Acquisition of Spatial Language by Signing and Speaking Children:

A comparison of Turkish Sign Language (TİD) and Turkish

Proefschrift

ter verkrijging van de graad van doctor

aan de Radboud Universiteit Nijmegen

op gezag van de rector magnificus prof. dr. Th.L.M. Engelen,

volgens besluit van het college van decanen

in het openbaar te verdedigen op maandag 20 april 2015

om 14.30 uur precies

door

Beyza Sümer

geboren op 12 juli 1981

te Edirne, Turkije

Promotor

Prof. dr. Aslı Özyürek

Copromotoren

Dr. Pamela Perniss (University of Brighton, Groot-Britannië)

Dr. Inge Zwitserlood

Manuscriptcommissie

Prof. dr. Asifa Majid

Prof. dr. Bencie Woll (University College London, Groot-Britannië)

Prof. dr. Aylin Küntay (Koç Üniversitesi İstanbul, Turkije)

Acquisition of Spatial Language by Signing and Speaking Children:

A comparison of Turkish Sign Language (TİD) and Turkish

Doctoral thesis

to obtain the degree of doctor

from Radboud University Nijmegen

on the authority of the Rector Magnificus prof. dr. Th.L.M. Engelen,

according to the decision of the Council of Deans

to be defended in public on Monday, 20 April 2015

at 14.30 hours

by

Beyza Sümer

Born on 12 July 1981

in Edirne, Turkey

Supervisor

Prof. dr. Aslı Özyürek

Co-supervisors

Dr. Pamela Perniss (University of Brighton, United Kingdom)

Dr. Inge Zwitserlood

Doctoral Thesis Committee

Prof. dr. Asifa Majid

Prof. dr. Bencie Woll (University College London, United Kingdom)

Prof. dr. Aylin Küntay (Koç Üniversitesi, İstanbul, Turkey)

To Kalamalka

Table of Contents

Acknowledgements

At the beginning of this PhD project, I used to dream of the day I would write the most exciting part of my manuscript – acknowledgements. Today (December 25, 2014) is the day. Before starting my thanks, I would like to note that today is also the day my childhood dream has (almost) come true: Being a doctor – well, I meant to be a medical doctor at those days, but it still counts for me.

First and foremost, I would like to thank my supervisor Aslı Özyürek, who gave me the opportunity to realize my childhood dream. Her knowledge, patience, and wisdom helped me get through all the hardships and challenges that I met during this strenuous journey. Indeed, she has been more than a supervisor, but a mentor who has always been there to discuss ideas, solve problems of any kind (i.e., academic, non-academic), and provide support for both PhD and non-PhD life. Thanks to her profound expertise and critical mind, I was able to survive many talks given in front of experts in the field, and many manuscripts that passed with minor corrections – although it required preparing drafts after drafts, all of which were always critically read by her in amazingly short times. My English, even my Turkish, is not enough to describe my gratitude to her.

I was a very lucky PhD student to have two co-supervisors, whose academic guidance and enthusiastic support have been invaluable in the writing of this dissertation. Pamela – thanks for our long and very inspiring discussions of the data, where we spent hours trying to figure out what the signers/speakers do and why. Without your ideas and your encouragement, I would not write the discussion sections of many chapters of this dissertation. And Inge – thanks to your critical eye and comments, I learnt how to pay attention to very minor details. I also enjoyed our Dutch and Turkish lessons where we spent

a lot of time trying to figure out the complexities of these languages. It was sometimes very difficult to get approval from my supervisors about the quality of the work done due to their keen eye for the details and unparalleled knowledge on the areas related to this research, but their "yes" always made me feel more comfortable about the work that I did. I also would like extend my gratitude to Peter Hagoort, whose generosity helped me stay at MPI longer than I expected. Without him, I would be writing this part in Turkey, obviously.

In addition to my supervisors, I would like to thank Asifa Majid, Bencie Woll, and Aylin Küntay for accepting to be in my manuscript committee and taking time to read my dissertation. It was a great honour to be able to get their approval. Also, I have been fortunate enough to meet and share my ideas with the experts in sign language research. One of them is Jennie Pyers, who shared not only her stimulus materials but also her experience and knowledge with me. The stimuli developed by her team were central to data collection for this project and her work inspired the way that I approached my own data.

MPI is a heaven of intellect with talks, project/data meetings, and visits of the famous scientists from all over the world. Science is in the air here, and there is no way to escape without being infected with the virus of curiosity. Thanks to excellent supporting staff at TG, TLA, library, and administration, several things which were vital to my project such as data collection, archiving, technical issues, accessing to library sources, and all kinds of administrative staff went all smoothly, with almost no problems.

The time that I spent as a PhD student at MPI and Radboud University was more than great thanks to the people here. Especially the members, both former and current, of Gesture and Sign group (which has become Multimodal Language and Cognition group recently) have already left a mark in my life: Zeynep Azar, Emanuella Campisi, Sandra Debreslioska, Linda Drijvers, Anne Therese Frederiksen, Reyhan Furman, Judith Holler, Gerardo Ortega, David Peeters, Louise Schubotz, Renske Schilte. Thank you for sharing many moments of

Abbreviations and transcript conventions

Abbreviations of sign languages:

ASL   American Sign Language

Auslan   Australian Sign Language

BSL   British Sign Language

DSL   Danish Sign Language

DGS   German Sign Language (*Deutsche Gebärdensprache*)

HKSL   Hong Kong Sign Language

IrSL   Irish Sign Language

Kata Kolok   Kata Kolok (Bali)

NGT   Sign Language of the Netherlands (*Nederlandse Gebarentaal*)

NSL   Nicaraguan Sign Language

TİD   Turkish Sign Language (*Türk İşaret Dili*)

VGT   Flemish Sign Language (*Vlaamse Gebarentaal*)

Abbreviations in general:

3   Third Person

ABL   Ablative

ABS   Absence of linguistic marking

FoR   Frames of Reference

ACC   Accusative

DAT   Dative

DIM   Diminutive

GEN   Genitive

GER   Gerund

LOC   Locative

NEG   Negative

NP	Noun phrase
PAST	Past tense
PLU	Plural
POSS	Possessive
PREP	Preposition
PROG	Progressive tense

Transcription conventions:

CAR	Lexical sign
CAR$_{loc}$	Lexical sign placement
CL(long)	Classifier followed by the classificatory feature or the identity of the referent
CL(long)$_{loc}$	The location of the referent presented with a classifier is in subscript
CL(man)$_{walk}$	The movement of the referent presented with a classifier is in subscript
ENACT	Enactment
IX$_{loc}$	The location of the referent shown by a pointing sign (index finger)
LH	Left hand
RH	Right hand
SASS(long)	Shape and Size Specifier followed by the size and/or shape feature of the referent
SASS(long)$_{loc}$	The location of the referent presented with a SASS is in subscript
--- HOLD ---	A sign form holds for the duration of the dotted line

CHAPTER 1

Introduction

The ability to use language to talk about space is a fundamental aspect of language and cognition. In learning to talk about space, children need to figure out adult-like correspondences between linguistic forms and how they map onto space. This requires segmenting events into semantic components, and distributing them into language-specific lexical and syntactic constructions (e.g., Bowerman, 1996a, b; E. Clark, 2004; Slobin, 2006). Furthermore, this mapping shows variation across spoken languages of the world (e.g., Talmy, 1985; Levinson & Wilkins, 2006), and is radically different between sign and spoken languages (e.g., Emmorey, 2003; Talmy, 2003). In the case of sign languages, natural languages that operate in the visual-spatial modality, signers use linguistic forms that map spatial relations between objects in the real world onto signing space in iconic ways (i.e., using visually-motivated form-meaning mappings) to varying degrees using the body and the hands as main articulators (Emmorey, 2002; Perniss, 2007). In contrast, the auditory-vocal modality of spoken languages does not afford such iconic mappings to linguistically encode these relations.[1] The modality difference between sign and spoken languages raises interesting questions about whether the modality of the linguistic expression can influence the acquisition of spatial language. The current dissertation investigates whether modality shapes the course of spatial language development by comparing spatial expressions of deaf children and adults using Turkish Sign Language (Türk İşaret Dili [TİD]) to those of their hearing counterparts who speak Turkish.

Sign languages are the natural languages of deaf communities. In spite of the differences in the modality of expression, speech and sign share basic linguistic properties on the levels of

---

[1] In spoken languages, speakers can express iconically motivated representations in spatial communication through iconic gestures (e.g., McNeill, 1992; Kita & Özyürek, 2003; Goldin-Meadow, 2004). The use of gestures in speech will be left out of the main investigation in this dissertation. However, in the cases where they are relevant in interpreting the results, they will be discussed based on other work I have conducted with co-speech gestures using the same data set used in this dissertation (Sümer, Zwitserlood, Perniss, & Özyürek, 2014).

phonology, morphology, and syntax (Battison, 1978; Klima & Bellugi, 1979; Sandler & Lillo-Martin, 2006). Like spoken languages, sign languages of different countries have been shown to vary in terms of their vocabularies and syntax (Woll, 2003; Perniss, Pfau, & Steinbach, 2007). Moreover, similar neural structures have been found to support processing of both sign and spoken languages (Poizner, Klima, & Bellugi, 1987; Emmorey, 2002; Emmorey & Özyürek, 2014).

In spite of fundamental similarities found in several domains of linguistic structure, the effects of modality are obvious for the expression of spatial relations between entities: Sign languages use space to talk about space (Emmorey, 2002) while spoken languages employ arbitrary forms that label different types of spatial relations. In order to describe the spatial relations between entities, signers mainly use linguistic forms that are iconic and analogue to the real spatial configuration (as in example 1a). This is not the case in spoken languages where spatial relations are expressed through arbitrary forms that carry no visual resemblance to the spatial configuration itself (as in example 1b). These differences might shape spatial language development differently for children learning a sign versus a spoken language. One prediction is that children acquiring a sign language would learn to express spatial relations earlier than children acquiring a spoken language since the visual-spatial modality affords iconic form-meaning mappings in sign languages. However, as will be explained in Chapter 2 (2.3.2.1), the linguistic forms that encode location and motion of the entities, most prominently classifier predicates, are morphologically complex constructions (e.g., Supalla, 1982; Zwitserlood, 2012). For example, in sign languages relational encodings generally require the simultaneous expression of referents using the two hands (as in 1a) and are considered to exhibit complex simultaneous morphology which might be hard to acquire for signing children (Supalla, 1982). Therefore, an alternative possibility is that signing children may learn to express spatial relations later than speaking children. Finally, it is possible that modality does not influence spatial language acquisition, in which case both signing and speaking children will achieve adult forms at similar ages. These are the main hypotheses that will be tested in this dissertation.

(1a)   *American Sign Language [ASL]* (Arık, 2009)

   "*The cup is on the book.*"

(1b) The cup is on the book.   *English*

In many respects, the acquisition of sign languages is found to be similar to the acquisition of spoken languages. For example, first signs appear at around 12 months of age; a vocabulary spurt typically occurs at 18 months; two sign combinations appear at 24 months; the 500-sign stage is reached by 36 months; grammar emerges between two and three years of age; and the acquisition of discourse functions continues up to school age (Chamberlain & Mayberry, 2000; Morgan & Woll, 2002). However, such equality is not seen for the acquisition of spatial language, for which distinct modality differences have been attested. Even though speaking children are reported to produce language-specific spatial expressions at around three years of age (e.g., Johnston & Slobin, 1979; Choi & Bowerman, 1991; Bowerman, 1996a, b; Bowerman & Choi, 2001), the development of different aspects of spatial expressions has been reported to continue even beyond 10 years of age for children acquiring a sign language (Kantor, 1980; Supalla, 1982; Newport & Meier, 1985; Slobin, Hoiting, Kuntze, Lindert, Weinberg, Pyers, Anthony, Biederman, & Thumann, 2003 for American Sign Language [ASL]; Engberg-Pedersen, 2003 for Danish Sign Language [DSL]; Tang, Sze, & Lam, 2007 for Hong Kong Sign Language [HKSL]; Morgan, Herman, Barriere, & Woll, 2008 for British

Sign Language [BSL]). However, none of these studies with signing children investigated the acquisition of spatial language through direct comparisons to children acquiring a spoken language, and only few of them compared signing children to adults (Engberg-Pedersen, 2003; Tang et al., 2007) in similar tasks. Therefore, the delay reported for signing children in acquiring spatial language has been mostly assumed, but not verified with necessary comparisons to be convincing. Moreover, most of these studies examined motion event narrations (Kantor, 1980; Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007), disregarding another type of spatial domain such as location events.

The purpose of the current dissertation is to explore the possible effects of modality (i.e., visual-spatial versus auditory-vocal) on the acquisition of spatial language in a sign (TİD) and a spoken language (i.e., Turkish). More specifically, I investigate spatial encodings of signing and speaking children by comparing them to those of adults in both languages by using the same tasks, which focus on different types of spatial events (i.e., location versus motion events) and spatial relations (i.e., topological relations as expressed in English with "in", "on", under" and viewpoint-dependent ones with "left", "right", "front", "behind"). In this respect, this is the first comprehensive study comparing acquisition of spatial language in a sign and a spoken language by looking at different types of spatial events and relations, and comparing signing and speaking children to adult targets using the same tasks. In the end, this dissertation aims to provide insights on to what extent to language acquisition follows a universal trajectory and to what extent it is shaped by specific properties of the language that is being acquired (in this case, visual-spatial modality versus auditory-vocal modality).

Spatial language mainly comprises expressions that describe how entities are located in relation with each other (i.e., location) or how they change location with respect to each other (i.e., motion) (Levinson, 1996; 2003). While previous studies have investigated motion events, there has been little investigation of location encoding. In order to see whether it is justified to generalize findings from motion event encodings to spatial language development in general, the current dissertation explores the developmental patterns for not only motion, but also for different types of location events, thus taking a wider perspective. For this reason, first, the notion of spatial domain,

and how it is linguistically expressed in sign and spoken languages will be introduced briefly in section (1.1). The next section (1.2) will outline the overall motivations and questions of the current dissertation. This chapter ends with an outline of the individual chapters in section (1.3).

1.1 The spatial domain and its linguistic expression in sign and spoken languages

The world around us consists of several entities that are in various spatial relations with respect to one another. Some are likely to be statically located (e.g., your favourite cup on a book), while others are in dynamic relations in which they change their location (e.g., your next-door neighbour walking towards her car). As a semantic notion, space refers to the location and motion of referents with respect to other referents. Linguistically, the spatial domain covers all implicit and explicit answers to *where* questions (Levinson, 1996).

In both types of spatial events (i.e., location and motion) the smaller and foregrounded entity is mostly termed the "Figure", which is located or changes its location with respect to a backgrounded and usually bigger entity, called the "Ground" (Talmy, 1985). Figure 1.1 below exemplifies a location event in which the Figure (i.e., cup) does not change its location, and is static in relation to the Ground (i.e., book). These two entities are in a support/contact type of spatial relation, which can be expressed by the preposition *on* in English, as in (1b) above.

Figure 1.1: A location event consisting of a Figure object (i.e., cup) located in relation to a Ground object (i.e., book)

Signers express this same spatial configuration primarily through linguistic forms that carry visual-spatial resemblance to the entities and the visual configurations they describe. For example, as shown in (1a), an adult signer of ASL encodes the spatial relation (i.e., on top of) by localizing her right hand (representing the cup) with respect to her left hand (representing the book) in the signing space. Unlike the English preposition "on", the ASL form is analogue to the real spatial configuration and the signer's hands iconically represent the entities involved in the spatial relation (i.e., curved hand for cup and flat hand for book). These forms are called "classifier predicates": The position and the movement of the hand(s) in signing space communicate information about the location and motion of the referent(s) (Supalla, 1982; Emmorey, 2002; Zwitserlood, 2003; Perniss, 2007) and the classifiers themselves are expressed by handshapes that *classify* entities by representing their salient characteristics, predominantly size and shape features (Supalla, 1982; Emmorey, 2002; Zwitserlood, 2003; 2012). Thus, in sign languages, the relative location of referents in sign space and the handshapes used to locate them mostly carry visual resemblances to the features of the events expressed (Perniss, 2007). Further information on other forms available in sign and spoken languages to encode spatial relations will be provided in detail in Chapter 2.

