  (((x1 TTYPE) = PARTICIPLE)
   ((x1 TTYPE) = *remove*)
   ((x1 *CONV*) = *DEFINED*)
   (*TEST* (if (equal (x1 *CONV* *WITH-SUFFIX*) "yacak") t))
   (*TEST* (if (equal (x2 *R*) "ol") t))
   ((x2 *R*) = (*NOT* n))
   ((x2 ARGS) = *remove*)
   ((x0 ARGS) = (x1 ARGS))
   ((x1 ARGS) = *remove*)
   ((x0 PART1) = x1)
   ((x0 COMPOUND-TYPE) = INTENSION)
   (x0 = x2)))

```

Figure 4.31. Compound verbs that express intension.

‘He is pleased to see you.’
 b. Seni memnun etti.
 you pleased make+PAST+3SG
 ‘He made you pleased.’

```

;"mutlu olmak" "yardım etmek"
(<VP> <==> (<NP> <V>))
  (((x1 *CASE*) =c NOM)
   (*TEST* (if (member (x2 *R*) '("ol" "et") :test #'equalp) t))
   ((x2 ARGS) = *remove*)
   ((x0 ARGS) <= (add-compound-args (x1 *R*) (x2 *R*)))
   ((x0 PART1) = x1)
   (x0 = x2)))

```

Figure 4.32. Compound verbs that are formed by auxiliary verbs.

4.2.5 Sentences

In Turkish, the typical order of constituents in a sentence may change due to a number of reasons (see Section 3.2.1). Because of this rather free nature of word-order in Turkish syntax, and the fact that the order of phrases is

fixed in the phrase structure component of an LFG rule, some of the rules for sentences and dependent clauses in our grammar are repeated for different phrase structures. As a result, there are a great number of redundant rules for these categories. Though we suggest a solution to this problem in Chapter 6 we haven't successfully implemented this solution yet.

In Figure 4.33 we present an example rule for sentences. Note that the other rules are very similar to this one. (Actually, the only thing that really differs is the phrase structure component.) This rule says that a sentence can be constructed by a noun phrase followed by an adverbial phrase and a verb phrase. Note that although there are three constituents in the phrase structure of this rule this doesn't imply that there are three constituents in the sentence, but that there are at least three constituents, since the adverbial phrase may consist of more than one independent adverbial phrase (see Section 4.2.3, page 83), and the verb phrase may contain an indefinite direct object and an adverbial complement of quality (see Section 4.2.4, pages 92–92). Besides, there may be an implicit subject. We would like to make a few remarks about this rule:

- We first check whether the verb phrase already contains an adverbial complement. If so, we move its f-structure to ADVCOMPLEMENTS part of the S's f-structure, where the f-structures of the other adverbial complements of the sentence will be kept⁵. Then we assign the VP's f-structure to the VERB part of the S's f-structure.
- The f-structure of the adverbial phrase is assigned to the ADVCOMPLEMENTS part of the S's f-structure.
- Then we concern ourselves with the NP node:
 1. We first check whether its case is nominative. If so, it can be the subject.
 2. It can also be an object, if the verb can take an object with its case. (Recall that the LISP function *find-object-type* performs this check (see Section 4.2.4, page 92).) In other words, we check whether the Coherence Condition is satisfied (see Section 2.3). If it is an accusative marked direct object then it is definite (see Section 3.3.5). Also its case cannot be nominative since any indefinite direct (nominative) object must already be processed by the first VP-rule in Figure 4.28.

⁵Recall that multiple values can be assigned to a feature (see Section 4.1.1, page 61).

3. The NP can also be an indirect complement. The LISP function *find-complement-type* checks if this is the case. Since we let only locative marked noun phrases be indirect complements (see Section 3.3.6), this function merely checks whether the NP's case is locative. Besides, locative marked noun phrases with temporal features are not allowed to be indirect complements since such phrases function as temporal adverbial complements (see Section 4.2.3). *find-complement-type* performs also this check.
- Then we check whether the f-structure satisfies the coherence and completeness conditions (see Section 2.3)⁶. Recall that Coherence Condition is checked also by the function *find-object-type*. The check here ensures that no two objects already assigned as the objects of the sentence have the same thematic role. The check for the Completeness Condition makes sure that the verb has already taken all the objects that it obligatorily subcategorizes for.
 - At the end, if the subject is already defined the concordance of the subject and the verb is tested (see Section 3.3.4). If the subject is not defined (i.e., if it is implicit) we assign the agreement of the verb to the agreement of the subject (see Section 3.2.2)⁷.

4.2.6 Dependent Clauses

The rules for dependent clauses are similar to those for sentences. In the rules for dependent clauses, the finite verb is replaced by a non-finite one. Besides, the way that we deal with the subject is rather different: We classify the rules for dependent clauses into three categories according to the subjects of the clauses they deal with:

1. Those that handle clauses which have no overt subjects: If the non-finite verb of the clause is an infinitive (i.e., converted from a verbal root

⁶Note that we do not need to check the Uniqueness Condition explicitly since the unification process, which is performed by the Parser/Compiler, would itself fail in case of a conflict.

⁷Note that we do not deal with sentences that grammatically do not have subjects (see Section 3.3.3). Another alternative is to avoid this last assignment.


```

(<S> <==> (<NP> <ADVP> <VP>))
;Check whether the verb phrase already contains an adverbial
;complement. If so, move its f-structure to ADVCOMPLEMENTS.
(*OR*
  (((x3 ADVCOMPLEMENT) = *DEFINED*)
   ((x0 ADVCOMPLEMENTS) > (x3 ADVCOMPLEMENT))
   ((x3 ADVCOMPLEMENT) = *remove*))
  (((x3 ADVCOMPLEMENT) = *UNDEFINED*)))
;Assign the VP's f-structure to the VERB part of the S's f-structure.
((x0 VERB) = x3)

;Assign the f-structure of the adverbial phrase to the ADVCOMPLEMENTS.
((x0 ADVCOMPLEMENTS) > x2)

(*OR*
  ;Check whether NP's case is nominative. If so, it can be the subject.
  (((x1 *CASE*) =c NOM)
   ((x0 SUBJ) = x1))

  ;It can be an object, if the verb can take an object with its case.
  (((x1 FLAG) <= (find-object-type (x1 *CASE*) (x1 *SUB*)
                                   (x0 VERB ARGS) (x3 *VOICE*)))
   ((x1 FLAG) = *DEFINED*)
   (x1 = (x1 FLAG))
   ((x0 VERB ROLES) > (x1 FLAG *ROLE*))
   ((x1 FLAG) = *remove*))

  (*OR*
   ;If it is an accusative marked direct object then it is definite.
   (((x1 *CASE*) =c ACC)
    ((x1 *DEF*) = *remove*)
    ((x1 *DEF*) = +))

   ;Its case cannot be nominative since any indefinite direct object
   ;must already be processed by the first VP-rule.
   (((x1 *CASE*) = (*NOT* NOM))
    ((x1 *CASE*) = (*NOT* ACC))))
  ((x0 VERB OBJS) > x1))

```

Figure 4.33. An example rule for sentences.

```

;The NP can also be an indirect complement.
(((x1 *TYPE*) <= (find-complement-type (x1 *CASE*) (x1 *SUB*))))
  ((x1 *TYPE*) = *DEFINED*)
  ((x0 COMPLEMENT) = x1)))

;Check whether the f-structure is coherent and complete.
((x3 NECC) <= (requires-objects (x3 ARGS) (x3 *VOICE*)))
((x0 TEST) <= (check-coherence-completeness (x3 NECC) (x0 VERB ROLES)))
((x0 TEST) = *DEFINED*)
((x0 TEST) = *remove*)
((x0 VERB ROLES) = *remove*)
((x3 NECC) = *remove*)

(*OR*
;If the subject is already defined check for the concordance of the
;subject and the verb.
(((x0 SUBJ) = *DEFINED*)
;ozne-yuklem sayi+kisi uyumu
(*OR*
  (((x0 SUBJ *AGR*) =c 3PL)
  ((x0 VERB *AGR*) = (*OR* 3SG 3PL)))
  (((x0 SUBJ *AGR*) = (*NOT* 3PL))
  ((x0 SUBJ *AGR*) = (x0 VERB *AGR*))))))

