GRAMMATICAL RELATIONS AND WORD ORDER IN TURKISH SIGN LANGUAGE (TİD)

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AYÇA MÜGE SEVİNÇ

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Assoc. Prof. Dr. Nazife Baykal
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

Prof. Dr. Deniz Zeyrek
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

Assoc. Prof. Dr. H. Cem Bozşahin
Supervisor

Examining Committee Members

Assoc. Prof. Dr. Şükriye Ruhi (METU, FLE) _____

Assoc. Prof. Dr. H. Cem Bozşahin (METU, CENG) _____

Assist. Prof. Dr. Bilge Say (METU, COGS) _____

Assist. Prof. Dr. Annette Hohenberger (METU, COGS) _____

Dr. Ayşenur Birtürk (METU, CENG) _____

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Name, Last Name: AYÇA MÜGE SEVİNÇ

Signature :

ABSTRACT

GRAMMATICAL RELATIONS AND WORD ORDER IN
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Sevinç, Ayça Müge

M.S., Department of Cognitive Science
Supervisor : Assoc. Prof. Dr. H. Cem Bozşahin

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This thesis aims at investigating the grammatical relations in Turkish Sign Language (TİD). For this aim, word order, nominal morphology, and agreement morphology of verbs are examined. TİD lacks morphological case, but it has a very rich pronominal system like other sign languages. Verbs are classified according to their morphosyntactic features. With this classification, we can observe the effect of word order and agreement morphology on the grammatical relations.

Combinatory Categorial Grammar as a lexicalized grammar encodes word order, morphological case, and agreement features in the lexicon. Hence, it has the tools for testing any lexicalized basic word order hypothesis for a language based on the gapping data. Gapping data based on grammatical judgments of native signers indicate that TİD is a verb final language.

Syntactic ergativity seems to be prevailing in coordination of a transitive sentence and an intransitive sentence where the single argument of the intransitive clause or

one of the arguments of the transitive clause is missing. TİD also shows a tendency for ergativity in lexical properties such as agreement and pro-drop.

Keywords: Turkish Sign Language, Word Order, Grammatical Relations, Combinatory Categorial Grammar, Ergativity

ÖZ

TÜRK İŞARET DİLİNDEKİ DİLBİLGİSEL BAĞLAR VE SÖZ DİZİMİ

Sevinç, Ayça Müge

Yüksek Lisans, Bilişsel Bilimler Bölümü

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Bu tez, Türk İşaret Dili (TİD)'ndeki dilbilgisel bağları incelemeyi amaçlıyor. Bu amaca ulaşmak için, dildeki söz dizimi, isimlerin biçim-bilimsel halleri, ve fiiller üzerindeki biçim-bilimsel uyum ögeleri incelenmiştir. Birçok işaret dilinde de olduğu gibi, TİD'nde isimler ve zamirler, sadece yalın halde bulunurlar, ancak zamir sistemi oldukça zengindir. Fiiller, bu çalışmada biçim-bilimsel özelliklerine göre sınıflandırılmıştır. Bu sınıflandırma ile, söz diziminin ve fiiller üzerindeki biçim-bilimsel uyum ögelerinin dilin dilbilgisel bağlarına etkisi karşılaştırmalı olarak gözlemlenmiştir.

Ulamsal Dilbilgisi, söz dizimini, biçim-bilimsel halleri ve uyum ögelerini ulamlarında tutabilen bir teori olduğundan temel söz dizimi hipotezlerini test edebilmek için uygun araçlara sahiptir. Anadili TİD olan bir grubun, cümlelerin bağlaçlarla birleşmesi esnasında ortak olan elamanların düşmesi davranışını gösteren verileri değerlendirmelerine dayanarak, TİD'in fiil-sonlu bir dil olduğu sonucuna ulaştık.

Bu dildeki dilbilgisel bağları incelemek amacıyla, geçişsiz ve geçişli fiilli cümlelerin bağlanmasında, fiillerden birinin argümanının düşerek diğer cümlenin argümanı ile eşleştirilmesi durumu test edilmiştir. Bu testlerden elde edilen sonuçlara bakıldığında, TİD'de kılıcı (ergatif) yapının yaygın olduğu anlaşılmıştır. Ayrıca, isim fiil uyumunda ve şahıs zamirlerinin fiildeki uyum ögelerinin varlığı nedeniyle düşmesinde kılıcılığın varlığına işaret eden yapılar söz konusudur.

Anahtar Kelimeler: Türk İşaret Dili, Söz Dizimi, Dilbilgisel Bağlar, Ulamsal Dilbilgisi, Kılıcı Sistemler

To the Deaf in Türkiye

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CHAPTER 1

INTRODUCTION

This thesis aims at investigating grammatical relations in Turkish Sign Language (Türk İşaret Dili - TİD). To determine grammatical relations of a language, grammatical markings on the single argument ($\mathcal{S}$) of an intransitive verb are compared with the ones on agent-like argument ($\mathcal{A}$) and the patient-like argument ($\mathcal{P}$) of a transitive verb.[1] Palmer (1994) introduces three types of grammatical markings: morphological case on nominals, agreement with the verb, and word order.

The grammatical relations are the relations between the grammatical roles ($\mathcal{S}$, $\mathcal{A}$, and $\mathcal{P}$) such as the alignments $\mathcal{S}$=$\mathcal{A}$, or $\mathcal{S}$=$\mathcal{P}$. There are four possible grammatical relations and consequently four possible systems. The alignment $\mathcal{S}$=$\mathcal{A}$ signals that the system is accusative. An ergative system has the grammatical relation $\mathcal{S}$=$\mathcal{P}$. Agentive systems have alignments $\mathcal{S}_\mathcal{A}$=$\mathcal{A}$ and $\mathcal{S}_\mathcal{P}$=$\mathcal{P}$, where $\mathcal{S}_\mathcal{A}$ and $\mathcal{S}_\mathcal{P}$ are agentive and patientive single argument of an intransitive verb respectively. Finally, there can be systems where there is no alignment of $\mathcal{S}$ with $\mathcal{A}$ or $\mathcal{P}$. We need to talk in terms of the systems in a language, not the language itself, because systems of a language may have different grammatical relations. For example, a language can be fully ergative like Dyirbal or fully accusative like Turkish, but it is also possible that it has an ergative morphology but an accusative syntax like Basque.

Our study focuses on nominal morphology, agreement morphology of verbs and word order in TİD. There is no morphological case on nouns and pronouns in TİD. The pronominal system is very rich and it is fundamental to agreement system. In general, agreement can be defined as the matching between verb's and its arguments' features such as person, gender, case and number. In TİD, only a class of verbs shows

[1] We leave thematic aspects of grammatical roles, such as Beneficiary, Locative, Instrumental outside the scope of the thesis.

agreement. In fact, TİD verbs are grouped according to Padden's (1988) classification. Padden (1988) was first to classify ASL verbs into three groups as (i) inflecting (agreement) verbs, (ii) plain verbs and (iii) spatial verbs, according to their morphological features. This classification is widely accepted in sign linguistics literature, has been applied to other sign languages, e.g., Israeli SL (Meir, 2002), Danish SL (Engberg-Pederson, 2002) and British SL (Kyle and Woll, 1985).

Sign languages differ in their word orders, i.e. ASL is Subject-Verb-Object (SVO) (Fischer, 1975; Liddell, 1980), Japanese SL (Rathmann and Mathur, 2002), Argentine SL (Massone, 2004), German SL (Pfau and Steinbach, 2005) and many others are believed to be SOV. The studies on ASL word order (Fischer, 1975; Liddell, 1980) are briefly summarized in the following lines in order to give an idea of the main methodology of the investigation, focus of interest, and important observations on this issue.

Fischer (1975) was the first to claim that the underlying sign order of ASL is Subject-Verb-Object (SVO) and supported her claim with the following facts:

> This order [SVO] is the order one finds in a sentence with reversible subject and object which are full noun phrases and not 'apposativized' with pronouns. It is also the order in the subordinate sentences with any two full noun phrases for subject and object. Any other order will have intonation breaks. (Fischer, 1975, p.5)

A sentence with reversible subject and object is the one which is semantically plausible when the positions of the subject and object are changed. For example, both of the following sentences, 'John likes Mary' and 'Mary likes John', are semantically plausible so we can say that John and Mary are reversible subject and object in the first sentence. Hence, according to Fischer (1975), it is possible to say the sentences with the meaning 'the man eat the apple' in any orders, since apple and man are irreversible. In that case, Fischer (1975) claims the other orders rather than SVO would have "intonation breaks".

Liddell (1980) disagrees with Fischer (1975) in two main points based on his observations on natural data. First, according to him, all noun-verb-noun sequences are in SVO order even if they are irreversible. Secondly, he stated that only marked SVO, OSV and OVS orders can be derived from SVO by the process of subject, object and verb phrase topicalization respectively. Topicalization is a process in which an element of the sentence is marked as the topic and taken to the front of the sentence.

Liddell (1980, p.80) explains what Fischer (1975) calls 'intonation breaks' as the duration for a change from the non-manual marking of topicalization (brow raise and slight backward head) to a neutral facial expression and a neutral head pose.

Liddell (1980, p.70) also argues that the word order is what determines the subject and object of a sentence::

> ...on either side of the intonation break, if the subject or object accompanies the verb, the subject precedes the verb and the object follows the verb. There can be never confusion between the subject and the object.

In summary, both studies focus on word order in 'main and subordinate clauses' when identifying the underlying word order of ASL as SVO, and the other orders they have observed in ASL as marked. To be a marked order in a sign language means there is some special kind of expression on the face (eye gaze, raising brows, etc.), and/or in the movement or pose of the head.

A closely related construction to word order is gapping. Gapping (Ross, 1967) is the reduction of identical elements under coordination. Ross (1970, p.251) classifies gapping as forward and backward as follows:

> ...if the identical elements are on left branches, gapping operates forward and; if they are on right branches, it operates backward.

In other words, in coordination of sentences with identical verbs, forward verb gapping is the deletion of the identical verbs other than the first verb for the verb-initial orders, and backward verb gapping is the deletion of the identical verbs other than the last one for the verb-final orders. Table (1.1) shows whether forward or backward verb gapping is predicted by (Ross, 1970) to be grammatical for a basic word order.

Table 1.1: Ross's (1970) generalization of Verb Gapping

Basic Word Order	**Gapping**	**Predicted Gapping Type**
SVO	SVO & SVO $\Rightarrow$ SVO & SO	forward
OVS	OVS & OVS $\Rightarrow$ OVS & OS	forward
SOV	SOV & SOV $\Rightarrow$ SO & SOV	backward
OSV	OSV & OSV $\Rightarrow$ OS & OSV	backward
VSO	VSO & VSO $\Rightarrow$ VSO & SO	forward
VOS	VOS & VOS $\Rightarrow$ VOS & OS	forward

Ross (1970) makes a generalization for the verb-medial order SVO, that forward verb gapping but not backward verb gapping takes place for this order, in effect

aligning SVO languages with VSO. Steedman (1990) shows that both Ross's (1970) generalization is a prediction of Combinatory Categorial Grammar (CCG).

In fact, gapping is a good test for determining the basic word order of a language as suggested by Ross (1970) and explicitly formulated by Steedman (1990; 2000) and Bozsahin (2000b).

Gapping behaviour is not taken into consideration as a claim in favor of SVO and against SOV order in Liddell's (1980) work. In fact, ASL seems to have forward gapping (1a), but not backward gapping (1b). Liddell (1980, p.30) gives (1a) as a gapping example and states that when gapping occurs in a sentence, a slow head node (represented as 'hn' in the examples) accompanies the object of the gapped verb.

(1) a. (Liddell, 1980, ex.29)

HAVE WONDERFUL PICNIC. PRO.1 BRING SALAD,

hn *hn* *hn*

JOHN BEER , SANDY CHICKEN , TED HAMBURGER.

'We had a wonderful picnic. I brought the salad, John (brought) beer beer, Sandy (brought) the chicken, and Ted (brought) the hamburger.'

b. (personal communication with Liddell)

hn *hn* *hn*

*JOHN BEER , SANDY CHICKEN , TED BRING HAMBURGER.

Following Ross (1970), it can be claimed that there is evidence in favor of SVO order, since in a SVO language, the verbs except for the first verb may be gapped and it is the case for ASL's gapping behaviour. In fact, determining the basic word order depending on the gapping data is what we are exactly doing for TİD

After we draw conclusions about the morphology and the word order in the language, we investigate whether they mark ergativity, accusativity, or agentivity. We have also looked at coordination to investigate the underlying syntactic system of TİD.

This study adopts CCG since it has the advantage of formulating word order and grammatical relations in the lexicon, and as a consequence, of having the power of testing the basic word order hypothesis for a language by using 'gapping' data. The lexicon in CCG is very different from a lexicon in the traditional sense. It is

a lexicalized theory, hence most of the work is carried by the categories of lexical entries.

1.1 Outline of the thesis

Chapter 2 introduces the main problems one can face when doing field work in sign linguistics. Since there were no available data prepared for linguistic purposes, we have collected data from native signers according to the methodologies stated in that chapter.

Chapter 3 introduces nominal, pronominal and verbal systems of TİD and explains word order relationship between the verb and its arguments. In section 3.4. TİD is claimed to be a pro-drop language and the differences between different verb classes with respect to their pro-drop behaviour are introduced. In section 3.5, we introduced the results of our investigation of TİD's word order in both simple and verb-gapped sentences. Our tests on simple sentences are based on the verb classification which can be found in section 3.4. We also evaluate the effects of animacy and non-manual marking factors on the word order.

Chapter 4 is on the grammatical relations in TİD. In the first part of the chapter, we discuss the effect of nominal and verbal morphology and word order on the grammatical relations. In the rest of the chapter, we investigate whether syntax is ergative, accusative or agentive in TİD. For determining syntactic relations, a general test which investigates the behaviour of the language under coordination is applied to TİD.

Chapter 5 gives an overview of Combinatory Categorial Grammar (CCG) and introduces a proposal for a CCG lexicon for TİD. An analysis of our data on the pronominal, nominal and verbal system of TİD is given based on the findings in the previous chapters.

CHAPTER 2

METHODOLOGY

2.1 Methodology for Collecting Data

2.1.1 Availability of Data

One of the drawbacks of working on Turkish sign language (TİD) is that there are very few studies dealing with it, and almost no publicly available data which is collected and annotated for linguistic purposes. In fact, natural data (such as conversations, story-telling, or interviews) which are available for spoken languages, are absent. There exists a big archive of video recordings of news in TİD. However, our informants reported the unnaturalness of these data. The news are presented by hearing bilinguals and look more like word-by-word translation from Turkish.

2.1.2 Informants

Many deaf people are not born into deaf families, and this may lead to the problem of late exposure to language. For many sign languages including TİD, there are few deaf people who are native signers. In the website at `http://turkisaretdili.ku.edu.tr`, Özyürek, İlkbaşaran, and Arık (2004) reported that 90% of all deaf children are in this condition. Oral methods have been the education policy in the schools for the deaf, and TİD has been banned from the classrooms since 1953. The preschools for the deaf, such as "İşitme Engelli Çocuklar için Eğitim Merkezi" (İÇEM), are on the oralist side. However, deaf children of hearing parents and deaf children of deaf parents communicate in such schools; and for deaf children of hearing parents, this is often their first exposure to TİD. Many deaf people do not go to preschools and their exposure to TİD may be quite late. As a consequence, there are few deaf people who are native signers of TİD.

Late learners are not good at non-manual markings, hence are not suitable as informants. For that reason, people who became deaf and learned TİD after the critical period of language acquisition are not involved in the data collection task. The informants in this study are chosen among signers who were born to a family with deaf parents or elder deaf members, and were exposed to TİD during the critical age of acquisition, in other words, our informants are native signers.

Many deaf parents have hearing children. Mostly, these hearing children have naturally become bilinguals of the spoken language and the sign language available to them. However, these bilinguals can unconsciously switch from their natural use of sign language to an unnatural form in order to be more easily understood by a hearing person. Such switching between two or more languages is known as *code switching* (Aarons, 1994). In order to avoid code switching effects and any effects of spoken language on sign language, hearing bilinguals of TİD and Turkish did not take part as informants in judgment tests and natural data elicitation tasks.

However, a deaf bilingual native signer with an excellent Turkish worked as an interpreter during this study, helped us apply the grammaticality judgment tests to the informants. He also helped us for annotating the natural data collected from the signers. Moreover, he did these tests on his own before applying them to the informants.

The number of informants for the grammaticality judgment tests is eight, only one of them was a deaf bilingual. All the informants are native, and the primary language is TİD in their daily lives except for the bilingual informant. The age of the informants is between 21-43 with a mean of 25. At minimum, they are graduates of high school. All the informants live in Ankara for the time the elicitation and judgment tests were being conducted, but the place of acquisition of TİD differs among the subjects. It should be noted that the informants almost exclusively use the Ankara Dialect. The study is planned to be expanded to all the dialects of TİD in the future.

Every subject filled a questionnaire that was prepared to gather her/his background information such as place and age of acquisition of TİD, the number of people in the family who use TİD, education, hearing status and use of language in daily life. The questionnaire is in Turkish, but an interpreter helped the informants whenever they needed.

2.1.3 Data Elicitation

Following Senghas et al. (1997) and Sandler et al. (2005), we prepared short video clips for elicitation of simple sentences. Each of the videos contains a scene where someone does an action (to someone or something). Signers watched these video clips, and were asked to tell what they see in the video clips. Their responses are recorded with two cameras. One of the cameras focuses on the face of the signer, and the other camera records the signer from the front-side. The camera that zoomed at the face is needed for the analysis of non-manual markings; the aim of this camera is to obtain video clips for later use in the markedness analysis of the clauses.

The videos the signers watched are designed to have four classes of verbs: (i) intransitive, (ii) transitive with animate arguments, (iii) transitive verb with inanimate arguments, and (iv) ditransitive verbs.

The recorded responses of the signers are used for gathering information about the directionality of verbs produced and the word order. Animacy is taken into consideration to understand if (in)animacy of the patient affects the clause order in TİD. Some researchers claim that it does. For example, Senghas et al. (1997) reported that first signer generation of Nicaraguan Sign Language use both n_1-n_2-verb and n_2-n_1-verb orders when the n_2 (having the notional role of patient) is inanimate, whereas they do not use these orders when n_1 and n_2 are both animate, instead they sign in the order of n_1-verb$_1$-n_2-verb$_2$ where the second verb is "thematically reverse" of the first verb. Similarly, animacy is taken as an argument for investigating the word order of ASL. Fischer (1975) states that the Subject-Verb-Object (SVO) order is the underlying order of ASL, and other orders are possible if (i) the verb is an agreement verb (see section 3.4.1), (ii) subject and object are non-reversible, or (iii) there is topicalization. In (ii), non-reversibility means one of the two noun phrases is possibly the subject, based on factors such as animacy or world-knowledge.

Moreover, video clips are prepared in order to elicit data that contain sentences reflecting the grammatical relations of TİD. These clips contain scenes where a person is doing both an intransitive and transitive action. For example, a man stands up and kisses a woman. To elicit gapping data, some short films in which a group of people is doing the same action to different things or different people were prepared.

2.1.4 *Grammaticality Judgment Tests*

Another method followed in the present study is applying the grammatical judgment tests to the native signers. The reason why judgment tests are needed for this study is that the natural data collected from native signers do not contain sufficiently specific data to conclude about the basic word order and the grammatical relations in TİD.