According to Talmy (1985), a motion event has four main internal semantic components: Figure, Ground, Path and Motion.[2] The Ground represents a landmark with respect to which the Figure changes its location. The Ground can be the "Source" (Motion from A), the "Goal" (Motion towards/to A), or the "Surface" on which the Motion takes place. The Motion refers to the movement of the Figure. Path is the trajectory followed by the Figure object in relation to the Ground object. A motion event can also have Manner, which refers to the way in which a Motion takes place such as walking or bouncing (Talmy, 1985).[3] Below I give an example of Motion encoding from a spoken (i.e., English) and a sign language (i.e., TİD) to highlight the difference in encoding motion events in these two modalities. Please note that substantial variation in expressing different components of a

---

[2] In the present study, motion with lower case "m" refers to a type of a spatial event (i.e., motion event) whereas Motion with capitalized "M" refers to a component in a motion event.
[3] A motion event can optionally have a "Cause" that brings about the motion, for example an agent causing an entity to change the location of the Figure by acting on it (e.g., a man rolling the ball down the hill) (see 2.3 in Chapter 2 and 6.1 in Chapter 6 for more details).

motion event has been observed across spoken languages (e.g., Talmy, 1985; 1991; Slobin, 2003), as will be further explained in Chapter 2.

In order to describe the movement of the man shown in Figure (1.2) below, an English speaker can use the verb "roll" to encode how the movement has been realized (i.e., Manner) and the satellite preposition "down" to express the trajectory of the Motion (i.e., Path) (as in 2a). The hill in this example can be considered as the Ground in relation to which the Figure (i.e., man) changes his location.

Figure 1.2: A motion event consisting of a Figure (i.e., man) changing its location with respect to a Ground (i.e., hill) in a certain Manner (i.e., rolling) and along a Path (i.e., down).

(2a) The man is rolling down the hill.   *English*

To encode the same motion event, a TİD signer in (2b)[4] typically localizes the hill (i.e., Ground, her left hand) in the signing space and describes the movement of the man by moving her right hand (with index and middle fingers extended horizontally) rotating (i.e., Manner) down (i.e., Path). Thus, unlike the English sentence in (2a), the signer's linguistic representation of the movement of the man down the hill bears a visual resemblance to the real spatial event.

---

[4] In the whole utterance from which the specific example was taken, the classifier predicate was preceded by lexical signs first for "hill" (i.e., Ground), and then for "man" (i.e., Figure).

(2b)   TİD

"*The man is rolling down the hill.*"

Another difference between sign and spoken languages in terms of spatial language pertains to the fact that while the visual-spatial modality of sign languages allows for the expression of several dimensions of a spatial event in simultaneous way, this is not possible in spoken languages. Semantic elements of spatial events are typically distributed throughout a sentence in spoken languages, which employ linearization and sequencing (Levelt, 1983; Levinson, 2003). In the spoken language example in (2a), the Manner of Motion is expressed in the verb (i.e., roll) and the Path of Motion is encoded in "down", which follows the verb. Moreover, the Figure (i.e., the man) and the Ground (i.e., the hill) are expressed through different linguistic devices that are produced sequentially. However, unlike spoken languages, sign languages allow and make use of simultaneity. In (2b), the TİD signer encodes the Manner and Path of Motion in addition to the Figure within the same classifier predicate and at the same time (her right hand) while also expressing the Ground with her left hand in a different classifier predicate. Thus, in her description, the Figure, Path and Manner of its Motion in addition to the Ground are all expressed simultaneously.

The main focus of the current dissertation is to explore if such modality differences between sign and spoken languages (i.e., the affordance of the visual-spatial, but not the auditory-vocal modality, for visually-motivated, iconic correspondences between linguistic form and the real-world events and for the simultaneous expression of event components) have an effect on the acquisition of spatial language by signing and speaking children. How children learn to express spatial relations between entities has been studied previously for children acquiring a sign language and children

8

acquiring a spoken language. However, in the current study, I aim to go beyond the earlier studies in several ways, which will be the topic of the next section.

1.2 Motivations

Despite the modality difference that has been briefly sketched out in the previous section, the acquisition of many language structures (e.g., phonology, first words, word order, negation, relative clauses, use of pronouns) has been found to follow similar developmental patterns in sign and spoken languages (see Emmorey, 2002 for a review). However, in the domain of spatial language, where sign languages employ iconic linguistic forms – in contrast to the arbitrary forms used in spoken languages – signing children seem to lag behind their speaking peers. This can be attributed to the fact that the linguistic expressions can represent many semantic aspects of the spatial events at the same time, and children acquiring a sign language need to learn to represent these aspects (i.e., Ground, Figure, Manner, and Path) simultaneously, both at the cognitive level (e.g., which aspects go together and how) and at the articulatory level (e.g., simultaneous use of hands).

The results of previous developmental studies on sign languages are, however, equivocal for a number of reasons. First, in most studies, patterns observed in child data are not compared to data from deaf adults on the same tasks (e.g., Supalla, 1982; Schick, 1990; Slobin et al., 2003; Morgan et al., 2008), so it is not clear to what extent and how children's patterns actually differ from adult patterns. Second, some studies have a mixed set of child participants, for instance, some including deaf children with deaf or hearing parents (Engberg-Pedersen, 2003; Tang et al., 2007), or hearing children of deaf parents, whose language development is bimodal bilingual rather than monolingual (Morgan et al., 2008). Different kinds of parental input in these different populations of children (i.e., spoken language from hearing parents, sign language from deaf parents) may lead to different developmental patterns in learning different aspects of languages, which is an issue that still needs further investigation. Third, these studies do not compare data from age-matched speaking and signing children performing the same tasks. Forth, most of these studies focused on the narration of motion events in elicited tasks (Supalla, 1982; Schick, 1990; Engberg-Pedersen, 2003; Slobin et al.,

2003; Tang et al., 2007). Thus, it is not clear to what extent the findings can be generalized over static location events. Moreover, researchers did not differentiate between different types of spatial relations (i.e. viewpoint-dependent ones or topological ones) in these studies. It is important to note that previous studies with speaking children have found a developmental split for the acquisition of these two types of spatial relations (i.e., topological ones expressed with "in", "on", "under" appearing earlier than viewpoint dependent ones expressed with "left", "right", "front", "behind") (Piaget & Inhelder, 1971; Harris, 1972; Shepard & Hurwitz, 1984; Johnston & Slobin, 1979; Choi & Bowerman, 1991; Shusterman & Li, under review). Finally, these studies mainly focus on the acquisition of classifier predicates. However, as will be presented in Chapter 2, signers can employ other locative devices (e.g., relational lexemes), which might show different developmental patterns than classifier predicates.

The studies in this dissertation go beyond the previous studies in the following ways: First of all, I collected data from signing children who acquired TİD natively (i.e., from deaf parents) since birth. Similar data were also collected from native adult TİD signers, age-matched speaking children who are acquiring Turkish natively, and native adult speakers of Turkish by using the same tasks in each language. After I determined the target forms as produced by adults, I compared forms produced by different age groups of children to the ones observed in the adult data in order to see when children reach adult forms in each language. Moreover, in order to see to what extent the findings from previous studies with signing children can be generalized to static location events, the data for the current dissertation included descriptions of both location and motion events. Due to the different developmental patterns found for acquisition of terms for "in, on, under" and "left-right, front-behind" relations in spoken languages (e.g., Piaget & Inhelder, 1971; Johnston & Slobin, 1979), I furthermore differentiated these two types of spatial relations. I also analysed the use of all linguistic devices occurring in the language to encode the location and motion of the referents, rather than focusing on only one type, namely classifier predicates. Finally, most of the sign language acquisition literature has taken English as the spoken language to which sign language development has been compared. Thus, acquisition has not been considered in relation to a typologically different spoken language such as Turkish that uses case-marking postpositions instead of prepositions, that has rich morphology, and

where the expression of motion events differs markedly from English (Berman & Slobin, 1994; Özçalışkan & Slobin, 1999; 2000a, b; 2003; Allen, Özyürek, Kita, Brown, Furman, Ishizuka, & Fujii, 2007).

1.3 Outline of the dissertation

This dissertation examines the effects of modality (visual-spatial versus auditory-vocal) on the acquisition of spatial language by TİD signers and Turkish speakers in three age groups: Younger, (ages ranging between 3;5-6;11), older (ages ranging between 7;2-9;11),[5] & adults. Each chapter is aimed to be able to stand on its own as much as possible. However, the chapters assume that the reader is familiar with the domain of spatial language and with how spatial relations are expressed in spoken and sign languages, in general, as presented in Chapter 2. Note that while the analyses are more similar between the Chapters 4 and 5 investigating different types of locative relations, Chapter 6 takes a slightly different approach to analysing the data due to the different nature of the spatial event, stimuli and its immediate link to previous literature. The comparisons of findings presented in Chapters 4, 5, and 6 are discussed in Chapter 7.

In this chapter, I have outlined the general aim of the dissertation, presented a brief introduction of the spatial domain, and of how signers and speakers encode spatial relations between the entities in different ways. I also provided the motivations for why I have undertaken the current study. I end this chapter by outlining the contents of the following chapters of the dissertation.

Chapter 2 gives an overview of earlier research related to the current study. First, it provides theoretical information regarding the spatial domain as a semantic domain. Then, it expands on the linguistic expression of the spatial domain in spoken and sign languages. I briefly present the variation observed in encoding different types of spatial events across spoken languages, and the linguistic forms observed in sign languages with a wider lens that covers not only classifier predicates but also other forms (e.g., relational lexemes, lexical sign placements, etc.). Since this dissertation is

---

[5] Throughout the dissertation, when indicating the ages of the participants, the first number indicates number of years and the second number following the semicolon indicates number of months.

concerned with the developmental patterns in learning to express spatial relations in two languages that operate in different modalities, I also review previous research conducted with signing and speaking children on the acquisition of location and motion relations, including what is known about the structure and acquisition of spoken Turkish as a typologically distinct language.

Chapter 3 introduces the main research question of the current dissertation and presents the general hypotheses that will be tested throughout the dissertation. This chapter also provides details on the data collection specifying how, where, and from whom the data were collected. Since the stimulus materials vary depending on the spatial domain under investigation (e.g., location and motion), further information on these materials is provided in the relevant chapters. At the end, I present historical, sociolinguistic, and educational background on TİD in addition to an overview of previous research on it.

Chapter 4 presents the analyses of picture descriptions that depict topological spatial relations between entities. These spatial relations include containment, support, and occlusion types. By using a picture description task that shows static scenes with two different objects, I first report the qualitative patterns that emerged in the spatial descriptions of adults and children in TİD and Turkish. In order to see when signing and speaking children produce adult-like expressions, the frequencies of these patterns in the child data are compared to those of adult data in both languages. The results reveal similar developmental patterns for signing and speaking children. Regardless of the modality of language being acquired, children reach the adult patterns in expressing different aspects topological spatial relations at similar ages, thus suggesting no effect of modality in this domain of spatial language. Furthermore, TİD-acquiring children of all age groups could use simultaneous expressions as frequently as their adults – unlike what is reported by previous research.

Chapter 5 investigates the acquisition of the expression of spatial relations that require interlocutors to impose a viewpoint in their relational encodings using a similar picture description task as used for the study reported in Chapter 4. Here the quantitative findings showed different developmental trajectories not only between TİD and Turkish, but also for linguistic encoding of relations of objects configured on the lateral vs. sagittal axis in the pictures. Facilitating as well as

12

hindering effects of modality were observed depending on the axis type for which relational encodings were produced.

Finally, *Chapter 6* investigates developmental patterns for motion event expressions. This is the spatial domain mostly studied in previous research with signing children, and where signing children were reported to omit Grounds in their motion event narrations and to have difficulties in representing Figure and Ground simultaneously (Newport & Supalla, 1980; Supalla, 1982; Engberg-Pedersen, 2003; Slobin et al., 2003; Tang et al., 2007; Morgan et al., 2008). Thus, this chapter focuses on the acquisition patterns of these specific domains (i.e., Figure and/or Ground expression and their simultaneous representation) in TİD signers and Turkish speakers. In this analysis, unlike previous research, no effect of modality was found in terms of Ground omission and signing children of all age groups used simultaneous expressions as frequently as adults.

Chapter 7 summarizes and discusses the results presented in the previous chapters in a comparative way. It also outlines the theoretical implications of different developmental trajectories found for different types of spatial events and relations. This chapter ends with the conclusions that can be drawn from this dissertation and the implications for the acquisition of spatial language as a consequence of the language modality.

CHAPTER 2

Linguistic Expression of Space and Its Acquisition in Sign and Spoken Languages

2.1 Introduction

The aim of the current dissertation is to investigate the effects of modality on the acquisition of spatial language. Therefore, I will explore developmental patterns in the expression of spatial relations in TİD and Turkish within different subdomains of space. To provide further background, I will elaborate in the first two sections of the current chapter on the notion of spatial domain and its subcomponents relevant for the dissertation (2.2), and on how speakers and signers of different languages express different spatial events and relations in section (2.3). Understanding how modality differences between sign and spoken language affects acquisition needs to be situated in relation to what is known about how children learn to tune into language-specific encodings of space. Therefore, I will also review the literature on developmental studies looking at the acquisition of spatial language in spoken and sign languages in section (2.4). I will summarize the information presented in the current chapter in section (2.5).

2.2 Spatial domain

As a semantic notion, the spatial domain covers location and motion (Levinson, 1996).[6] Although Talmy (1985) considers location as a special case of a motion event, his uniform treatment of location and motion becomes insufficient when considering the enormous variation in linguistic devices across spoken languages to express space, since many languages express location and motion through very different linguistic systems (Levinson & Wilkins, 2006). For this reason, I will follow Levinson (1996; 2003), and treat location and motion as two separate subdomains of space (2.2.1 and 2.2.2, respectively) and follow further distinctions that he has introduced within the domain of location.

---

[6] Levinson (1996) also mentions the domain of shape. In the current dissertation, however, I will limit myself to location and motion only.

After giving detailed information on different subdomains of space, I will focus on the ones that will be relevant for the current dissertation.

2.2.1 Location

In Levinson (1996; 2003) location is further divided into two sub-groups; "non-angular" and "angular". The first group (i.e., non-angular) consists of deixis, naming locations (i.e., toponomy), and topology. In deictic expressions, the Figure is encoded as being in a particular region of space, as denoted by a deictic term such as "here" or "there" in English (e.g., the cat is *here*). In naming locations (i.e., toponymy), speakers state that the Figure is at a named location (e.g., the venue of the 17th World Congress of the Deaf is *İstanbul*). In topological expressions, finally, the Figure's location is specified with respect to another entity, the Ground. Topology refers to the part of the spatial domain encoded by English prepositions "in", "on", "at", "near", "between". The Figure and Ground are essentially in the same place, in relations defined by the notions of containment, support, contact, proximity, etc. (see Levinson, 1996; 2003 for detailed information). The second group (i.e., angular) consists of spatial relations in which the Figure and Ground are not in the same place, and the Figure is essentially located by projecting a search domain in some direction from the Ground. In Levinson's terms, this type of spatial relation thus requires the employment of a coordinate system, in which the location of Figure must be established by specifying an *angle* with respect to Ground. In the following lines, I will briefly introduce these coordinate systems, also called "frames of reference", in three main categories (Levinson, 1996; Levinson & Wilkins, 2006).[7]

In the *Intrinsic frame of reference*, the location of the Figure is expressed with respect to the inherent features (e.g., front side) of the Ground. Consider, for example, Figure 2.1. In this spatial configuration, the Figure (i.e., girl) can be localized with respect to the *front* side of the Ground (i.e., motorbike) as in "the girl is in front of the bike". The location of the Figure in this spatial configuration can also be expressed in a *Relative frame of reference*, where the location of the Figure with respect to the Ground is defined from an external viewpoint, usually the viewpoint of the

---

[7] Frames of reference have been studied in different academic disciplines such as psychology, linguistics, psycholinguistics, brain sciences, which make different distinctions (e.g., egocentric versus allocentric; viewer-centered versus object-centered; deictic versus intrinsic) (see Levinson, 1996 for more details).

speaker, but it can also be the addressee or any other third party. Thus, an English speaker may describe the spatial setting in Figure 2.1 as "the girl is to the left of the motorbike". The location of the Figure with respect to the Ground is indicated from the viewpoint of the viewer, and the viewer's own body coordinates are mapped onto the Ground. Therefore, the search domain is projected off the corresponding side of the Ground in order to locate the Figure. In this example, "leftness" is, then, secondarily derived through mapping the viewer's body coordinates onto the motorbike. The relative frame of reference expresses "viewpoint-dependent" spatial relations, and will be the main focus of Chapter 5. Finally, it is possible to employ an *Absolute frame of reference* to encode the spatial relation between the girl and the motorbike. Here the location of the Figure object is defined with respect to absolute and conventionally fixed bearings such as geographical landmarks or cardinal directions. For example, the location of the girl in Figure 2.1 can be expressed as "the girl is to the *West* of the motorbike" if West happens to be in the direction of your left as the viewer of the picture. This expression will not change depending on the location or the viewpoint of the person describing this scene in this frame of reference.