;If the subject is not defined assign the agreement of the verb to
;the agreement of the subject.
(((x0 SUBJ) = *UNDEFINED*)
  ((x0 SUBJ *AGR*) = (x0 VERB *AGR*))))))

```

Figure 4.34. An example rule for sentences continued.

by the suffix *+mEk*) then the subject is totally absent⁸. Otherwise, there must be an implicit subject. All the verbal nouns, participles and gerunds can form such dependent clauses:

- (17) a. *Sınava çalışmam çok uzun sürdü.*
 exam+DAT study+VN+1SP too long take+PAST+3SG
 ‘It took me too long to study for the exam.’
- b. *Gideceğin yerleri önceden belirlemelisin.*
 go+PART+2SP place+PLU+ACC beforehand
 determine+NEC+2SG
 ‘You have to determine the places that you will go beforehand.’
- c. *Adamın durmadan konuşması herkesi bıktırdı.*
 man+GEN stop+VN+ABL talk+VN+3SP everyone+ACC
 annoy+CAUS+PAST+3SG
 ‘The man’s uninterrupted talking made everyone annoyed.’
- d. *Biz bunları konuşa konuşa yürürken ortalık kararmıştı.*
 we these+ACC talk+OPT+3SG talk+OPT+3SG
 walk+AOR+GER surroundings get dark+NAR+PAST+3SG
 ‘The night had fallen while we were walking talking about these.’
- e. *İşlerimi bitirip tatile çıkacağım.*
 job+PLU+1SP+ACC finish+GER holiday+DAT
 go out+FUT+1SG
 ‘I will go out for a holiday when I finish my jobs.’

In (17a) it is evident that the subject of the dependent clause is the first person singular because of the possessive suffix at the end of the verbal noun *çalışmam*. Similarly, in (17b) it is the second person singular since the participle *gideceğin* has a second person singular possessive suffix. In (17c) it is

⁸Lewis says that in the older language, the infinitive could regularly have a subject, and provides some examples where this usage still survives (e.g., proverbial expressions, dictionary definitions) [7]. However, we argue these are very special examples, and are not used commonly. Hence, we prefer to exclude them since to let the infinitive take subject would cause redundant ambiguities in many cases.

the man who talks and doesn't stop at all. So the adverbial dependent clause *durmadan* (*without stopping*) which is embedded in a nominal one (i.e., *adamın durmadan konuşması* (*the man's uninterrupted talking*)) shares its subject (i.e., *adam* (*the man*)). Similarly, in (17d) the subject of the adverbial dependent clause *bunları konuşa konuşa* (*talking about these*) is the same as the adverbial one that involves it (i.e., *biz bunları konuşa konuşa yürürken* (*while we were walking talking about these*)), that is, *biz*. In (17e) the subject of the adverbial clause *işlerimi bitirip* (*when I finish my jobs*) shares the subject of the sentence, i.e., *ben* (I)⁹.

2. Those that handle clauses whose subjects are genitive: All verbal nouns except for infinitives (i.e., those that are derived by the suffixes *+mE*, *+mEkIlk*, *+Iş*, *+mEzIlk*, *+mEmEzIlk*), and object participles (i.e., participles derived by the suffixes *+dIk*, *+cEk*) can take genitive marked subjects when they are affixed possessive suffixes¹⁰:

- (18) a. Adamın aniden ölmesi herkesi
 man+GEN unexpectedly die+VN+3SP everyone+ACC
 sarstı.
 shock+PAST+3SG
 ‘The unexpected dying of the man shocked everyone.’
- b. Çocuğun okula gelişi sorun yarattı.
 child+GEN school come+VN+3SP trouble cause+PAST+3SG
 ‘The child’s coming to the school caused trouble.’
- c. Annemin pişirdiği yemekler harika.
 mother+1SP+GEN cook+PART+3SP meal+PLU marvellous.
 ‘The meals that my mother cooks are marvellous.’
- d. Onun geleceğini neden bana
 his come+PART+3SP+ACC why me
 söylemedin?
 tell+NEG+PAST+2SG
 ‘Why didn’t you tell me that he would come?’

3. Those that handle clauses whose subjects are nominative: Verbal

⁹Note that here *ben* is an implicit subject of the sentence.

¹⁰Recall that in such clauses the subject and the non-finite verb may be considered as forming a definite compound noun (see Sections 3.3.3 and 3.4).

nouns except for infinitives, all participles and gerunds can take nominative subjects:

- (19) a. Burada sigara içilmesi yasaktır.
 here cigarette smoke+PASS+VN+3SP forbidden+BE+3SG
 ‘It is forbidden to smoke here.’
- b. Yola kamyon girişi engellendi.
 road+DAT truck enter+3SP obstruct+PASS+PAST+3SG
 ‘Trucks were not allowed to enter the road.’
- c. Ev yapılacak yerler belirlendi.
 house build+PASS+PART place+PLU determine+PASS+PAST+3SG
 ‘The places where houses would be built were determined.’
- d. Adana yöresinde insanları şehre
 Adana environs+3SP+LOC people+3SP town+DAT
 göçmedik yayla kalmadı.
 move to+NEG+PART mountain village remain+NEG+PAST+3SG
 ‘There are no mountain villages whose people haven’t moved to the town in the environs of Adana.’
- e. Çocuğu okula giden adam geldi.
 child+3SP school+DAT go+PART man come+PAST+3SG
 ‘The man whose child has gone to the school came.’
- f. Ben gelmeden hiçbir yere gitme.
 I come+VN+ABL anywhere+DAT go+NEG+IMP+2SG
 ‘Don’t go anywhere before I come.’
- g. Ben gelince gidebilirsin.
 I come+GER go+POT+AOR+2SG
 ‘You may go when I come.’
- h. Ben gelir gelmez gidebilirsin.
 I come+GER come+GER go+POT+AOR+2SG
 ‘You may go as soon as I come.’
- i. İnsan yaşlandıkça kalbi katılaşıyor.
 man grow old+GER heart become hard+PRG+3SG
 ‘A man becomes hard-hearted as he grows old.’

```
(<N> <--> (%)  
  ((x0 <= (find-morph (x1 value) 'N))  
    (x0 = *DEFINED*)))  
  
(<V> <--> (%)  
  ((x0 <= (find-morph (x1 value) 'V))  
    (x0 = *DEFINED*)))
```

Figure 4.35. An example rule for sentences continued.

4.2.7 Lexical Rules

Lexical rules are used just to call the morphological analyzer. We have a lexical rule for each lexical category. Figure 4.35 illustrates two of these rules, i.e., the ones for noun and verb. The LISP function *find-morph* takes a word symbol and its category, and returns an appropriate f-structure for the word. “%” is the wild card character that can match with any single symbol, and the symbol is put into the *value* slot of **x1**.

Chapter 5

Performance Evaluation

In this chapter, we present some statistical information about the performance of our system that we obtained from the test runs of the system with two different documents on different subjects. The first one is taken from a story book for children and the second one is a story from a TV magazine. We used the Lucid Common Lisp system running in a Unix environment, on SUN SPARC workstations at Bilkent University.

In both of the documents some of the sentences are outside our scope. These are:

- inverted sentences,
- sentences that contain substantival sentences,
- conditional sentences, and
- ordered sentences.

Besides,

- We do not handle some of the adverbial phrases like *haftalardır* (*for weeks*) and *az kalsın* (*nearly, almost*).
- We do not deal with phrases such as *Çiftçi Ali* (*Farmer Ali*), *Can Bey* (*Mister Can*).

Table 5.1. Statistical information about the test runs.

Document	Number of sentences	Average number of parses	Average runtime
Document 1	105	5.94	11.29 sec.
Document 2	94	4.93	30.07 sec.

- The morphological analyzer that we use doesn't handle gerunds that are derived by the suffixes *-Ir* and *-mEz*.¹ So, we do not deal with sentences that contain such gerunds.
- We do not handle sentences that contain compound verbs that are semantically coalesced, e.g., *vakit geçirmek* (*to spend the time*), *geç kalmak* (*to be late*) (see pages 33 and 94).

We pre-edited the documents so that the sentences fall into our scope (e.g., we converted the inverted sentences to regular ones, eliminated some of the adverbial phrases, separated the independent clauses in ordered sentences, and totally ignored some of the sentences). The original and pre-edited versions of documents are given in Appendix A. Table 5.1 illustrates statistical information about the test runs. The first, second and third columns show the number of sentences in the pre-edited versions of the documents, average number of parses generated and average runtime for each of the documents.

We give the outputs of some of the sentences in Appendix B. Here, we will further investigate one of these outputs. The output for (1a) indicates that there are four ambiguous interpretations for this sentence as indicated in (1b-e)²:

- (1) a. Küçük kırmızı top gittikçe hızlandı.
 little red ball go+GER speed up+PAST+3SG
 b. 'The little red ball gradually sped up.'
 c. 'The little red sped up as the ball went.'

¹Note that such words have two ambiguous interpretations: third person singular of the aorist tense and gerund. The second interpretation is not very likely, and causes a great deal of redundancy in some cases. Hence, we have decided to eliminate it.

²In fact, this sentence has five interpretations. In Turkish, *kırmızı* is the name of a shining, red paint obtained from an insect with the same name. So, (1) also means '*His little paint sped up as the ball went.*' However, this is very unlikely to come to mind even for native speakers.

- d. ‘The little sped up as the red ball went.’
- e. ‘It sped up as the little red ball went.’

The output of the parser for the first interpretation is given in Figure 5.1. This output indicates that the subject of the sentence is a compound of which modifier is *küçük*, and modified is another compound of which modifier is *kırmızı* and modified is *top*. The agreement of the subject is third person singular, case is nominative, etc. *Hızlandı* is the verb of the sentence, and its voice is active, aspect is past, agreement is third person singular, etc. *Gittikçe* is a temporal adverbial complement.

Figures 5.2–5.5 illustrate the c-structures of the four ambiguous interpretations (1b–e), respectively. Note that in (1e), the subject is implicit. Hence, it does not appear in the c-structure shown in Figure 5.5.