In ASL literature, many researchers (Neidle et al., 1998; Liddell, 1980; Padden, 1988) have used judgments of native signers. However, some researchers (Aarons, 1994; Neidle et al., 1998; Neidle et al., 2000) find the grammaticality judgment tests risky and unreliable under some conditions such as doing elicitation with non-native signers, or doing the transcription of the utterance while the informant signs.

To reduce the effect of spoken language (Turkish) on the informants during the judgment tests, judgment elicitation sessions are done by a native signer on a one-subject per session basis, and the sessions are video taped. A web-based graphical user interface was developed with the aim of obtaining grammaticality judgments from the informants in a standardized form, hence the same setting was applied to all the informants. The only difference among the tests is that different informants see the same sentences in different orders. The order of presentation is randomized.

This interface is designed in such a way that the informants are able to watch a brief video containing a signing sequence, either grammatical or ungrammatical, to judge the degree of grammaticality on a 5-point rating scale (from perfectly OK to completely unacceptable), and to answer some questions about the meanings of the sentences. The mode of presentation of sentences to the informants has to be signed rather than written or spoken, since sign languages have no written form (orthography). The videos, which contain sign sequences whose grammaticality are to be judged, have been prepared with the help of a deaf bilingual native signer. Writing Turkish word translation of each sign would be inappropriate because the task could be effected by Turkish. With such a written translation mode, non-manual signals occurring on the face cannot be well-expressed, and judgers cannot fully understand the sentences.

In the design phase of the graphical user interface, *task-related factors* (Schütze, 1996) were taken into consideration. Schütze (1996, p.132) states that the results are meaningless if subjects are not given a clear interpretation of grammaticality.

First of all, our native deaf interpreter informed the subject about the concept of grammaticality and the types of questions (s)he is going to answer. The informant was told that (s)he shall sign the utterance (s)he watched, and judge whether it is natural for her/him. It was also explained that (s)he should think if (s)he would produce such an utterance when talking to her/his deaf parent before judging, and also be asked to think of contexts where the given utterance would be acceptable. In addition, the signer is warned not to accept a sentence that is understood because of semantics or that is interpretable but not natural, and also not to reject a well-formed sentence because it is meaningless. The frequency of occurrence of such sentences is very low, if not zero. The signers are given some examples of well-formed but meaningless and ill-formed but interpretable sentences. Since one of the aims of these tests is to find out which word orders are acceptable to native signers, the subjects are also requested to pay attention to the sign order of the sentences they watch.

After that part, the subject was shown a brief technical description of how to use the interface on a few examples. The subject also had the opportunity to do a few examples before taking the test in order to feel comfortable with the procedure. During the test, whenever the informant judged the grammaticality of a sentence, the reasons behind his/her answer is asked. When any inconsistency between the judgments of informants occurred, these answers were reconsidered. All the judgments for the sentences (which include information about word order, pro-drop and grammatical relations) and the answers (s)he gave for the questions about semantics were recorded in a database.

There was no time limit for the informant to judge the grammaticality of a sign sequence in this study. In order to deal with the effect of the subjects' fatigue or boredom, a button to stop and restart at the point (s)he has left had been added to the interface.

2.2 Data Annotation

It is very important to prepare the collected data according to the standards in sign linguists. Our data will be publicly available at the website of the Laboratory for Computational Study of Language (www.lcsl.metu.edu.tr/TID). The information about the recordings (date, place, camera positions .etc), the details of the elicitation methods used in the study, and the background information about informants in-

volved in the elicitation sessions are stored as meta-data. The annotations contain the glosses for signs, the translations of the data both in English and Turkish, and the non-manual markings on the face.

The natural data we collected are annotated with ELAN (EUDICO Linguistic Annotator), a tool developed by the Max Plank Institute for Psycholinguistics for annotation of video and audio. This tool allows for detailed descriptions of manual and non-manual behaviors of the signers, and to connect them to a time line. The reader is referred to technical manual for the tool (Hellwig and Uytvanck, 2005) for more details. A Turkish TİD bilingual signer was involved in the annotation of the data.

CHAPTER 3

TİD LEXICON

In this chapter, we introduce TİD data we have obtained from the judgment tests and the natural data elicitation tasks. We first describe the pronominal system in TİD because it is crucial for understanding verbal agreement in TİD. Section 3.1 on pronouns begins with the discussion of how spoken languages and sign languages differ in their pronominal systems. Section 3.2 introduces nominal system and the locus setting mechanism for nouns in TİD, and section 3.3 explains TİD conjunctions.

In section 3.4, verbs are classified according to their morphosyntactic features and agreement and pro-drop processes are introduced in detail. The last section introduces investigation of the word order relation between verb and its arguments in TİD. In that section, we claim that the language is verb final depending on the evidence from gapping data.

3.1 Pronouns

The pronominal system of TİD encodes person, number and locus but it does not encode gender.

3.1.1 Personal Pronouns

In many sign languages (for example ASL, TİD, and British sign language - BSL), personal pronouns are signed as an index finger pointing to a location in the signing space (see Figure 3.1 for singular personal pronouns of TİD). Zeshan (2002, p.262) states that TİD signers point to themselves for first person reference, to the addressee for second person reference and to an arbitrary place in space often on the right or left of the signers for third person reference. The plural form of the personal pronouns is a sign whose hand shape is an index finger extended, whose movement is a

horizontal arc, and whose location depends on the person parameter as the singular form.

IND_1 IND_i IND_i

Figure 3.1: Singular Personal Pronouns

However, the location where the index finger points varies for the second and third person reference. For example, both of the signs in the second and the third photographs in Figure 3.1 may be used by the signers for referring to the addressee depending on the location of the addressee. The non-addressed person reference is exemplified in the third photograph, however there are many other alternatives as well. As shown in Figure 3.2, the relative positions of the subject, addressee and the non-addressed person may change from one conversation to another. This change in the relative positions leads to a change at the place where the signer points. These two observations, namely the overlapping sets of pointing signs for the second and third persons, and these sets being infinitive, have been discussed in ASL literature as well. Comrie (1989, p.230) states that spoken languages and ASL differ in pronouns; the set of pronouns in spoken languages is restricted whereas there is *"an indefinite number of entities to be tracked in terms of anaphoric relations"* in ASL, and this number is only restricted in terms of limited memory and the problem of discriminating two close locations.

For ASL, two suggestions for the pronominal system have been put forward as an alternative to distinct-three-persons system. The first suggestion, by Meier (1990) and many other researchers following him (Emmorey, 2002, p.52-53), is that a *"first person vs. non-first person"* classification is to be made. They argue that, in ASL, there is no distinction between the second and the third person pronouns since the signer can point to any point in space to specify an addressee or non-addressed person. In

contrast to Meier's(1990) view, Lillo-Martin and Klima (1990) suggest that there are no contrasts for person in the mental lexicon, and consequently no list for the forms. Instead the lexicon has only one personal pronoun which is assigned an index at each use. Lillo-Martin and Klima (1990) support that view with the fact that the mental lexicon is bounded and listable.

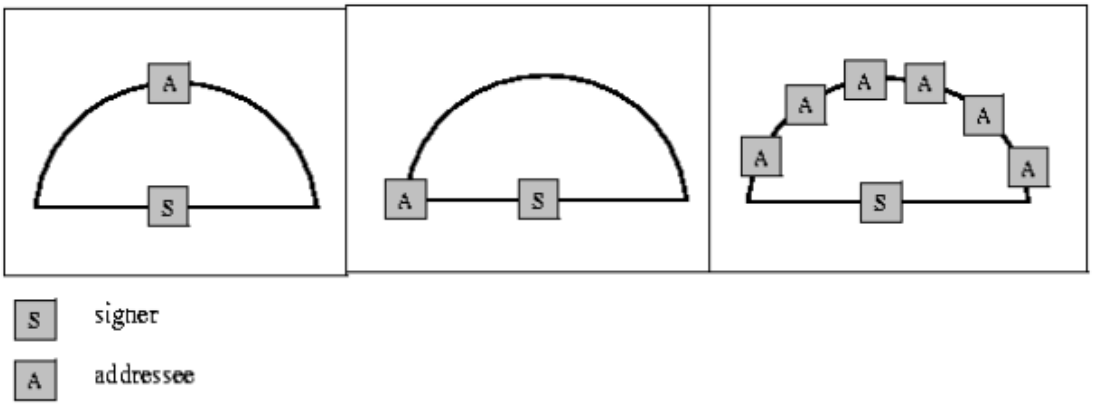


Figure 3.2: The locations of the subject and the addressee in some possible conversations may vary. The arc in the figures represents the space in front of the signer.

We accept that the first vs. non-first person analysis of Meier (1990) holds for the pronouns in TİD. However, we shall note that when the locus of a pronoun agrees with the locus of its antecedent, the non-first person feature is unified with the feature value of third person if the antecedent is a proper name having the feature of third person. Similarly, unification occurs with the second person if the signer is known to be pointing at the addressee. For a sign-to-text or text-to-sign translation system, it is more appropriate to have a lexical entry for a pronoun that can distinguish the second and third person whenever possible, otherwise the person feature remains as non-first person.

The lexical entry for a personal pronoun has three basic features, person, number and locus. Number is the property of being singular or plural. The person feature can take 4 values: 1, non-1, 2, and 3 for the first, non-first, second and third person respectively. On the other hand, the locus can take infinitely many different values including S (signer's chest) or any arbitrary point i, j, k, etc. Hence, the following is a template lexical item for personal pronouns.

$$\text{IND}_{pnl} := \begin{bmatrix} \text{N} & \\ \text{PERSON:} & \text{p} \\ \text{NUMBER:} & \text{n} \\ \text{LOCUS:} & \text{l} \end{bmatrix}$$

The first line represents the syntactic category of the item. and the following lines shows the features and the values for them. For example, $\text{IND}_{1,SG,Ls}$ has the following feature structure.

$$\text{IND}_{1,SG,Ls} := \begin{bmatrix} \text{N} & \\ \text{PERSON:} & 1 \\ \text{NUMBER:} & \text{SG} \\ \text{LOCUS:} & \text{Ls} \end{bmatrix}$$

3.1.2 Possessive Pronouns

The hand-shape for a possessive pronoun in TİD is different than the one for a personal pronoun as shown in Figure 3.3. The direction of movement is determined according to the location of the possessor. The hand orientation for possessive pronouns changes whereas it does not change for personal pronouns.

The hand-shape for the possessive pronoun POSS_i

Figure 3.3: Possessive pronouns

3.1.3 Reflexive Pronouns

Zeshan (2002, p.263) claims that there are no reflexive pronouns in TİD. [1] There is a sign KENDİ 'self' which emphasizes that the action is done by the agent, not by others (see (2a-c)). However, this sign does not inflect for person and does not function as a reflexive pronoun unlike Turkish 'kendi' (see 2d).

(2) a. ADAM AĞAÇ TIRMAN ISTE, KENDİ DÜŞ
man tree climb want self fell-down
'The man wanted to climb the tree but he himself fell down.(Nobody caused his falling)'

b. KEDİ KÖPEK KABUL DEĞİL, KENDİ YE İSTE
cat dog welcome not self eat want
'The cat did not welcome the dog, and wanted to eat (it) itself.'

c. *ADAM KENDİ GÖR
man self saw
'The man saw himself.'

d. Ben kendi-m-i gör-dü-m.
man.NOM self-1SG-ACC see-PAST-1SG
'I see myself'

3.2 Nouns

In TİD, we have observed that there are three types of nominal usage as arguments of predicates: (i) bare nouns which are not associated with a locus, (ii) nouns associated with a locus, and (iii) pronouns (which are also associated with a locus). When a noun is followed by an index finger pointing at an arbitrary location in space,[2] it is associated with that locus and it agrees with an agreement verb through this locus. The sign used for pointing is exactly the same for non-first personal pronouns. Since its function is setting a locus to a noun rather than being a pronoun, and making it definite, it functions as a determiner in the language. The reader is referred to Neidle

[1] The lack of reflexives holds for American sign language as well (Padden, 1988).

[2] It is sometimes the case that the noun is preceded by a IND sign, or both can be simultaneously signed if the noun in consideration is a one-handed sign.

et al. (2000, p.88-90) for a more comprehensive discussion of definite determiners in sign languages.

3.3 Conjunctions

TİD has conjunctions VE 'and' AMA 'but. However, signers tend not to use these signs very frequently. Instead, they coordinate sentences as serial verb constructions without using any conjuncts, as shown in (3).

(3) ÇOCUK EMEKLE, TOP YAKALA, OYNA FUTBOL, BÜYÜ FUTBOL OL.
child crawl ball catch play football grown-up football-player be
'The child crawled, caught the ball, played football, when he is grown-up he will be a football player'

In fact, Johannessen (1998) reported that there are conjunctionless languages like Dyirbal and the Turkic language Old Uighur. Also, in Turkish, coordination without conjunctions is possible even if there are conjunctions in the language.

3.4 Verb Classes

In (Padden, 1988; Padden, 1990), ASL verbs are classified into three groups according to their morphological features: (i) inflecting (agreement) verbs, (ii) plain verbs and (iii) spatial verbs. Padden (1988) puts the distinction between the three verb classes as follows: Agreement verbs inflect for person and number, spatial verbs have markers for location and manner, and plain verbs do not have these affixations. TİD verbs are observed to have a verbal morphology very similar to ASL verbs, so it is feasible to classify TİD verbs in the same way. Moreover, this classification is convenient for investigating the effect of verbal morphology on grammatical relations and word order of a sign language. The following sections explain the properties of verb classes in detail with examples of TİD verbs.

3.4.1 Agreement Verbs

The agreement in consideration is a bit different than subject-verb (person and number) agreement found in the English sentences 'They run' versus 'He runs', where pro-drop is impossible. It is what Blake (1994, p.14) calls "cross-referencing agreement": the grammatical relations are represented on the predicate, and this marking on the verb is mentioned as person agreement. Unlike English subject-verb agree-

ment, the pronominals that have this kind of person agreement with the verb can be omitted in the sentences, in other words, pro-drop is possible for languages which show cross-referencing agreement.

Spoken languages such as Swahili (Blake, 1994), Chichewa, some other Bantu languages (Mchombo, 2001), and Turkish show this kind of agreement. For example, Turkish verbs show cross-referencing agreement only with the agent-like argument of the transitive and ditransitive verbs, and the single argument of the intransitive verb, which supports the claim that Turkish is an accusative language. Due to accusativity of Turkish, the person agreement on the verb can be called subject-agreement. The Turkish sentences (4a-f) exemplify the cross-referencing subject agreement in the intransitive (4c-e) and transitive sentences (4a-b). If the verb does not agree with the subject, the sentence becomes ungrammatical. The subject in Turkish sentences can be omitted (pro-drop) as shown with the example (4f).

(4) a. Ahmet arkadaş-ı-nı gör-dü.
Ahmet.NOM friend-POSS+3sg-ACC see-PAST-3SG
'Ahmet saw his friend.'

b. Ben arkadaş-ım-ı gör-dü-m.
I.NOM friend-POSS+1sg-ACC see-PAST-1SG
'I saw my friend.'

c. Adam koş-tu.
man.NOM run-PAST-3SG
'The man ran.'

d. Ben koş-tu-m.
I.NOM run-PAST-1SG
'I ran.'

e. *Ben koş-tu-n.
I.NOM run-PAST-2SG

f. koş-tu-m.
run-PAST-1SG
'I ran.'

Subjects in Turkish have the nominative case which has a zero surface form, i.e., no suffix, and direct objects have the accusative case which is signaled with the suffix -(y)H.[3] Cross-referencing agreement is an alternative to case in signaling grammatical relations, for example, Turkish has accusative case for marking the patient (object) of the sentence since it does not need cross-referencing object agreement. On the other hand, as reported by Blake (1994), Swahili has both subject agreement (marked with the first affix 'a-' in the sentences (5a) and (5b) and object agreement (marked with the third order prefix '-m-'). It does not have a morphological case that marks accusativity for nominals, and both the objects and subjects can be omitted. See Swahili examples in (5).

(5) a. Ali a-na-m-penda m-wanemke m-rembo
Ali 3SG-PRES-3SG-love M-woman M-beautiful
'Ali loves a beautiful woman' (from (Blake, 1994, p.14))

b. a-na-m-penda
3SG-PRES-3SG-love
'S/he loves him/her' (from (Blake, 1994, p.14))

TİD needs a different type of morphological and phonological analysis than spoken languages because of the modality of the language is signed rather than spoken. Neidle et al. (2000, p.27) explains the morphological analysis for the signed languages as follows:

> Morphemes are distinguished by differences in hand-shape, hand orientation, movement, and the location relative to the signer's body at which the morpheme is articulated.

Similarly, Rathmann and Mathur (2002) group agreement verbs into five, according to their phonological features. The important point of this grouping is that it shows different methods of distinguishing the morphemes in these verbs. We also used these phonological features for identifying agreement verbs in TİD. For example in TİD:

1. Verbs that change only in palm orientation. Ex: GÜL 'laugh at' [4]

[3] The parentheses emphasize the optionality of the consonant 'y', and H stands for high vowels ı, i, u, ü.

[4] The glosses used for TİD signs are represented in capitals, following the general convention in sign language research.

2. Verbs that change only in direction of movement. Ex: ANLAT 'tell', SAT 'sell', BORÇ 'owe'

3. Verbs that change both in orientation and direction of movement. Ex: ALAY 'mock', GÖNDER 'send'

4. Verbs that change in orientation, direction of movement, and the relative positions of two hands with respect to the body. Ex: DURDUR 'stop somebody', ÖDE 'pay'

5. Verbs that change in orientation and the relative positions of two hands with respect to the body.

However, in our study, classification of agreement verbs is done at the morphosyntactic level. It is different than the grouping of Rathmann and Mathur (2002) because agreement verbs can show similar morphosyntactic behaviors even if they belong to different groups in the above list.

Like Swahili and Turkish verbs, agreement verbs in TİD are inflected for person,[5] with one difference: some agreement verbs in TİD agree with both the patient and the agent of the predicate, whereas some of them agree only with the patient.

The transitive agreement verbs of TİD in consideration have $\mathcal{P}$-agreement with the nominals which have the notional roles of instrument, object, goal, source and $\mathcal{A}$-agreement with the nominals with notional roles of agent or experiencer. The agreement verbs with three arguments (ditransitive verbs) in TİD show $\mathcal{P}$-agreement with the nominals in notional roles of receiver, goal or source.[6]

An agreement verb is morphologically divided into three parts: an optional $\mathcal{A}$-agreement morpheme, the verb stem, and the $\mathcal{P}$-agreement morpheme.[7] $\mathcal{A}$ and $\mathcal{P}$ are set to some loci, and these loci are used as the beginning and ending points of the signs of agreement verbs.[8] The person agreement marker for the 1st person is near

[5] See Lillo-Martin (1991) for a discussion that agreement is inflection rather than cliticization, based on Zwicky and Pullum's (1983) classification of inflection and cliticization.

[6] For a discussion of inappropriateness of terms such as direct object, indirect object or to/from phrases for ISL, see (Meir, 2002, p.422-423).

[7] See Tables in appendix A for a list of agreement verbs that are sub-classified.