Figure 2.1: Spatial setting with a Figure (i.e., girl) and a Ground (i.e., motorbike)

As highlighted in grey in Figure 2.2 below, this dissertation is concerned with expressions of topological relations (e.g., that can be expressed with "in", "on", "under" in English, Chapter 4) as well as those that require angular specification with relative frame of reference (e.g., that can be expressed with "left", "right", "front", "behind" in English, Chapter 5).
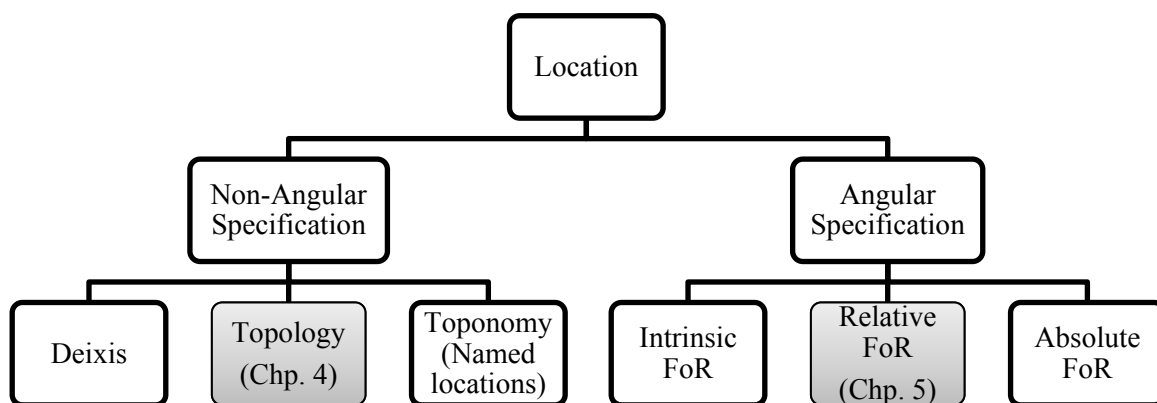
Figure 2.2: A schematic overview of the semantic subfields in the domain of spatial location specification. This adapted version is from Levinson (2003). FoR stands for Frames of Reference. Subdomains relevant for the current dissertation are highlighted.

2.2.2 Motion

Figure, Ground, Path and Motion are proposed to be four main semantic components of a motion event (Talmy, 1985), as explained in Chapter 1. A motion event can optionally have a Manner and Cause. Please note that motion event expressions that will be analyzed in the current dissertation (Chapter 6) do not include Cause.

2.3 Linguistic expression of space

The ability to use language to talk about space and denote the spatial relations between entities is a characteristic of all humans that differentiates us from other species (Jackendoff, 1996). There is, however, substantial variation across different spoken languages, and expression is moreover radically different between sign and spoken languages (Emmorey, 2002; Talmy, 2003; Levinson & Wilkins, 2006). In the current section, I will present general information about how different subdomains of space are expressed across spoken (2.3.1) and sign languages (2.3.2). Then, I will highlight the influences of modality (visual-spatial versus auditory-vocal) in the expression of space in (2.3.3).

2.3.1 Linguistic expression of space across spoken languages

Acknowledging the variation in spatial encoding possibilities in spoken languages is necessary to compare expressions in sign languages to those in spoken languages. Unfortunately, in the previous literature where sign and spoken languages are compared, English has been taken as the main spoken language to which sign languages are compared, thus disregarding the substantial variation that exists in the expression of location and motion events across different spoken languages (Berman & Slobin, 1994; Levinson & Wilkins, 2006).

This section presents an overview of studies that show the variation in encoding location and motion in different spoken languages. I first focus on the linguistic expressions that encode topological spatial relations. Then, I move on to the other group of spatial relations whose encoding requires the use of frames of reference. Finally, I provide information on how different languages encode different components of a motion event.

i) Location: Topology

Linguistic devices for encoding a spatial relationship between Figure and Ground exhibit a great deal of variation across spoken languages, ranging from the use of elements from small inventories of closed-class forms (e.g., adpositions, case markers) to elements of large inventories of open-class forms (e.g., verbs, positionals) (Levinson & Wilkins, 2006; Evans & Levinson, 2009). For example, one language, Tiriyo, has a rich set of spatial adpositions while another language, Tzeltal has only one for this purpose. On the other hand, Tiriyo has only one locative verb available for its basic locative construction, but Tzeltal has a large set of verbs for the same purpose.

Many spoken languages use adpositions to encode the spatial relation between entities. Adpositions include prepositions (e.g., "in", "on", "under" in English) or morphological case markers, which mostly occur as postpositions (e.g., "-de/da" in Turkish). For example, the English preposition "on" below indicates that the Figure (i.e., cat) is in a support/contact type of spatial relation with the Ground (i.e., chair).

18

(1a)   The cat is *on* the chair.   *English*

In many morphologically complex languages, case markers as postpositions can be attached to the noun that indicates the Ground. For example, in Turkish, a general locative case marker ("-de/da" - *at*) can be attached to the noun expressing the Ground (1b) or to a spatial noun specifying a spatial aspect of the Ground noun (e.g., üst - *on top*; alt - *under*), which conveys in a more semantically specific way the nature of the spatial relation between the Figure and the Ground (1c). The spatial noun is further linked to the Ground noun with genitive and possessive case markers.

(1b) Sandalye+*de*   kedi   var.   *Turkish*
     chair+LOC   cat   there_is
"There is a cat on the chair." (lit. There is a cat at the chair)

(1c) Sandalye+nin   *üst+ün+de*   kedi   var.   *Turkish*
     chair+GEN   on+POSS+LOC   cat   there_is
"There is a cat on the chair." (lit. There is a cat at the top of the chair.)

In addition to the forms mentioned above, spoken languages can use open-class linguistic forms that provide information about the shape or orientation of the Figure object, sometimes in combination with another linguistic device that encodes the location of the Figure with respect to the Ground (e.g., locative verbs, posture verbs, and positional verbs). For example, Tzeltal speakers use positionals that incorporate information about the shape of the Figure in their locative expressions (Brown, 1994). In (2) below, "ta" serves as a general locative marker, but it needs to be employed with positionals such as "waxal" that is used for tall, oblong-shaped containers (e.g., bottle) standing canonically. If it were a wide flat object lying on a surface, then the preferred positional would be "lechel" instead of "waxal".

(2) Kajal+0   *waxal*   ta   tz'ante'   ala   limete.   *Tzeltal* (Brown, 2004)

   Mounted_on+ABS3   standing   PREP   beam   DIM   bottle

   "*The bottle is standing on the beam (above us).*"

Unlike adpositions, positionals do not typically encode the nature of the spatial relation (e.g.,

containment, support), and the specific nature of the relation must be inferred from the semantics of

the predicate that provides detailed information about the shape or orientation of the Figure and/or

from general world knowledge.

Languages also provide different ways of grouping spatial configurations, and highlight

different features of spatial relations (Bowerman 1989; 1996a, b). For example, for English speakers,

"the cup is *on* the table"; "the picture is *on* the wall"; and "the ring is *on* the finger" while Dutch

speakers use three different prepositions for these cases (i.e., "op", "aan", "om", respectively).

Similarly, English and Korean categorize spatial relations differently: In expressing support or

containment type of spatial relations, English does not consider if a Figure object is "tightly"

contained in or interlocked on a Ground object. However, Korean highlights tight vs. loose

distinctions in the expression of spatial relations (with predicates *kkita* and *nehta/nohta*, respectively)

(Bowerman, 1996a, b).

   ii)   Location: Frames of reference

Previous research has shown that languages differ in the availability of or preference for frames of

reference for describing spatial relations (Pederson, Danzinger, Wilkins, Levinson, Kita, & Senft,

1998; Levinson, 2003; Levinson & Wilkins, 2006). Some languages employ predominantly one only,

and some use two, while some others employ all three (Levinson, 1996). There have been some

generalizations made about the distribution of use of frames of reference across languages. Generally

speaking, the intrinsic frame of reference is nearly always present, and can co-exist either with the

relative or absolute frame of reference. For example, in English, it is possible to describe the location

of the girl with respect to the motorbike in Figure 2.1 in two different ways: English speakers can use

either the intrinsic (e.g., "the girl is to the front of the motorbike") or the relative frame of reference

(e.g., "the girl is to the left of the motorbike"). However, use of the absolute frame of reference in a language tends to be exclusive of using relative one, and vice versa (Majid, Bowerman, Kita, Haun, & Levinson, 2004; Levinson & Wilkins, 2006). Bohnemeyer (2011) has recently shown evidence for "referential promiscuity" in some languages (e.g., Yucatec Maya), which refers to the unrestricted availability of all three spatial frames of reference and the lack of a default perspective.

When using a relative frame of reference, speakers describe the spatial relation between entities "relative" to their own viewpoint or to that of their addressee, and interlocutors should keep track of their conversation partners' viewpoint for successful interaction. Early studies on the use of viewpoint in spatial descriptions have mixed results: Some of them report the primacy of adopting an (speaker's) egocentric viewpoint (Piaget & Inhelder, 1971; H. Clark, 1973a; Miller & Johnson-Laird, 1976; Levelt, 1989), while some others have found that speakers prefer to adopt the view of their addressee, and indicate them in their spatial descriptions such as "on your left/right" (Schober, 1993; Mainwaring, Tversky, & Schiano, 1996; Mainwaring, Tversky, Ohgishi, & Schiano, 2003).

Spoken languages show variation with respect to semantics of locative particles encoding viewpoint-dependent spatial relations. Some languages such as Jaminjung, Warrwa, and Arrernte have terms corresponding to "left" or "right", which do not encode any spatial information, but refer to body parts only while English speakers, for example, use these terms in a relative sense to refer to the spatial relations between entities (Levinson & Wilkins, 2006). Tamil demonstrative "itu - *this*" refers to "the left on", while "atu - *that*" indicating "the right one", thus distinguishing "left-right" specification in demonstratives (Levinson, 2003). In contrast to English, Finnish has several postpositions to encode "in front of" or "behind" type of spatial relations, thus allowing for finer discriminations of this type of spatial organization (Nikkane, 2003; Coventry & Frias-Lindqvist, 2005).

iii) Motion

Previous research has shown that languages differ drastically from one another in how they distribute semantic elements of a motion event (e.g., Path and Manner) both at the lexical and syntactic levels (e.g., Allen et al., 2007; Naigles, Eisenberger, Kako, Highter, & McGraw, 1998; Papafragou, Massey,

& Gleitman, 2006; Slobin, 1996; Talmy, 1985; Furman, 2012).

To classify languages with respect to how they distribute features of motion events into linguistic units, Talmy (1985; 1991) takes Path information as the core element, and suggests two main categories of languages: "Verb-framed Languages", such as Turkish and Spanish, conflate Motion and Path in the main verb and express Manner in a separate element (3a). On the other hand, "Satellite-framed Languages", such as English, conflate Manner and Motion in the main verb and express Path in *satellites*, which are elements from the closed-class subsystem of the language (3b). Furthermore in languages that use case markers, the verbs of motion are related to the Ground nouns by attaching ablative (3a), dative or locative case markers to the Ground nouns as in Turkish (see 6.4.1 in Chapter 6 for further information for Turkish).

(3a) Kaya   yuvarlan+arak   tepe+den   *in+di.*   *Turkish*
       Rock   roll+GER   hill+ABL   descend+PAST
       Figure   *Manner*   Ground   *Path+Motion*
"The rock rolled down the hill."

(3b) The rock   *rolled*   down   the hill.   *English*   (Talmy, 1985)
       Figure   *Manner + Motion*   *Path*   Ground

2.3.2 Linguistic expression of space across sign languages

Sign languages use space to describe space, and in this way they differ radically from spoken languages (Emmorey, 2002; Talmy, 2003). The modality of sign languages allows an analogue mapping of spatial relations between entities onto the physical space (i.e., the signing space) in front of the signer's body through the use of the hands. Nevertheless, variation in spatial expressions has also recently been noted across sign languages (Perniss, Zwitserlood, & Özyürek, in press; Nyst, 2007). In the following section, I will, first of all, describe the linguistic forms that are used to encode location and motion in sign languages and how they vary in terms of the degree of the iconic/analogue

mapping of space to space in (2.3.2.1). Then, I will give an overview of how different frames of references and viewpoint are expressed by signers in section (2.3.2.2).

2.3.2.1 Linguistic forms that encode location and motion in sign languages

While describing different types of spatial events (i.e., location and motion), signers show a strong preference for the use of signing space to indicate spatial relationships between entities in iconic ways, e.g., through the use of the classifier predicates, both for location and motion encoding (Emmorey, 2002; Perniss, 2007). However in sign languages, other linguistic devices can also be used such as Size and Shape Specifiers (SASS), relational lexemes, lexical sign placements (Özyürek, Zwitserlood, & Perniss, 2010; Perniss et al., in press) and lexical verbs. Compared to spoken languages, less variation in the range of linguistic devices has been reported across sign languages, which has been attributed to visual-spatial properties of the modality (Talmy, 2003; Sandler & Lillo-Martin, 2006; Aronoff, Meir, Padden, & Sandler, 2003). However, some recent studies have found more variation than previously reported (Nyst, 2007; Arık, 2011; Perniss et al., in press). Below I will explain each of these devices in more detail.

i) *Classifier predicates*

Although their status and structure are debated among sign language researchers (Emmorey, 2003), the general agreement is that classifier predicates are morphologically complex structures, and contain at least one meaningful hand configuration and one meaningful movement (see Zwitserlood, 2012 for an elaborate discussion). In a classifier predicate, the position and/or the movement of the hand(s) in signing space communicate information about the location and/or motion of the referent(s) (Supalla, 1982; Emmorey, 2002; Zwitserlood, 2003; Perniss, 2007). The classifiers themselves are expressed by handshapes that *classify* entities by representing their salient characteristics, predominantly size and shape features (Supalla, 1982; Emmorey, 2002; Zwitserlood, 2003; 2012). An example of a classifier construction used to describe a location event is given in (4a) below for TİD. As shown in the 3rd still, the signer expresses the spatial relation between the Figure (i.e., pencil) and the Ground (i.e., paper) in classifier predicates. The classifier on her right hand represents the long, elongated shape of

23

the pencil; the classifier on her left hand represents the flat surface of the paper. The signer localizes these classifiers in the signing space in a way that reflects the locations of the pencil and the paper as shown in the picture. Note that before localizing the Figure and the Ground in the signing space, she introduces them by their lexical signs (see the 1st still for the Ground and the 2nd still for the Figure).

(4a)   *TİD* (Sümer et al., 2012)
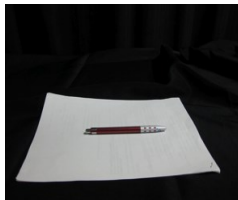
LH:			CL(flat)$_{loc}$
RH:	PAPER	PENCIL	CL(long)$_{loc}$

"There is a paper. There is a pencil. The pencil is on the paper."