```

;**** ambiguity 1 ***

((SUBJ
  ((*AGR* 3SG) (*CASE* NOM)
    (*DEF* -)
    (*CAT* N)
    (MODIFIED
      ((*CAT* N)
        (MODIFIER
          ((*CASE* NOM) (*AGR* 3SG)
            (*LEX* "kIrmIzI")
            (*CAT* ADJ)
            (*R* "kIrmIzI"))))
        (MODIFIED
          ((*CAT* N) (*CASE* NOM)
            (*AGR* 3SG)
            (*LEX* "top")
            (*R* "top"))))
          (*AGR* 3SG)
          (*CASE* NOM)
          (*LEX* "top")
          (*DEF* -)))
        (MODIFIER
          ((*SUB* QUAL) (*CASE* NOM)
            (*AGR* 3SG)
            (*LEX* "kUCUk"))))
          (*LEX* "top"))))
  (VERB
    ((*TYPE* VERBAL) (*VOICE* ACT)
      (*LEX* "hIzlandI")
      (*CAT* V)
      (*R* "hIzlan")
      (*ASPECT* PAST)
      (*AGR* 3SG)))
  (ADVCOMPLEMENTS
    ((*SUB* TEMP) (*LEX* "gittikCe")
      (*CAT* ADV)
      (*CONV*
        ((*WITH-SUFFIX* "dikce") (*CAT* V)
          (*R* "git")
          (*VAL* INTR))))))

```

Figure 5.1. Output of the parser/compiler for one of the ambiguous interpretations of (1).

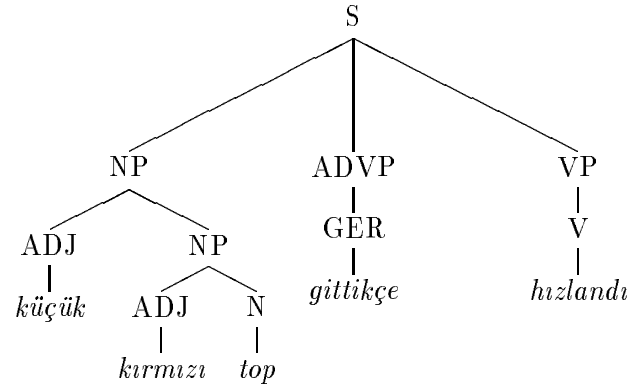


Figure 5.2. C-structure for (1b).

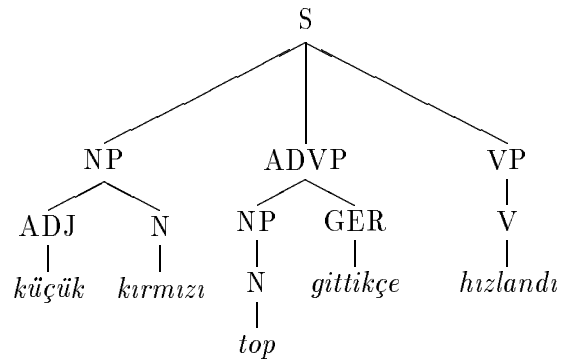


Figure 5.3. C-structure for (1c).

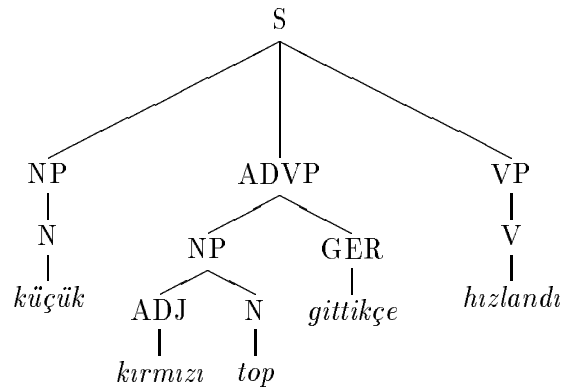


Figure 5.4. C-structure for (1d).

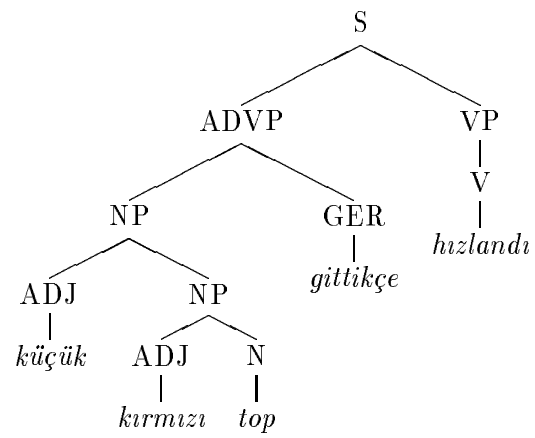


Figure 5.5. C-structure for (1e).

Chapter 6

Conclusions and Suggestions

In this thesis, we have presented an LFG specification for a subset of Turkish syntax. Our domain includes regular Turkish sentences which are structurally simple or complex.

NLP is a research area which is becoming increasingly popular day by day. NLP has several application areas such as machine translation, database front ends and explanation generation for expert systems. All of these applications require syntactic analysis as an underlying process because understanding the meaning of a sentence depends on an ability to recover its structure. Consequently, any nontrivial NLP application involving Turkish has to use some form of syntactic analysis. However, Turkish syntax has not been thoroughly investigated from a computational point of view until recently. These are the reasons for us attacking the problem of syntactic analysis of Turkish sentences computationally.

During the development of the grammar we encountered several problems. The most important one of these problems arises because of the rather free nature of word-order in Turkish syntax, and the fixed order of phrases in the phrase structure component of an LFG rule. In order to overcome this problem we restricted our domain with regular Turkish sentences, in which the verb appears always at the end. However, we still have a number of redundant rules for sentences and dependent clauses since the places of noun and adverbial phrases in the phrase structures may change rather freely. A better solution for this problem might be to use the same place holder, say $\langle XP \rangle$, for all the syntactic categories in the phrase structure component of a rule, and then to check the categories of these phrases in the equations part. This will also

let us handle inverted sentences with no further effort. Recall that a nominative marked direct object always precedes the verb, and some of the adverbial complements of quality (those that are actually qualitative adjectives) always precede the verb or the indefinite object, if there is one (see pages 92- 92). So, we treat such objects and adverbial complements as a part of the verb phrase (see Figure 4.28). This makes it easy to adopt the above strategy in our current grammar. Otherwise, those restrictions had to be checked in the sentence or dependent clause level which would be a rather difficult task.

As presented in Section 3.3.7, Turkish is very rich in terms of the kinds of adverbial phrases. We handle a great deal of these phrases by using a vast number of rules. It might be a better idea to use a tagger beforehand to deal with most of these phrases. In this way, most of the idiomatic expressions that we do not deal with for the time being (e.g., adverbial phrases such as *yillar ynh* (*for years*) and compound verbs that are semantically coalesced (see pages 82 and 94)) can also be handled.

Another concern about improving the grammar might be to extend the subset of sentences dealt with in respect of structure. In order to handle substantival sentences inside sentences, we might need to let sentences be noun and adjectival phrases (see Section 3.5.2). For conditional sentences an immediate observation is that both of the dependent and main clauses are full sentences, and that the mood of the verb of the dependent clause should be conditional. Handling ordered sentences requires rules which let sentences be formed of other sentences combined by conjunctions, commas and semicolons. However, all of these ideas need further investigation. For example, it might be necessary for a dependent ordered sentence whose independent clauses have a common constituent, to indicate this constituent as part of the f-structures of all the independent clauses that refer to it.

Bibliography

- [1] E.L. Antworth, *PC-KIMMO: A Two-level Processor for Morphological Analysis*. Summer Institute of Linguistics, 1990.
- [2] G. Gazdar and C. Mellish, *Natural Language Processing in PROLOG, An Introduction to Computational Linguistics*. Addison-Wesley Publishing Company, 1989.
- [3] J. Hankamer, "Finite state morphology and left to right phonology," in *Proceedings of the West Coast Conference on Formal Linguistics*, volume 5. Stanford University, 1986.
- [4] W.J. Hutchins and H.L. Somers, *An Introduction to Machine Translation*. Academic Press, 1992.
- [5] R. Kaplan and J. Bresnan, *The Mental Representation of Grammatical Relations*, chapter Lexical-Functional Grammar: A Formal System for Grammatical Representation, pp. 173–281. MIT Press, 1982.
- [6] L.E. Knecht, *Subject and Object in Turkish*. PhD thesis, Department of Linguistics and Philosophy, Massachusetts Institute of Technology, Cambridge, Massachusetts, February 1986.
- [7] G.L. Lewis, *Turkish Grammar*. Oxford University Press, 1988.
- [8] R. H. Meskill, *A Transformational Analysis of Turkish syntax*. Mouton, The Hague, Paris, 1970.
- [9] T. Mitamura, H. Musha and M. Kee, *The Generalized LR Parser/Compiler Version 8.1: User's Guide*. Carnegie-Mellon University, April 1988.
- [10] K. Oflazer, "Two-level description of Turkish morphology," in *Proceedings of the Sixth Conference of the European Chapter of the Association for Computational Linguistics*, April 1993.

- [11] K. Özgüven, “An approach to machine translation,” in *Proceedings of the First Turkish Symposium on Artificial Intelligence and Artificial Neural Networks*, Ankara, Türkiye, 1992.
- [12] Z. Sagay, “A computer translation of English to Turkish,” M.Sc. thesis, Middle East Technical University, Ankara, Türkiye, 1981.
- [13] P. Sells, *Lectures on Contemporary Syntactic Theories*. CSLI-Lecture Notes 3, 1985.
- [14] S.M. Shieber, *An Introduction to Unification-Based Approaches to Grammar*. CSLI-Lecture Notes 4, 1986.
- [15] A. Solak, “Design and implementation of a spelling checker for Turkish,” M.Sc. thesis, Department of Computer Engineering and Information Sciences, Bilkent University, Ankara, Türkiye, June 1991.
- [16] R. Şimşek, *Örneklerle Türkçe Sözdizimi (Turkish Syntax with Examples)*. Kuzey Matbaacılık, 1987.
- [17] M. Tomita, *Efficient Parsing for Natural Language*. Kluwer Academic Publishers, 1985.
- [18] M. Tomita, “An efficient augmented-context-free parsing algorithm,” *Computational Linguistics*, vol. 13, 1-2, pp. 31–46, January-June 1987.

Appendix A

Input Documents

A.1 Document 1 – A Story for Children

bir zamanlar kUCUK , parlak , kIrmIzI bir top vardı .
o , dUnyadaki toplarIn hepsinden Cok zIplardı .
bUtUn toplardan daha hIzLI koSardı .
zIplarken koSarken de gUzel SarkIlar sOylerdi .
bu gUzel top kUCUK yIlmaz'In topuydu .
gUneSli bir gUnde yIlmaz topunu aldı .
bahCenin OnUndeki yola CIktI .
topunu yere vura vura yUrUdU .
kIrmIzI top yere CarptIkCa :