[8] This is known as 'R-locus view' (Rathmann and Mathur, 2002). A different view on locus and agreement verbs, suggested by Liddell (2003), states that these verbs are "indicating verbs", i.e., they are directed toward entities in mental space rather than directed toward a point in space. Moreover, he claims that such entities cannot be a proper part of a linguistic system. From this point of view, there is no need to define a locus morphologically or phonologically.

the signer's chest; for the 2nd person, in the direction of the addressee; and for the 3rd person, the locus point set for the nominal.

$\mathcal{A}$ and $\mathcal{P}$ for nominals are encoded by word order and/or verbal agreement, and not marked by morphological case as in Turkish or Latin.[9] The grammatical roles $\mathcal{A}$ and $\mathcal{P}$ on the predicate are marked by the order of morphemes. Hence, agreement verbs in TİD are sub-grouped into 'single agreement' and 'double agreement' verbs according to their morphosyntactic features such as having agreement with only the patient or with both arguments, and the order of the agreement morphemes in the verb.

(a) Single Agreement Verbs: They only agree with $\mathcal{S}$ or $\mathcal{P}$, and tend to be body-anchored, i.e., the movement of these signs begins at a fixed location on the body. For example, BAK 'look at', BAĞIR 'shout at', GÜL 'laugh at' are body-anchored verbs.

Single agreement verbs can be intransitive, transitive or ditransitive. Some examples of intransitive agreement verbs are OTUR 'sit down', ÖL 'die' and DÜŞ 'fall down'.[10] An intransitive verb agrees with the locus that is set for its $\mathcal{S}$. In other words, the agreement is satisfied by the articulation of the sign at the same locus with $\mathcal{S}$, or movement of the sign begins or ends at the locus of $\mathcal{S}$. The snapshots in Figure 3.4 introduce us the intransitive verb OTUR 'sit down'.

Transitive single agreement verb BAK 'look at' in (6a-b) agrees with $\mathcal{P}$ because movement of the sign finishes at the locus of the patient.

(6) a. $IND_{non\_1,SG,Li}$ $IND_{1.SG.L1}$ BAK_1
he/she/you I see-1+SG+L_1
'He/she/you saw me.'

b. $IND_{1,SG,L1}$ $IND_{non\_1.SG.Li}$ BAK_i
I he/she/you see-non_1+SG+L_i
'I saw him/her/you.'

[9] See section 3.5 for a discussion on the word order and agreement.

[10] Due to the fact that it is hard to distinguish an intransitive agreement verb from a plain verb, we cannot identify many intransitive single agreement verbs. Some of them have plain versions as well. Cormier (1998, p.8) reported that there are a few intransitive single agreement verbs such as DIE or COLLAPSE with a patientive notional role in ASL.

OTUR$_1$: 'I sat down.'

OTUR$_i$: 'You/he/she sat down.'

Figure 3.4: OTUR 'sit down' is a single agreement intransitive verb which agrees with $\mathcal{S}$ in its locus. The direction of movement is towards the locus of $\mathcal{S}$. The photographs in the first row show first-person agreement, and the second row exemplifies non-first person agreement. The morpheme order is Verb-Stem + $\mathcal{S}$-Agreement Marker

Pro-drop of $\mathcal{S}$ and $\mathcal{P}$ is possible for the sentences with a single agreement verb, as in (7a-c). However, pro-drop of $\mathcal{A}$ is impossible for these sentences (7d), but ellipsis is possible if $\mathcal{A}$ can be determined from context.

(7) a. *OTUR*$_1$
sit down-1+SG+L$_1$
'I sat down.'

b. *IND*$_{non\_1,SG,Li}$ *BAK*$_1$
he/she/you see-1+SG+L$_1$
'He/she/you saw me.'

c. $IND_{1,SG,L1}$ BAK_i
I see-non_1+SG+L_i
'I saw him/her/you.'

d. *BAK_i

(b) Double Agreement Verbs: These verbs agree with both $\mathcal{A}$ and $\mathcal{P}$, or only with $\mathcal{P}$. They can be transitive or ditransitive. They are classified as forward or backward, according to the order of agreement morphemes in the verb. Forward verbs have their morphemes in the order of $\mathcal{A}$-marker, verb-stem, $\mathcal{P}$-marker, whereas backward verbs have the $\mathcal{P}$-marker, verb-stem, $\mathcal{A}$-marker order. Figures 3.5 and 3.6 show the forward vs. backward distinction for double agreement verbs.

Signers may use plain versions of agreement verbs as well. Plain version of an agreement verb is not inflected for person or number. In this study, we have not investigated which one of the agreement markers on the verb are optional. However, such an investigation would give more information about verbal morphology of the language and grammatical relations.

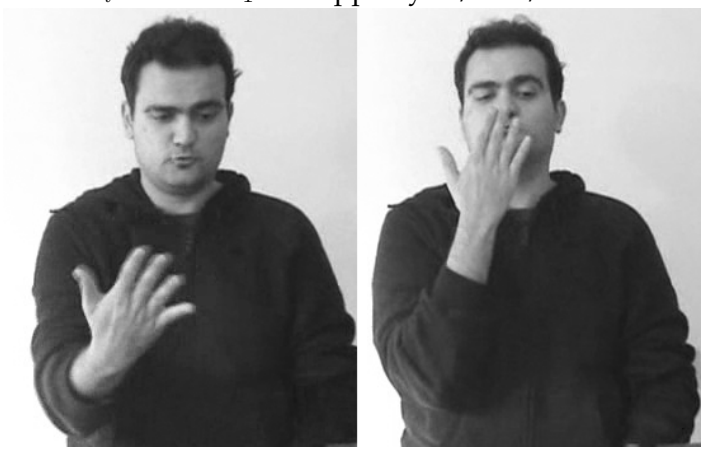
Pro-drop of only $\mathcal{P}$ or pro-drop of both $\mathcal{A}$ and $\mathcal{P}$ are possible for the sentences with a double agreement verb as in examples (8b-c). Pro-drop of only $\mathcal{A}$ is accepted by lower number of informants.

(8) a. $IND_{1.SG.L1}$ $IND_{non\_1.SG.Lj}$ $_jDAVET_1$
I he/she/you non_1+SG+L_j-invite-1+SG+L_1
'I invited him/her/you.'

b. $IND_{non\_1.SG.Li}$ $_1DAVET_i$
he/she/you 1+SG+L_1-invite-non_1+SG+L_i
'He/she/you invited me.'

c. $_jDAVET_i$
non_1+SG+L_j-invite-non_1+SG+L_i
'He/she/you invites he/she/you.'

$_i$DURDUR$_1$: 'I stopped you/him/her.'



$_1$DURDUR$_i$: 'You/he/she stopped me.'

$_i$DURDUR$_j$: 'He/she stopped him/her.

Figure 3.5: DURDUR 'stop someone' is a verb where the orientation of the palm, direction of movement, and the relative positions of two hands with respect to the body change. It is a double agreement forward verb. In each row, the beginning locus of the verb agrees with $\mathcal{A}$ and the ending locus agrees with $\mathcal{P}$. The morpheme order is as follows:
$\mathcal{A}$-Agreement Marker + Verb-Stem + $\mathcal{P}$-Agreement Marker

$_i$DAVET$_1$: 'I invited you/him/her.'

$_1$DAVET$_i$: 'You/he/she invited me.'

$_i$DAVET$_j$: 'He/she invites him/her.

Figure 3.6: DAVET 'invite' is a verb that changes the direction of movement, and the relative positions of two hands with respect to the body. The palm orientation does not change. It is a double agreement transitive backward verb. The photographs in each row show the beginning and the ending locations of the verb. The sign consists of three morphemes in the order:
$\mathcal{P}$-Agreement Marker + Verb-Stem + $\mathcal{A}$-Agreement Marker

3.4.1.1 *Number Agreement*

Agreement verbs show number (dual, reciprocal, exhaustive) agreement with arguments. The number is unmarked for the verbs with single and collective plural. For one-handed agreement verbs, dual agreement can be represented via simultaneous execution of the sign with two hands. See the dual form of BAK 'look at' in Figure 3.7.

BAK $\quad$ BAK$_{Dual}$

Figure 3.7: The sign BAK 'look-at' is normally a one-handed sign. It has two possible hand-shapes: index finger is extended or two fingers are extended (V-hand). The two-handed (dual) form is signed simultaneously as seen in the photograph, when there is exactly two people who are looking at someone, or someone is looking at exactly two people.

The reciprocal form, which has the meaning 'each other', is a dual form in which each of the one-handed forms has a locus agreement with the others. The exhaustive form is used when there are at least three arguments, and it is formed by the repetition of the verb stem at least three times. (See Figure 3.8.)

3.4.2 *Plain Verbs*

Padden (1988, p.37) defines the class of plain verbs as the verbs that inflect for neither number nor person. Some example TİD plain verbs are SEV 'love', KOŞ 'run, ÇAL 'steal', ÖZLE, İSTE 'want' and BİL 'know' (see Appendix A). The plain verbs do not change their form depending on the number and person features of their arguments whereas agreement verbs do (see (9a-b)). In fact, they are signed at a fixed location. Since there is no person agreement marker for plain verbs, pro-drop of overt arguments is not possible (9c).

ADAM KADIN VE COCUK

BAK$_{reciprocal+exhaustive}$

Figure 3.8: The dual form of the sign BAK 'look-at' is signed three times reciprocally. The sentence is translated into English as '(Each of) the man, the woman and the child looked at each other.'

(9) a. *IND*$_{non\_1,SG,Li}$ *IND*$_{1,SG,Ls}$ *SEV*
He/she/you I love
'he/she/you love(s) me'

b. *IND*$_{1,PL,Ls}$ *IND*$_{non_1,PL,Li}$ *SEV*
we you/they love
'We love you/them'

c. **IND*$_{non\_1,SG,Li\ Li}$*SEV*$_{Ls}$
*She/he/you love-me

3.4.3 Spatial Verbs

Like the plain verbs, spatial verbs do not mark for person and number. However, they are different than plain verbs in that they mark some locations in space. Spatial verbs move between two locations in signing space, and these locations are real-world loci. They are not loci that are set for the patient and the agent. For example, IND$_{1,SG,Ls\ i}$YÜRÜ$_j$ simply means 'I walked from here to there'.

3.5 Word Order

The first step in our investigation of TİD's word order is finding the acceptable orders in simple sentences for the native signers, and analyzing the data for markedness. The first methodology was showing some brief videos to signers as described in section 2.1.3. The word orders, which are observed in natural data elicited from native TİD signers, show that sentences are most frequently signed in $\mathcal{S}$V for intransitive clauses, $\mathcal{AP}$V is the most frequent order for transitive clauses with two animate arguments , in addition to this order we also observed $\mathcal{AVP}$ when the verb is an agreement verb. For transitive clauses with one animate and one inanimate argument, the native signers signed both in $\mathcal{AP}$V and $\mathcal{PA}$V. Natural data signals that animacy is a factor that affects word order, i.e. only $\mathcal{AP}$ order is possible when both arguments are animate, whereas both $\mathcal{AP}$ and $\mathcal{PA}$ are possible if the patient is inanimate.

For a wider investigation of the word order and the relation between word order and agreement, the informants are asked to judge the grammaticality of the sign sequences which were shown in video format. The judgment tests included simple sentences in every possible order, with verbs of every class defined in section 3.4. Animacy was also taken into consideration.

The results of the judgment tests for the simple sentences are shown in Tables 3.1 and 3.5. Table 3.1 supports the claims that animacy plays a great role. Native signers find $\mathcal{AP}$V, $\mathcal{AVP}$†, and V$\mathcal{AP}$ orders grammatical but not any of the $\mathcal{PA}$ orders, when the patient is animate.[11] $\mathcal{P}$V$\mathcal{A}$ order is observed in natural data as indicated at the beginning of this chapter, but in judgment tests, the subjects always attest NVN order as $\mathcal{AVP}$. We conclude that $\mathcal{AP}$ is the unmarked order, and $\mathcal{PA}$ order is only possible when marked. V$\mathcal{PA}$is simply the subject detopicalized form of $\mathcal{AP}$V. Among these orders, they scored $\mathcal{AP}$V as perfect, $\mathcal{AVP}$† between very good and perfect, and V$\mathcal{AP}$ order on a scale from 'somehow acceptable' to perfect. The reason for verb-initial sentences to get lower scores may be due to ellipsis.

For the sentences with inanimate patients, all the informants find $\mathcal{AP}$V order the best among others, six of eight signers accepted $\mathcal{PA}$V as perfect, $\mathcal{AVP}$ and $\mathcal{P}$V$\mathcal{A}$ are scored as very good, and V$\mathcal{AP}$ gets lower scores than the others, but it is found to be

[11] † in Table 3.1 means that $\mathcal{AVP}$ order is observed for plain versions of these verbs. We have not got any examples with a plain verb in $\mathcal{AVP}$. The plain versions of the agreement verbs do not inflect for person.

Table 3.1: Order in simple sentence with plain verbs

	Animacy+		**Animacy-**
	$\mathcal{S}$V$_{intr}$		$\mathcal{S}$V$_{intr}$
	V$_{intr}\mathcal{S}$		V$_{intr}\mathcal{S}$
	$\mathcal{AP}$V		$\mathcal{AP}$V
$*$	$\mathcal{PA}$V		$\mathcal{PA}$V
†	$\mathcal{AVP}$		$\mathcal{AVP}$
$*$	$\mathcal{PVA}$		$\mathcal{PVA}$
	V$\mathcal{AP}$	?	V$\mathcal{AP}$
$*$	V$\mathcal{PA}$	?$*$	V$\mathcal{PA}$

Table 3.2: Order in simple sentence with agreement verbs

	Single Agreement		**Forward Double Agreement**
	$\mathcal{S}$V$_{intr}$		-
	V$_{intr}\mathcal{S}$		-
	$\mathcal{AP}$V		$\mathcal{AP}$V
?	$\mathcal{PA}$V	$*$	$\mathcal{PA}$V
	$\mathcal{AVP}$		$\mathcal{AVP}$
$*$	$\mathcal{PVA}$	?$*$	$\mathcal{PVA}$
$*$	V$\mathcal{AP}$		V$\mathcal{AP}$
?$*$	V$\mathcal{PA}$	$*$	V$\mathcal{PA}$

somehow acceptable. V$\mathcal{PA}$ is unacceptable for half of the signers. For plain verbs, $\mathcal{S}$V$_{intr}$ order is preferable to V$_{intr}\mathcal{S}$, but both are grammatical.

To our surprise, using agreement verbs does not result in free word order. The $\mathcal{PA}$V order does not get as high scores as the $\mathcal{AP}$V order does, but it is acceptable. For the verbs which only agree with their patients, both $\mathcal{PVA}$ and verb-initial orders are not acceptable. For forward double agreement verbs which agree with their agents and patients, $\mathcal{PA}$ serialization is ungrammatical,whereas V$\mathcal{AP}$ is acceptable.

Another set of sentences in judgment tests involve both forward and backward verb gapping construction for the six possible word orders. Gapping is crucial in determining basic word order as (Ross, 1970) and much subsequent work showed that it depends on surface word order, and, it seems, nothing else. We asked our informants for judgments on gapping concerning the animacy factor. They rejected any kind of verb gapping when the arguments are all animate. Tables 3.3 and 3.4 show the results for the forward and backward verb gapping behaviour in the sentences where the patients are inanimate.

From Tables 3.3 and 3.4, we can suggest that verb-final orders differ from verb-medial and verb-initial orders in their gapping behaviours; and also that forward and

Table 3.3: Forward Verb Gapping (Inanimate patient)

	Forward Verb Gapping (Inanimate patient)		
	$\mathcal{A}\mathcal{P}$V & $\mathcal{A}\mathcal{P}$	?∗	$\mathcal{A}\mathcal{P}$V & $\mathcal{P}\mathcal{A}$
	$\mathcal{P}\mathcal{A}$V & $\mathcal{P}\mathcal{A}$		$\mathcal{P}\mathcal{A}$V & $\mathcal{A}\mathcal{P}$
∗	$\mathcal{A}$V$\mathcal{P}$ & $\mathcal{A}\mathcal{P}$	∗	$\mathcal{A}$V$\mathcal{P}$ & $\mathcal{P}\mathcal{A}$
–	$\mathcal{P}$V$\mathcal{A}$ & $\mathcal{P}\mathcal{A}$ (no data)	∗	$\mathcal{P}$V$\mathcal{A}$ & $\mathcal{A}\mathcal{P}$
–	V$\mathcal{A}\mathcal{P}$ & $\mathcal{A}\mathcal{P}$ (no data)	–	V$\mathcal{A}\mathcal{P}$ & $\mathcal{P}\mathcal{A}$ (no data)
∗	V$\mathcal{P}\mathcal{A}$ & $\mathcal{P}\mathcal{A}$	–	V$\mathcal{P}\mathcal{A}$ & $\mathcal{A}\mathcal{P}$ (no data)

Table 3.4: Backward Verb Gapping (Inanimate patient)

	Backward Verb Gapping (Inanimate patient)		
	$\mathcal{A}\mathcal{P}$& $\mathcal{A}\mathcal{P}$V		$\mathcal{P}\mathcal{A}$& $\mathcal{A}\mathcal{P}$V
	$\mathcal{P}\mathcal{A}$& $\mathcal{P}\mathcal{A}$V		$\mathcal{A}\mathcal{P}$& $\mathcal{P}\mathcal{A}$V
–	$\mathcal{A}\mathcal{P}$& $\mathcal{A}$V$\mathcal{P}$ (no data)	?∗	$\mathcal{P}\mathcal{A}$& $\mathcal{A}$V$\mathcal{P}$
?∗	$\mathcal{P}\mathcal{A}$& $\mathcal{P}$V$\mathcal{A}$	∗	$\mathcal{A}\mathcal{P}$& $\mathcal{P}$V$\mathcal{A}$
–	$\mathcal{A}\mathcal{P}$& V$\mathcal{A}\mathcal{P}$ (no data)	–	$\mathcal{P}\mathcal{A}$& V$\mathcal{A}\mathcal{P}$ (no data)
∗	$\mathcal{P}\mathcal{A}$& V$\mathcal{P}\mathcal{A}$	∗	$\mathcal{A}\mathcal{P}$& V$\mathcal{P}\mathcal{A}$

backward verb gapping is allowed in verb-final orders, but not in the others. This asymmetry seems to signal that TİD is verb-final when the patient is inanimate.[12] Steele (1978) observes that in the majority of SOV and VSO languages, OSV and VOS, respectively, appear as second most basic word order in main clauses, and this observation holds for TİD when the patient is animate. The order seems to be $\mathcal{A}\mathcal{P}$V when both arguments are animate.

Table 3.5: Intransitive Verb Gapping

Intransitive Verb Gapping
$\mathcal{S}$& $\mathcal{S}$V
∗V$\mathcal{S}$& $\mathcal{S}$
∗$\mathcal{S}$V & $\mathcal{S}$
∗$\mathcal{S}$& V$\mathcal{S}$

The intransitive verbs in TİD do only backward gapping ($\mathcal{S}$& $\mathcal{S}$V) for both animate and inanimate arguments as shown in Table 3.5. If V$\mathcal{S}$ were an unmarked order, TİD should allow forward subject gapping (V$\mathcal{S}$& $\mathcal{S}$). Since it does not allow this kind of gapping, intransitive clauses are verb-final ($\mathcal{S}$V) and V$\mathcal{S}$ is a marked order in TİD.

[12] The number of examples for each gapping type and the number of informants are limited in the judgment tests, so the results shall be considered as preliminary, and our conclusions are tentative.