Note that the signer not only encodes the location and shape of the entities, but also their orientation (i.e., horizontal for both the paper and the pen). If the pen were upright in the picture, then the signer would likely have used a different orientation of her right hand accordingly. As is obvious in this example, the use of classifier predicates affords a highly iconic and analogue representation of the locations of entities in addition to providing information about them such as their shape and orientation (Perniss, 2007; Perniss et al., in press). In this way, classifier predicates are somewhat similar to Tzeltal positionals which provide detailed information about the Figure object in terms of its size, shape, and orientation (e.g., "waxal" for oblong-shaped standing container or "lechel" for flat-bottomed object lying on its flat surface) (Brown, 1994; Ameka & Levinson, 2007; Bohnemeyer & Brown, 2007; see Grinevald, 2006 for further information). However, sign languages afford such representations in a visually iconic way while spoken languages do not. Moreover, spoken languages such as Tzeltal provide shape/positional information mostly for the Figure object, but not for the

Ground objects – unlike classifiers in sign languages that provide information on both (Talmy, 2003).[8] Classifier predicates can also be used to describe the Motion of referents. In (4b) below, a TİD signer describes a short video in which a man is rolling down a hill. She first introduces the Ground (i.e., rocky mountain) by lexical signs in TİD (1st and 2nd stills). Then, she localizes the Ground through lexical sign placement (3rd still). In the 4th still, she introduces the man by a lexical sign (right hand of the signer). Finally, she describes the Motion of the man by rotating her right hand downward with two extended and horizontally-oriented fingers (4th still, her right hand). In this description, the signer combines the classifier for the man with a Motion morpheme, where she expresses both Manner of Motion (i.e., roll) and Path of motion (i.e., down).

(4b)

	1	2	3	4		*TİD*
LH:	STONE	MOUNTAIN	----------------- HOLD -----------------			
RH:	STONE	MOUNTAIN	MAN	CL(man)roll_down		

"There is a rocky mountain. There is a man. He is rolling down the mountain."

In many sign languages, objects that are considered flat or to have flat surfaces (e.g., paper) are classified with a flat handshape (4a). Although some overlaps exist, each sign language has its own set of classifiers. For example, in ASL, signers classify vehicles with , but TİD signers prefer a

---

[8] Note that in spoken languages, too, information about the shape of the Ground can be provided, but it is more limited (Jackendoff, 1992; Levinson, 2003).

flat handshape. Classifiers have been categorized into different subtypes (see Zwitserlood, 2003; Schembri, 2003). The examples in (4a) and (4b) show the use of *entity classifiers*. These classifiers can represent both animate (e.g., 4th still, right hand in 4b) and inanimate (both hands in 4th still of 4a) objects. The predicates formed with entity classifiers are intransitive (i.e., no object argument) and are usually non-agentive (4a), but can be agentive (4th still, right hand in 4b), as well (Schick, 1990; Benedicto & Brentari, 2004; Zwitserlood, 2012). Another major type of classifiers is *handling classifiers*, which represent the handling or the manipulation of an object usually (but not necessarily) by an animate referent. Classifier predicates with handling handshapes are agentive and transitive constructions with a subject (i.e., agent) and an object argument (i.e., patient). This dissertation concerns intransitive location and motion events, and thus it will mostly focus on predicates with entity classifiers.

ii) *Size and Shape Specifiers (SASSes)*

Signers can also represent entities by means of Size and Shape Specifiers (SASSes) that trace the outline of the referent or indicate its dimensional extensions (Supalla, 1982; Engberg-Pedersen, 1993; Zwitserlood, 2003).[9] These forms are typically inanimate predicate adjectives used to describe a nominal referent (Klima & Bellugi, 1979).

Apart from specifying certain properties of referents, SASSes can be used to localize referents in the signing space. In a previous study on locative expressions in TİD, Özyürek et al. (2010) observed that TİD signers occasionally combined SASSes with locative predicates to localize referents. For example, in (5), a TİD signer introduces the Ground (i.e., the wall) by a lexical sign articulated in front of her (2nd still). Then, she introduces the Figure (i.e., the paintings) with a lexical sign (3rd still), and the localization of the paintings is subsequently done by SASSes articulated simultaneously (4th still) next to each other at the previously indicated location of the wall.

---

[9] SASSes have been divided into two subtypes: static SASSes and tracing SASSes (see Zwitserlood, 2003 for a detailed discussion on differences and similarities between these two types). Tracing SASSes are also known as extent classifiers, surface classifiers, perimeter classifiers, and static SASSes as object classifiers, class classifiers, whole entity classifiers, semantic classifiers, and descriptive instrumental classifiers. In this dissertation, static SASSes are considered not as a separate class, but as entity classifiers.

(5)	1	2	3	4	*TİD* (Özyürek et al., 2010)[10]
LH:	STONE	WALL$_{loc}$	PAINTING	SASS(rectangle)$_{loc}$	
RH:	STONE	WALL$_{loc}$	PAINTING	SASS(rectangle)$_{loc}$	

"There is a stone wall. There are two paintings on it."

iii) Relational lexemes

Although they have attracted less attention, sign languages also have dedicated signs to encode spatial relations in more categorical rather than analogue and gradient ways – similar to prepositions such as "in", "on", "left", "front" in English (Emmorey 2002 for ASL; Perniss 2007 for German Sign Language [DGS]; Arık & Wilbur 2008; Özyürek et al., 2010; Sümer, Zwitserlood, Perniss, & Özyürek, 2013a; Zwitserlood, Sümer, & Özyürek, 2013 for TİD). Following Arık (2009) and Perniss et al. (in press), I call these signs *relational lexemes*, although they are often called "prepositions" in the literature (Emmorey, 2002), thus considering them as akin to prepositions in English. However, the status of relational lexemes in sign languages as prepositions has been debated, and they are suggested to be predicative in nature (Johnston, Vermeerbergen, Schembri, & Leeson, 2007; Zwitserlood et al., 2013). Relational lexemes are reported to be used less frequently, compared to classifier predicates (Emmorey, 2002 for ASL; Perniss, 2007 for DGS; Arık & Wilbur 2008; Özyürek et al., 2010; Arık, 2013b; Sümer et al., 2013a; Zwitserlood et al., 2013 for TİD; Johnston et al., 2007 for Irish Sign Language (IrSL) and Flemish Sign Language (Vlaamse Gebarentaal, VGT)).

In contrast to classifier predicates, relational lexemes are fixed forms with a specific meaning

---

[10] I have taken only the stills from the original example that are relevant here.

that categorically indicate a type of spatial relation. These forms still typically exhibit some iconicity with respect to encoding the spatial relation of a Figure with respect to a Ground, but they do not communicate shape and size information about these entities. Moreover, they are less specific in providing information about the exact position of referents in space than classifier predicates and localized SASSes. Rather, they are considered as categorical expressions similar to the spatial terms in spoken languages. For example, a TİD signer in (6a) shows the location of the Figure (i.e., cat) by using the TİD relational lexeme for "under" (see 3rd still). Similarly, in (6b), another TİD signer encodes the location of the Figure (i.e., cake) and the Ground (i.e., box), positioned on the lateral axis in the picture, with a relational lexeme meaning "right" (3rd still). These relational lexemes are used for all types of objects that are located "under" or "right" of another object – regardless of their shape, size, or orientation. In other words, the handshapes in these devices do not convey specific information about the entities (such as their size and shape) involved in the spatial configuration – unlike classifier predicates.
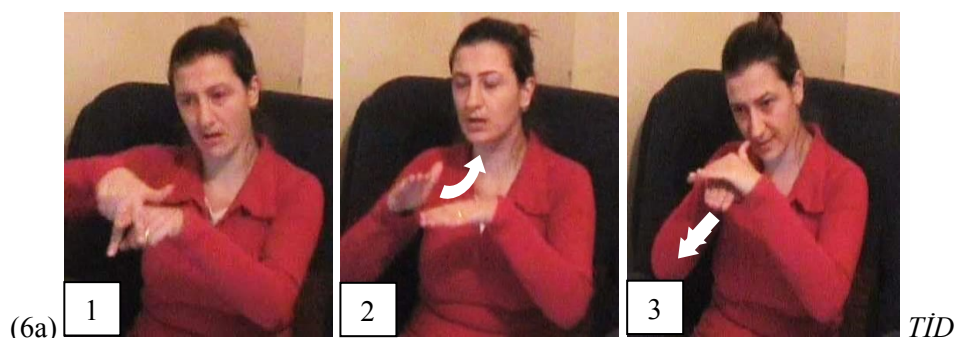
	1	2	3	
(6a)				TİD
LH:	HORSE	CAT	UNDER	
RH:	HORSE	CAT	UNDER	

"There is a horse. There is a cat. It is under the horse."

	1	2	3	TİD
LH:	RECTANGULAR	-------- HOLD -------	RIGHT	
RH:	RECTANGULAR	CAKE	RIGHT	

"There is a rectangular-shaped object. There is a cake. The cake is to the right of the rectangular-shaped object."

iv) Lexical Sign Placement

In some sign languages, in addition to classifier predicates and SASSes, another linguistic device for expressing object locations has been the localization of lexical signs for entities (de Beuzeville, Johnston, & Schembri, 2009 for Australian Sign Language [Auslan]; Nijhof & Zwitserlood, 1999 for Sign Language of the Netherlands [NGT] ; Özyürek et al., 2010; Sümer et al., 2012 for TİD). In these forms, locative relations are expressed through direct placement of the noun sign for the Figure at a particular location in signing space in relation to the Ground (Özyürek et al., 2010; Perniss et al., in press). In example (7), the signer localizes the boats on the sea by articulating two lexical signs for "boat" (3rd and 4th stills) in relation to the location where the sea has been localized (2nd still). Note that in these constructions, localized lexical signs also express the locations of the entities in an analogue way, as is the case with classifier predicates.

(7)

	1	2	3	4	
LH:	SEA	SURFACE_loc	BOAT_loc	BOAT_loc	
RH:	SEA	SURFACE_loc	BOAT_loc	BOAT_loc	

TİD (Özyürek et al., 2010)[11]

"There is sea here. There is a boat here and there is a boat here on its surface."

v) Lexical verbs

In addition to classifier predicates, signers can encode Motion through the use of lexical verbs (Zwitserlood, 2003). In such predicates no classifier regarding the Figure is incorporated. As exemplified in (8) below, a TİD signer describes a short vignette in which a triangle hops around a tree and then moves toward the right of, and off, the screen. In her description, the signer first introduces the Ground (i.e., tree, 1st still) and the Figure (i.e., triangle, 2nd still) by their lexical signs. Then, she encodes the Motion (with Path and Manner information) of the Figure in a classifier predicate (3rd still). Then, she describes leaving the scene first using a classifier predicate (4th still), and then with a lexical verb meaning "go" in TİD (5th still).

---
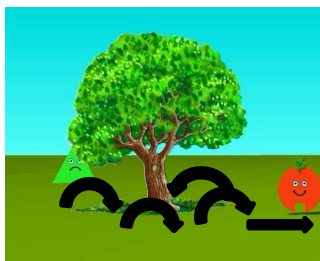
[11] I have taken only the stills from the original example that are relevant here.

(8)

	1	2	3	4	5	*TİD*
LH:	TREE	TRIANGLE	------- HOLD -------			
RH:	TREE	TRIANGLE	CL(triangle)$_{hop\_up}$	CL(triangle)$_{walk}$	GO	

"There is a tree. There is a triangle. It hops around [the tree]. It walks. It goes."

2.3.2.2 Expression of frames of reference and viewpoint in sign languages

When compared to spoken languages, the number of studies looking at whether and how signers employ frames of reference in sign languages is relatively low (Emmorey, 1996; 2002 for ASL; Arık, 2006; 2008 for TİD; Perniss, 2007 for DGS; Marsaja, 2003; de Vos, 2012 for Kata Kolok). However, as it turns out, there are modality-specific differences between how sign and spoken languages express frames of reference, as will be explained below in more detail (Emmorey, 1996; Perniss, 2007).

Intrinsic frame of reference: In sign languages, it is possible to refer to intrinsic properties of objects through classifiers. As exemplified in (9), the tip of the index and middle fingers of ASL vehicle classifier ( ) refers to the front of a car. To describe the illustration in (9), ASL signers orient the fingertips of the vehicle classifier (i.e., Ground) towards the tree (i.e., Figure), as in (9a) or in (9b).
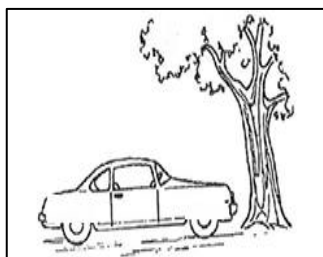
(9a)   (9b)   *ASL* (Emmorey, 1996)

LH: CL(vehicle)$_{loc}$ LH: TREE

RH: TREE   RH: CL(vehicle)$_{loc}$

Relative frame of reference: This frame of reference requires the viewpoint of an observer (e.g., a third party who may be the speaker or the addressee) in addition to a Figure and a Ground object. In sign languages, spatial descriptions are primarily expressed from the signer's viewpoint (Emmorey, 1996; Emmorey, Klima, & Hickok, 1998; Perniss, 2007; Pyers, Perniss, & Emmorey, accepted), and rarely use the addressee viewpoint (Emmorey & Tversky, 2002; Emmorey et al., 1998; Pyers et al., accepted). Emmorey (1996) reports that ASL signers almost always expressed their own view of the picture with the car and the tree above. Please note that the female signer in (9a) adopts her own viewpoint, thus describing the picture as she sees it, while the male signer in (9b) adopts the addressee's viewpoint. However, Emmorey (1996) also notes variability in viewpoint preference among these signers to describe the location of the entities which are configured on a sagittal axis (i.e., "front" or "behind"). In such cases, ASL signers sometimes preferred addressee-viewpoint, as well. Although the spatial descriptions of these ASL signers do not contain any overt linguistic cues indicating the viewpoint being adopted, consistency in their selection is taken to be indicative of a certain viewpoint (Emmorey, 1996).

ASL expressions shown in the examples (9a) and (9b) above can be translated as "the tree is in front of the car" without referring to any viewpoint and just focusing on the intrinsic features of the car. However, it is also possible to interpret these expressions from a certain viewpoint since signers see their articulators which are located "relative to" each other in space, such as "the tree is to the left/right of the car" (Emmorey, 1996). Similar results have been reported for spatial descriptions

elicited in TİD, as well (Arık, 2008). In a study where TİD signers were asked to give spatial descriptions for intrinsically-featured objects which are statically located either on the lateral or sagittal axis, it was found that TİD signers mostly expressed the spatial relations using forms that combined intrinsic and relative frames. So, similar to spoken languages, sign languages use different frames of references. Unlike spoken languages, the modality of sign languages allows signers to use intrinsic and relative frame of reference at the same time. Thus, expression of two frames of reference simultaneously in sign languages underlines a very modality-specific feature of sign languages in this domain.

Taking a viewpoint to specify a spatial relation by the signers, however, does not tell us anything in itself about how conventionalized the use of a relative frame of reference is in the language unless the signers are consistent in their viewpoint preference, and the addressees are also able to understand the described spatial relation through the same viewpoint assumed by these signers. However, linguistic and non-linguistic factors influencing the choice of viewpoint in a relative frame of reference have not been determined yet, and frame of reference ambiguities can abound in sign languages (Emmorey, 1996; Pyers et al., accepted). For Nicaraguan Sign Language (NSL), which is an emerging sign language, it has been shown that the utterances of first cohort signers, who acquired the language in its early stages, are ambiguous with respect to "left-right" encoding: Objects on the left side are represented sometimes with signs articulated on the left, and sometimes on the right in their descriptions for an addressee. However, the signers of the second cohort, who acquired a more complex form of the language 10 years later, tend to be consistent in this domain (Senghas, 2003). Thus, this change observed in NSL indicates that mapping the spatial relations between the entities onto signing space is more than "copying" these entities by hands in the signing space, and it takes time to conventionalize a viewpoint for a successful communication (i.e., between signer/speaker and addressee). Moreover, the difference observed between the two cohorts in the linguistic encoding of "left-right" is reflected in differences on spatial cognition tasks (Pyers, Shusterman, Senghas, Spelke, & Emmorey, 2010).