- tInn tIn tIn !
diye , SarkIlar sOylUyordu .
yIlmaz bir aralık Cok dUz bir yere geldi .
durdu , topunu taSa hIzla CarptI .
kIrmIzI top :
- tInn tIn !
diye SarkIsInI sOyledi .
sonra havaya CIktI .
bulutlara doGru yUkseldi .
yIlmaz ellerini havaya kaldIrInca tekrar geriye dOndU .
bu oyun yIlmaz'In Cok hoSuna gitti .
sevinCle baGIrdI :
- haydi benim gUzel topum !

bu sefer daha yUkseklere !
 topunu bUtUn kuvvetiyle yere CarptI .
 kIrmIzI top bu sefer :
 - tInn , tInnn !
 diye daha uzun bir SarkI sOyledi .
 yIlmaz ellerini aCtI , bekledi .
 eyvah !
 bir tUrlU geri gelmiyordu .
 yIlmaz elleri aCIk bekledi ...
 bekledi ...
 ama boSuna !
 kIrmIzI top o kadar Cok sICramIStI ki , bUyUk Cam aGacInIn
 dallarI arasInda kaybolup gitti .
 yIlmaz CamIn dallarIna baktI .
 CalIlarIn , otlarIn arasInI aradI .
 kIrmIzI topunu bir tUrlU bulamadI .
 - gUzel topum kayboldu , diye aGlamaya baSladI .
 sevgili Cocuklar :
 yIlmaz'In gUzel topu kaybolmamIStI .
 Citin ObUr tarafIna , otlarIn arasIna dUSmUStU .
 orada bir o yana , bir bu yana birkaC kere sICradI .
 sonra tepeden aSaGIya yuvarlanmaya baSladI .
 minik tavSan onun sesini duydu .
 merak etti .
 baSInI yuvasIndan dISarI CIkardI .
 kIrmIzI top onun burnuna Oyle hizLI vurdu ki , az kalsIn
 tavSancIGIn bIyIklarInI koparacaktI .
 minik tavSan :
 - aman , bu ne canavar Sey !
 diye baGIrdI .
 eliyle burnunu ovalaya ovalaya yuvasIna sokuldu .
 korkudan bir daha dISariya CIkmadI .
 kUCUk kIrmIzI top gittikCe hizlandI .
 kirpi oralarda otlamaya CIkmIStI .
 az kalsIn ona da CarpacaktI .
 kUCUk kIrmIzI top Cok korktu .
 CUnkU kirpinin sivri dikenleri kIrmIzI topa bir batarsa
 bir daha zIplayamazDI .

bereket versin , o sIrada bir taSa CarptI .
hIzla sICradI .
kirpinin Uzerinden atladI .
yuvarlana yuvarlana CayIra indi .
orada inek anne ile yavrusu otluyorlardI .
inek anne kIrmIzI topa bakmadI bile ...
CUnkU o CayIrda oynayan Cocuklarda tUrLU tUrLU toplar gOrmUStU .
ama kUCUK buzaGI bOyle bir Seyi ilk defa gOrUyordu .
kIrmIzI topu gOrUnce telaSlandI :
- muu mu !
Suradan bUyUk bir elma yuvarlanIyor .
onu tutup yiyeceGim , dedi .
inek anne :
- o elma deGil .
yenecek Sey de deGil .
senin iSine yaramaz .
bIrak yuvarlansIn !
dedi .
kUCUK buzaGI kIrmIzI topun arkasIndan bir kere daha baktI :
bu kIrmIzI elmadan baSka bir Sey olamaz , dedi .
topun arkasIndan koSmaya baSladI .
kIrmIzI top gittikCe daha hIzLI yuvarlandI .
kUCUK buzaGI koStu ...
koStu ...
bir tUrLU onu yakalayamadI .
kIrmIzI top o kadar hIzlanmIStI ki , artIk gOrUnmez oldu .
yIlmaz , topunu Cok aradI .
bulamayacaGInI anladI .
aGlaya aGlaya eve dOnUyordu .
o sIrada CiftCi hasan amca kOpeGi Comar'la gezmeye CIkmIStI .
yIlmaz'I gOrUnce :
- ne var , neye aGliyorsun yIlmaz ?
diye sordu .
yIlmaz olanlari anlatti .
hasan amca :
aGlama yIlmaz , dedi , kIrmIzI topun belki bizim CayIra yuvarlanmIStir .
gel bir kere de orayI arayalIm .
bizim Comar , kaybolan Seyleri bulmakta Cok ustadIr .

birlikte CayIra gittiler .
 ali dayI her tarafI aradI ...
 yIlmaz saGa sola koStu ...
 Comar onlarIn ne aradIklarInI anlayamamIStI .
 o , tavSan arIyorlar sandI .
 saGa sola koSuyor , olanca sesiyle havliyor keskin burnu ile
 orayI burayI kokluyordu .
 hasan amca :
 buralarda yok , biraz daha aSaGIya inelim , dedi .
 anne inekle buzaGInIn yanIndan geCtiler .
 kUCUK gOlUn yakInlarIna geldiler .
 Comar , hasan amca ile gezmeye CIkInca bu gOle girer , orada
 yIkanmayI Cok severdi .
 gOle yaklaSInca onlarIn yanIndan ayrIldI .
 koSa koSa suyun kenarIna geldi .
 iCine girmedi .
 kIyIda havlamaya baSladI .
 Comar acaba neden boyle telaSlanmIStI , biliyor musunuz ?
 CUnkU kIrmIzI top durgun temiz suyun yUzUnde pIrlil pIrlil parliyordu .
 Comar onu gOrmuStU .
 hasan amca ile yIlmaz'In ne aradIklarInI o zaman anlamIStI .
 hemen suya atladI .
 kIrmIzI topu aGzIna aldI .
 sudan CIkardI .
 yIlmaz'In ayaklarInIn dibine biraktI .
 yIlmaz , Comar'In Islak baSInI okSadI .

A.2 Pre-edited Version of Document 1

bir zamanlar kUCUK , parlak , kIrmIzI bir top vardı
 o dUnyadaki toplarIn hepsinden Cok zIplardi
 bUtUn toplardan daha hIzli koSardi
 zIplarken koSarken de gUzel SarkIlar sOylerdi
 bu gUzel top kUCUK yIlmaz'In topuydu
 gUneSli bir gUnde yIlmaz topunu aldI
 bahCenin OnUndeki yola CIktI
 topunu yere vura vura yUrUdu

kIrmIzI top yere CarptIkCa SarkIlar sOylUyordu
yIlmaz bir aralik Cok dUz bir yere geldi
durdu
topunu taSa hIzla CarptI
kIrmIzI top SarkIsInI sOyledi
sonra havaya CIkti
bulutlara doGru yUkseldi
yIlmaz ellerini havaya kaldIrInca tekrar geriye dOndU
bu oyun yIlmaz'In Cok hoSuna gitti
sevinCle baGIrdI
haydi benim gUzel topum
bu sefer daha yUkseklere
topunu bUtUn kuvvetiyle yere CarptI
kIrmIzI top bu sefer daha uzun bir SarkI sOyledi
yIlmaz ellerini aCIp bekledi
bir tUrlU geri gelmiyordu
yIlmaz elleri aCIk bekledi
bekledi
ama boSuna
kIrmIzI top o kadar Cok sICramIStI
bUyUk Cam aGacInIn dallarI arasInda kaybolup gitti
yIlmaz CamIn dallarIna baktI
CalIlarIn , otlarIn arasInI aradI
kIrmIzI topunu bir tUrlU bulamadI
gUzel topum kayboldu
yIlmaz'In gUzel topu kaybolmamIStI
Citin ObUr tarafIna , otlarIn arasIna dUSmUStU
orada bir o yana , bir bu yana birkaC kere sICradI
sonra tepeden aSaGIya yuvarlanmaya baSladI
minik tavSan onun sesini duydu
merak etti
baSInI yuvasIndan dISarI CIkardI
kIrmIzI top onun burnuna Oyle hIzLI vurdu
aman bu ne canavar Sey
eliyle burnunu ovalaya ovalaya yuvasIna sokuldu
korkudan bir daha dISarIya CIkmadI
kUCUK kIrmIzI top gittikCe hIzlandI
kirpi oralarda otlamaya CIkmIStI

kUCUK kIrmIzI top Cok korktu
CUnkU kirpinin dikenleri kIrmIzI topa batabilirdi
o sIrada bir taSa CarptI
hIzla sICradI
kirpinin Uzerinden atladI
yuvarlana yuvarlana CayIra indi
orada inek ile yavrusu otluyorlardI
inek kIrmIzI topa bakmadI bile
CUnkU o CayIrda oynayan Cocuklarda tUrlU tUrlU toplar gOrmUStU
ama kUCUK buzaGI bOyle bir Seyi ilk defa gOrUyordu
kIrmIzI topu gOrUnce telaSlandI
Suradan bUyUk bir elma yuvarlanIyor
onu tutup yiyeceGim
o elma deGil
yenecek Sey de deGil
senin iSine yaramaz
kUCUK buzaGI kIrmIzI topun arkasIndan bir kere daha baktI
bu kIrmIzI elmadan baSka bir Sey olamaz
topun arkasIndan koSmaya baSladI
topun arkasIndan koSmaya baSladI
kIrmIzI top gittikCe daha hizLI yuvarlandI
kUCUK buzaGI koStu
koStu
bir tUrlU onu yakalayamadI
kIrmIzI top o kadar hizlanmIStI
yIlmaz topunu Cok aradI
bulamayacaGInI anladI
aGlaya aGlaya eve dOnUyordu
o sIrada CiftCi kOpeGiyle gezmeye CIkmIStI
yIlmaz'I gOrUnce sordu
neye aGliyorsun
yIlmaz olanlarI anlattI
kIrmIzI topun belki bizim CayIra yuvarlanmIStIr
bir kere de orayI arayalIm
bizim Comar kaybolan Seyleri bulmakta Cok ustadIr
birlikte CayIra gittiler
ali her tarafI aradI
yIlmaz saGa sola koStu

Comar onlarIn ne aradIklarInI anlayamamIStI
 olanca sesiyle havliYordu
 keskin burnu ile orayI , burayI kokluyordu
 buralarda yok
 biraz daha aSaGIya inelim
 inekle buzaGIInIn yanIndan geCtiler
 kUCUK gOlUn yakInlarIna geldiler
 Comar hasan ile gezmeye CIkInca bu gOle girerdi
 orada yIkanmayI Cok severdi
 gOle yaklaSIInca onlarIn yanIndan ayrIldI
 koSa koSa suyun kenarIna geldi
 iCine girmedi
 kIyIda havlamaya baSladI
 Comar acaba neden bOyle telaSIlanmIStI
 CUnkU kIrmIzI top durgun temiz suyun yUzUnde pIrIl pIrIl parliYordu
 Comar onu gOrmuStU
 hasan ile yIlmaz'In ne aradIklarInI o zaman anlamIStI
 hemen suya atladI
 kIrmIzI topu aGzIna aldI
 sudan CIkardI
 yIlmaz'In ayaklarInIn dibine bIraktI
 yIlmaz Comar'In Islak baSInI okSadI

A.3 Document 2 – A Story from A TV Magazine

oldukCa sIcak bir gUndU .
 bir Seye ihtiyaCI olmadIGI halde CarSIda almIStIm soluGu yine .
 bir saatlik yemek molasInI ancak bOyle deGerlendiriyordum .
 kalabalIGa aldIrdIGIm bile yoktu .
 aklIm CalIStIGIm sigorta Sirketindeydi .
 mesleGimi ve can bey'i dUSUnuyordum durmadan .
 onu keSfetmeye CalISIYordum .
 sekreter olarak CalIStIGIm Sirkete sekiz ay Once girmiSti can bey .
 evli deGildi ama kIzlarIn baSInI dOndUrduGUne gOre boS sayIlmazDI muhakkak .
 emin olduGum tek Sey gerCekten cazibeli ve etkileyici bir insan olmasIydI
 .
 benim gibi sIradan bir kIza bakacak tip deGildi .

bUyUk bir maGazaya girip iCini gezmeye baSladIm .
 yolum kozmetik reyonuna dUStU .
 makyajla bir ilgim yoktu pek .
 arada bir rimel sUrerdim o kadar .