CHAPTER 4

GRAMMATICAL RELATIONS

Morphological and syntactic analysis of grammatical relations begins with determining whether the language assigns grammatical roles to nominal arguments. As pointed out by Palmer (1994), it might be possible for a language to lack any grammatical markings for these roles. He reports three types of grammatical markings: (i) word order, (ii) nominal (or pronominal) morphology, and (iii) agreement with the verb.

Section 4.1 explains which of these markings are used in TİD. Section 4.2 discusses grammatical relations from a syntactic point of view, namely coordination.

4.1 Grammatical Markings in TİD

4.1.1 Nominal Morphology (Case)

If a language assigns the same morphological case to $\mathcal{S}$ and $\mathcal{A}$ or to $\mathcal{S}$ and $\mathcal{P}$, we can conclude that nominal morphology determines the grammatical relations in that language. This is the case for many languages such as Latin, Turkish, Dyirbal (Palmer, 1994; Bozsahin and Steedman, in submission). However, there is no morphological case for $\mathcal{S}$, $\mathcal{A}$ or $\mathcal{P}$ in TİD.

(10) *ADAM* *IND*$_i$ *KADIN* *IND*$_j$ *BAĞIR*$_j$
man locus$_i$ woman locus$_j$ shout-at
'This man shouted at that woman'

The locus marker in (10) does not differentiate between the grammatical roles as case does since the same sign is articulated after the nouns having the notional roles of agent and patient, which are indicated by pointing at different arbitrary loci. When

there is agreement between the nouns associated with a locus and the verb, the locus marker functions as a grammatical marker.

Thus, morphology of TİD does not assign grammatical roles to nominals and it does not mark grammatical relations on the nominals.

4.1.2 Verbal Morphology (Agreement)

For plain and spatial verbs, there are no inflections for person and number. We can conclude that neither verbal morphology nor nominal morphology plays a role for determining the grammatical relations for these verbs. On the other hand, morphological inflections on agreement verbs (together with the pronouns or nouns marked with loci) function as an alternative to the case system in signaling grammatical relations.

The intransitive agreement verbs agrees with $\mathcal{S}$ in locus. For the transitive agreement verbs, there can be one ($\mathcal{P}$-marker) or two agreement markers (both $\mathcal{A}$- and $\mathcal{P}$-markers) on the verb. For single agreement verbs, we can claim that agreement with the verb marks ergativity ($\mathcal{S}$=$\mathcal{P}$) since only $\mathcal{S}$ and $\mathcal{P}$ agrees. Sentence in (6a) which exemplifies $\mathcal{P}$-agreement of transitive single agreement verbs is repeated in (11) and an example of $\mathcal{S}$-agreement of intransitive verbs is given in (12).

(11) $IND_{non\_1,SG,Li}$ $IND_{1.SG.L1}$ BAK_1
he/she/you I see-1+SG+L_1
'He/she/you saw me.'

(12) $IND_{1,SG,L1}$ $OTUR_1$
I sit-down-1+SG+L_1
'I sat down.'

However, for double-agreement verbs, since both arguments agree with the verb, there is no alignment of $\mathcal{S}$ with $\mathcal{A}$ or $\mathcal{P}$. We thus need further examination of possible omissions of agreement markers of the double-agreement verbs. For example, if both $\mathcal{S}$-markers and $\mathcal{P}$-markers are obligatory but $\mathcal{A}$-markers are optional, then we can claim that agreement attests $\mathcal{S}$=$\mathcal{P}$.

4.1.3 Word Order

Language typology is usually defined over S, O, V. In our terms, they correspond to $\mathcal{A}$, $\mathcal{P}$, and V. We prefer this terminology because it is more convenient for explaining not only the accusative systems, but also the ergative systems.

In (Palmer, 1994), for languages with verb-medial word orders ($\mathcal{A}$V$\mathcal{P}$ or $\mathcal{P}$V$\mathcal{A}$), it is claimed that word order encodes case and grammatical roles, therefore allows grammatical relations to be formulated even if there is no morphological case for the nominals. His argument is that grammatical relation $\mathcal{S}$=$\mathcal{A}$ (or $\mathcal{S}$=$\mathcal{P}$) is marked by word order, when $\mathcal{S}$ and $\mathcal{A}$ (or $\mathcal{S}$ and $\mathcal{P}$) occupy the same position with respect to the verb.

In section 3.5, by looking at gapping data, we claimed that TİD has $\mathcal{S}$V and $\mathcal{A}\mathcal{P}$V orders. In TİD, $\mathcal{A}$ and $\mathcal{P}$ have different positions with respect to each other, but $\mathcal{S}$, $\mathcal{A}$ and $\mathcal{P}$ all precede the verb. Hence, according to Palmer's(1994) view, it would not be the word order that marks grammatical relations in TİD.

4.2 Syntactic Relations

Whether the grammatical relations operate in syntax of a languages is determined by looking at asymmetries in coordination of intransitive and transitive clauses. For languages with an accusative system, such as English, German, Russian and Turkish, the subject ($\mathcal{S}$ or $\mathcal{A}$) of the second clause is normally omitted under coordination. However, $\mathcal{S}$ or $\mathcal{P}$ can be omitted in an ergative syntax. In Dyirbal example (Manning, 1996, p.9–12.b), $\mathcal{S}$=$\mathcal{P}$ is established since the missing single argument of the intransitive clause *baji-gu* 'fell down' can only be the patient of the first clause, Burrbula.

(13) *bayi* *burrbula* *baŋgul* *gubi-ŋgu* *bara-n* *baji-gu*
I.ABS.TH B.ABS I.ERG.TH gubi-ERG punch-NFUT fall.down-PURP
$\mathcal{P}$ [$\mathcal{A}$ V][V]

'The gubi punched Burrbula$_i$ and [he$_i$] fell down.'

We have elicited the two following TİD sentences (14,15) from a native signer by showing her a brief video about a dog carrying a cat and a picture of a soldier shooting at a man.

(14) *KÖPEK* *GÖR*$_i$ *KEDİ,* *AĞIZ_İLE_TAŞI*$_i$, *KOŞ*
dog see+LOCUS$_i$ cat carry_with_mouth+LOCUS$_i$ run
'The dog saw the cat, carried it with its mouth and ran'.

Example in (14) has the order $\mathcal{A}V\mathcal{P}$&V&V. The plain unergative verb KOŞ 'run' needs an $\mathcal{S}_A$ argument, and alignment of $\mathcal{S}_A$=$\mathcal{A}$ is attested.

(15) *ASKER SAVAŞ ADAM ATEŞ_ET$_i$ ÖL$_i$*
soldier war man shoot+LOCUS$_i$ die+LOCUS$_i$
'In war, the soldier shot the man$_k$ and [he$_k$] died'

Figure 4.1: Snapshots for the sentence in (15) show that the patient-like argument of the verb ATEŞ_ET$_i$ 'shoot' and the single agreement unaccusative verb, ÖL$_i$ are articulated at the same locus.

In sentence (15), word order assigns the role of 'shooter' to the sign ASKER 'soldier', and the role of 'shootee' to the sign ADAM 'man'. As a forward single agreement transitive verb, ATEŞ_ET$_i$ 'shoot' shows agreement with the patient-like argument of the verb. From the point where ATEŞ_ET$_i$ is signed in the sentence, the locus for ADAM 'man' is processed as the locus for the verb ATEŞ_ET$_i$, namely locus i. Hence, the single agreement unaccusative verb, ÖL$_i$, shows agreement with the patient-like argument of the verb ATEŞ_ET$_i$ instead of the missing single argument, $\mathcal{S}$. Figure 4.1 illustrates how the agreement occurs.

As stated in section 4.1.2, there is an ergative morphology for the single agreement verbs in TİD. Sentence in (15) exemplifies the relation between ergative mor-

phology and syntax. Alignment $\mathcal{S}_P$=$\mathcal{P}$ is satisfied with the help of the agreement features of the verbs.[1]

From these examples, we observed that both $\mathcal{S}_A$=$\mathcal{A}$ and $\mathcal{S}_P$=$\mathcal{P}$ are possible. They suggest that TİD might have an agentive system that aligns $\mathcal{S}$ with $\mathcal{A}$ or $\mathcal{P}$ according to the type of the intransitive verb, namely unergative verbs leads to $\mathcal{S}_A$=$\mathcal{A}$ and unaccusative verbs to $\mathcal{S}_P$=$\mathcal{P}$.

However, we need to test these initial findings with more examples. For this aim, we have prepared a grammaticality judgment test which has examples with both unergative and unaccusative verbs. We have tried to find out whether the system is really agentive. We also tried to find whether there is a possibility of the system being accusative or ergative. Moreover, the effect of agreement and/or non-manual markings on ergativity, accusativity and agentivity is investigated.

Eight informants judged the grammaticality of a set of sign sequences and were asked questions about who is doing what to whom. These sequences in the grammatical judgment tests can be grouped into two as shown in Table 4.1.

Table 4.1: Types of sign sequences investigated with judgment tests

Forward Argument Gapping	**Backward Argument Gapping**
NNV$_{tr}$ & V$_{intr}$	NV$_{tr}$& NV$_{intr}$
NV$_{tr}$N & V$_{intr}$	NV$_{tr}$& V$_{intr}$N
V$_{tr}$NN & V$_{intr}$	V$_{tr}$N& NV$_{intr}$
NV$_{intr}$& NV$_{tr}$	V$_{tr}$N& V$_{intr}$N
V$_{intr}$N& V$_{tr}$N	

Examples in (16) are in the form NV$_{intr}$ & NV$_{tr}$, and for these examples, the unaccusativity/unergativity distinction seems to be effective. It is this distinction which seems to be used by the informants to disambiguate the second N as $\mathcal{A}$ or $\mathcal{P}$. For the sentences with unaccusative verbs, the informants judged the second N to be the agent ($\mathcal{A}$), and identify the missing argument of the second clause ($\mathcal{P}$) with the single argument of V$_{intr}$. An unaccusative verb takes a patientive argument, so the single argument of V$_{intr}$ (first N) is labeled as $\mathcal{S}_P$ and the alignment is $\mathcal{S}_P$=$\mathcal{P}$. When the intransitive verb is unergative, the informants identified the agent ($\mathcal{A}$) with the

[1] Since TİD is a pro-drop language, the single argument of the intransitive verb ÖL 'die' may be pro-dropped as well. The identification of the single argument with the shootee, namely the man in the example, is again done by agreement. In a pro-drop analysis, there need not be an underlying ergative syntax. Another argument about the example in (15) is that there is semantic bias for the patient. We would argue that in this example semantics and agreement would overrule an accusative syntax but would work parallel with an ergative syntax.

single argument of the intransitive ($\mathcal{S}_A$) and the second N as the patient ($\mathcal{P}$). The system considered here is $\mathcal{S}_A$=$\mathcal{A}$. For all these examples, although it is semantically plausible that the missing argument of the transitive verb can be either the agent or the patient, the informants agree on only one interpretation for each sentence.

Most of our informants found all examples in (16) grammatical. One of our informants, who is bilingual, found examples with unergatives to be grammatical, but for the unaccusative examples he thinks that there is ellipsis in the second clause or $\mathcal{S}_P$=$\mathcal{A}$. It might be due to the fact that he is using an accusative language, namely Turkish, more frequently than TİD in his daily life. He does not seem to be using the unaccusative/unergative distinction for disambiguating the second N.

(16) a. *ADAM* *OTUR* *VE* *KADIN* *SARIL* *($\mathcal{S}_A$=$\mathcal{A}$)*
man sit-down and woman hug
$\mathcal{S}_A$ V_{unerg} $\mathcal{P}$ V_{tr}

'The man sat down and hugged the woman.'

b. *KEDİ* *KORK* *VE* *KADIN* *SALDIR* *($\mathcal{S}_P$=$\mathcal{P}$)*
cat frighten and woman attack
$\mathcal{S}_P$ V_{unacc} $\mathcal{A}$ V_{tr}

'The cat$_i$ was frightened and the woman attacked [it$_i$].'

c. *ADAM* *KOŞ* *VE* *ÇOCUK* *YAKALA* *($\mathcal{S}_A$=$\mathcal{A}$)*
man ran and child catch
$\mathcal{S}_A$ V_{unerg} $\mathcal{P}$ V_{tr}

'The man ran and caught the child.'

d. *ÇOCUK* *AĞLA* *VE* *ÇAGIR* *ANNE* *($\mathcal{S}_A$=$\mathcal{A}$)*
child cry and call mother
$\mathcal{S}_A$ V_{unerg} V_{tr} $\mathcal{P}$

'The child cried and called his/her mother.'

e. *KADIN* *ÇOK* *ÜZÜL* *VE* *ADAM* *KÜS* *($\mathcal{S}_P$=$\mathcal{P}$)*
woman very become-sad and man cross-with
$\mathcal{S}_P$ V_{unacc} $\mathcal{A}$ V_{tr}

'The woman$_i$ became very sad and the man crossed with [her$_i$].'

f. *MÜDÜR* *SURAT-AS* *VE* *ADAM* *KOV* *($\mathcal{S}_A$=$\mathcal{A}$)*
director sulk and man fire
$\mathcal{S}_A$ V_{unerg} $\mathcal{P}$ V_{tr}

'The director sulked and fired the man.'

If the underlying mechanism for the sentences in (16) were discourse-binding and it did not rely on the agentive system we have claimed above, there should have been an additional mechanism that could identify the patient of the transitive with

the topic KEDİ 'cat'(16b) and KADIN 'woman' in (16e), but it would also allow identifying the agent with the topic in the other examples. There are two alternative additional mechanisms: verbal agreement and semantics. However, the verbs SALDIR 'to attack' and KÜS 'to cross' are plain verbs, and they do not show agreement with the topic. If they showed $\mathcal{P}$-agreement with the topic, then it could be the agreement that assigns the patientive interpretation. Moreover, there is no semantic bias for preferring the patientive reading. Hence, this additional mechanism can neither be agreement nor semantics. We can conclude that the underlying mechanism cannot be solely discourse-binding, and the agentive system is at work for NV_{intr} & NV_{tr}.

Moreover, for the sentences in (16), the alternative that the system is ergative and that it lets accusative interpretations by the help of agreement does not hold since transitive verbs SARIL 'to hug' and KOV 'to fire' are plain verbs. Similarly, the other alternative that the system is accusative and ergative interpretations are produced by agreement does not also hold.

The V_{intr}N & V_{tr}N pattern is not considered grammatical by the informants. V_{tr}NN & V_{intr} pattern is mostly rejected or found to be ambiguous between ergative and accusative alternatives. Since T.ID is verb-final, verb-initial orders VN and VNN in coordination are not ungrammatical.

In patterns such as NNV_{tr}&V_{intr}, NV_{tr}N&V_{intr} and V_{tr}NN&V_{intr}, that is in forward $\mathcal{S}$ gapping, the missing $\mathcal{S}$ is not aligned to $\mathcal{A}$ or $\mathcal{P}$ according to the unergativity/unaccusativity distinction, e.g. as the minimal pair in (17) shows. This result is observed in many other examples (20b). It shows that the system is not agentive for these patterns, in contrast to the examples in (16).

(17) a.

HAKEM	*FUTBOLCU*	*IT*	*VE*		*KAÇ*	*($\mathcal{S}_A$=$\mathcal{P}$)*
referee	footballer	push	and		ran-away	
$\mathcal{A}$	$\mathcal{P}$	V_{tr}		($\mathcal{S}_A$)	V_{unerg}	

'The referee pushed the footballer$_i$ and [he$_i$] ran away.'

b.

HAKEM	*FUTBOLCU*	*IT*	*VE*		*DÜŞ*	*($\mathcal{S}_P$=$\mathcal{P}$)*
referee	footballer	push	and		fell-down	
$\mathcal{A}$	$\mathcal{P}$	V_{tr}		($\mathcal{S}_P$)	V_{unacc}	

'The referee pushed the footballer$_i$ and [he$_i$] fell down.'

Six informants, who considered the sentences in (17) grammatical, agreed with the interpretations in (17). Example (17a) is accepted grammatical by the other two informants. One of them was a bilingual, and he understood the sentence as 'the referee pushed the footballer and ran away'. The other informant said that the person

who run away cannot be known from the context. Only two informants found (17b) ungrammatical. The bilingual informant insisted that the single argument is obligatory and should not be omitted for the sentence (17b). This shows that the bilingual informant is effected by the unergative/unaccusative distinction for these examples.

In sign sentences (18) of the form $\mathrm{NV}_{tr}\mathrm{N}$ & V_{intr}, we observed that informants accepted the sentences grammatical and interpret them as shown in the glosses. However, these examples show semantic bias for the patient to be identified with the missing argument of intransitive verb. We argue that semantics would override syntax if the syntax were accusative. Since there is patientive semantic bias in these examples, the argument that there is an ergative syntax that operates in these examples is weak.

(18) a.

POLIS	*ATEŞ_ET*	*HIRSIZ*	*VE*		*YARALAN*	*($\mathcal{S}_P$=$\mathcal{P}$)*
police	shoot	burglar	and		be-injured	
$\mathcal{A}$	V_{tr}	$\mathcal{P}$	&	($\mathcal{S}_P$)	V_{unacc}	

'The police shot the burglar$_i$ and [he$_i$] was injured'

b.

KADIN	*BAĞIR*	*ADAM*	*VE*		*ÜZÜL*	*($\mathcal{S}_P$=$\mathcal{P}$)*
woman	shout-at	man	and		become-sad	
$\mathcal{A}$	V_{tr}	$\mathcal{P}$	&	($\mathcal{S}_P$)	V_{unacc}	

'The woman shouted at the man$_i$ and [he$_i$] became sad'

c.

KEDİ	*GÖR*	*FARE*	*VE*		*KORK*	*($\mathcal{S}_P$=$\mathcal{P}$)*
cat	see	mouse	and		be-frightened	
$\mathcal{A}$	V_{tr}	$\mathcal{P}$	&	($\mathcal{S}_P$)	V_{unacc}	

'The cat see the mouse$_i$ and [it$_i$] was frightened'

When there is agentive semantic bias as in the example (19), four informants considered the sentence unacceptable because they cannot identify who sleeps or both who sleeps and who eats whom. They found this sentence semantically odd. Other four gave a score of 3 which means 'somehow ok'. One of them, who is bilingual, understands the sentence as $\mathcal{A}\mathrm{V}_{tr}\mathcal{P}$&($\mathcal{S}_A$)$\mathrm{V}_{intr}$ where $\mathcal{S}_A$=$\mathcal{A}$. Three of them assigns the pattern $\mathcal{A}\mathrm{V}_{tr}\mathcal{P}$&($\mathcal{S}_A$)$\mathrm{V}_{intr}$ where $\mathcal{S}_A$=$\mathcal{P}$.