Absolute frame of reference: This frame of reference is based on cardinal directions or geographical landmarks, and does not anchor on any viewpoint. Use of this frame of reference by signers has been reported for Kata Kolok (Marsaja, 2003; Zeshan, 2006; de Vos, 2012) and Inuit Sign Language (Schuit, Baker, & Pfau, 2011). Studying narratives elicited in Kata Kolok, de Vos (2012) reports that in classifier constructions, Kata Kolok signers keep their signs constant with respect to the absolute direction of the story events. In Inuit Sign Language, locations in signing space reflect the use of absolute frame of reference, especially through the use of pointing signs (Schuit et al., 2011; de Vos, 2012).[12]

As reported for spoken languages, different frames of reference can co-exist in a sign language although signers may prefer to use one or two more frequently. However, unlike spoken languages, using two reference frames in a spatial description simultaneously is possible only in sign languages (Emmorey, 1996, 2002; Arık, 2008). As mentioned earlier, spoken languages generally do not make use of absolute frame of reference if they use relative frame of reference, and vice versa (Majid et al., 2004; Levinson & Wilkins, 2006), although its co-occurrence has been reported for Kata Kolok (de Vos, 2012). [13] However, please remember that Bohnemeyer (2011) suggested that some languages are referentially promiscuous such as Yucatec Maya, which has all three spatial frames of reference and lacks a default perspective.

2.3.3 Consequences of the modality on the expression of space

The studies and the examples presented above clearly indicate that both sign and spoken languages display cross-linguistic similarities and differences. In the current section, I will briefly focus on the

---

[12] Emmorey (1996; 2002) also reports the employment of an absolute frame of reference in ASL by using specific signs to encode cardinal directions (i.e., East, West, North, South). However, these signs are not anchored on real geographical West or North since ASL signers do not direct these signs towards the real cardinal directions. This is what we would expect from Kata Kolok signers, for example, where they point to the real world locations of referents to refer to them, thus using a true absolute system. Thus, ASL signers use these cardinal terms similar to English speakers, without keeping track of the real cardinal directions (e.g., being able to say "North" without being able to point to the North).

[13] The use of relative frame of reference was reported for a narration of an event (i.e., a motorbike accident). De Vos (2012) suggests that the use of the relative frame of reference was motivated by the lack of an eye-witness account of the event.

comparison of the linguistic means of expression of location and motion events in spoken and sign languages.

According to Talmy (2003), both spoken and sign languages have subsystems to represent spatial relations between entities. They mostly include closed-classed linguistic elements (e.g., adpositions, inflection forms, conjunctions, etc.) in spoken languages and classifier predicates in sign languages. In both systems, there are basic elements which refer to specific elements of a spatial event, and can be combined systematically for the description of spatial scenes.

As to the differences in how space is expressed by signers and speakers, Talmy (2003) states that the representation of space through a classifier system in a sign language is more analogue to the spatial event it represents compared to representation with the linguistic devices of spoken languages. He suggests that due to this property, the classifier system of sign languages has more basic elements, categories, and elements per category in the linguistic realization of the space. For example, ASL signers' descriptions of motion events have been found to include more Motion, Path, and Manner information compared to English speakers (Taub & Galvan, 2001). Moreover, the visual-spatial modality of sign languages affords more distinct elements and categories to be represented in a simultaneous way. Similarly, Emmorey (2002) argues that linguistic forms that convey spatial relations in ASL have "gradient" and "analogue" properties rather than categorical ones such as with the closed-class forms of spoken languages. Moreover, the fine-grained details of a spatial configuration (e.g. "downward and slightly to the right" or "forward but also slightly upward") can be expressed in a sign language through finer distinctions (Emmorey, McCullough, Mehta, Ponto, & Grabowski, 2013). The closed-class system of spoken languages cannot express such fine-grained details.

Even though these views capture the main differences between sign and spoken languages, some caveats are in order. First of all, as we have seen, sign languages have a variety of other devices such as relational lexemes or lexical verbs (described above) that encode spatial distinctions in varying degrees of iconicity (Özyürek et al., 2010; Perniss et al., in press). Secondly many spoken languages other than English do make more semantically specific distinctions (e.g., encoding information about the Figure in Tzeltal) that are in some ways more akin to sign languages.

Furthermore while many semantic components can be expressed simultaneously in sign languages due to the affordances of the modality, spoken languages express these components in a sequential and linear way.

The studies mentioned so far draw their conclusions from adult data, and not much is known about how signing and speaking children tune into the modality-specific encodings of their target languages. In the next chapter, I will provide information on the developmental studies with signing and speaking children.

2.4 Acquisition of spatial language

As outlined in Chapter 1, previous research has found similar acquisition patterns in sign and spoken languages such as the emergence of babbling (Boyes Braem, 1990; Pettito & Marentette, 1991; Marentette & Mayberry, 2000), the emergence of two-word utterances (Newport & Meier, 1985, Pizzuto, 2002), negation (Newport & Meier, 1985; Lacy, 1972; Ellenberger, Moores, & Hoffmeister, 1975), the use of deictic references (Petitto, 1983; Hoffmeister, 1977), anaphoric pronouns (Hoffmeister, 1977; Newport & Meier, 1985), and narrative discourse development (Morgan, 2000, 2002; Morgan & Woll, 2003; Rathmann, Mann, & Morgan, 2007). However, such equality has not been reported for the acquisition of spatial language. In the following sections, a very brief literature review will be presented about the acquisition of spatial language by speaking children learning different languages (2.4.1) and by signing children (2.4.2).

2.4.1 Acquisition of spatial language in spoken languages

The question of how and why children have the ability to acquire their language has intrigued many researchers for many years. Within the domain of spatial language acquisition, two main guiding principles have been put forward in the literature.

The first principle indicates that nonverbal conceptual development about space plays a major determining role in learning spatial relations (e.g., Johnston, 1985; 1988). The evidence for this claim comes from studies conducted in a variety of spoken languages: English (E. Clark, 2004; Johnston &

Slobin, 1979; Tomasello, 1987), German (Grimm, 1975), Hebrew (Dromi, 1979), Afrikaans (Vorster, 1984), Italian, Serbo-Croatian, Turkish (Johnston & Slobin, 1979). Their results indicate that children's acquisition of locative expressions follows a similar sequence in which "in", "on" and "under" type of spatial relations appear early in the speech of children (E. Clark, 1973; Johnston & Slobin, 1979; Johnston, 1985; 1988; Tomasello, 1987; Bowerman & Choi, 2001; Loewenstein & Gentner, 2005). These are followed by "next to", "between", "front-behind", and "left-right" (Piaget & Inhelder, 1971; Johnston, 1984; 1985; 1988; Durkin, 1980; 1981; Bowerman, 1996a, b). These findings suggest that locative terms are apparently learned at predictable ages and in a predictable order. Thus, it must be the result of general cognitive development, which is a strong drive that determines the similar process of acquisition of these terms in different languages.

Similar universal tendencies were also observed for the expression of motion event components in the acquisition of different languages. For example, by comparing narratives produced by adults and children (4 to 10 years old) in four different spoken languages (English, French, German, Mandarin Chinese), Hickmann (2003) has shown strikingly similar developmental progression in which children showed a tendency for omitting Grounds in their narratives. She also reports that learning to express them in an adult-like way is a late aspect of language development which may take until 10 years of age. In another study, 5-year old children acquiring Turkish were found to omit the expression of Ground objects while describing vignettes showing caused motion events (Furman, 2012). Allen et al. (2007) also found that children (mean age: 3;8) acquiring English, Turkish, or Japanese omitted either Path or Manner in their motion event descriptions. There have been different accounts concerning children's spatial language acquisition such as that of E. Clark (1973; 2004) and H. Clark (1973a) emphasizing the role of innate perceptual processing mechanisms, or of the neurophysiological bases of spatial perception and cognition (Landau & Jackendoff, 1993), while yet others have drawn attention to the role of functional knowledge of objects and canonical function-form relations (Freeman, Lloyd, & Sinha, 1980; Sinha, 1982).

The second principle suggests that it is language-specific factors, rather than principles of nonverbal (i.e., cognitive) development, that play a role in acquiring a spatial language. Choi & Bowerman (1991), Bowerman (1996a, b) and Bowerman & Choi (2001) argue that diversity in spatial

semantic structuring imposes the requirement on children that they employ language-specific acquisition strategies, and children's spatial semantic categories are language-specific from an early age onwards. In a series of comparative studies, these researchers investigated the developmental patterns in learning to encode spatial relations in English and Korean. They found that children tuned into specific patterns of their language very early, and began to use spatial words in their language productively and language-specifically as early as 14-16 months – despite the fact that these two languages highlight different aspects of spatial relations (e.g., "tight-fit" versus "loose-fit" in Korean, but not in English). The details of this study will be further discussed in Chapter 4, but their findings basically indicate that if general cognitive principles were at work, both Korean and English children would produce spatial terms that highlight similar aspects of spatial relations (e.g., not producing spatial terms for "tight-fit" versus "loose-fit" in Korean, but starting with the ones for containment and support). Evidence for early tuning to language specific encodings were also found for children acquiring Tzotzil (Bowerman, de Leon, & Choi, 1995), Tzeltal, Hindi (Narasimhan & Brown, 2009), English, Danish, and Chinese (Sinha, Thorseng, Hayashi, & Plunkett, 1994).

Supporting evidence for the effect of language-specific factors on the acquisition of spatial language has also been found for lexical and syntactic packaging of components of motion events such as Path and Manner (e.g., Allen et al., 2007 for Japanese; Choi & Bowerman, 1991 for Korean; Gullberg, Hendriks, & Hickmann, 2008; Hickmann, Taranne, & Bonnet, 2009 for French; Hohenstein, 2013; McNeill, 2000 for Spanish; Papafragou, Massey, & Gleitman, 2002; Papafragou et al., 2006; Papafragou, Hulbert, & Trueswell, 2008 for Greek; Özçalışkan, 2005; 2007; 2009; Özçalışkan & Slobin, 1999, 2000a, b for Turkish). These studies provide overwhelming evidence showing that children display language-specific patterns in their speech about encoding Path and/or Manner at a very young age (at around 3 years).

Although these two views could be considered as opposing, language acquisition is influenced to some degree by both of these guiding principles in learning to map semantic elements onto lexical and syntactic structures (e.g., Allen et al., 2007).

The studies mentioned so far have focused on comparing spoken languages that are typologically different from each other, and have not directly compared how spatial language is learned in a sign versus spoken language. Modality, as an additional factor to cognitive and language-specific guiding principles, may influence the course of learning form-meaning mappings in the domain of spatial language. Such a comparison might reveal what is modality-specific and what is general in the acquisition of spatial language.

2.4.2 Acquisition of spatial language in sign languages

In spite of the iconic correspondences between form and meaning in encoding spatial relations between entities in sign languages, previous production studies conducted with children acquiring a sign language report that full mastery in learning locative devices that encode spatial relations goes even beyond 10 years of age (e.g., Kantor, 1980; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). This is quite late when compared to the studies with speaking children who were reported to produce spatial terms as early as 2 years of age (e.g., Johnston & Slobin, 1989). This has been attributed to the challenges of the complex simultaneous morphology of classifier predicates in sign languages (Supalla, 1982) and of representing Figure and Ground simultaneously in classifier constructions (Newport & Supalla, 1980; Supalla, 1982; Newport & Meier, 1985; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007). The difficulty of learning adult-like classifiers to represent referents in classifier predicates has been also reported to be another source of difficulty for the acquisition of these structures by sign-language-acquiring children (Kantor, 1980; Supalla, 1982; Slobin et al., 2003; Bernardino, 2006; Tang et al., 2007; Brentari et al., 2013). The acquisition of classifier handshapes is, however, beyond the scope of the current dissertation (but see Zwitserlood, Sümer, & Özyürek, in prep.).

Newport & Supalla (1980) and Newport (1981) discussed the acquisition of some movement morphemes in three ASL-acquiring children between the ages of 3;6 and 5;11. They report that the youngest child (age 3;6) was able to produce simple Path movements (e.g., linear, arc). These early productions do not convey information about the Manner component. A few months later, a small

proportion of the productions convey Path and Manner information, but they are articulated sequentially rather than simultaneously (Newport, 1981).

In the case of simultaneous expression of Figure and Ground in classifier constructions, it is important to coordinate the two articulators (i.e., hands) that represent them. Studying spontaneous and elicited data from ASL- or NGT-acquiring children (aged 1;6-3;9 in the spontaneous and 5;0-12;0 in the elicited data), Slobin et al. (2003) observed that especially very young children omitted the classifier predicate for the Ground, and late preschool and school-age children had difficulty using classifier predicates in an adult-like fashion, even though no direct comparison to adult language use was made. As one of the reasons for this late development, the authors pointed to the articulatory difficulties in using both hands to simultaneously represent the Figure and the Ground. Similar results were also reported by Supalla (1982) who found that three deaf children (aged 3;6-5;11) acquiring ASL were similar to each other in expressing motion events that included only the Figure, but for events where there was also a Ground present, the youngest child marked the Ground less frequently than the older ones. Even when they marked the Ground, they did so in a sequential (expressing Figure and Ground one after another – not simultaneously) manner. Ground omissions were also observed in the spontaneous data collected from a BSL-acquiring child (between 2;0 and 2;6) (Morgan et al., 2008).

Tang et al. (2007) suggested that the development of simultaneous constructions depends on the learners' knowledge of encoding the Ground with the non-dominant hand. In their data comprising picture story narrations of 14 deaf children acquiring HKSL between the ages of 6;0-13;0, and of four adult HKSL signers, they observed a higher frequency of omission of the Ground classifier by children in all age groups, although the adults expressed them in their narrations. Similarly, Engberg-Pedersen (2003) reported more omission of the classifier predicates for the Ground in frog story narratives (e.g., the boy falls from a tree to the ground) by deaf children (aged 6;6-9;3) acquiring DSL compared to adults.

These studies suggest that, modality-specific aspects of sign languages (e.g., simultaneous expression of different event components) hinder the acquisition process for children who acquire a sign language rather than facilitate it. As mentioned earlier, these studies mostly attribute the late

mastery of spatial language to the morphological complexity of the classifier constructions, which mainly stems from the simultaneous expression of different components (e.g., Figure and Ground). In these studies, morphological complexity has only been discussed in the domain of classifier constructions, and less is known with respect to the complexities of other linguistic forms used in sign languages and their effects on the acquisition of spatial language. Moreover, most of these studies draw their conclusions primarily from comparisons with English, where the linguistic forms of spatial expression (e.g., "in", "on", "up") are morphologically less complex than the classifier predicates (Newport & Supalla, 1980; Newport, 1981; Supalla, 1982). Also, the milestones of spatial language development in sign languages have been only indirectly compared to the developmental steps in a spoken language. Direct comparisons of development in spoken and sign language using the same tasks are necessary to see clearly whether and how modality might impact the language development process.

2.5 Summary

In this chapter, I introduced the notion of the spatial domain with its subdomains: Different types of spatial events (i.e., location and motion) and spatial relations (i.e., topological and viewpoint-dependent). I also provided brief information on how signers and speakers encode spatial relations between entities, and on how sign and spoken languages (with specific information on Turkish) differ from each other in the domain of spatial language. I concluded this chapter with a section where I presented general information on previous studies about the acquisition of spatial language by signing and speaking children as a background to provide motivations for the current dissertation. Although the findings on the acquisition of spatial language by signing children suggest a late developmental pattern, I stated that it is not clear to what extent these findings can be generalized to the expression of different types of spatial events and relations and to the acquisition of linguistic devices other than classifier predicates. The studies also had some drawbacks in lacking comparisons of developmental patterns across sign and spoken languages directly and comparison to adult patters. In order to expand our understanding of the effect of modality in spatial language acquisition, the current dissertation

aims to investigate different types of spatial events and relations in a sign (i.e., TİD) and a spoken (i.e., Turkish) language. The following chapter will explain how this goal will be achieved in the current study by introducing the current hypotheses and the methodology that is used.