 zorla gUzellik olmayacaGIIna inanmIStIm bir kez .
 geCerken bir postere takIldI gOzUm .
 bir parfUm reklamIydI bu :
 " allure parfume " yazIliyDI Uzerinde .
 altInda da kUCUK harflerle ufak bir not :
 " allure ile cazibenize dayanamayacak ."

posterdeki kIza tatli tatli gUlUmseyen delikanlIyI can bey'e benzettim birden .
 elimi Ceneme koyup yakISIkli delikanlIyI incelemeye koyuldum .
 gerCekten benziyor muydu acaba ?
 hayIr , herhalde delirmeye baSlamIStIm .
 haftalardIr baktIGIm her yerde onu gOrmeye baSlamIStIm .
 aslInda posterdeki adam hiC de ona benzemiyordu .
 arkamdaki ses birden dUSUncelerimi daGIttI .
 " size yardIm edebilir miyim kUCUK hanIm ? "

bir rUyadan uyanIr gibiydim .
 " allure gerCekten etkileyici bir koku .
 hiC denediniz mi ? "

hayIr anlamIna baSImI salladIm .
 " Oyleyse deneyin bir kez . " ,
 " hayIr , buraya parfUm almak iCin gelmedim ben . "

gOzUm yine postere takIlmIStI .
 " ama bir kez denesem fena olmayacak " ,
 aGzImdan CIkan kelimelelere dikkat etmemiStim .
 yanImda o kadar para olup olmadIGInI bile bilmiyordum .
 gUnlerce biriktirdiGim parayI kasaya sayarken gOzUm hala posterdeydi .
 evet , evet ona benziyordu !
 iSe 5 dakika geC kaldIm .

hanImlar tuvaletine koStuGumda bizim kIzlar hala sallana sallana
 makyajlarInI tamamlIyorlardI .
 tuvaletin birine girip gOzlerimi kapadIktan sonra bileklerime ,
 boynuma aceleyle parfUm siktIm .
 aniden etrafImI saran aGIr kokuyla birlikte onun da hayali gOzlerimde
 canlanmIStI .
 CIkInca kIzlarIn arasIndan hizla sIyrIlIp odama koStum .

onlar gevezelik ededursunlar , ben her zamanki gibi Onceden masama geCip ,
can bey yazI getirince onlardan Once kapacaktIm .
masama oturur oturmaz can bey elinde bir tomar kaGIItla kapIda gOrUndU .
milletin dOnmesini bekliyormuS meGer .
nazikCe kaGIItlarI uzatIrken " bunlarI en kIsa zamanda yetiStireceGinden
eminim sevgi " dedi parfUmUn bUyUsU cesaret vermiSti bana .
gOzlerimi ona doGru dikip , " hiC kuSkunuz olmasIn " dedim .
sonra birden kaGIItlarI elimden alIp , " sana Ozellikle gOstermek istediGim
bir paragraf var " diye devam etti .
" o bOlUme Ozen gOsterirsen memnun olurum .
kelimeler biraz hatalI yazIlmIS da ...
seni SaSirtmasIn " .
eGilip baktIm .
her Sey gayet dUzgUn ifade edilmiSti .
gULUmsedim .
oyalanmak ister gibi bir tavrI vardI masamda .
eline kalemi alIp bir iki cUmleyi dUZeltmek isterken parmaklarIma dokundu .
elimi hafifCe yana kaydirirken gULUmsUyordum .
birden doGrulup yUZUme baktI .
" bu akSam CIkISta birlikte bir Seyler iCebilir miyiz ? "
oldukCa tedirgin bir hali vardI .
" bir derdiniz mi var ?
iyi gOrUnmUyorsunuz " diye sordum .
" yoo , aksine Cok iyiyim .
ancak siz hala bir cevap vermediniz bana "
kIzlar masalarIna dOnmeye baSlamISlardI bile .
" CIkISta durakta gOrUSmeye ne dersin ? "
o gUne kadar parfUm kullanmadIGIma yanIyordum .
erkekleri ne denli etkiliyormuS meGer !
bir lokantaya gitmemizi teklif etti .
eve Onceden geC geleceGimi bildirdiGim iCin sevinCle kabul ettim .
birlikte oldukCa hoS vakit geCirdik .
tek sorun ikide bir hapSirmasIydI .
" eminim USUttUnUZ " dedim ona .
gitgide hapSirmalarI fazlalaSInca OzUr dileyerek , " erken kalkalIm " dedi .
ayrIlIrken , ertesi gUn iCin tekrar randevu istedi .
Cok sevinmeme raGmen hasta olduGunu dUSUnerek itiraz ettim .
dinlemedi .

el sallayIp uzaklaSirken birden Cok yalnIz hissettim kendimi .
 sonra sesini aldIm yeniden .
 " bir saniye bekle sevgi !
 bir Sey sOyleyecektim " , " yarIn iCinse dert etme .
 baSka zamana erteleyebiliriz randevuyu .
 " yoo bu deGildi " diye atIldI .
 yUzU asIk gOrUnUyordu .
 " ben yarIn aynI kokuyu sUrmemeni rica edecektim .
 bunu sOylemek istemezdim ama benim kokulara karSI alerjim vardIr da ... "
 aptallaSmIStIm birden .
 kendimi hemen toparlayamadIm , " seni kIrmadIm ya ... " ,
 " yoo , hayIr ... "
 o akSamdan sonra daha birCok kez birlikte olduk .
 ona duyduGum sevgiyi tarif etmemin imkanI yok
 o da gitgide bana baGlanmaya baSladI .
 Ustelik allure'Un etkisi olmadan .
 arasIra yaptIGIm maskaralIGI dUSUndUkCe gUlUyorum ...

A.4 Pre-edited Version of Document 2

oldukCa sIcak bir gUndU
 bir Seye ihtiyaCIm olmadIGI halde soluGu yine CarSida almIStIm
 bir saatlik yemek molasInI ancak bOyle deGerlendiriyordum
 kalabalIGa aldIrdIGIm bile yoktu
 aklIm CalIStIGIm sigorta Sirketindeydi
 durmadan mesleGimi ve can'I dUSUnUyordum
 onu keSfetmeye CalISIyordum
 can sekreter olarak CalIStIGIm Sirkete sekiz ay Once girmiSti
 emin olduGum tek Sey gerCekten cazibeli ve etkileyici bir insan olmasIydI
 benim gibi sIradan bir kIza bakacak tip deGildi
 bUyUk bir maGazaya girip iCini gezmeye baSladIm
 yolum kozmetik reyonuna dUStU
 makyajla pek bir ilgim yoktu
 arada bir rimel sUrerdim
 zorla gUzellik olmayacaGIna bir kez inanmIStIm
 geCerken gOzUm bir postere takIldI
 bu bir parfUm reklamIydI

Uzerinde parfUm yazIliydi
altInda da kUCUK harflerle ufak bir not vardI
bu parfUm ile cazibenize dayanamayacak
birden posterdeki kIza tatLI tatLI gUlUmseyen delikanliyi can'a benzettim
elimi Ceneme koyup yakISIKLI delikanliyi incelemeye koyuldum
acaba gerCekten benziyor muydu
hayIr herhalde delirmeye baSlamIStim
baktIGim her yerde onu gOrmeye baSlamIStim
aslInda posterdeki adam hiC de ona benzemiyordu
arkamdaki ses birden dUSUncelerimi daGIttI
size yardIm edebilir miyim
bu parfUm gerCekten etkileyici bir koku
hiC denediniz mi
hayIr anlamIna baSimI salladIm
hayIr ben buraya parfUm almak iCin gelmedim
gOzUm yine postere takIlmIStim
ama bir kez deneyeyim
aGzImdan CIkan kelimelere dikkat etmemiStim
yanImda o kadar para olup olmadIGInI bile bilmiyordum
gUnlerce biriktirdiGim parayI kasaya sayarken gOzUm hala posterdeydi
evet ona benziyordu
hanImlar tuvaletine koStuGumda bizim kIzlar hala sallana sallana
makyajlarInI tamamlIyorlardI
tuvaletin birine girip gOzlerimi kapadIktan sonra bileklerime , boynuma
aceleyle parfUm sIktIm
aniden etrafImI saran aGir kokuyla birlikte onun da hayali gOzlerimde
canlanmIStim
CIkInca kIzlarIn arasIndan hizla sIyrIlIp odama koStum
onlar gevezelik ededursunlar
ben her zamanki gibi Onceden masama geCip can yazI getirince onlardan
Once kapacaktIm
masama oturur oturmaz can elinde bir tomar kaGIItla kapIda gOrUndU
meGer milletin dOnmesini bekliyormuS
parfUmUn bUyUsU bana cesaret vermiSti
gOzlerimi ona doGru diktim
hiC kuSkunuz olmasIn
sonra birden kaGIItlarI elimden alIp devam etti
sana Ozellikle gOstermek istediGim bir paragraf var

o bOlUme Ozen gOster
kelimeler biraz hatalI yazIlmIS da
seni SaSirtmasIn
eGIlip baktIm
her Sey gayet dUzgUn ifade edilmiSti
gUlUmsedim
eline kalemi alIp iki cUmleyi dUzeltmek isterken parmaklarIma dokundu
elimi hafifCe yana kaydIrIrken gUlUmsUyordum
birden doGrulup yUZUme baktI
bu akSam CIkISta birlikte bir Seyler iCebilir miyiz
oldukCa tedirgin bir hali vardI
bir derdiniz mi var
iyi gOrUnmUyorsunuz
yoo aksine Cok iyiyim
ancak siz hala bana bir cevap vermediniz
kIzlar masalarIna dOnmeye baSlamISlardI bile
CIkISta durakta gOrUSmeye ne dersin
iS CIkISI ilk kez gUzel bir makyaj yapIp her tarafIma cOmertCe parfUm siktIm
o gUne kadar parfUm kullanmadIGIma yanIyordum
meGer erkekleri ne denli etkiliyormuS
bir lokantaya gitmemizi teklif etti
eve Onceden geC geleceGimi bildirdiGim iCin sevinCle kabul ettim
tek sorun ikide bir hapSirmasIydI
gitgide hapSirmalarI fazlalaSIInca OzUr dileyerek erken kalkmamIzI istedi
ayrIlIrken ertesi gUn iCin tekrar randevu istedi
Cok sevinmeme raGmen hasta olduGunu dUSUnerek itiraz ettim
dinlemedi
el sallayIp uzaklaSIrken birden kendimi Cok yalnIz hissettim
sonra yeniden sesini aldIm
bir saniye bekle
bir Sey sOyleyecektim
randevuyu baSka zamana erteleyebiliriz
yoo bu deGildi
yUZU asIk gOrUnUyordu
ben yarIn aynI kokuyu sUrmemeni rica edecektim
bunu sOylemek istemezdim
benim kokulara karSI alerjim vardIr da
kendimi hemen toparlayamadIm

o akSamdan sonra birCok kez birlikte olduk
ona duyduGum sevgiyi tarif etmemin imkanI yok
o da gitgide bana baGlanmaya baSladI
Ustelik o parfUmUn etkisi olmadan
arasIra yaptIGIm maskaralIGI dUSUndUkCe gUlUyorum

Appendix B

Example Outputs

Enter the sentence : kUCUk kIrmIzI top gittikCe hIzlandI
4 (4) ambiguities found and took 4.856550 seconds of real time

;**** ambiguity 1 ***