(19)

**FARE*	*YE*	*YILAN*	*VE*	*UYU*
mouse	eat	snake	and	sleep

The sign sequence in examples with $\mathrm{NV}_{tr}\mathrm{N}$ & V_{intr} (18) is found to be $\mathcal{A}\mathrm{V}_{tr}\mathcal{P}$ & V_{intr}. There may be exception to it as in (20b) which has the order $\mathcal{P}\mathrm{V}_{tr}\mathcal{A}$ & V_{intr}. While preparing this sentence, our interpreter was requested to translate the Turkish sentence in (20a). There are two signs in TİD with closer meaning: $\mathrm{EŞ}_1$ 'married husband/wife' and $\mathrm{EŞ}_2$ 'husband/wife'. The interpreter hesitated and signed both. We

shall better accept the sequence after the first EŞ to be a sentence. I believe that seven of informants understood the sentence as an instance of detopicalization because of the non-manual markings that the signer signaled with the movements of his head. During 'EŞ$_1$ KIZ' sequence, the head is moved to the left, then become neutral. Due to detopicalization of agent, the order becomes $\mathcal{P}$V$_{tr}\mathcal{A}$ & V$_{intr}$ but $\mathcal{S}$=$\mathcal{P}$ still holds. To conclude, we can claim that $\mathcal{AP}$ serialization is attested both in simple sentences and embedded sentences unless there is a special kind of non-manual marking which forces the signers to understand it the other way.

(20) a. (Turkish) ($\mathcal{S}$=$\mathcal{A}$)

Eşine *kızdı* *kadin* *ve* *sustu*

husband/wife.GEN+DAT got-angry woman.NOM and became-quieter

'The woman got angry at her husband and became quiter.'

b. (TİD) ($\mathcal{S}_A$=$\mathcal{P}$)

	head left					*head right*
EŞ$_1$.	*EŞ$_2$*	*KIZ*	*KADIN*	*VE*		*SUS*
married-h/w	h/w	get-angry	woman	and		become-quieter
	$\mathcal{P}$	V$_{tr}$	$\mathcal{A}$	&	($\mathcal{S}_A$)	V$_{unerg}$

'The woman got angry at her husband$_i$ and [he$_i$] became quiter.'

For the examples in (21), the informants agree that the interpretation is $\mathcal{AP}$V$_{tr}$&($\mathcal{S}$)V$_{intr}$ where $\mathcal{S}$=$\mathcal{A}$ is the alignment. The unaccusativity/unergativity distinction does not hold.

(21) a.

FİL	*FARE*	*KOVALA*	*VE*		*DÜŞ*	($\mathcal{S}_p$=$\mathcal{A}$)
elephant	mouse	chase	and		fall-down	
$\mathcal{A}$	$\mathcal{P}$	V$_{tr}$	&	($\mathcal{S}_P$)	V$_{unacc}$	

'The elephant chased the mouse and fell-down'

b.

ÇOCUK	*ARKADAŞ*	*GÖR*	*VE*		*HEYECANLAN*	($\mathcal{S}_p$=$\mathcal{A}$)
child	friend	see	and		get-excited	
$\mathcal{A}$	$\mathcal{P}$	V$_{tr}$	&	($\mathcal{S}_P$)	V$_{unacc}$	

'The child saw his friend and got excited'

c.

ADAM	*FİL*	*TAŞI*	*VE*		*YORUL*	($\mathcal{S}_p$=$\mathcal{A}$)
man	elephant	carry	and		become-tired	
$\mathcal{A}$	$\mathcal{P}$	V$_{tr}$	&	($\mathcal{S}_P$)	V$_{unacc}$	

'The man carried the elephant and became tired'

Accusativity in these examples seems to be conveyed by non-manual markings such as eye gaze, body and/or head posture. For example, in (21a, 22a) head posture marks [FARE KOVALA] as a constituent. Similarly , in (21b, 22b), [ARKADAŞ GÖR] forms a constituent by the help of eye gaze and body posture. In (21c,22c), eyes open wide and eyebrows are raised spontaneously with the constituent [FİL TAŞI].

There are also examples (20b, 15) that show that non-manual markings and agreement help the signers to arrive at the ergative meaning. However, in examples (17,18) of the form $\mathcal{A}_{tr}\mathcal{P}$V & V$_{intr}$ and $\mathcal{A}$V$_{tr}\mathcal{P}$ & V$_{intr}$ where $\mathcal{S}$=$\mathcal{P}$ is the alignment, we do not observe any non-manual markings.

(22) a.

	FİL	*FARE*	*KOVALA*	*VE*	*DÜŞ*
Eyebrows	**raised**	**neutral**			
Eye gaze	**neutral**	**at the active hand**	**neutral**		
Head	**neutral**	**front, down**		**neutral**	

b.

	ÇOCUK	*ARKADAŞ*	*GÖR*	*VE*	*HEYECANLAN*
Eye gaze	**neutral**	**to the left**		**neutral**	
Dir. of mov.	**neutral**		**to the left**	**neutral**	
Body	**neutral**	**to the left**		**neutral**	

c.

	ADAM	*FİL*	*TAŞI*	*VE*	*YORUL*
Eyebrows	**neutral**	**raised**		**neutral**	
Eye	**neutral**	**wide**		**neutral**	

Our findings on backward argument gapping (Table 4.1) show that these sentences signal either ellipsis or ergativity. In some sentences all the informants (except for the bilingual) agree on ergativity (23,24), in some others all think that there is ellipsis (25), however in (26), the informants' judgments are ambiguous on two arguments. We claim that these constructions also do not signal accusativity.

(23)

ÇOCUK	*IND*$_{left}$	*KIZ*	*VE*	*ADAM*	*GİT*	*($\mathcal{S}_A$=$\mathcal{P}$)*
child		get-angry	and	man	go	
$\mathcal{A}$		V$_{tr}$	&	$\mathcal{S}_A$	V$_{unerg}$	

'That child got angry at (the man$_i$) and the man$_i$ went'

(24)

ADAM	*BAĞIR*	*VE*	*ÜZÜL*	*KADIN*	*($\mathcal{S}_P$=$\mathcal{P}$)*
man	shout-at	and	become-sad	woman	
$\mathcal{A}$	V$_{tr}$	&	$\mathcal{S}_P$	V$_{unacc}$	

'The man shouted at (the woman$_i$) and the woman$_i$ became sad'

(25) *KEDİ* *EZ* *VE* *ADAM* *AĞLA* *(ellipsis)*
cat squash and man cry
$\mathcal{P}$ V_{tr} & $\mathcal{S}_A$ V_{unerg}

'The cat was squashed (by someone$_i$) and the man$_j$ cried'

(26) *KADIN* *BEĞEN* *VE* *ADAM* *SEVİN* *(ellipsis or $\mathcal{S}_P$=$\mathcal{P}$)*
woman like and man feel-happy
$\mathcal{A}$ V_{tr} & $\mathcal{S}_P$ V_{unacc}

'The woman liked (something$_{i,j}$) and the man$_i$ felt happy.'

It seems that the underlying system is ergative for all acceptable patterns except for NV_{intr} & NV_{tr} (which is agentive), because even without non-manual markings and agreement features, ergativity can be captured in the language, whereas accusativity is only manifested when there is strong evidence from the non-manual markings and/or agreement features. Before we conclude this, we shall look at the following questions:

1. When there is semantic bias for the missing single-argument of the intransitive verb to be the agent but not the patient of the transitive clause,
   a. Does $\mathcal{S}$=$\mathcal{P}$ still hold?
   b. Do signers reject the sentences because they find them semantically odd?
   c. Do they prefer $\mathcal{S}$=$\mathcal{A}$ when there is support from the non-manual marking and/or agreement features?
2. If there is no cause-effect relationship between the intransitive and the transitive verb, in other words, the verb pairs are neutral and there is no semantic bias, does the claim that the underlying system is ergative still hold?

For the first group of questions, if our answers are positive we can conclude that the facts of coordination in TİD suggest ergative syntax. If the informants prefer accusativity when there is agentive-bias, then 'semantics will overrule the syntax', and these principles would become 'preferences rather than rules'. In fact, there is a language where this is the case. Palmer (1994, p.91) cites Dixon's study on Yidiny which has an accusative syntax when coreferential NPs are pronouns and ergative syntax when they are nouns. He reports that even if the NPs are pronouns in coordination, the patientive semantic bias can assign the ergative interpretation.

In order to answer these questions, we conducted a small experiment with five native signers. The informants watched some video-taped TİD sentences and were

then asked 'who did what to whom'. In the test, verb pairs that have a semantic bias for the agent, such as 'pay-feel sad' and 'accuse-feel happy', are used. For example, in (27), since the payer would feel sad rather than the payee, there is semantic bias that suggests informants $\mathcal{S}$=$\mathcal{A}$ alignment.

(27)

	YAŞAM	*BÜLENT*	*ÖDE*	*ÜZÜL*
	Yaşam	Bülent	pay	feel-sad
Eye Brows	**raised**	**neutral**		

Informant	$\mathcal{A}$	$\mathcal{P}$	$\mathcal{S}$	**Score**
1.	Bülent	Yaşam	Yaşam	3
2.	Bülent&Yaşam	?	Bülent&Yaşam	4
3.	Yaşam	Bülent	?	2
4.	Bülent	Yaşam	Bülent or Yaşam	5
5.	Yaşam	Bülent	Yaşam	4

The informants' judgments for (27) are varying. The first informant got the reading where the missing argument of the second clause is the patient. Her answer indicates that ergative syntax overrides semantics. It may be the case that she realized the non-manual marking on Yaşam and accept Yaşam as the topicalized patient. This analysis is very similar to one for Dyirbal's topic chains. In Dyirbal, only $\mathcal{S}$ and $\mathcal{P}$ can be the topic. Even if there is the semantic bias that 'the payer would feel sad rather than the payee', only the second and the fifth informants have assigned $\mathcal{S}$=$\mathcal{A}$ alignment. The second informant judged that both Yaşam or Bülent pay to someone else and felt happy. The third informant rejected the sentence and said that the one who felt sad cannot be known from the context. The fourth informant said that there was ambiguity, either Yaşam or Bülent felt sad. For the fourth judgment, we can say that there are two alternative interpretations that are produced by semantics and ergative syntax, and these alternatives lead the ambiguity.

Example (27) where there is no non-manual marking on [BÜLENT ÖDE] is not similar to the examples in (22). The judgments were far from being consistent for this example. In example (28), there is a non-manual marking on [BÜLENT SUÇLA IND_{right}] clause which might have caused more informants to attach the accusative reading. We conclude that accusativity is not preferred without non-manual markings even if there is semantic bias for $\mathcal{S}$=$\mathcal{A}$ alignment.

(28)

	YAŞAM Yaşam	*BÜLENT* Bülent	*SUÇLA* accuse	IND_{right} $locus_{right}$	*SEVİN* feel-happy
Eye gaze	**neutral**	**to the right**			**neutral**
Mov. of Head	**neutral**	**to the right**			**neutral**

'Yaşam accused Bülent and felt happy.' or

'They accused Yaşam and Bülent and felt happy.'

Informant	$\mathcal{A}$	$\mathcal{P}$	$\mathcal{S}$	**Score**
1	Yaşam	Bülent	Yaşam	2
2	they	Yaşam & Bülent	they	4
3	Yaşam	Bülent	Yaşam	5
4	they	Yaşam & Bülent	they	5
5	Yaşam	Bülent	Yaşam	3

To investigate the second research question above, the verbs 'to look at', 'to thank' and 'to announce' which are more neutral than psych-verbs such as 'to love' and 'to hate', are used. All of the neutral verbs in consideration are single agreement verbs. Single agreement transitive verbs show agreement with the patient. So, when a neutral verb is followed by a single agreement intransitive verb, the missing single argument of the intransitive is automatically identified with the patient of the transitive due to the fact that both of the verbs agree with the locus of the patient. Hence, ergativity is conveyed by the agreement system. Sentences in (29) and (30) exemplify this fact.

(29) *YAŞAM* *BÜLENT* BAK_r $GİT_r$
Yaşam Bülent look-at go

'Yaşam looked at Bülent$_i$ and [he$_i$] went.'

Informant	$\mathcal{A}$	$\mathcal{P}$	$\mathcal{S}$	**Score**
1	Yaşam	Bülent	Bülent	4
2	Yaşam	Bülent	Bülent	5
3	Yaşam	Bülent	Bülent	4
4	Yaşam	Bülent	Bülent	5
5	Yaşam	Bülent	Bülent	5

(30) *YAŞAM* *BÜLENT* $TEŞEKKÜR_r$ $OTUR_r$
Yaşam Bülent thank sit

'Yaşam thanked Bülent$_i$ and [he$_i$] sat down.'

Informant	$\mathcal{A}$	$\mathcal{P}$	$\mathcal{S}$	**Score**
1	Yaşam	Bülent	Bülent	4
2	Yaşam	Bülent	Bülent	5
3	I	Yaşam & Bülent	Yaşam & Bülent	4
4	Yaşam	Bülent	Bülent	4
5	Yaşam	Bülent	Yaşam	5

To produce the accusative meaning for the sentences above, my interpreter articulated a sign on his body before the intransitive verb. The hand-shape of this sign is different than the first person pronoun's hand-shape but it has the same meaning so we index it as IND_1 in the following examples. Hence, the intransitive verb agrees with the first person locus and does not agree with the patient of the transitive verb this time. The informants' judgments for examples (31) and (32) show that the result is not exactly what my interpreter expected. Since non-identification of $\mathcal{S}$ with $\mathcal{P}$ cannot guarantee that $\mathcal{S}$ will be identified with $\mathcal{A}$, the results are not surprising.

(31) *YAŞAM* *BÜLENT* BAK_r [IND_1 GİT_1]
Yaşam Bülent look-at I go

'Yaşam looked at Bülent and went.'

Informant	$\mathcal{A}$	$\mathcal{P}$	$\mathcal{S}$	**Score**
1	Yaşam	Bülent	Yaşam	4
2	Yaşam	Bülent	?	5
3	Yaşam	Bülent	I	4
4	Yaşam	Bülent	Yaşam	5
5	Yaşam	Bülent	Bülent	3

(32) *YAŞAM* *BÜLENT* TEŞEKKÜR_r [IND_1 OTUR_1]
Yaşam Bülent thank I sit

'Yaşam thanked Bülent and sat down.'

Informant	$\mathcal{A}$	$\mathcal{P}$	$\mathcal{S}$	**Score**
1	Yaşam	Bülent	Yaşam	4
2	$?_i$	Bülent&Yaşam	$?_i$	4
3	Yaşam	Bülent	Yaşam	5
4	Yaşam	Bülent	Yaşam	5
5	Yaşam	Bülent	Bülent	4

The verb HABER 'to announce' causes most of the informants to think that there is an indirect speech effect involved. For example,

(33) *YAŞAM* *BÜLENT* *HABER*$_r$ [*IND*$_1$ *GIT*$_1$]
Yaşam Bülent announce I go

'Yaşam announced Bülent: 'I go'. '

For the neutral verb examples in (31) and (32), to express the accusative meanings unambiguously, the informants seem to need a pronoun or the noun itself in the position of the missing $\mathcal{S}$.

The single-agreement verbs, even neutral or not, have a tendency for ergativity. These verbs agree with the patient and set a locus of the patient. This locus is used for agreement with an intransitive verb (15,29,30). These facts suggest that morphological ergativity in TİD is prevailing, but establishing a full syntactic ergativity needs further research.

On the other hand, syntactic accusativity is hard to establish as well since there is ambiguity even for the sentences with agentive semantic bias as in (27), however it is satisfied only with the help of non-manual markings as in examples in (22 and 28).

CHAPTER 5

A CCG LEXICON FOR TİD

The present study adopts the theory of Combinatory Categorial Grammar (CCG) (Steedman, 1996; Steedman, 2000). The following section summarizes the aspects of the theory that are relevant to this study. It aims at showing how CCG relates basic word order with coordination (especially gapping), and why it reveals certain sets of data to look at. The reader is referred to (Steedman, 1996; Steedman, 2000; Steedman and Baldridge, 2004) for a complete exposition to the theory. In the remainder of this chapter, we will present the TİD lexicon.

5.1 Combinatory Categorial Grammar

CCG is a lexicalized theory of grammar. A language differs from another only in its lexicon. The same set of universal principles and combinatory rules apply to all languages. Hence, the lexicon is the place where the language specific information such as word order, relations of control, the behavior under relativization and coordination, are specified. This information is projected from the lexicon by the combinatory rules.

The lexicon contains lexical items which model a correspondence between the phonological form and the logical form.[1]

5.1.1 Categories

The lexical entries are formed by three basic terms, phonological form ϕ, syntactic category σ, and semantic category μ, as $\phi := \sigma{:}\mu$.

[1] A morphemic rather than lexemic lexicon is proposed as an extension to CCG in (Bozsahin, 2002), which aims at providing transparent semantics for morphosyntax.

Definition: Syntactic Categories

β is the set of basic syntactic categories. Let β = {**S**, **N**, **NP**}.[2] Then, the set of complex categories C is defined as the categories derived from basic categories as follows:

1. $\beta \subseteq C$
2. If **A** and **B** $\in C$, then $\mathbf{A}/_m\mathbf{B}$ and $\mathbf{A}\backslash_m\mathbf{B} \in C$, where the $\backslash$ and $/$ indicates the directionality of the argument (**B**) with respect to the functor ($\mathbf{A}/\mathbf{B}$ and $\mathbf{A}\backslash\mathbf{B}$), and m represents a modal restriction on combinatory possibilities.[3]

$\mathbf{A}/\mathbf{B}$ is a function from **B** to **A** which takes **B** from the right, and $\mathbf{A}\backslash\mathbf{B}$ is a function from **B** to **A** which takes **B** from the left. The syntactic categories are defined as functors and arguments, rather than phrase markers. The information of how words are combined into phrases is encoded in the syntactic category, hence CCG does not need syntactic rules as phrase structure grammars (PSGs) do.

The semantic category of a lexical item is defined in terms of λ-calculus and attached to the syntactic category via a colon ':' operator. The predicate-argument structure of a verb with n arguments is represented as the following logical form: $predicate\ Arg_n\ Arg_{n-1}...Arg_1$ where Arg_1 is the maximally LF-commanding term. (LF-command is similar to c-command defined over the logical form.) It is left-associative, hence it is equivalent to $(((predicate\ Arg_n)\ Arg_{n-1})...Arg_1)$, and it can also be represented as a tree as in Figure (5.1).

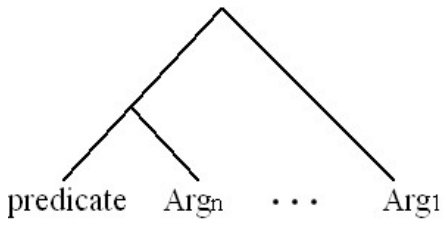


Figure 5.1: Predicate-argument structure

The arguments of the functor in a syntactic category are mapped to the variables in its semantic category at the level of predicate-argument structure. Examples in (34a-d) show some lexical entries in the English lexicon. In (34d), /**NP** is mapped to x,

[2] **S**: sentence, **N**: noun, **NP**: noun phrase.

[3] Throughout the thesis, we adopt the most permissive modality, /and \, with the convention that a slash without modality is most permissive. See (Baldridge, 2002) for more details on modalities.

and **NP** to y, thereby establishing the correspondence that **NP** is the maximally LF-commanding argument (lover) because it corresponds to y, /**NP** is the object (lovee) because it corresponds to x which is LF-commanded by y.

(34) a. Harry := **NP** :harry'

b. chocolate := **NP** :chocolate'

c. runs := **S****NP** :λx.run' x

d. loves := **S****NP** /**NP** :$\lambda x \lambda y$.love' xy

5.1.2 Combinatory Rules

The simplest combinatory rule is the functional application rule (35) which combines a functor looking for a Y to form an X with its argument Y. The semantic interpretation of the resultant category X is obtained by applying β-reduction to λ-abstraction of the functor.