CHAPTER 3

The Present Study

3.1 Introduction

The aim of this chapter is to provide information about the general methodology of the studies reported in the current dissertation. First, I mention the general hypotheses of the present study, which have been formulated in relation to earlier developmental studies on the acquisition of spatial language by signing and speaking children (3.2). Then I move onto the section (3.3) that details the methodology used to collect data and provides information on the procedure and the participants. All the studies in the current dissertation were conducted with similar methods and the same participants. Obviously, the stimuli differed in each study depending on the type of spatial event and relation under investigation. These will be further explained in the relevant chapters. This chapter ends with a section (3.4) that gives historical, sociolinguistic, and educational background in addition to an overview of previous studies on TİD.

3.2 General hypotheses

The overall question of this dissertation relates to whether patterns in spatial language acquisition are universal or language (modality)-specific for different types of spatial events (i.e., location versus motion) and relations (i.e., topological versus viewpoint-dependent). Three general hypotheses regarding this question are considered throughout the dissertation:

i)   *Facilitating effect of modality*: The visual-spatial modality of sign languages allows location and motion events to be expressed mostly in an iconic and analogue manner in the space in front of the body of the signers (Emmorey, 2002; Perniss, 2007). Spoken languages, on the other hand, mainly express space categorically and in a non-iconic way (e.g., Talmy, 2003). The visual resemblance between language forms of sign languages (e.g., classifier predicates) and the real spatial events may facilitate the expression of

43

location and motion for children acquiring a sign language. If these properties are, indeed, facilitating, one would expect signing children to exhibit adult-like forms earlier than speaking children.

ii) *Hindering effect of modality*: As claimed by previous studies on the acquisition of spatial language by signing children, the challenges of acquiring expressions that require simultaneous representations of event components, for example, in classifier predicates (e.g., in simultaneous expression of Figure and Ground) might have a hindering effect in learning to encode spatial relations in sign languages (Newport & Supalla, 1980; Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). If this is true, signing children will exhibit adult patterns later than speaking children.

iii) *Neutral effect of modality*: This hypothesis predicts that there will not be an additional effect of modality above and beyond the general universal principles of cognitive development and the early-attunement into language specific patterns, which have been proposed to be two guiding principles of language acquisition in general. In this case, signing and speaking children will exhibit adult patterns at similar ages.

It is possible that these hypotheses might hold for the acquisition of all aspects of spatial language. Yet, it is also possible that modality effects will manifest differently for different aspects of spatial language. Below I present the methodology of the present study adopted to test the above mentioned hypotheses.

3.3 Methodology

This dissertation presents three main studies, each of which focuses on a different type of spatial event and relation. For these studies, I collected data from the same signers and speakers in the same data collection set-up. Due to time restrictions, the studies were cross-sectional, where the data were collected from different age groups of participants. I will present the information on the participants in

section (3.3.1) and the procedure in section (3.3.2). Since the stimulus materials used vary in each study, details about them are provided in the relevant chapters.

3.3.1 Participants

10 native Turkish speakers and 10 deaf native signers of TİD (i.e., all learned the language from their deaf parents) constituted the adult groups of this study. Furthermore 20 younger and 20 older signing and speaking children, 10 in each age group, were recruited. Table 3.1 below gives information about the means and age ranges of the participants in each group. In forming these age groups, the age at which children start primary school in Turkey was taken as the decision criteria.[14]

Table 3.1: Age ranges and (M=age means) for deaf and hearing children and adults who participated in the study

	TİD	Turkish
Adults (N=10)	18;5-45;10 (M=31;4)	28;2-51;3 (M=37;9)
Older Children (N=10)	7;2-9;10 (M=8;3)	7;2-9;11 (M=8;2)
Younger Children (N=10)	3;5-6;10 (M=5;2)	3;8-6;8 (M=5;3)

All signing children who participated in the study are profoundly deaf and acquired TİD natively from their deaf parents. Of these 20 deaf children, six of them have also deaf grandparents and five have deaf uncles and/or aunts in their families. Three of the deaf children (two in the older and one in the younger age group) have cochlear implants (CI). One of the older deaf children received his CI when he was 4 and the other at the age of 6. The younger deaf child got her CI when she was 3 years old.

In the older age group, seven deaf children attend a primary school for the deaf and three are in the mainstream schools for the hearing. As for the younger age group of deaf children, three of them are full-time (five days in a week) and four are part-time (two days in a week) attenders of a preschool education program for the deaf. The rest did not attend any preschool education programs

---

[14] During data collection, the starting age for primary school was 7 years in Turkey. However, after a change in the educational policy in September, 2012, children now start school at the age of 5-6 years.

and stay at home. All of the deaf children in this study also attended four-hour rehabilitation sessions (one session per week), which mostly included speech therapy. It is also important to note that the education in the schools for the deaf in Turkey is conveyed through oral methods, and TİD is not part of the curriculum. However, in one preschool education program, which four of the deaf children in this study attend, TİD lessons are provided by a deaf teacher for one hour in a week, although its teaching has not been very systematic yet. For the hearing children, all of them in the older age group receive formal education. Five of the younger hearing children attended a preschool education program five days in a week while the rest did not. Thus, overall, 30 deaf native TİD signers and 30 Turkish speakers, all residing in İstanbul, Turkey participated in the current study.

3.3.2 Procedure

In data collection sessions, signers/speakers were asked to sit opposite the addressee, who was a deaf or hearing confederate depending on the language condition. There was a laptop located on a table between them, and the table was below the waist of the participants so that their hands could easily be seen, as shown in Figure 3.1, where a schematic overview of the recording set-up is presented.
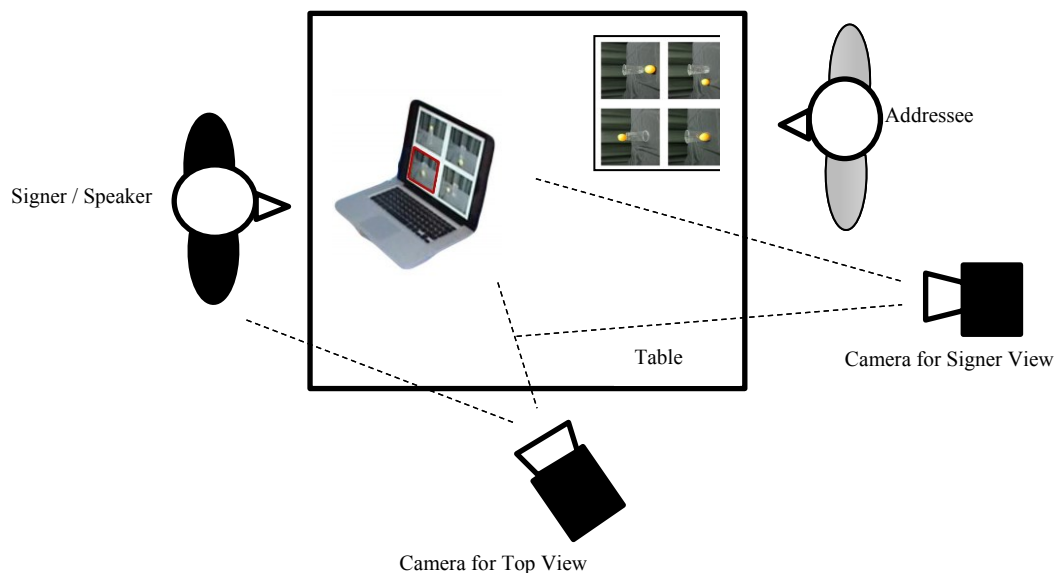
Figure 3.1: Data collection set-up

To collect data for different types of spatial relations (i.e., topological, viewpoint-dependent), the signer/speaker was shown sets of four pictures and asked to describe the picture with the red frame to the addressee who had the same picture set (but without any red frames) in a booklet in front of her. All pictures are given in the Appendix given at the end of each chapter. The data for the static location events for both types of spatial relations were collected in the same task. That is, the target picture for each picture description showed either a topological or a viewpoint-dependent spatial relation, and pictures were randomly ordered. All participants saw the pictures in the same order.

The task of the addressee was to choose the picture described by the signer/speaker. It is important to note that the picture with the red frame stayed on the screen during the description to avoid memory effects. Moreover, the participants were asked to describe the target picture indicated with the red frame, and they were never asked questions such as "Where is X?" before they began their descriptions since such questions might have invoked a description of the location of that object without a full locative description.

For the collection of motion event descriptions, participants were shown a series of short video vignettes on a computer screen, and asked to describe what happened in each vignette to their interlocutors, who purportedly had not seen it before. The vignettes were shown once unless they wanted to see it again, and the screen went black when the vignette was over. The task of the addressee was to listen to/watch the descriptions and ask clarification questions, if necessary, after the participants finished their descriptions.

All participants' descriptions were recorded by two cameras from different angles, as shown in Figure 3.2, so that both a front and a top view were available, providing as much as information as possible on locations, movement directions and sign forms, which facilitated the coding considerably. However, since data collection sessions took place in different home and classroom environments, recording set-ups and camera angles showed some variation.

Figure 3.2: Combined camera view on the signer

All edited and synchronized data are stored in the language archive of the Max Planck Institute for Psycholinguistics. The picture descriptions and motion event descriptions in TİD were annotated and coded by a deaf signer of TİD and two hearing researchers with knowledge of TİD. Turkish data were annotated by a native speaker of Turkish. The annotations were done in ELAN, a free annotation tool (http://tla.mpi.nl/tools/tla-tools/elan/) for multimedia resources, developed by the Language Archive Group at the Max Planck Institute for Psycholinguistics in Nijmegen, The Netherlands (Wittenburg, Brugman, Russel, Klassmann, & Sloetjes, 2006) (see Figure 3.3).
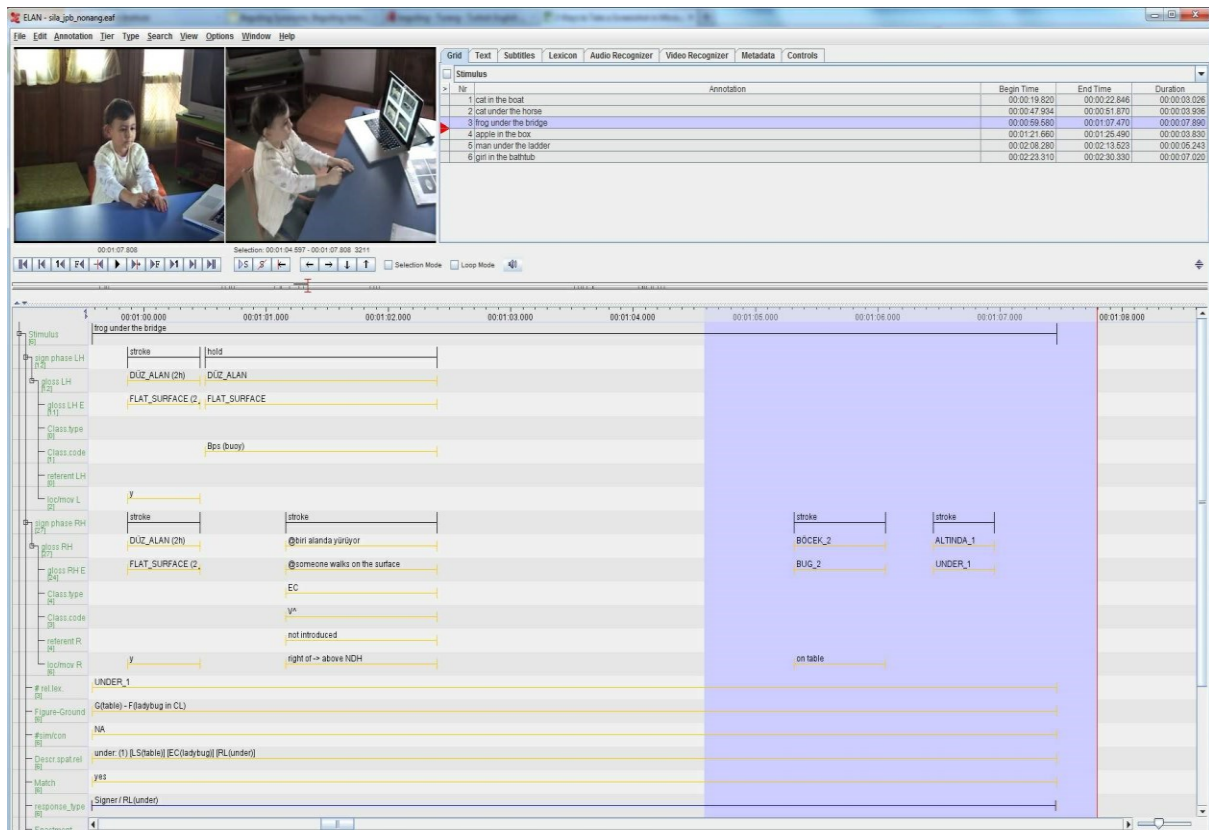
Figure 3.3: A screen snapshot that shows (TİD) annotations done in ELAN.

3.4 Historical, sociolinguistic, and educational background on TİD

Research on the historical background of TİD is very limited. The use of a sign language during 1500-1700 has been documented in the Ottoman Palace, but there is no clear evidence that current TİD is a continuation of this sign language. Miles (2000) reports the presence of deaf people at the Ottoman court. Deaf servants took responsibilities not only in courts but also as guards and executioners, which were respected positions in the Ottoman Empire. There, their lack of hearing was seen as a way of ensuring confidentiality. Additionally, Miles also reports instances in which a "rigid speech taboo" developed from the 16th century onwards. At such times, even whispering was forbidden in the presence of the Sultan, and people had to use a sign language to communicate. This put deaf people in an advantageous position and the knowledge of sign language was highly valued, which contributed to the rise of the sign language in the palace (see Kemaloğlu & Kemaloğlu, 2012 and Dikici, 2006 for a detailed review of the use of sign language in the Ottoman Palace).
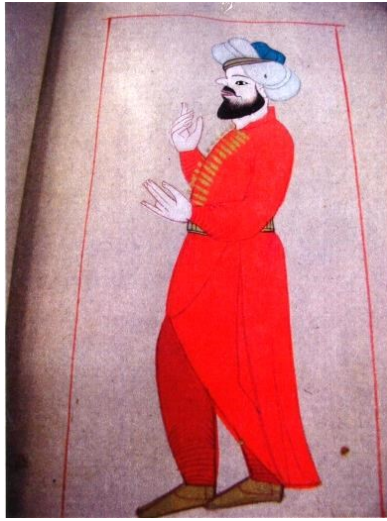
Figure 3.4: The mute of the Sultan in the Ottoman Empire in 1650. Retrieved from the archives in Berlin State Museums, Art Library Berlin, Lipperheide OZ 52, fol. 13a. Courtesy of Prof. Marc Baer.

The establishment of the first school for the deaf dates back to 1902 (Deringil, 2002; Kemaloğlu & Kemaloğlu, 2012). At the beginning of the 20th century, there were only a few private deaf schools in the country. These schools were established mainly in large cities such as İstanbul and İzmir, and their education was limited to the primary level. They were private organizations and there was not an established network of schools.

Today, with the growth of the deaf community in Turkey (around 3 million deaf people, İlkbaşaran, 2013) and the changes in the overall education system, more schools for the deaf have become available. Some of them are boarding schools and the level of education now covers primary and secondary school levels. In Eskişehir, there is also an institution that offers university level education for deaf people. Recently, in İstanbul, two preschool education programmes have also been launched for deaf children aged between 0-6 years. Since 1953 to present, education for deaf children in these schools has been mainly through oral methods, in which all subjects (e.g., mathematics, social sciences) are taught in spoken Turkish, although teachers acknowledge using some TİD signs to promote their teaching. During data collection for the current dissertation, deaf students in these

schools were observed to interact in TİD among themselves during lesson breaks. In 2007, a law that enables education in TİD was passed, although it has not been realized in practice so far, mostly due to the lack of qualified teachers who can use TİD in their classes. In one of the preschool education programmes, TİD lessons are offered by a deaf teacher two hours a week. In these lessons, the deaf teacher teaches the language itself rather than teaching different subjects in that language. However, attendance to this class is not compulsory and is based on the consent of the parents. Unfortunately, only a minor group of children attend this programme.