```
((SUBJ
  ((*AGR* 3SG) (*CASE* NOM)
    (*DEF* -)
    (*CAT* N)
    (MODIFIED
      ((*CAT* N)
        (MODIFIER
          ((*CASE* NOM) (*AGR* 3SG)
            (*LEX* "kIrmIzI")
            (*CAT* ADJ)
            (*R* "kIrmIzI")))
          (MODIFIED
            ((*CAT* N) (*CASE* NOM)
              (*AGR* 3SG)
              (*LEX* "top")
              (*R* "top")))
            (*AGR* 3SG)
            (*CASE* NOM)
            (*LEX* "top")
            (*DEF* -)))
        (MODIFIER
          ((*SUB* QUAL) (*CASE* NOM)
            (*AGR* 3SG)
            (*LEX* "kUCUk")
            (*CAT* ADJ)
            (*R* "kUCUk")))
          (*LEX* "top")))
  (VERB
    ((*TYPE* VERBAL) (*VOICE* ACT)
      (*LEX* "hIzlandI")
      (*CAT* V)
      (*R* "hIzlan"))
```

```

(*ASPECT* PAST)
(*AGR* 3SG))
(ADVCOMPLEMENTS
  ((*SUB* TEMP) (*LEX* "gittikCe")
    (*CAT* ADV)
    (*CONV*
      ((*WITH-SUFFIX* "dikce") (*CAT* V)
        (*R* "git")
        (*VAL* INTR))))))