(35) *Functional application rules*

a. *Forward application*

$$\mathbf{X/Y} : f \quad \mathbf{Y} : a \quad \Rightarrow \quad \mathbf{X} : fa \qquad (>)$$

b. *Backward application*

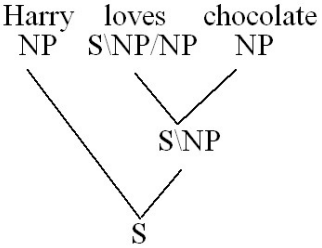
$$\mathbf{Y} : a \quad \mathbf{X\backslash Y} : f \quad \Rightarrow \quad \mathbf{X} : fa \qquad (<)$$

A Categorial Grammar (CG) which is only limited to functional application is called a *"pure CG"*. The weak equivalence of a pure CG to a context-free PSG was proved by Bar-Hillel, Gaifman, and Shamir (1960).

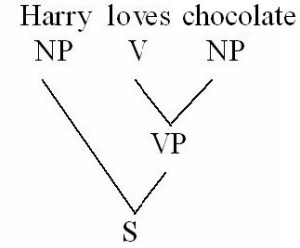
(36) a.

Harry	*loves*	*chocolate*
NP :harry'	**S****NP** /**NP** :$\lambda x \lambda y$.love' xy	**NP** :chocolate'
	S**NP** :λy.love' chocolate' y (>)	
S:love' chocolate' harry' (<)		

b. i.



ii.



The lexical categories in example (36a) are combined by the functional application rule in (35). The variable x in $\lambda x \lambda y$.love' xy is substituted with chocolate', and the corresponding λ-abstraction is removed. The variable y is then substituted in the same way. The derivation in (36a) and the trees in (36b) are clearly equivalent.

CCG has functional composition (37), type-raising (38), and functional substitution (40) rules as an extension to pure CG. As a result, it becomes *mildly context-sensitive* (Joshi, Vijay-Shanker, and Weir, 1991). That is, CCG has stronger generative power than context-free grammars, but weaker than context-sensitive grammars.

In the framework of CCG, there are no deletion or transformational rules. The universal combinatory rules and the lexical categories are capable of handling the nested and crossing dependencies attested in human languages, without the aid of extraneous devices such as deletion and movement.

(37) *Functional composition rules*

a. *Forward composition*

$$\mathbf{X/Y} : f \quad \mathbf{Y/Z} : g \quad \Rightarrow \quad \mathbf{X/Z} : \lambda x.f(gx) \qquad (> \mathbf{B})$$

b. *Backward composition*

$$\mathbf{Y\backslash Z} : g \quad \mathbf{X\backslash Y} : f \quad \Rightarrow \quad \mathbf{X\backslash Z} : \lambda x.f(gx) \qquad (< \mathbf{B})$$

c. *Forward crossed composition*

$$\mathbf{X/Y} : f \quad \mathbf{Y\backslash Z} : g \quad \Rightarrow \quad \mathbf{X\backslash Z} : \lambda x.f(gx) \qquad (> \mathbf{B}_{\times})$$

d. *Backward crossed composition*

$$\mathbf{Y/Z} : g \quad \mathbf{X\backslash Y} : f \quad \Rightarrow \quad \mathbf{X/Z} : \lambda x.f(gx) \qquad (< \mathbf{B}_{\times})$$

Under the functional composition rules, two functions f and g compose in order to form constituents.

Type-raising rules (38) turn an argument into a function over a function that take this argument. Arguments become functions in order to be able to compose with other functions under the composition rules (37). Hence, type-raising and composition together explain the construction of ''argument cluster coordination" (Steedman, 2000).

Steedman (2000) applies type-raising to phenomenon such as case. He suggests that nominative case turns a nominal into a function over a function over subjects, whereas accusative case turns the nominal into a function over a function over objects. In rule (38), **A** is restricted to **NP**s and argument **PP**s; and $\mathbf{T\backslash A}$ and $\mathbf{T/A}$ are restricted to the category of a verb looking for an argument **A**.

(38) *Type-raising rules*

Forward type-raising

$\mathbf{A} : a \quad \Rightarrow \quad \mathbf{T/(T\backslash A)} : \lambda f.f\ a \qquad (< \mathbf{T})$

Backward type-raising

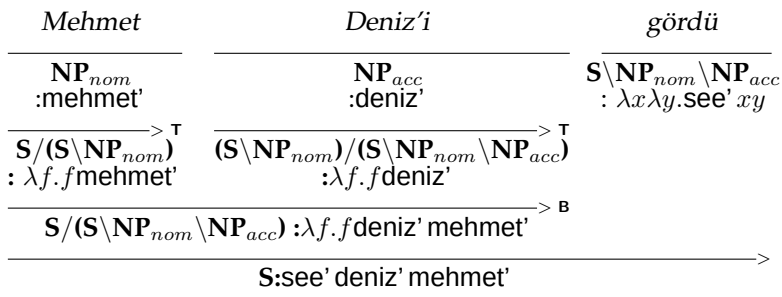
$\mathbf{A} : a \quad \Rightarrow \quad \mathbf{T\backslash(T/A)} : \lambda f.f\ a \qquad (< \mathbf{T})$

where **A** is an argument category ($\mathbf{A} \in \beta$), and $\mathbf{T\backslash A}$ and $\mathbf{T/A}$ are function categories ($\in C$) that the grammar licenses.

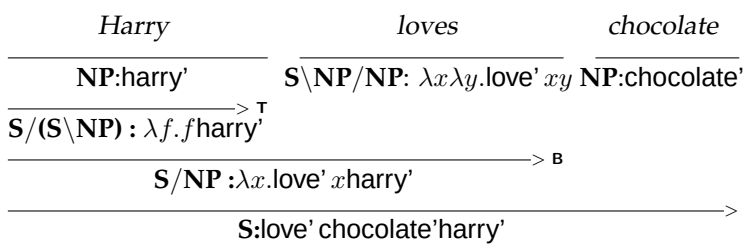
Type-raising rule is order-preserving. In other words, **T** in rule (38) depends on the lexical transitive verb category of the language in consideration. For an accusative SOV language like Turkish, a $\mathbf{NP}_{nom}$ can be turned into a functor $\mathbf{S/(S\backslash NP}_{nom})$ which looks rightward for a verb that looks leftward for its argument $\mathbf{NP}_{nom}$, and $\mathbf{NP}_{acc}$ can be turned into a functor $\mathbf{(S\backslash NP}_{nom}\mathbf{)/(S\backslash NP}_{nom}\mathbf{\backslash NP}_{acc}\mathbf{)}$ which looks rightward for a verb that looks leftward for this $\mathbf{NP}_{acc}$ as in example (39a).

Type-raised **NP**s may compose with other functions under the composition rules, and form constituents which are not (standard) traditional constituents. For example, CCG allows Subject-Object to be a constituent as in the Turkish example (39a), or a Subject-Verb as in the English example (39b), which predicts right-node raising varieties of (39a-b), as in (39c-d).

(39) a.



b.



c. *Mehmet Deniz'i, Ahmet Ayşe'yi gördü.*
Mehmet.NOM Deniz.ACC Ahmet.NOM Ayşe.ACC see.PAST.3sg
'Mehmet saw Deniz and Ahmet Ayşe.'

d. *Harry loves and John detests chocolate.*

(40) *Functional substitution rules*

a. *Forward substitution*

$$\mathbf{(X/Y)/Z} : f \quad \mathbf{Y/Z} : g \quad \Rightarrow \quad \mathbf{X/Z} : \lambda x.fx(gx) \qquad (> \mathbf{S})$$

b. *Backward substitution*

$$\mathbf{Y\backslash Z} : g \quad \mathbf{(X\backslash Y)\backslash Z} : f \quad \Rightarrow \quad \mathbf{X\backslash Z} : \lambda x.fx(gx) \qquad (< \mathbf{S})$$

c. *Forward crossed substitution*

$$\mathbf{(X/Y)\backslash Z} : f \quad \mathbf{Y\backslash Z} : g \quad \Rightarrow \quad \mathbf{X\backslash Z} : \lambda x.fx(gx) \qquad (> \mathbf{S}_{\times})$$

d. *Backward crossed substitution*

$$\mathbf{Y/Z} : g \quad \mathbf{(X\backslash Y)/Z} : f \quad \Rightarrow \quad \mathbf{X/Z} : \lambda x.fx(gx) \qquad (< \mathbf{S}_{\times})$$

Steedman (2000) explains the construction of 'parasitic gaps' with the rule of functional substitution.

5.1.3 Serialization

The six possible word orders of a simple transitive sentence; SOV, SVO, OSV, OVS, VSO and VOS[4] are distinguished in the CCG lexicon. The directional slashes in the syntactic categories of lexical items encode directionality, one of the consequences of which is word order. The directionally-specified **NP**s ($\backslash$**NP**, /**NP**) are ordered in the syntactic category of a transitive verb. For example, caseless VSO and OSV languages would have the categories **S**/**NP** /**NP**:$\lambda y\lambda x$.pred' xy and **S**$\backslash$**NP** $\backslash$**NP**:$\lambda y\lambda x$.pred' xy, respectively, which differ from the transitive verb categories in caseless VOS and SOV languages only in the λ-bindings of the arguments in their predicate-argument structures.

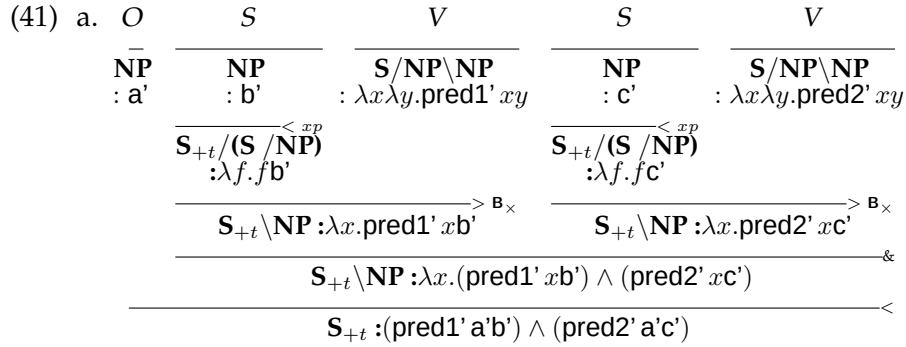
A VSO, OVS, or OSV language's transitive verbs first combine with the subject and then with the object, whereas a VOS, SOV, or SVO language has transitive verbs that do the reverse.[5]

A template lexical category **S**$\backslash$**NP** /**NP**:$\lambda x\lambda y$.pred' xy represents a transitive verb of a SVO language. An OVS language has the template lexical entry either **(S/NP)**$\backslash$**NP**:$\lambda x\lambda y$.pred' xy, or **(S**$\backslash$**NP)/NP**:$\lambda x\lambda y$.pred' yx for transitive verbs in its lexicon. The choice for the category of OVS transitive verbs depends on whether the language shows OSV & SV coordination (Bozsahin and McConville, 2005). As seen in derivation (41a), the first category option handles OSV & SV coordination.

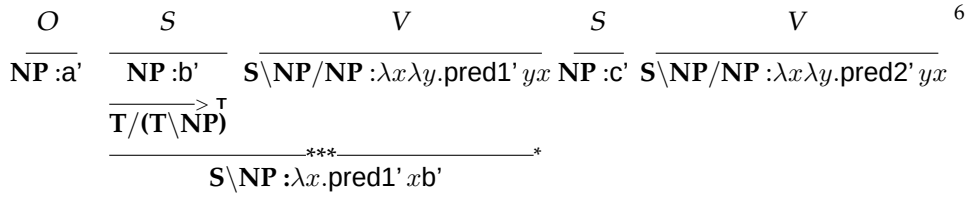
[4] S stands for subject, V for verb, and O for object.

[5] OVS language that allows OSV & SV coordination has transitive verbs that first combine with the object and then with the subject.

(41) a.

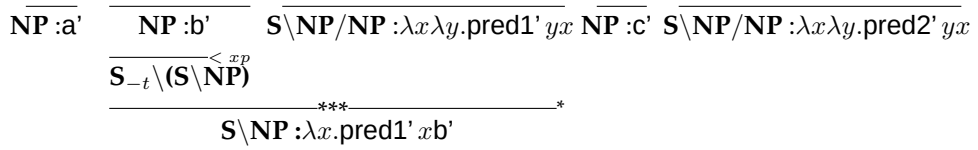


b.



[6]

c.



Bozsahin (2002) defines *c*ontraposition as reversing the position of a constituent with respect to the position of the verb as in rules (42).[7] $\mathbf{S}_{+t}$ is the category of a topicalized sentence, whereas $\mathbf{S}_{-t}$ is the category of a detopicalized sentence.

(42) *Contraposition rules*

Leftward contraposition

$$\mathbf{X} : a \;\Rightarrow\; \mathbf{S}_{+t}/(\mathbf{S}/\mathbf{X}) : \lambda f.f\ a \qquad (<\mathbf{xp})$$
$$\mathbf{S}_{+t}/(\mathbf{S}_{+t}/\mathbf{X}) : \lambda f.f\ a$$

Rightward contraposition

$$\mathbf{X} : a \;\Rightarrow\; \mathbf{S}_{-t}\backslash(\mathbf{S}\backslash\mathbf{X}) : \lambda f.f\ a \qquad (>\mathbf{xp})$$
$$\mathbf{S}_{-t}\backslash(\mathbf{S}_{-t}\backslash\mathbf{X}) : \lambda f.f\ a$$

Derivation (41a) also exemplifies the re-ordering effect of forward crossed composition rule ($> \mathbf{B}_\times$), in fact all the crossed composition (37c-d) and crossed substitution (40c-d) rules have a ''permutation property" that effects the word order (Steedman, 2000), whereas the rules in (37a-b) and (40a-b) are order-preserving.

On the other hand, neither type-raising nor contraposition rules can turn the subject **NP** in (41b) to a function that can compose (or combine) with the transitive verb

[6] '***' on the derivations means that it can not be derived.

[7] See the revised version of the rule in (55)

(**S****NP** /**NP** :$\lambda y \lambda x$.pred' xy), hence composition of S and V is impossible in the derivations (41bc).

As the discussion of the effect of coordination on determining the transitive verb category of an OVS language showed, coordination and especially gapping are the topics to be investigated to understand the word order of a language. The next section explains the coordination rules and gapping in detail.

5.1.4 Coordination and Gapping

Coordination conjoins the constituents of like types into a constituent of the same type as shown in coordination schema (43).

(43) *Coordination Schema* (&): **X & X** $\Rightarrow$ **X**

Conjunctions like '*and*' have the category in (44), where **X** can be **S** or any function category onto **S**, hence conjuncts have the capacity of conjoining the non-traditional constituents produced by composition rules (37). Thus, coordination is lexicalized in CCG; it is not a rule schema as in (43).

(44) *and* := **(X\X)/X**: $\lambda p \lambda q.p \wedge q$

Steedman (1990) shows that both Ross's (1970) generalization, and the fact that verb-initial languages show only forward verb gapping whereas verb-final languages show only backward verb gapping, are predictions of CCG. The example derivation in (45) shows how CCG predicts the forward gapping SVO & SO when the word order is SVO. As discussed before, if the language is SVO, then its lexicon has transitive verbs with the syntactic category of **S\NP/NP**, and this category forces the language to have forward gapping but not backward gapping as in (45).

(45)

Harry	*bought*	*chocolate*	*and*	*Marry*	*chips*
NP	**S\NP/NP**	**NP**	**X\X/X**	**NP**	**NP**
	S\NP (>)			**T\(T/NP)** (<T)	**T\(T/NP)** (<T)
S (<)				**T\(T/NP/NP)** (<B)	
S/NP/NP (<dcomp)		**S\(S/NP/NP)**			
			(T\(T/NP/NP))\(T\(T/NP/NP)) (>)		
		S\(S/NP/NP) (<)			
S (<)					

The decomposition of **S** into **S/NP/NP** and **S\(S/NP/NP)** is satisfied by the rule in (46). This decomposition forces English to have a virtual VSO verb category **S/NP/NP**, hence it is what makes SVO and VSO orders closer. In fact when the parser is applying this rule, it decomposes the category into **X** and **X\Y** such that **X\Y** is equivalent to the syntactic category of the right conjunct in the coordination. (See Steedman (2000, p.187-193) for more details.)

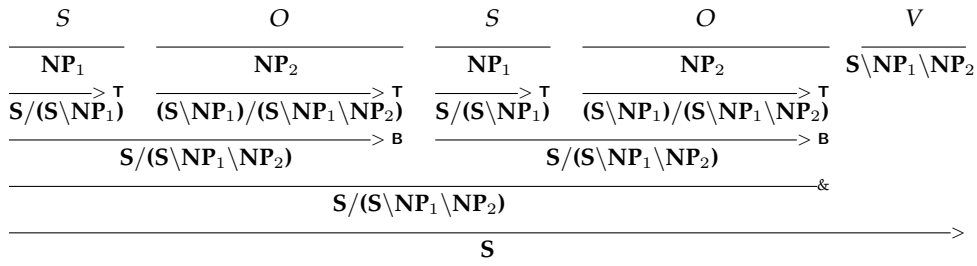
(46) *Category decomposition rule*

$\mathbf{X} : left \;\Rightarrow\; \mathbf{Y} : \theta'' \quad \mathbf{X}\backslash\mathbf{Y} : \lambda y.left \qquad (< dcomp)$

where **Y** = **S/$**

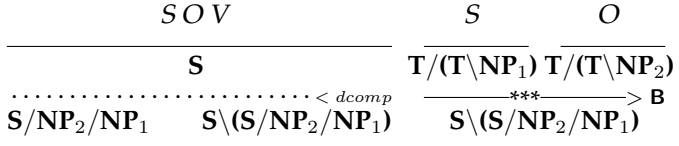
Similarly, derivation in (47) shows that backward verb gapping can take place for a strictly SOV language (like Japanese), given the independent assumptions of CCG. Since the lexicon is the place where information of the word order of the language is kept, lexicon of a strictly SOV language has the category, **(S\NP$_1$)\NP$_2$**:$\lambda x \lambda y$.pred' xy, for its transitive verbs.

(47)

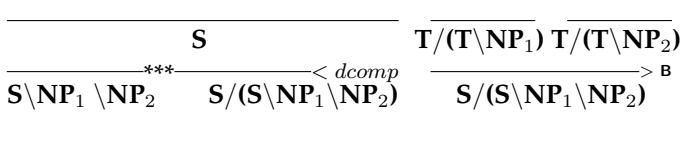


Type-raising (38) and functional composition rules (37a-b) are order-preserving. A strictly SOV language allows type-raising and composition rules that end up with functions looking rightward for the transitive verb. Forward gapping is impossible, because for such languages **S\(S/NP$_2$/NP$_1$)** category cannot be generated with the rules that the language allows as shown in (48a), and also the decomposition of **S** into **S\NP$_1$ \NP$_2$** and **S/(S\NP$_1$\NP$_2$)** violates the category decomposition rule (46) as shown in (48b).

(48) a.