The Turkish Federation for the Deaf has been promoting sign language among the deaf population throughout the country since its establishment in 1964 (for a detailed account about the Turkish deaf community and deaf institutions, see Zeshan, 2002; İlkbaşaran, 2013). For almost 10 years, there has been an accumulating body of research done on TİD (see www.enginarik.com for a complete list of linguistic studies on TİD). These studies mainly focus on how adult signers of TİD express different aspects of grammar such as phonology (e.g., Göksel & Kelepir, 2013), morphology (e.g., Kubuş, 2008; Zwitserlood, Perniss, Özyürek, 2012), classifiers (e.g., Arık, 2013a), negation (e.g., Gökgöz, 2011; Zeshan, 2006), word order (e.g., Sevinç, 2006) in addition to studies that have a more sociolinguistic approach (e.g., Dikici, 2006; Kemaloğlu & Kemaloğlu, 2012; İlkbaşaran & Taşçı, 2012; İlkbaşaran, 2013; 2015). Moreover, especially within the domain of spatial language, there has been a considerable amount of studies conducted with TİD signing adults, thus leading to a considerable amount of knowledge about adult patterns in encoding different types of spatial relations and spatial events (e.g., Arık, 2009; 2010; 2013b; Özyürek & Perniss, 2011; Özyürek et al., 2010). Some of these studies have been compiled in a recent book edited by Arık (2013c). These studies show that while TİD exhibits sign language structures that are found in many established sign languages such as ASL or BSL at the level of phonology, morphology, and syntax, it also exhibits language-specific constructions in negation and spatial expressions. However, the acquisition of TİD, neither in the domain of spatial language nor in other domains, has not been investigated so far. Therefore, the current dissertation is the first endeavour in explaining the developmental patterns in this domain as observed in children acquiring TİD.

CHAPTER 4

Learning to Encode Topological Spatial Relations in TİD and Turkish

This chapter is a slightly revised version of:

Sümer, B., Zwitserlood, I., Perniss, P., & Özyürek, A. (2012). Development of locative expressions by Turkish deaf and hearing children: Are there modality effects? In A. K. Biller, E. Y. Chung, & A. E. Kimball (Eds.), *Proceedings of the 36th Annual Boston University Conference on Language Development (BUCLD 36)* (pp. 568-580). Boston: Cascadilla Press.

Sümer, B., Zwitserlood, I., Perniss, P., & Özyürek, A. (2013). Acquisition of locative expressions in children learning Turkish Sign Language (TİD) and Turkish. In E. Arık (Ed.), *Current directions in Turkish Sign Language Research* (pp. 243-272). Newcastle upon Tyne: Cambridge Scholars Publishing.

4.1 Introduction

How do children learn to express simple relations between two entities such as a cup on a table? Research has shown that spatial terms expressing relations among entities that are topological in nature are one of the earliest productions of children learning spoken languages (e.g., "in", "on", "under" in English) (E. Clark, 1973; Johnston & Slobin, 1979; Johnston, 1985; 1988; Tomasello, 1987; Bowerman & Choi, 2001; Loewenstein & Gentner, 2005), and appear earlier than spatial relations such as the ones as expressed by "front", "behind" or "left", "right" in English (Piaget & Inhelder, 1971; Johnston, 1984; 1985; 1988; Durkin, 1980; 1981; Bowerman, 1996a, b). However, full expression of spatial relationships in a discourse context where both Figure and Ground objects need to be mentioned in relation to each other seems to take more time and does not emerge until children are 10-12 years old (Ehrich, 1982; Weissenborn, 1986; Lloyd, 1991; Hickmann, 2003). There is less research, however, about how deaf children learning a sign language master the expression of such relations (e.g., Morgan et al., 2008). This chapter compares acquisition of expressions for topological spatial relations in TİD and Turkish.

As described in Chapter 1, sign languages rely on iconic and analogue means to describe locative relations among entities in terms of representing the shape of objects depicted and the relative spatial relations between them (see 1a in Chapter 1) – unlike spoken languages (see 1b in Chapter 1).

Such iconic (i.e., motivated visual form-meaning mappings) structures might facilitate spatial language acquisition in children learning a sign compared to a spoken language. Surprisingly, however, previous research has indicated that children learning a sign language might in fact have difficulty mastering these forms until 13 years of age (e.g., Engberg-Pedersen, 2003; Tang et al., 2007). Yet few of these studies have compared sign to spoken languages and to adult patterns directly. Moreover, there has been little focus on the acquisition of simple locative relations; rather, conclusions have been drawn mostly from motion event narrations.

To be able to advance our understanding of the role of the spatial modality in learning to express topological relations, the study reported in this chapter compares language development in expressing topological relations of support, containment, and occlusion in signing children (in a younger and an older age group) acquiring TİD and in age-matched speaking children acquiring Turkish and in relation to adult target language. The chapter first presents previous studies about how topological spatial expressions are acquired in spoken and sign languages in section (4.2). This is followed by explanation of the present study in section (4.3) including motivation, hypotheses, stimulus materials used to collect the data, and coding and analysis of the data. Qualitative and quantitative analyses are presented in sections (4.4) and (4.5) respectively. I end this chapter with sections (4.6) and (4.7) where the results are discussed in relation to previous literature and conclusions are presented.

4.2 Learning to encode topological spatial relations

In this section, the findings of previous studies on children who acquire a spoken language and a sign language are presented in sections (4.2.1) and (4.2.2), respectively.

4.2.1 Learning to encode topological spatial relations in spoken languages

Two main guiding hypotheses have been proposed in the previous literature to explain patterns of how children learn to map linguistic structures onto spatial relations in spoken languages. One of them suggests that the acquisition of spatial language is initially guided by universal cognitive and

perceptual categories of space. Later, children map the semantic and grammatical structures offered by their language onto these cognitive categories of space. Support for this first claim comes from studies conducted in a variety of spoken languages: English (E. Clark, 2004; Johnston & Slobin, 1979; Tomasello, 1987), German (Grimm, 1975), Hebrew (Dromi, 1979), Afrikaans (Vorster, 1984), Italian, Serbo-Croatian, Turkish (Johnston & Slobin, 1979). These studies indicate that children's acquisition of locative expressions follows a similar sequence in which topological spatial relations (i.e., such as "in", "on", "under" as expressed in English) appear early in the speech of children (E. Clark, 1973; 2004; Johnston & Slobin, 1979; Johnston, 1985; 1988; Tomasello, 1987; Bowerman & Choi, 2001; Loewenstein & Gentner, 2005). These are followed by "next to", "between", "front-behind", and "left-right" (Piaget & Inhelder, 1971; Johnston, 1984; 1985; 1988; Durkin, 1980; 1981; Bowerman, 1996a, b). These findings, thus, suggest that locative terms are learned at predictable ages and in a predictable order. This universal nature of locative learning suggests that nonverbal conceptual development plays a major determining role in learning these spatial relations (Johnston, 1985). There have been different accounts regarding the universality found for the acquisition of spatial relations. For example, E. Clark (1973) and H. Clark (1973a) emphasize the role of innate perceptual processing mechanisms. Landau and Jackendoff (1993) emphasize the neurophysiological bases of spatial perception and cognition. Others have drawn attention to the role of functional knowledge of objects and canonical function-form relations (Freeman et al., 1980; Sinha, 1982).

These accounts, however, are criticized for failing to take the wide diversity in spatial semantics and its linguistic expression across languages into account. Moreover, as pointed out by Johnston (1988), these studies have focused on the expression of the spatial terms themselves and on their morphological complexity, but not on how they are situated in the whole utterance and the discourse context. Furthermore, it is not known in these studies whether these expressions show any development over time. However, the few studies that have focused on the discourse of children have shown that they have difficulties in organizing spatial information up to 10 to 12 years of age. For example, analyses of room descriptions (Ehrich, 1982 for Dutch) and route directions (Lloyd, 1991 for English; Weissenborn, 1986 for German) have revealed that children have difficulty in using linguistic devices such as prepositions and adverbials unambiguously while describing the locations

of entities. Similarly, Hickmann (2003) reports that children who acquire different languages (English, French, Chinese, German) omit the expression of Ground, thus not anchoring the location of the Figure with respect to the Ground in adult-like ways until 10 years of age.

The important foundation for the universalist view has been the assumption that although the linguistic forms of spatial terms differ across languages, their meanings are closely related (e.g., Slobin, 1973). However, research has found more crosslinguistic variation in spatial semantic structuring than had been supposed before (e.g., Talmy, 1985; Brown, 1994; Levinson, 1994; 1996). Spatial situations can obviously be constructed in different ways in different languages, and these differences may have consequences for the acquisition of spatial encoding.

This brings us to the other hypothesis that put forwards language-specific factors, rather than principles of non-verbal (i.e., cognitive) development, as an influential factor in learning to express spatial relations. In line with this principle, Choi & Bowerman (1991), Bowerman (1996a, b), and Bowerman & Choi (2001) argue that children's spatial semantic categories are language-specific from an early age onwards. In a series of comparative studies, they investigated the developmental patterns exhibited by children learning to encode spatial relations about placement events in English and Korean. They focused on these two languages since they highlight different aspects of spatial relations: In describing containment type of events, English does not make a distinction between whether the Figure is tightly or loosely contained by the Ground, but uses "in" for both cases. Korean, however, uses verbs that distinguish between "kkita - *tight-fit*" versus "nehta - *loose-fit*" configurations. English-acquiring and Korean-acquiring children were found to tune into specific patterns of their language very early, at around 14-16 months, despite the fact that these two languages highlight different aspects of spatial relations. Children's early tuning to language-specific semantic encoding of locative relations has also been reported for children learning Tzotzil, (Bowerman et al., 1995), Tzeltal and Hindi (Narasimhan & Brown, 2009).

Compared to studies with speaking children, studies on how signing children learn locative spatial relations are relatively fewer in number, and limited to a very small number of sign languages (e.g., ASL, BSL). These studies mainly suggest that, in spite of the iconic affordances of the modality,

the acquisition of the typical devices for expression of spatial language seems to pose a challenge for children acquiring sign language, as will be reviewed in the following section.

4.2.2 Learning to encode topological spatial relations in sign languages

In sign languages, the spatial relation between Figure and Ground is expressed mainly through classifier predicates (e.g., Emmorey, 2002; Perniss, 2007), which are morphologically complex structures (e.g., Supalla, 1982; Zwitserlood, 2012). Morphological complexity in these forms is argued to arise mainly in: i) The use of classifier predicates (Kantor, 1980; Supalla, 1982; Slobin et al., 2003; Morgan, Herman et al., 2008; Bernardino, 2006; Tang et al., 2007; Brentari et al., 2013) and ii) representing Figure and Ground simultaneously in classifier constructions (Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). Even though most of the studies that will be reviewed below draw their conclusions from motion event descriptions (except Schick, 1990 and Brentari et al., 2013) or the use of different aspects of spatial language in general (e.g., classifier predicates, simultaneous representation of Figure and Ground) – not specifically on the expression of static topological spatial relations, they are mentioned to give an impression of how signing children learn to use space to talk about spatial relations.

i) *Learning to use classifier predicates*

To be able to learn how to use classifier predicates, signing children need to figure out which classifier handshapes represent which entities in their specific language, and also learn how to locate them in signing space. Previous studies report that signing children have difficulty in choosing adult-like classifier handshapes and/or the type of classifier (e.g., entity versus handling) (Kantor, 1980; Supalla, 1982; Slobin et al., 2003; Bernardino, 2006; Tang et al., 2007; Morgan et al., 2008; Brentari et al., 2013) and sometimes use a "general classifier" instead of a specific, adult-like one. For example, studying spontaneous productions and imitations of classifier predicates of ASL-acquiring children between the ages of 3;0 and 7;0, Kantor (1980) found that the classifiers she examined (e.g., vehicle classifier -) were not completely mastered until the children were 9 years old. She

observed that children tended to modify such handshapes by substituting them with simpler handshapes (e.g., 5-hand). However, Schick (1990) argues that it is not handshape, but the location morpheme that causes difficulty in learning classifier predicates. In order to examine the factors that influence the acquisition of classifier predicates in ASL (i.e., age, complexity of classifier predicates in terms of the use of handshape and location morphemes, type of classifier such as entity, handling, or SASS), she asked 24 native signing children aged between 4;5 and 9;0 years to describe pictures showing static locative spatial relations between objects (e.g., two clocks are on a shelf). As a result, she found age-related effects for the *correct* use of location morphemes, but not for handshape morphemes. Therefore, she reports that handshape is an inadequate parameter to use as an indicator of linguistic maturity – at least for signing children older than four and a half, and handshape use, for the most part, is adult-like at an earlier age than the use of location morphemes in classifier predicates. Unfortunately, it is not clear how location errors were coded in this study.

ii)   Learning simultaneous representation of Figure and Ground in classifier constructions

Simultaneous representation of Figure and Ground referents in classifier constructions has also been reported to be a feature that seems to be difficult to master by signing children since it requires the co-ordination of two articulators (i.e., hands) (Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007). That is, signing children need to learn that information about Figure and Ground are assigned to two articulators independently and simultaneously. In their data including narrations of six 4-picture comic strip stories by 14 signing children acquiring HKSL between the ages of 6;0-13;0 and two adult signers, Tang et al. (2007) observed a high frequency of omission of the Ground classifier in classifier predicates by children in all age groups. However, in this study it is not reported if adult signers also omitted the Ground in their narrations or not.

Studying spontaneous (aged 1;6-3;9) and elicited data (aged 5;0-12;0) from deaf children acquiring either ASL or NGT, Slobin et al. (2003) observed that especially very young children omitted Ground classifiers in classifier predicates, and even late preschool and school-age children had difficulty in using them in adult-like fashion. As one of the reasons, the authors point to the

articulatory difficulties in using both hands to simultaneously represent the Figure and the Ground in acquiring classifier constructions.

Similar results were also reported by Supalla (1982), who followed the language development of three ASL-acquiring deaf children between the ages of 3;6-4;0-5;11, found that these children were similar to each other in expressing simple motion events that involve only a Figure, but not for the events where there was also a Ground present. His results showed that the younger the children were, the less frequently the Grounds were marked in their productions. Even when they marked it, they tended to do so in a sequential manner (expressing Figure and Ground one after another – not at the same time). Supalla (1982) attributes these findings to the morphological complexity of the simultaneous constructions rather than to articulatory difficulties. Similarly, Engberg-Pedersen (2003) reported the omission of Ground classifiers in motion event descriptions (e.g., the boy falls from a tree to the ground) in narrations of the frog story by deaf children (aged 6;6-9;3) acquiring DSL.

I would like to note that all of these studies examined the expression of Figure and/or Ground in classifier constructions in mainly motion narrations or in spontaneous conversations. So, there is no information on whether signing children also show a tendency to omit Figure and/or Ground in static locative events. Furthermore, it is not clear whether the children in these studies omitted the mention of Grounds altogether in the narration (i.e., did not introduce the Grounds at all) or introduced the Grounds by means of lexical signs, but did not express them in simultaneous classifier constructions.

Previous studies, then, present evidence that rather than having a facilitating effect of iconicity, modality-specific aspects of sign languages (e.g., simultaneous expression of Figure and Ground) hinder the acquisition process for children acquiring a sign language for the various reasons described above. However, the milestones of spatial language development in sign languages have been only indirectly compared to the developmental steps of learning a spoken language or to adult patterns. Direct comparisons are necessary to see clearly whether and how modality might impact the language development process, in addition to other guiding factors such as general cognitive development and language specific ones.