;**** ambiguity 2 ***

((SUBJ
  (*OR*
    ((*AGR* 3SG) (*CASE* NOM)
      (*DEF* +)
      (*CAT* N)
      (MODIFIED
        ((*CAT* N) (*DEF* +)
          (*CASE* NOM)
          (*AGR* 3SG)
          (*LEX* "kIrmIzI")
          (*R* "kIrmIzI")))
      (MODIFIER
        ((*SUB* QUAL) (*CASE* NOM)
          (*AGR* 3SG)
          (*LEX* "kUCUk")
          (*CAT* ADJ)
          (*R* "kUCUk")))
        (*POSS* 3SG)
        (*LEX* "kIrmIzI")))
    ((*AGR* 3SG) (*CASE* NOM)
      (*DEF* -)
      (*CAT* ADJ)
      (MODIFIED
        ((*CAT* ADJ) (*CASE* NOM)
          (*AGR* 3SG)
          (*LEX* "kIrmIzI")
          (*R* "kIrmIzI")))
      (MODIFIER
        ((*SUB* QUAL) (*CASE* NOM)
          (*AGR* 3SG)
          (*LEX* "kUCUk")
          (*CAT* ADJ)
          (*R* "kUCUk")))
        (*LEX* "kIrmIzI"))))
  (VERB
    ((*TYPE* VERBAL) (*VOICE* ACT)
      (*LEX* "hIzlandI")
      (*CAT* V)
      (*R* "hIzlan")
      (*ASPECT* PAST)
      (*AGR* 3SG))
    (ADVCOMPLEMENTS
      ((INFINITIVAL
        ((*CONV* ((*WITH-SUFFIX* "dikce") (*CAT* V)
          (*R* "git")
          (*VAL* INTR)))
        (*SUB* TEMP)
        (ARGS

```

```

      (((*CASE* DAT) (*TYPE* OBLIQUE)
        (*OCC* OPTIONAL)
        (*ROLE* GOAL))
      ((*CASE* ABL) (*TYPE* OBLIQUE)
        (*OCC* OPTIONAL)
        (*ROLE* SOURCE))))
      (*LEX* "gittikCe")
      (*CAT* ADV)))
(SUBJ
  ((*CASE* NOM) (*DEF* NIL)
    (*CAT* N)
    (*AGR* 3SG)
    (*LEX* "top")
    (*R* "top"))))

;**** ambiguity 3 ***

((SUBJ
  ((*AGR* 3SG) (*CASE* NOM)
    (*DEF* NIL)
    (*CAT* ADJ)
    (*SUB* QUAL)
    (*LEX* "kUCUk")
    (*R* "kUCUk")))

(VERB
  ((*TYPE* VERBAL) (*VOICE* ACT)
    (*LEX* "hIzlandI")
    (*CAT* V)
    (*R* "hIzlan")
    (*ASPECT* PAST)
    (*AGR* 3SG)))

(ADVCOMPLEMENTS
  ((INFINITIVAL
    ((*CONV* ((*WITH-SUFFIX* "dikce") (*CAT* V)
      (*R* "git")
      (*VAL* INTR))))

    (*SUB* TEMP)
  (ARGS
    (((*CASE* DAT) (*TYPE* OBLIQUE)
      (*OCC* OPTIONAL)
      (*ROLE* GOAL))
    ((*CASE* ABL) (*TYPE* OBLIQUE)
      (*OCC* OPTIONAL)
      (*ROLE* SOURCE))))
    (*LEX* "gittikCe")
    (*CAT* ADV)))
(SUBJ
  ((*CASE* NOM) (*DEF* -)
    (*CAT* N)
    (MODIFIED
      ((*CAT* N) (*CASE* NOM)
        (*AGR* 3SG)
        (*LEX* "top")
        (*R* "top")))
    (MODIFIER
      ((*CASE* NOM) (*AGR* 3SG)
        (*LEX* "kIrmIzI")
        (*CAT* ADJ)
        (*R* "kIrmIzI")))
    (*AGR* 3SG)

```



```

(*LEX* "top"))))))
;**** ambiguity 4 ***
((SUBJ ((*AGR* 3SG))
(VERB
  ((*TYPE* VERBAL) (*VOICE* ACT)
  (*LEX* "hIzlandI")
  (*CAT* V)
  (*R* "hIzlan")
  (*ASPECT* PAST)
  (*AGR* 3SG)))
(ADVCOMPLEMENTS
  ((INFINITIVAL
    ((*CONV* ((*WITH-SUFFIX* "dikce") (*CAT* V)
    (*R* "git")
    (*VAL* INTR)))
    (*SUB* TEMP)
    (ARGS
      (((*CASE* DAT) (*TYPE* OBLIQUE)
      (*OCC* OPTIONAL)
      (*ROLE* GOAL))
      ((*CASE* ABL) (*TYPE* OBLIQUE)
      (*OCC* OPTIONAL)
      (*ROLE* SOURCE))))
    (*LEX* "gittikCe")
    (*CAT* ADV)))
  (SUBJ
    ((*CASE* NOM) (*DEF* -)
    (*CAT* N)
    (MODIFIED
      ((*CAT* N)
      (MODIFIER
        ((*CASE* NOM) (*AGR* 3SG)
        (*LEX* "kIrmIzI")
        (*CAT* ADJ)
        (*R* "kIrmIzI")))
      (MODIFIED
        ((*CAT* N) (*CASE* NOM)
        (*AGR* 3SG)
        (*LEX* "top")
        (*R* "top")))
      (*AGR* 3SG)
      (*CASE* NOM)
      (*LEX* "top")
      (*DEF* -)))
    (MODIFIER
      ((*SUB* QUAL) (*CASE* NOM)
      (*AGR* 3SG)
      (*LEX* "kUCUk")
      (*CAT* ADJ)
      (*R* "kUCUk")))
    (*AGR* 3SG)
    (*LEX* "top"))))))))

```

Enter the sentence : ayrIlIrken ertesi gUn iCin tekrar randevu istedi
6 (6) ambiguities found and took 12.373762 seconds of real time

;**** ambiguity 1 ***

```
((SUBJ
  ((*AGR* 3SG) (*CASE* NOM)
    (*DEF* NIL)
    (*CAT* N)
    (*LEX* "randevu")
    (*R* "randevu")))
  (VERB
    ((*TYPE* VERBAL) (*VOICE* ACT)
      (ARGS
        (((*CASE* (NOM ACC)) (*TYPE* DIRECT)
          (*OCC* OPTIONAL)
          (*ROLE* THEME))))
        (*LEX* "istedi")
        (*CAT* V)
        (*R* "iste")
        (*ASPECT* PAST)
        (*AGR* 3SG)))
    (ADVCOMPLEMENTS
      (*MULTIPLE*
        ((*SUB* REPETITION) (*LEX* "tekrar")
          (*CAT* ADV)
          (*R* "tekrar"))
        ((*SUB* QUALITY) (*QUALITY-TYPE* REASON)
          (OBJ
            ((*CASE* NOM)
              (MODIFIED
                ((*CAT* N) (*SUB* TEMP-UNIT)
                  (*CASE* NOM)
                  (*AGR* 3SG)
                  (*LEX* "gUn")
                  (*R* "gUn")))
              (MODIFIER
                ((*CASE* NOM) (*AGR* 3SG)
                  (*LEX* "ertesi")
                  (*CAT* ADJ)
                  (*R* "ertesi")))
                (*AGR* 3SG)
                (*CAT* N)
                (*SUB* TEMP-UNIT)
                (*LEX* "gUn")
                (*DEF* -)))
            (*R* "iCin")
            (*LEX* "iCin")
            (*CAT* POSTP))
          ((*SUB* TEMP) (*LEX* "ayrIlIrken")
            (*CAT* ADV)
            (*CONV*
              ((*WITH-SUFFIX* "ken") (*CAT* V)
                (*R* "ayrIl")
                (*ASPECT* AOR)
                (*AGR* 3SG)))))))))
```

;**** ambiguity 2 ***

```

((SUBJ
  ((*AGR* 3SG) (*CASE* NOM)
   (*DEF* NIL)
   (*CAT* N)
   (*LEX* "tekrar")
   (*R* "tekrar")))

(VERB
  ((OBSJ
    ((*DEF* -) (*R* "randevu")
     (*LEX* "randevu")
     (*AGR* 3SG)
     (*CAT* N)
     (*CASE* NOM)
     (*TYPE* DIRECT)
     (*ROLE* THEME)))

   (*TYPE* VERBAL)
   (*VOICE* ACT)
   (ARGS
    (((*CASE* (NOM ACC)) (*TYPE* DIRECT)
      (*OCC* OPTIONAL)
      (*ROLE* THEME))))

   (*LEX* "istedi")
   (*CAT* V)
   (*R* "iste")
   (*ASPECT* PAST)
   (*AGR* 3SG)))

(ADVCOMPLEMENTS
  (*MULTIPLE*
   ((*SUB* QUALITY) (*QUALITY-TYPE* REASON)
    (OBJ
     ((*CASE* NOM)
      (MODIFIED
       ((*CAT* N) (*SUB* TEMP-UNIT)
        (*CASE* NOM)
        (*AGR* 3SG)
        (*LEX* "gUn")
        (*R* "gUn")))

      (MODIFIER
       ((*CASE* NOM) (*AGR* 3SG)
        (*LEX* "ertesi")
        (*CAT* ADJ)
        (*R* "ertesi")))

       (*AGR* 3SG)
       (*CAT* N)
       (*SUB* TEMP-UNIT)
       (*LEX* "gUn")
       (*DEF* -)))

     (*R* "iCin")
     (*LEX* "iCin")
     (*CAT* POSTP))

   ((*SUB* TEMP) (*LEX* "ayrIlIrken")
    (*CAT* ADV)
    (*CONV*
     ((*WITH-SUFFIX* "ken") (*CAT* V)
      (*R* "ayrIl")
      (*ASPECT* AOR)
      (*AGR* 3SG))))))

```

;**** ambiguity 3 ***