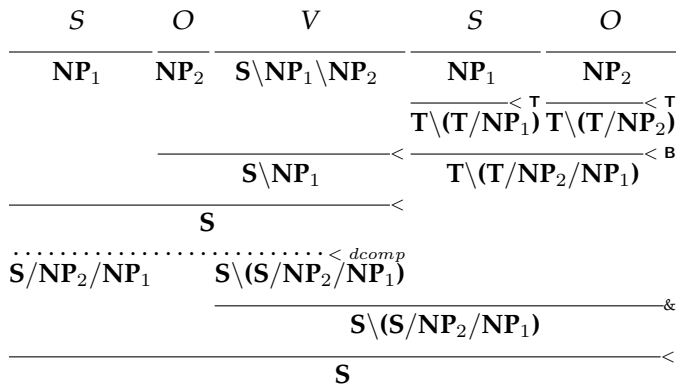


b.



If the language is not strictly SOV, then it allows for backward type-raising rules, and consequently can handle forward gapping with the help of virtual VSO verb category in decomposition as shown in (49)

(49)



Languages may have multiple word orders in their lexicons. For example, a language with SOV and OSV word orders has both of the following categories:

1. **S****NP** **NP**:$\lambda x \lambda y$.pred' xy

2. **S****NP** **NP**:$\lambda x \lambda y$.pred' yx

Even if multiple lexical categories for transitive verbs are possible, it does not mean that any observed order can be put as a different lexical category in the lexicon. Unless there are semantic differences and genuine lexical ambiguity, proliferating the verbal entries in the lexicon is a formal device with no linguistic inside. Word order assumptions for a language can be formulated explicitly in the lexicon and tested against syntactic constructions as suggested by Bozsahin (2000a). Thus, gapping is a good test for basic word orders as suggested by Ross (1970) and Koutsoudas (1971) and explicitly formulated by Steedman (1990; 2000) and Bozsahin (2000b). This is the reason why we have tried to elicit gapping data for TİD.

An alternative to multiple categories is to allow categories to contain multi-set arguments (Hoffman, 1995). In this alternative, a verb-final accusative language like Japanese (with OSV, SOV orders) has the transitive verb category in (50) and an accusative language with SOV and SVO word orders has the category in (51) where (|) is the non-directional slash and that can be instantiated to (\) and (/):

(50) tv := **S** {**NP**$_{nom}$, **NP**$_{acc}$}

(51) tv := **S****NP**$_{nom}$|**NP**$_{acc}$

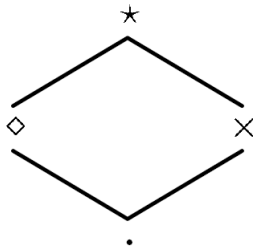


Figure 5.2: CCG type hierarchy for slash modalities (from Steedman & Baldridge, 2004)

Baldridge (2002) adopted a type hierarchy system to the combinatory rules to retain mild-context-sensitivity while making use of these multi-set categories. The type modalities ($\star$, $\diamond$, $\times$, $\cdot$) have the hierarchy in Figure 5.2, whose meaning is explained in (Steedman and Baldridge, 2004, p.12) as follows:[8]

> ...the $\star$ modality is the most restricted and allows only the most basic applicative rules; $\diamond$ permits order-preserving associativity in derivations; $\times$ allows limited permutation; and $\cdot$ is the most permissive, allowing all rules to apply.

With the addition of type-modalities, the combinatory rules in (35), (37), and (40) are rewritten as in (52), (53), and (54).

Since $\star$ modality is the super-type of the other modalities, functional application rules (52) can combine all kinds of categories. The rules which carry $\diamond$ modality (53a-b and 54a-b) cannot combine the function categories carrying the modalities of $\star$ and $\times$. Similarly, the rules which carry $\times$ modality (53c-d and 54c-d) cannot combine the categories carrying the modalities of $\star$ and $\diamond$.

(52) *Functional application rules*

a. *Forward application*

$$\mathbf{X}/_{\star}\mathbf{Y} : f \quad \mathbf{Y} : a \quad \Rightarrow \quad \mathbf{X} : fa \qquad (>)$$

b. *Backward application*

$$\mathbf{Y} : a \quad \mathbf{X}\backslash_{\star}\mathbf{Y} : f \quad \Rightarrow \quad \mathbf{X} : fa \qquad (<)$$

[8] /. and \. are the same as plain slashes / and \ we have used before, since they are the most permissive modality.

(53) *Functional composition rules*

a. *Forward composition*

$$\mathbf{X}/_{\diamond}\mathbf{Y} : f \quad \mathbf{Y}/_{\diamond}\mathbf{Z} : g \quad \Rightarrow \quad \mathbf{X}/_{\diamond}\mathbf{Z} : \lambda x.f(gx) \qquad (> \mathbf{B})$$

b. *Backward composition*

$$\mathbf{Y}\backslash_{\diamond}\mathbf{Z} : g \quad \mathbf{X}\backslash_{\diamond}\mathbf{Y} : f \quad \Rightarrow \quad \mathbf{X}\backslash_{\diamond}\mathbf{Z} : \lambda x.f(gx) \qquad (< \mathbf{B})$$

c. *Forward crossed composition*

$$\mathbf{X}/_{\times}\mathbf{Y} : f \quad \mathbf{Y}\backslash_{\times}\mathbf{Z} : g \quad \Rightarrow \quad \mathbf{X}\backslash_{\times}\mathbf{Z} : \lambda x.f(gx) \qquad (> \mathbf{B}_{\times})$$

d. *Backward crossed composition*

$$\mathbf{Y}/_{\times}\mathbf{Z} : g \quad \mathbf{X}\backslash_{\times}\mathbf{Y} : f \quad \Rightarrow \quad \mathbf{X}/_{\times}\mathbf{Z} : \lambda x.f(gx) \qquad (< \mathbf{B}_{\times})$$

(54) *Functional substitution rules*

a. *Forward substitution*

$$(\mathbf{X}/_{\diamond}\mathbf{Y})/_{\diamond}\mathbf{Z} : f \quad \mathbf{Y}/_{\diamond}\mathbf{Z} : g \quad \Rightarrow \quad \mathbf{X}/_{\diamond}\mathbf{Z} : \lambda x.fx(gx) \qquad (> \mathbf{S})$$

b. *Backward substitution*

$$\mathbf{Y}\backslash_{\diamond}\mathbf{Z} : g \quad (\mathbf{X}\backslash_{\diamond}\mathbf{Y})\backslash_{\diamond}\mathbf{Z} : f \quad \Rightarrow \quad \mathbf{X}\backslash_{\diamond}\mathbf{Z} : \lambda x.fx(gx) \qquad (< \mathbf{S})$$

c. *Forward crossed substitution*

$$(\mathbf{X}/_{\times}\mathbf{Y})\backslash_{\times}\mathbf{Z} : f \quad \mathbf{Y}\backslash_{\times}\mathbf{Z} : g \quad \Rightarrow \quad \mathbf{X}\backslash_{\times}\mathbf{Z} : \lambda x.fx(gx) \qquad (> \mathbf{S}_{\times})$$

d. *Backward crossed substitution*

$$\mathbf{Y}/_{\times}\mathbf{Z} : g \quad (\mathbf{X}\backslash_{\times}\mathbf{Y})/_{\times}\mathbf{Z} : f \quad \Rightarrow \quad \mathbf{X}/_{\times}\mathbf{Z} : \lambda x.fx(gx) \qquad (< \mathbf{S}_{\times})$$

Bozsahin and McConville (2005) revised the rules (42) as in (55)[9] and stated that "$(< \mathbf{T}_{\times})$ is topicalization, and $(> \mathbf{T}_{\times})$ detopicalization/backgrounding."

(55) a. *Leftward Contraposition*

$$\mathbf{NP} : a \quad \Rightarrow \quad \mathbf{S}/(\mathbf{S}/_{\times\triangleright}\mathbf{NP}_{+\text{top}}) : \lambda f.fa \qquad (< \mathbf{T}_{\times})$$

b. *Rightward Contraposition*

$$\mathbf{NP} : a \quad \Rightarrow \quad \mathbf{S}\backslash(\mathbf{S}\backslash_{\triangleleft\times}\mathbf{NP}_{\text{-top}}) : \lambda f.fa \qquad (> \mathbf{T}_{\times})$$

The lexical categories are also modalized. These lexical categories have the control of selecting the rules to apply from all universal combinatory rules. For example, in (56), the slashes are modified to have $\star$ modality. It restricts the function category of *and* only to functional application rules.

(56) *and* := $(\mathbf{X}\backslash_{\star}\mathbf{X})/_{\star}\mathbf{X}$: $\lambda p\lambda q.p \wedge q$

Such lexical control allows CCG to model island constraints in coordination, e.g. *'*a player that shoots and he misses'*, in which the second conjunct would compose with

[9] See Baldridge (2002) for an introduction of set-modal CCG that contains the modalities in (55).

shoots without modalities (Baldridge, 2002). Languages need to restrict or ban the universal combinatory rules (37) and (40) without these modalities on the slashes of function categories, as stated by Steedman (2000, p.55):

> Any language is free to restrict these rules to certain categories, or entirely exclude a given rule type.

However, with the modalities, all languages share the same universal rules without any restrictions on the rules. Hence, modalized function categories in a lexicon handles all the cross-linguistic variations, and multi-modal CCG has the property of being a fully-lexicalized grammar. In an investigation of basic word order and grammatical relations, this property cuts down the hypothesis space enormously; only the lexical categories of argument-taking elements can model word order and grammatical relations difference, hence deriving the lexical categories is a crucial first step in the investigation.

5.2 A lexicalized grammar of TİD

As implicated in section 5.1, verbal categories do most of the work in CCG, including encoding the basic word order and grammatical relations. Since CCG is a fully-lexicalized theory with no movement, there are not too many degrees of freedom to handle cross-linguistic variation of word order and grammatical relations; it boils down to the categories of argument-taking entities, i.e verbs. In this section, we will show that CCG is capable of capturing these aspects in the TİD lexicon via verbal categories.[10]

5.2.1 Plain Verbs

In section 3.5, we claim that TİD's word order in transitive clauses seems to be effected by the animacy factor. Plain verbs with animate arguments have unmarked $\mathcal{AP}$ serialization as Table 3.1 shows. $\mathcal{AP}$V and V$\mathcal{AP}$ orders are possible. For the plain versions of agreement verbs, $\mathcal{A}$V$\mathcal{P}$ is also possible. Marked $\mathcal{P}$V$\mathcal{A}$ order is also grammatical as shown in example (20b) repeated below:

[10] It seems that TİD does not have verb gapping when both arguments are animate, however it has gapping when patient is animate. we do not have a syntactic explanation for this fact.

(57)

	head left					*head right*
EŞ$_1$.	*EŞ*$_2$	*KIZ*	*KADIN*	*VE*		*SUS*
married-h/w	h/w	get-angry	woman	and		become-quieter
	$\mathcal{P}$	V_{tr}	$\mathcal{A}$	&	$(\mathcal{S}_A)$	V_{unerg}

'The woman got angry at her husband$_i$ and [he$_i$] became quiter.'

The basic word order of TİD plain verbs cannot be $\mathcal{A}V\mathcal{P}$ because this would allow rightward extraposition of $\mathcal{A}$ which results in V$\mathcal{P}\mathcal{A}$, and leftward extraposition of $\mathcal{P}$ which predicts $\mathcal{P}\mathcal{A}$V to be grammatical. Hence, we will test two hypotheses both of which assume the underlying order is $\mathcal{A}\mathcal{P}$V.

Based on the assumption that the class of plain verbs contains plain versions of agreement verbs, we hypothesize that plain verbs with two animate arguments have the syntactic category:

(58) verb := $\mathbf{S}\backslash\mathbf{N}_{+an}\backslash\mathbf{N}_{+an}$: $\lambda x\lambda y.\mathsf{pred'}xy$

The basic word order for plain verbs in this hypothesis is $\mathcal{A}\mathcal{P}$V and it leads to the derivation in (59a). $\mathcal{A}V\mathcal{P}$, V$\mathcal{A}\mathcal{P}$ and $\mathcal{P}$V$\mathcal{A}$ are derived from the basic order by leftward extraposition of $\mathcal{A}$ and $\mathcal{P}$ as shown in (59b-d). VNN sequences can only be V$\mathcal{A}\mathcal{P}$ in a caseless $\mathcal{A}\mathcal{P}$V language as the semantics in (59d-e) show, hence V$\mathcal{P}\mathcal{A}$ order is ungrammatical.

(59) a.

$$\dfrac{\dfrac{\mathcal{A}\quad\quad\dfrac{\mathcal{P}\quad\quad V}{\mathbf{S}\backslash\mathbf{N}_{+an}}<}{\mathbf{S}}<}{\mathbf{N}_{+an}\quad\mathbf{N}_{+an}\quad(\mathbf{S}\backslash\mathbf{N}_{+an})\backslash\mathbf{N}_{+an}}$$

b.

$$\dfrac{\dfrac{\mathcal{P}\quad\quad V\quad\quad\dfrac{\mathcal{A}}{\mathbf{S}\backslash(\mathbf{S}\backslash_{\lhd\times}\mathbf{N}_{\text{-top,+an}})}>\mathbf{T}_{\times}}{\mathbf{S}\backslash\mathbf{N}_{+an}}<}{\mathbf{S}}<}{\mathbf{N}_{+an}\quad(\mathbf{S}\backslash\mathbf{N}_{+an})\backslash\mathbf{N}_{+an}\quad\mathbf{N}_{+an}}$$

c.

$$\dfrac{\dfrac{\dfrac{\mathcal{A}}{\mathbf{N}_{+an}}}{\mathbf{S}/(\mathbf{S}\backslash\mathbf{N}_{+an})}{>}^{\mathbf{T}} \quad \dfrac{V}{(\mathbf{S}\backslash\mathbf{N}_{+an})\backslash\mathbf{N}_{+an}} \quad \dfrac{\dfrac{\mathcal{P}}{\mathbf{N}_{+an}}}{\mathbf{S}\backslash(\mathbf{S}\backslash_{\triangleleft\times}\mathbf{N}_{\text{-top,+an}})}{>}^{\mathbf{T}_\times}}{\mathbf{S}\backslash\mathbf{N}_{+an}}{>}^{\mathbf{B}_\times}}{\mathbf{S}}{<}$$

d.

$$\dfrac{\dfrac{\dfrac{V}{(\mathbf{S}\backslash\mathbf{N}_{+an})\backslash\mathbf{N}_{+an}:\lambda x\lambda y.\text{pred'}xy} \quad \dfrac{\dfrac{\mathcal{A}}{\mathbf{N}_{+an}:\text{a'}}}{\mathbf{S}\backslash(\mathbf{S}\backslash_{\triangleleft\times}\mathbf{N}_{\text{-top,+an}}):\lambda f.f\text{a'}}{>}^{\mathbf{T}_\times} \quad \dfrac{\dfrac{\mathcal{P}}{\mathbf{N}_{+an}:\text{b'}}}{\mathbf{S}\backslash(\mathbf{S}\backslash_{\triangleleft\times}\mathbf{N}_{\text{-top,+an}}):\lambda f.f\text{b'}}{>}^{\mathbf{T}_\times}}{\mathbf{S}\backslash\mathbf{N}_{+an}:\lambda x.\text{pred'}x\text{a'}}{<}^{\mathbf{B}}}{\mathbf{S}:\text{pred'a'b'}}{<}$$

e.

$$\dfrac{\dfrac{\dfrac{*V}{(\mathbf{S}\backslash\mathbf{N}_{+an})\backslash\mathbf{N}_{+an}:\lambda x\lambda y.\text{pred'}xy} \quad \dfrac{\dfrac{\mathcal{P}}{\mathbf{N}_{+an}:\text{b'}}}{\mathbf{S}\backslash(\mathbf{S}\backslash_{\triangleleft\times}\mathbf{N}_{\text{-top,+an}})}{>}^{\mathbf{T}_\times} \quad \dfrac{\dfrac{\mathcal{A}}{\mathbf{N}_{+an}:\text{a'}}}{\mathbf{S}\backslash(\mathbf{S}\backslash_{\triangleleft\times}\mathbf{N}_{\text{-top,+an}})}{>}^{\mathbf{T}_\times}}{\mathbf{S}\backslash\mathbf{N}_{+an}:\lambda y.\text{pred'b'}y}{<}^{\mathbf{B}}}{}***$$

Since there is no morphological case to distinguish the agent N and the patient N, this assumption predicts an ambiguity in NNV sequences. As shown in (59a) and (60), NNV sequences could be $\mathcal{A}\mathcal{P}$V or $\mathcal{P}\mathcal{A}$V under this hypothesis.

(60)

$$\dfrac{\dfrac{*\mathcal{P}}{\mathbf{N}_{+an}} \quad \dfrac{\dfrac{\mathcal{A}}{\mathbf{N}_{+an}}}{\mathbf{S}/(\mathbf{S}\backslash\mathbf{N}_{+an})}{>}^{\mathbf{T}} \quad \dfrac{V}{(\mathbf{S}\backslash\mathbf{N}_{+an})\backslash\mathbf{N}_{+an}}}{\mathbf{S}\backslash\mathbf{N}_{+an}}{>}^{\mathbf{B}_\times}}{\mathbf{S}}{<}$$

However, informants do not accept $\mathcal{P}\mathcal{A}$V order and there is no ambiguity for NNV sequences. Thus, this hypothesis is eliminated since it overgenerates.

In our second hypothesis, we will assume that the class of plain verbs does not contain plain versions of agreement verbs. The verb category in (61) does not allow $\mathcal{A}$V to be a constituent and eliminates the derivations (60) and (59c).

(61) verb := $\mathbf{S}\backslash\mathbf{N}_{+an}\backslash_{\diamond}\mathbf{N}_{+an}$: $\lambda x\lambda y$.pred'xy

The $\diamond$ modality in (61) does not allow the verb to be applied the crossed composition rule which is needed in (60) and (59c). The other derivations in (59) are similar for this hypothesis, since $\diamond$ modality does not effect the application of other rules.

We can conclude that CCG predicts either $\mathcal{A}V\mathcal{P}$ and $\mathcal{P}\mathcal{A}$V to be both grammatical or both ungrammatical given the verbal categories in (58) and (61). In other words, we expect either sentences with plain verbs are to be unacceptable in $\mathcal{A}V\mathcal{P}$ order since $\mathcal{P}\mathcal{A}$V is unacceptable. When preparing the examples, we had accepted plain versions of the agreement verbs as if they were plain. However, we did not have examples with plain verbs in $\mathcal{A}V\mathcal{P}$ order. To be sure, tests shall be repeated with such examples.

Transitive clauses with an inanimate and an animate argument are verb-final, since there is the asymmetry that verb gapping is possible for only verb-final orders, and not for any other order. The transitive verbs that take an inanimate and an animate argument have the category in (62).

(62) verb := **(**$\mathbf{S}\backslash\mathbf{N}_{+an}$**)** $\backslash\mathbf{N}_{-an}$: $\lambda x\lambda y$.pred'xy
verb := **(**$\mathbf{S}\backslash\mathbf{N}_{-an}$**)** $\backslash\mathbf{N}_{+an}$: $\lambda y\lambda x$.pred'xy

In fact, the category (64) is for unergative verbs such as 'sleep', 'run' , 'cry' ... etc. For the unaccusative verbs such as 'die', 'fall down', the category is as in (63).[11]

(63) unaccusative verb := $\mathbf{S}\backslash\mathbf{N}$: λx.pred' x one'

As shown in Table 3.5, only backward gapping is possible for TİD intransitive verbs, which means that the verb is looking left for its argument. Animacy does not affect gapping behaviour in intransitive clauses. They have the category in (64), which predicts that $\mathcal{S}\&\mathcal{S}$V (65) is grammatical and V$\mathcal{S}\&\mathcal{S}$ (66) is ungrammatical.