```

((SUBJ
  ((*AGR* 3SG) (*CASE* NOM)
    (*DEF* +)
    (*CAT* N)
    (*POSS* 2SG)
    (*LEX* "iCin")
    (*R* "iC")))

(VERB
  ((OBJS
    ((*DEF* -) (*R* "randevu")
      (*LEX* "randevu")
      (*AGR* 3SG)
      (*CAT* N)
      (*CASE* NOM)
      (*TYPE* DIRECT)
      (*ROLE* THEME)))

    (*TYPE* VERBAL)
    (*VOICE* ACT)
    (ARGS
      (((*CASE* (NOM ACC)) (*TYPE* DIRECT)
        (*OCC* OPTIONAL)
        (*ROLE* THEME))))

    (*LEX* "istedi")
    (*CAT* V)
    (*R* "iste")
    (*ASPECT* PAST)
    (*AGR* 3SG)))

(ADVCOMPLEMENTS
  (*MULTIPLE*
    ((*SUB* REPETITION) (*LEX* "tekrar")
      (*CAT* ADV)
      (*R* "tekrar"))

    ((*TEMP-TYPE* TIME) (*AGR* 3SG)
      (*CASE* NOM)
      (MODIFIER
        ((*LEX* "ertesi") (*CASE* NOM)
          (*AGR* 3SG)
          (*CAT* ADJ)
          (*R* "ertesi")))

      (*SUB* TEMP-UNIT)
      (MODIFIED
        ((*CAT* N) (*SUB* TEMP-UNIT)
          (*CASE* NOM)
          (*AGR* 3SG)
          (*LEX* "gUn")
          (*R* "gUn")))

        (*CAT* N)
        (*LEX* "gUn")
        (*DEF* -))

    ((*SUB* TEMP) (*LEX* "ayrIlIrken")
      (*CAT* ADV)
      (*CONV*
        ((*WITH-SUFFIX* "ken") (*CAT* V)
          (*R* "ayrIl")
          (*ASPECT* AOR)
          (*AGR* 3SG))))))

```

;**** ambiguity 4 ***

```

((SUBJ
  (*OR*
    ((*AGR* 3SG) (*CASE* NOM)
      (*DEF* +)
      (*CAT* N)
      (MODIFIED
        ((*CAT* N) (*ROLE* ADJ)
          (*DEF* +)
          (*CASE* NOM)
          (*AGR* 3SG)
          (*LEX* "iCin")
          (*R* "ic")))
      (MODIFIER
        ((*CAT* N) (*SUB* TEMP-UNIT)
          (*DEF* -)
          (MODIFIER
            ((*CASE* NOM) (*AGR* 3SG)
              (*LEX* "ertesi")
              (*CAT* ADJ)
              (*R* "ertesi")))
            (*CASE* NOM)
            (MODIFIED
              ((*CAT* N) (*SUB* TEMP-UNIT)
                (*CASE* NOM)
                (*AGR* 3SG)
                (*LEX* "gUn")
                (*R* "gUn")))
              (*AGR* 3SG)
              (*LEX* "gUn")))
          (*POSS* 2SG)
          (*LEX* "iCin"))
      ((*AGR* 3SG) (*CASE* NOM)
        (*DEF* +)
        (*CAT* N)
        (MODIFIED
          ((*CAT* N) (*ROLE* ADJ)
            (MODIFIER
              ((*CASE* NOM) (*CAT* N)
                (*SUB* TEMP-UNIT)
                (*AGR* 3SG)
                (*LEX* "gUn")
                (*R* "gUn")))
              (MODIFIED
                ((*CAT* N) (*ROLE* ADJ)
                  (*DEF* +)
                  (*CASE* NOM)
                  (*AGR* 3SG)
                  (*LEX* "iCin")
                  (*R* "ic")))
                (*AGR* 3SG)
                (*CASE* NOM)
                (*LEX* "iCin")
                (*DEF* +)))
            (*CASE* NOM)
            (*AGR* 3SG)
            (*LEX* "ertesi")
            (*CAT* ADJ)
            (*R* "ertesi")))
  ))

```

```

(*POSS* 2SG)
(*LEX* "iCin"))))
(VERB
  ((OBJS
    ((*DEF* -) (*R* "randevu")
      (*LEX* "randevu")
      (*AGR* 3SG)
      (*CAT* N)
      (*CASE* NOM)
      (*TYPE* DIRECT)
      (*ROLE* THEME)))
    (*TYPE* VERBAL)
    (*VOICE* ACT)
    (ARGS
      (((*CASE* (NOM ACC)) (*TYPE* DIRECT)
        (*OCC* OPTIONAL)
        (*ROLE* THEME))))
      (*LEX* "istedi")
      (*CAT* V)
      (*R* "iste")
      (*ASPECT* PAST)
      (*AGR* 3SG))
    (ADVCOMPLEMENTS
      (*MULTIPLE*
        ((*SUB* REPETITION) (*LEX* "tekrar")
          (*CAT* ADV)
          (*R* "tekrar"))
        ((*SUB* TEMP) (*LEX* "ayrIlIrken")
          (*CAT* ADV)
          (*CONV*
            ((*WITH-SUFFIX* "ken") (*CAT* V)
              (*R* "ayrIl")
              (*ASPECT* AOR)
              (*AGR* 3SG))))))

```

;**** ambiguity 5 ***

```

((SUBJ
  (*OR*
    ((*AGR* 3SG) (*CASE* NOM)
      (*DEF* +)
      (*CAT* N)
      (*POSS* 3SG)
      (*LEX* "ertesi")
      (*R* "erte"))
    ((*AGR* 3SG) (*CASE* NOM)
      (*DEF* NIL)
      (*CAT* ADJ)
      (*LEX* "ertesi")
      (*R* "ertesi"))))
(VERB
  ((OBJS
    ((*DEF* -) (*R* "randevu")
      (*LEX* "randevu")
      (*AGR* 3SG)
      (*CAT* N)
      (*CASE* NOM)
      (*TYPE* DIRECT)
      (*ROLE* THEME)))
    (*TYPE* VERBAL)

```

```

(*VOICE* ACT)
(ARGS
  (((*CASE* (NOM ACC)) (*TYPE* DIRECT)
    (*OCC* OPTIONAL)
    (*ROLE* THEME))))

(*LEX* "istedi")
(*CAT* V)
(*R* "iste")
(*ASPECT* PAST)
(*AGR* 3SG))
(ADVCOMPLEMENTS
  (*MULTIPLE*
    ((*SUB* REPETITION) (*LEX* "tekrar")
      (*CAT* ADV)
      (*R* "tekrar"))
    ((*SUB* QUALITY) (*QUALITY-TYPE* REASON)
      (OBJ
        ((*CASE* NOM) (*SUB* TEMP-UNIT)
          (*AGR* 3SG)
          (*LEX* "gUn")
          (*CAT* N)
          (*R* "gUn")))
        (*R* "iCin")
        (*LEX* "iCin")
        (*CAT* POSTP)))
    ((*SUB* TEMP) (*LEX* "ayrIlIrken")
      (*CAT* ADV)
      (*CONV*
        ((*WITH-SUFFIX* "ken") (*CAT* V)
          (*R* "ayrIl")
          (*ASPECT* AOR)
          (*AGR* 3SG))))))

;**** ambiguity 6 ***

((SUBJ ((*AGR* 3SG))
  (VERB
    ((ROLES THEME)
      (OBJS
        ((*DEF* -) (*R* "randevu")
          (*LEX* "randevu")
          (*AGR* 3SG)
          (*CAT* N)
          (*CASE* NOM)
          (*TYPE* DIRECT)
          (*ROLE* THEME)))
        (*TYPE* VERBAL)
        (*VOICE* ACT)
        (ARGS
          (((*CASE* (NOM ACC)) (*TYPE* DIRECT)
            (*OCC* OPTIONAL)
            (*ROLE* THEME))))

        (*LEX* "istedi")
        (*CAT* V)
        (*R* "iste")
        (*ASPECT* PAST)
        (*AGR* 3SG))
      (ADVCOMPLEMENTS
        (*MULTIPLE*
          ((*SUB* REPETITION) (*LEX* "tekrar")

```

```

(*CAT* ADV)
(*R* "tekrar")
(((*SUB* QUALITY) (*QUALITY-TYPE* REASON)
(OBJ
  ((*CASE* NOM)
  (MODIFIED
    ((*CAT* N) (*SUB* TEMP-UNIT)
    (*CASE* NOM)
    (*AGR* 3SG)
    (*LEX* "gUn")
    (*R* "gUn"))))
  (MODIFIER
    ((*CASE* NOM) (*AGR* 3SG)
    (*LEX* "ertesi")
    (*CAT* ADJ)
    (*R* "ertesi"))))
  (*AGR* 3SG)
  (*CAT* N)
  (*SUB* TEMP-UNIT)
  (*LEX* "gUn")
  (*DEF* -)))
(*R* "iCin")
(*LEX* "iCin")
(*CAT* POSTP))
(((*SUB* TEMP) (*LEX* "ayrIlIrken")
(*CAT* ADV)
(*CONV*
  ((*WITH-SUFFIX* "ken") (*CAT* V)
  (*R* "ayrIl")
  (*ASPECT* AOR)
  (*AGR* 3SG))))))

```