(64) verb := $\mathbf{S}\backslash\mathbf{N}$: λx.pred'x

[11] The symbol one' represents an arbitrary person.

(65)
$$\dfrac{\dfrac{\dfrac{\mathcal{S}}{\mathbf{N}}\quad\dfrac{\&}{\mathbf{(X\backslash_\star X)/_\star X}}\quad\dfrac{\mathcal{S}}{\mathbf{N}}}{\mathbf{N\backslash_\star N}}>}{\mathbf{N}}<\qquad\dfrac{V_{intr}}{\mathbf{S\backslash N}}}{\mathbf{S}}<$$

(66)
$$\dfrac{\dfrac{\dfrac{*V_{intr}}{\mathbf{S\backslash N}}\quad\dfrac{\mathcal{S}}{\mathbf{N}}\quad\dfrac{\&}{\mathbf{(X\backslash_\star X)/_\star X}}\quad\dfrac{\mathcal{S}}{\mathbf{N}}}{\mathbf{N\backslash_\star N}}>}{\mathbf{N}}<}{\mathbf{S}}***>$$

5.2.2 *Agreement Verbs*

a. Single Agreement Verbs:

For these verbs, both of the arguments are animate. Since the verb is inflected by a morpheme for $\mathcal{P}$-agreement, the secondary argument of the verb is to carry some morphological features such as person, number, and locus. The template for the syntactic category of a transitive single agreement verb is $\text{VERB}_{p,n,l}$:= $\mathbf{S\backslash N\backslash N}_{p,n,l}$: $\lambda x \lambda y.\text{pred'}\, xy$.[12] The word order encoded in this syntactic category is $\mathcal{AP}$V, which is the most frequently observed order in natural data we obtained.

The verb category above has agreement features for the patient, so it solves the ambiguity in $\mathcal{PA}$V order discussed in 5.2.1 for plain verbs. Six of our informants accept $\mathcal{PA}$V order for single agreement verbs whereas they consider this order as ungrammatical for plain verbs.

As stated in section 3.4, pro-drop of $\mathcal{P}$ is possible for the sentences with a single agreement verb, but pro-drop of $\mathcal{A}$ is impossible. The derivations in (67) show how agreement morphology effects semantics in case of pro-drop. Table 5.1 summarizes the effect of pro-drop on the categories of the transitive and

[12] There are two alternative designs for the CCG lexicon at this point. By Bozsahin's (2002) proposal for a morphemic lexicon rather than a lexemic lexicon, it is possible to put the inflectional morphemes (such as the one in (6a), namely non_1,SG,L_i) as a morphemic entry into the lexicon, and concatenate them with the roots of the sign via the rule of composition. For morphologically rich languages such as Turkish, this proposal minimizes the size of the lexicon. For now, it is known that agreement verbs in TİD inflect for aspect, person($\mathcal{A}$,$\mathcal{P}$), locus and number. However, it is not clear for the writer whether it is the whole picture for the verbal morphology of TİD. We will adopt a lexemic lexicon view in this study, and leave other choices to future research.

ditransitive verbs, which have agreement with first person pronoun or a non-first person nominal.

Table 5.1: Pro-drop of $\mathcal{P}$

Basic Category	$\mathcal{P}$ **pro-drop**
(S\N)\N$_{non\_1,SG,Li}$: $\lambda x\lambda y$.pred' xy	**S\N**: λx.pred' hsy' x
(S\N)\N$_{1,SG,Ls}$: $\lambda x\lambda y$.pred' xy	**S\N**: λx.pred' I' x
((S\N)\N$_{non\_1,SG,Li}$**)\N**: $\lambda x\lambda y\lambda z$.pred' xyz	**(S\N)\N**: $\lambda x\lambda y$.pred' x hsy' y
((S\N)\N$_{1,SG,Ls}$**)\N**: $\lambda x\lambda y\lambda z$.pred' xyz	**(S\N)\N**: $\lambda x\lambda y$.pred' x I' y

(67) a.
$$\dfrac{\dfrac{\overline{\mathbf{N}_{1,SG,Ls}:\text{I'}} \quad \dfrac{\overline{\mathbf{N}_{non\_1,SG,Li}:\text{hsy'}} \quad \overline{\mathbf{(S\backslash N)\backslash N}_{non\_1,SG,Li}:\lambda x\lambda y.\text{see' } xy}}{\mathbf{(S\backslash N):}\lambda y.\text{see' hsy' } y}<}{\mathbf{S}:\text{see' hsy' I'}}<$$

b.
$$\dfrac{\overline{\mathbf{N}_{1,SG,Ls}:\text{I'}} \quad \dfrac{\overline{\mathbf{(S\backslash N)\backslash N}_{non\_1,SG,Li}:\lambda x\lambda y.\text{see' } xy}}{\mathbf{(S\backslash N):}\lambda y.\text{see' hsy' } y}\mathcal{P}\text{-pro-drop}}{\mathbf{S}:\text{see' hsy' I'}}>$$

The change in semantics during pro-drop is triggered by the morphology of the verb.[13] The unary rule for $\mathcal{S}$ or $\mathcal{P}$ pro-drop for Turkish sign language (68) produces the categories in Table 5.1.[14]

(68) $\mathbf{((S\backslash N)\backslash N}_{Agr}\mathbf{)\$}_i \Rightarrow \mathbf{(S\backslash N)\$}_i$

b. Double Agreement Verbs: These verbs agree with both $\mathcal{A}$ and $\mathcal{P}$, or only with $\mathcal{P}$. They are classified as forward or backward, according to the order of agreement morphemes in the verb. Forward verbs have their morphemes in the order of $\mathcal{A}$-marker, verb-stem, $\mathcal{P}$-marker, whereas backward verbs have the $\mathcal{P}$-marker, verb-stem, $\mathcal{A}$-marker order. The verbal categories of the forward and backward double agreement verbs DURDUR and DAVET are as in (69).[15]

(69) $_{\mathcal{A}}$DURDUR$_{\mathcal{P}}$:= $\mathbf{S\backslash N}_{\mathcal{A}}\mathbf{\backslash N}_{\mathcal{P}}$: $\lambda x\lambda y$.stop'xy

$_{\mathcal{P}}$DAVET$_{\mathcal{A}}$:= $\mathbf{S\backslash N}_{\mathcal{A}}\mathbf{\backslash N}_{\mathcal{P}}$: $\lambda x\lambda y$.invite'xy

[13] hsy' is the abbreviation for he/she/you.

[14] **X** = $\mathbf{S\backslash N}_{Agr}$ or **X** = **S**. **X$** indicates an **X** category or a function into **X**, the left and right categories indexed with i are the same.

[15] The agreement features of the arguments are represented as subscripts.

Pro-drop of both $\mathcal{A}$ and $\mathcal{P}$ is possible for the sentences with a double agreement verb as in examples (8b-c) The lexical rule in (70) for $\mathcal{A}$-pro-drop for TİD produces the categories in Table 5.2, which can apply to the verbs that drop their $\mathcal{P}$-argument by the rule (68).

(70) $\mathbf{(S\backslash N}_{Agr}\mathbf{)\$}_i \Rightarrow \mathbf{S\$}_i$

Table 5.2: Pro-drop of $\mathcal{A}$ and $\mathcal{P}$

Basic Category	$\mathcal{A}\&\mathcal{P}$ **pro-drop**
$\mathbf{(S\backslash N}_{Agr1}\mathbf{)\backslash N}_{Agr2}$	**S**
$\mathbf{(S\backslash N}_{Agr1}\mathbf{)\backslash N}_{Agr2}\mathbf{\backslash N}$	**S\N**

5.2.3 Summary

The verb classes are specified according to morphological features. Plain verbs do not have any agreement features on its arguments whereas agreement verbs do. Agreement verbs has two subclasses: (i) single agreement verbs and (ii) double agreement verbs. Pro-drop is defined by two lexical unary rules (68) and (70). Since single agreement verbs have only agreement features for $\mathcal{S}$ or $\mathcal{P}$, only these arguments are pro-dropped by the rule (68) and the rule (70) does not apply. Sentences with double agreement verbs pro-drop their arguments by applying the rules (68) and (70) in order. Pro-drop rules cannot apply to plain verbs since they do not have any agreement features.

Animacy effects directionality and verb gapping, consequently verbs with an inanimate patient and verbs with two animate arguments have different verbal categories as (62) and (58) respectively. The nominal arguments of the verb categories are marked with an animacy feature. Word order variation between sentences with animate patients and inanimate patients is a consequence of directionality. The marked orders are shown to be derived from the basic $\mathcal{A}\mathcal{P}$V order by backgrounding. Thus, word order in TİD is captured via verb categories.

CHAPTER 6

CONCLUSION

In this thesis, we have investigated word order and grammatical relations in TİD. Word order in a TİD sentence is related to animacy of the arguments, agreement and pro-drop features of the verb. Animacy triggers an asymmetry in basic word order of transitive clauses and in verb gapping. The basic word order is $\mathcal{A}\mathcal{P}$V for the sentences with the verbs with animate arguments; $\mathcal{P}\mathcal{A}$ serialization is not acceptable. Verb gapping does not occur with two animate arguments. However, for the sentences with an inanimate patient, gapping is allowed in verb-final orders, but not in others. For these sentences, $\mathcal{P}\mathcal{A}$V order is also grammatical.

Gapping is a litmus test for determining basic word order (Ross, 1967; Ross, 1970), and such an asymmetry, which groups verb-final orders in one hand and verb-initial and verb-medial orders in the other, shows that TİD clauses with an inanimate patient are verb-final.

TİD is a pro-drop language. There is an asymmetry also in pro-drop. Pro-drop of the single argument of intransitive agreement verbs and the patient-like argument of single-agreement verbs are possible, but the agent-like argument of these verbs can not be pro-dropped. That is, pro-drop behaves the same for $\mathcal{S}$ and $\mathcal{P}$ but not for $\mathcal{A}$. For double agreement verbs, either both arguments are pro-dropped or only $\mathcal{P}$ is dropped. There is again an asymmetry between $\mathcal{A}$ and $\mathcal{P}$. These asymmetries in pro-drop suggest morphological ergativity.

In single agreement verbs, only $\mathcal{S}$ and $\mathcal{P}$ can agree with the verb, but not $\mathcal{A}$. In coordination of a transitive sentence with an intransitive clause whose $\mathcal{S}$ is missing, if the verbs are single agreement verbs, then only the ergative reading is possible. These facts suggest that morphological ergativity in TİD is prevailing.

In coordination, if there is no non-manual marking for accusativity, we found that the controller of the deletion is $\mathcal{S}$ and the target of deletion is $\mathcal{P}$, which are coreferential. We do not observe any sentences which have traces of accusativity without help from non-manual markings.

Unergativity/unaccusativity distinction is effective only in coordination of an intransitive clause and a transitive clause with a missing argument. If the intransitive verb is unergative, then the noun in the second clause could only be $\mathcal{P}$, attesting $\mathcal{S}_A$=$\mathcal{A}$, and if it is an unaccusative verb, the noun is interpreted as $\mathcal{A}$ and the missing patient is coreferential with $\mathcal{S}$, $\mathcal{S}_P$=$\mathcal{P}$. In that system, there seems to be agentivity.

There are not many studies (at least to my knowledge) on the ergativity and/or accusativity in sign languages. The most important findings on this topic stem from Goldin-Meadow (2005) who investigates what is innate in our minds. Goldin-Meadow (2005) reported ergative patterns in home-sign systems of Chinese and English deaf children with hearing parents. The intransitive actors resemble the patient of the transitive actions in these children's productions:

> "Both American and Chinese children produce signs for the intransitive actor as often as they produce signs for the patient, and far more often than they produce signs for the transitive actor." (Goldin-Meadow, 2005, p.209)

She claims that ergative patterns are innate since the language of such children is ergative although there is neither an ergative nor an accusative model available to them.

I suggest similar arguments for ergativity hold for other sign languages as well, because sign languages resemble a lot in their verbal morphology, agreement systems and pro-drop behaviours.

In this thesis, we pointed out many differences between Turkish and TİD, including their verbal agreement systems, word order and grammatical relations. Turkish has a very rich nominal and verbal morphology. TİD has no nominal morphology but a very rich verbal agreement system. Among the differences, the most important one is that Turkish has an accusative syntax and morphology whereas TİD has ergative morphology. We hope that our findings will have an impact on language teaching studies, involving teaching Turkish to the Deaf and teaching TİD. Considering the differences between the two languages, the language teaching community

in Turkey is expected to develop methodologies and do research in teaching Turkish to the deaf signers.

6.1 Future Work

Our findings yield evidence for an ergative morphology in TİD. However, establishing the ergativity of its syntax needs future research. Syntactic structures such as control and passives in TİD would give more information on the syntax.

We need to make further research on the relation between discourse topics and non-manual markings in TİD. TİD has non-manual markings such as head tilt and eyebrows raising for marking topicalization. Since a language with an ergative syntax would have $\mathcal{S}$ and $\mathcal{P}$ as the topic in topic chains, whereas an accusative language would have $\mathcal{S}$ and $\mathcal{A}$, non-manual markings should be closely examined to understand their effect on word order and grammatical relations.

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APPENDIX A

The List of TİD Verbs

Table A.1 summarizes the verb classes with a few examples in each class, and Tables A.2 and A.3 includes more examples with their phonological properties for each class. In Tables A.2 and A.3, 'Eng.' stands for the english translation of the verb, 'intr.' for intransitive, 'tr.' for transitive, 'ditr.' for ditransitive, 's' for single, 'd' for double, 'for.' for forward, 'back.' for backward, 'ori.' for change in the orientation of the palm, 'mov' for change in the direction of movement, and 'rph' for change in the relative positions of the hands with respect to body.

Table A.1: Verbs classes

- Agreement Verbs
  1. Intransitive (ex: ÖL ”die”, OTUR ’sit down’)
  2. Transitive
     (a) Single Agreement
        i. Forward (ex: GÜL ”laugh at”, BAK ”look at”)
        ii. Backwards† [1]
     (b) Double Agreement
        i. Forward (ex: GÖSTER ”show”, İFTİRA ”slander”, DURDUR ”stop”)
        ii. Backwards (ex: DAVET ”invite”, SORGULA ”question”, ETKILEN ”be impressed”)
  3. Ditransitive
     (a) Single Agreement
        i. Forward (ex: ANLAT ”tell”)
        ii. Backwards†
     (b) Double Agreement
        i. Forward (ex: VER ”give”)
        ii. Backwards(ex: AL ”take”)
- Plain Verbs
  1. Intransitive (ex: KOŞ ”fall down”, UYU ”sleep”)
  2. Transitive (ex: ÇAL ”steal”, NEFRET ”hate”)
- Spatial Verbs (ex: YÜRÜ ”walk”)

Table A.2: The list of agreement verbs

Gloss	**Eng.**	**tr./ditr.**	**s/d**	**for./back.**	**ori.**	**mov.**	**rph**
ALAY	'mock'	trans.	s	for.	yes	yes	no
AL	'get,take'	ditrans.	d	back.	no	yes	yes
ANLAT	'tell'	tr./ditr.	s	for.	no	yes	no
BAĞIR	'shout at'	trans.	s	for.	yes	yes	yes
BAK	'look at'	trans.	s	for.	yes	yes	yes
BESLE	'feed'	trans.	s	for.	no	yes	yes
BORÇ	'owe'	trans.	d	for.	no	yes	no
CEVAP	'answer'	trans.	d	for.	no	yes	yes
DAVET	'invite'	trans.	d	back.	no	yes	yes
DURDUR	'stop'	trans.	d	for.	yes	yes	yes
EMRET	'command'	trans.	s	for.	no	yes	no
ETKİLEN	'be impressed'	trans.	d	back.	yes	yes	yes
GİT	'go'	intrans.	s	-	-	-	yes
GÖNDER	'send'	ditrans.	d	for.	yes	yes	no
GÖSTER	'show'	tr./ditr.	d	for.	no	yes	yes
GÜL	'laugh at'	trans.	s	for.	yes	no	no
HABER	'announce'	trans.	s	for.	no	yes	yes
ISIR	'bite'	trans.	s	for.	yes	yes	yes
İLET	'transmit'	ditrans.	d	for.	no	yes	yes
OTUR	'sit down'	intrans.	s	-	-	-	yes
ÖDE	'pay'	trans.	d	back.	yes	yes	yes
ÖL	'die'	intrans.	s	-	-	-	yes
SAT	'sell'	ditrans.	d	for.	no	yes	no
SEÇ	'choose'	trans.	d	back.	yes	yes	yes
SORGU	'question'	trans.	d	back.	yes	yes	yes
SÖYLE	'say'	tr./ditr.	s	for.	no	yes	yes
SOR	'ask'	trans.	d	for.	no	yes	yes
SUÇÂT	'slander'	trans.	d	for.	yes	yes	yes
SUSTUR	'quiten'	trans.	s	for.	no	yes	yes
TAKİP	'follow'	trans.	s	for.	no	yes	yes
TAKLİT	'imitate'	trans.	d	back.	yes	yes	yes
TEŞEKKÜR	'thank'	trans.	s	for.	no	yes	no
VER	'give'	ditrans.	d	for.	no	yes	yes
ZORLA	'force'	trans.	d	for.	no	yes	no

Table A.3: The list of plain and spatial verbs

Gloss	**English Translation**	**Verb Class**	**intr./tr./ditr.**
KÜÇÜMSE	'look down on'	plain	transitive
BİL	'know'	plain	transitive
ÇAL	'steal'	plain	transitive
DENE	'try'	plain	transitive
DENETLE	'check,control'	plain	transitive
DİŞ-FIRÇALA	'brush teeth'	plain	intransitive
DUDAK-OKU	'lipread'	plain	intransitive
DUR	'stop'	plain	intransitive
DÜŞÜN	'think'	plain	intranstive
ESNE	'yawn'	plain	intransitive
EZBERLE	'memorize'	plain	transitive
HATIRLA	'remember'	plain	transitive
İNAN	'believe'	plain	transitive
İNŞA-ET	'build'	plain	transitive
İŞARETLE	'sign'	plain	intransitive
İSTE	'want'	plain	transitive
İZ-SÜR	'trace'	plain	transitive
EVET	'say yes'	plain	transitive
KARAR	'judge'	plain	transitive
OY-KULLAN	'vote'	plain	intransitive
KOPYALA	'copy'	plain	transitive
KORU	'protect'	plain	transitive
KUTLA	'greet'	plain	transitive
MERAK	'wonder.worry'	plain	transitive
NEFRET	'hate'	plain	transitive
ÖNEMSE	'care'	plain	transitive
RİCA	'request'	plain	transitive
TANIŞ	'meet'	plain	transitive
ŞÜPHELEN	'suspect'	plain	transitive
SAÇ-TARA	'comb'	plain	intransitive
ŞARKI	'sing'	plain	intransitive
TAHMİN	'guess'	plain	transitive
TERFİ	'promote'	plain	intransitive
UNUT	'forget'	plain	transitive
UYAR	'warn'	plain	transitive
YALVAR	'beseech'	plain	transitive
YAŞA	'live'	plain	intransitive
YAZ	'write'	plain	intransitive
FIRLAT	'throw'	spatial	transitive
GEL	'come'	spatial	intransitive
YÜRÜ	'walk'	spatial	intransitive