4.3 The present study

The current study investigates how children learn to express topological spatial relations in a sign (i.e., TİD) and a spoken (i.e., Turkish) language in order to understand whether and how the use of the spatial modality may shape spatial language development. Below I present the motivations in section (4.3.1) and the general hypotheses for the present study in section (4.3.2). Then, I will continue with a section where specific information about the methodology is provided in section (4.3.3).

4.3.1 Motivation

The aim of this study is to track the developmental pattern of spatial language used to encode topological spatial relations (e.g., containment, support, occlusion, as can be expressed with "in", "on", "under" in English) in a sign (i.e., TİD) and a spoken (i.e., Turkish) language. TİD and Turkish were chosen for the following reasons: Turkish, as a morphologically rich language, differs from many Indo-European languages in the way in which topological spatial relations are expressed. As explained in Chapter 2, Turkish speakers use a general postpositional locative case marker ("-de/da" - *at*), which can be attached to the noun expressing the Ground (Masa+da - *table+LOC*) or to a spatial noun (üst+ün+de - *top+POSS+LOC*). In Indo-European languages, in relation to which acquisition of sign languages has been implicitly compared, speakers mainly use prepositions to encode spatial relations. Moreover, TİD is not in a contact relation (genetically or geographically) with more widely studied (Western) sign languages, and also differs from Turkish (Zeshan, 2003). Thus, studying acquisition of TİD extends our knowledge about the acquisition of sign languages in general and in relation to typologically different spoken languages.

As mentioned earlier, the comparison of the findings of the studies with signing and speaking children seem to suggest that these children lag behind spoken language acquiring children in the expression of spatial relations. However, please note that this claim is based on studies that lack direct comparisons between signing and speaking children, and between signing children and signing adults. Therefore, the differences shown by these studies are mostly assumed rather than verified. Moreover, these studies mainly focus on learning to use classifier predicates in locative expressions. However, as explained in (2.3.2) in Chapter 2, sign languages offer other linguistic forms to signers to encode the

spatial relation between Figure and Ground (e.g., relational lexemes, lexical sign placements, SASSes).

In order to establish target and developmental patterns for the expression of topological spatial relations in TİD and Turkish, simple locative expressions were elicited from children and adults who were asked to describe pictures of static objects configured in relation to each other. In this way, patterns observed in the child data were directly compared to the adult data – rather than indirectly compared to assumed adult preferences. Since previous studies done in the domain of spatial language development lack direct comparisons between signing and speaking children using the same elicitation tasks, data in this study were collected using the same task (i.e., picture description, see 3.3.3) from both languages. To see whether and to what extent modality plays a role in learning to express these spatial relations, the data from TİD and Turkish were compared in terms of when children in each language become adult-like in different aspects of spatial language acquisition.

In the present study, both qualitative and quantitative analyses were conducted, focusing on three aspects of the locative expressions.

First, I investigated how frequently signers and speakers expressed both Figure and Ground in their picture descriptions since they sometimes dropped either Figure or Ground in these descriptions. Analysis of this kind is important since previous studies report Ground omissions by signing children (Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007), but it is not clear where these omissions exactly occur in locative expressions: Omissions of classifiers for Figure and/or Ground in classifier predicates, or without mentioning these components at all in the whole description. In the first case, children might introduce Figure and Ground referents in their descriptions, but omit them in their classifier constructions. In this case, children would likely be aware of the importance of mentioning the event components, but might have difficulty in expressing them by means of classifier handshapes in classifier predicates – for example, due to the simultaneity required in these predicates, as has been previously suggested. Note that a previous study on TİD adult signers' use of locatives in "next-to" relations with multiple objects have reported Ground omissions in classifier predicates even though they were mentioned by their lexical signs (Özyürek et

al., 2010). It is also possible that children may omit mention of Figure or Ground referents altogether in their descriptions – for example, due to memory issues. Actually, studies with speaking children also report a similar tendency for the omission of the Ground referent up until 10-12 years of age (e.g., Ehrich, 1982; Weissenborn, 1986; Llyod, 1991; Hickman, 2003).

As a next step, I focus on descriptions in which signers and speakers expressed both Figure and Ground, and investigated how many of them included a "relational encoding". In this study, relational encoding refers to the expression of the spatial relation between Figure and Ground. Specifically, in these descriptions, I look at the linguistic forms employed in each language to see whether signing and speaking children achieve adult-like patterns at similar ages in their preferred choices for the various linguistic devices. Although previous studies with speaking children report a timeline of when certain types of spatial relations appear in the speech of the children, they often do not provide information about the specific forms of the linguistic expression used to express these spatial relations (e.g., a general locative case marker or spatial noun in Turkish). Johnston & Slobin (1979) found that Turkish-acquiring children start talking about containment, support and occlusion at around 2 years of age. However, they do not provide any information about the linguistic forms employed in their locative expressions and whether they were adult-like in comparable situations. Similarly, TİD offers different locative devices in varying degrees of iconicity such as classifier predicates (e.g., 4a, b in Chapter 2) or relational lexemes (e.g., 6a in Chapter 2). However, it is not known (for TİD or any other sign language) whether any of these devices are acquired earlier than others by sign language acquiring children and their acquisition is mostly not compared to adult patterns.

Finally, I examine the acquisition of classifier predicates in terms of simultaneity of Figure and Ground expressions in relational encodings when both Figure and Ground are mentioned in TİD (e.g., 4a, b in Chapter 2). As mentioned before, simultaneous expression of Figure and Ground in sign languages has been suggested as one source of difficulty (i.e., morphological or articulatory) for signing children in learning to express spatial relations (Kantor, 1980; Newport & Supalla, 1980; Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). Simultaneous representation of entities is possible only in a visual-spatial language, and exploits all

affordances of modality for iconic representation. For this reason, this analysis is specific to TİD, and compares children's patterns to those of adults. Note that the present study does not focus on children's learning of adult-like classifier handshapes; however, this is analysed in another study (Zwitserlood et al., 2013; Zwitserlood et al., in prep.).

4.3.2 Hypotheses

Regarding the acquisition of topological spatial relations by signing and speaking children, I propose three possible hypotheses:

i) *Facilitating effect of modality*: The visual resemblance between sign language forms (e.g., classifier predicates, simultaneous constructions) and real-world spatial configurations may facilitate the acquisition of locative expressions with topological spatial relations for signing children compared to speaking children, whose language lacks such visual resemblance between form and meaning. If properties of the visual modality are indeed facilitating, I expect that TİD signing children will learn to use linguistic devices in adult-like ways earlier than Turkish speaking children. Furthermore, TİD signing children could be adult-like earlier in their use of linguistic forms which are more analogue (e.g., classifier predicates) than the use of less iconic forms (e.g., relational lexemes).

ii) *Hindering effect of modality*: The challenges of acquiring simultaneous structures specific to sign languages, as in the use of classifier predicates and in the simultaneous expression of Figure and Ground, might have a hindering effect in learning to encode topological spatial relations in TİD compared to Turkish. This hypothesis would support previous claims regarding the acquisition of spatial language in sign languages. In this case, TİD signing children will learn to express topological spatial relations at a later age than their Turkish speaking peers.

iii) *Neutral effect of modality*: The final hypothesis is that signing and speaking children are similar with respect to when they exhibit adult-like patterns in learning to encode topological spatial relations. This would imply that the modality of expression does not influence spatial

language development in addition to and beyond general principles of cognitive development and language-specific factors.

4.3.3 Stimulus materials

In order to elicit comparable locative expressions from children and adults in both languages, a picture description task was used (see Figure 4.2). All participants were asked to describe a target picture presented with three other pictures in the same set. In these pictures, a Figure object was situated in relation to a Ground object (e.g., ball *in* cup, pen *on* paper, pillow *under* bed).[15] None of these pictures show people acting upon objects, but all present objects in a static situation.

Initially, data were elicited with 10 picture sets for each type of spatial relation (i.e., containment, support, occlusion), thus with a total of 30 picture sets. However, stimulus pictures that included people as Figures were discarded since these pictures elicited a substantial number of motion event descriptions, instead of simple static locative descriptions, from both TİD signers and Turkish speakers. For example, in Figure 4.1a, most participants described the man as climbing up a ladder – not as being on a ladder. Additionally, some Ground objects were hard to identify; as a result, the pictures with such Grounds were also excluded from the study. For example, for the Ground in the picture shown below (Figure 4.1b), some signers and speakers could not decide how to describe it (e.g., whether as a table or as a bridge), and did not mention it at all.

(a) (b)
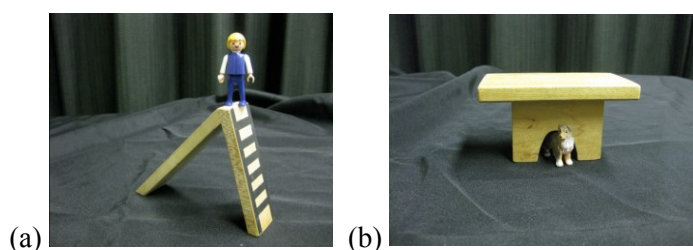
Figure 4.1: Examples of stimulus pictures that were taken out of the analysis.

---

[15] The stimuli used in the study were originally developed by Jennie Pyers. I thank her for sharing these materials with me.

After removing the pictures that caused the problems stated above, 7 picture sets for containment (i.e., "in"); 8 picture sets for support (i.e., "on"), and 6 picture sets for occlusion (i.e., "under") remained, resulting in a total of 21 picture sets. Participants were shown a set of four pictures on a laptop screen, one of which was the target picture, as indicated with a red frame (see Figure 4.2). In each set, in addition to the picture showing the target spatial relation, there were three other pictures showing different spatial relations, which are called "contrasts". These contrast pictures display either different spatial configurations of the Figure and Ground objects or the same spatial configuration with different objects. For example, the target spatial relation is "in" in both picture sets in Figure 4.2 below; the contrast relationships are "in", "front", "right" in (4.2a) and "on", "front", "left" in (4.2b). In nine of these picture sets, one contrast picture shows a spatial configuration in which the objects are different than the ones in the target one, but the spatial relation is the same as in the target spatial configuration. For example, in (a) in Figure 4.2, the target spatial configuration includes an apple and a box and the target spatial relation is "in". One of the contrasts includes two different objects (i.e., bowl and ball) but the spatial relation is the same as the target one (i.e., "in"). On the other hand, the other two contrasts depict different types of spatial relations (i.e., "right", "front") with the same objects as in the target spatial configuration (i.e., apple, box). In the remaining 12 stimulus pictures, all contrasts show different spatial configurations from the target one using the same objects as in the target spatial configuration, as in (b) of Figure 4.2 below (see Appendix 4.1 for all picture sets).
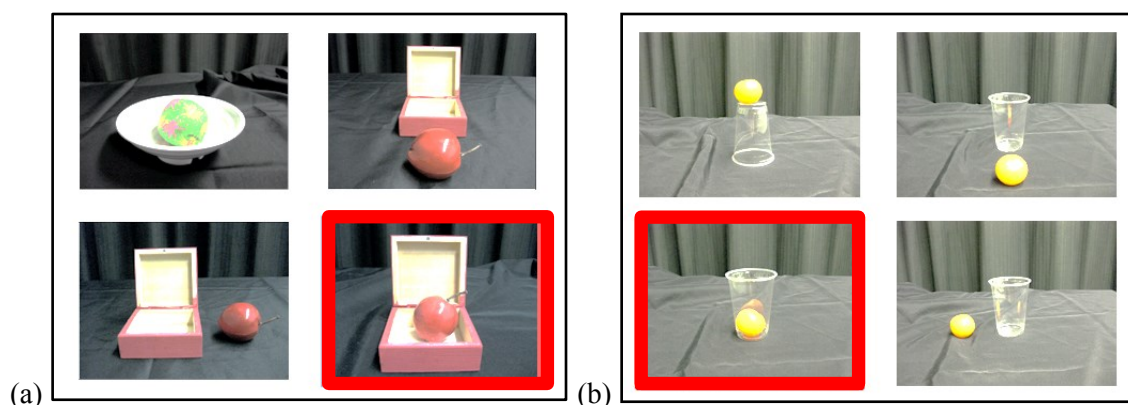
Figure 4.2: Examples of picture sets with different types of contrasts used in the study. Target items are indicated with a red frame, and the rest of the pictures are contrasts.

4.3.4 Data coding and analysis

The data elicited from signers and speakers using the stimulus pictures showing topological spatial relations yielded a total of 1244 descriptions (618 from signers and 626 from speakers). These picture descriptions were coded using ELAN (Wittenburg et al., 2006). Note that this total number of descriptions did not include cases where signers/speakers gave a second description, or repeated their descriptions upon being asked by the interlocutor since these cases introduced uncontrolled variability.

For each picture description, all signs were transcribed with Turkish and English glosses on separate tiers for the left and right hand by two hearing researchers who have good knowledge of TİD. These annotations were checked by a deaf TİD signer. The Turkish data were coded for each picture description by a Turkish speaking research assistant (see 3.3.2 in Chapter 3).

I now move on to the sections where the findings of the qualitative and quantitative analyses are presented. The qualitative analyses enabled a deeper understanding of the current data and provided a more elaborate account of the various means of expression of locative events by adults and children. Finding patterns in the data through qualitative analyses formed a base for the quantitative analyses where the frequencies of these patterns were calculated.

4.4 Qualitative findings

In order to describe the data elicited from children and adults in TİD and Turkish, qualitative analyses were conducted. In these qualitative analyses, I provided a descriptive classification and justifications for this classification of spatial constructions in both languages in three areas: i) Encoding Figure and/or Ground, and spatial relation between Figure and Ground when both were mentioned in TİD and Turkish (4.4.1); ii) linguistic devices in encoding spatial relations in TİD and Turkish (4.4.2), and iii) types of simultaneity in representing Figure and Ground (for TİD only) (4.4.3).

4.4.1 Encoding Figure and/or Ground, and spatial relation between Figure and Ground when both were mentioned in TİD and Turkish

Full expression of locative expressions consists of mention of Ground and Figure, and a relational predicate that specifies their relation to each other. However, as mentioned earlier, children might have a tendency to omit Grounds. In order to find out whether signing and speaking children exhibited such a tendency, all descriptions were first categorized into two main groups: i) Encodings where Figure or Ground is absent, and ii) encodings where Figure and Ground are both expressed. In the first group, signers and speakers omitted Figure or Ground in their locative expressions. This group of encodings with missing Figure or Ground allowed checking whether Ground omissions, which have been reported to be frequent in motion narrations of signing and speaking children (Ehrich, 1982; Weissenborn, 1986; Llyod, 1991; Hickman, 2003 for spoken languages; Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008 for sign languages). In the cases where the participants expressed both Figure and Ground, I examined whether signer/speakers expressed a spatial relation between two and if not, what they expressed instead of encoding the spatial relation between Figure and Ground.

i) *Encodings where Figure or Ground is absent*

Two patterns surfaced in the data: i) Signers and speakers omitted Ground, and expressed Figure only (see 1a for TİD and 1b for Turkish); or ii) they omitted Figure, and expressed Ground only (see 2a for TİD and 2b for Turkish). Please note that some cases where either Figure or Ground is omitted include the mention of a spatial relation (1b) – although this happened only very infrequently in the TİD and Turkish data.

(1a)   (age 3;5)

LH: LADYBUG

RH: LADYBUG[16]

"Ladybug"

(1b) Kova   üst+ün+de.   (boy, age 3;8)

      Bucket on+POSS+LOC

"The bucket is on [something]."

(2a)   (age 4;2)

LH:

RH: CUP

 "Cup"

---

[16] The TİD signing child in this example moves her thumbs, as in the form of the lexical sign for ladybug in TİD. For this reason, this is annotated by deaf and hearing researchers as LADYBUG, not as a construction representing a support type of spatial relation (e.g., one hand representing the book and the other the ladybug).

(2b) Bir bardak.   (boy, age 3;8)

    One cup

  "One cup"

   ii)   Encodings where both Figure and Ground are expressed

When signers and speakers expressed both Figure and Ground, they most of the time encoded the spatial relation between them using locative devices available in their language, which will be analyzed further in 4.4.2 in the current chapter. However, this was not always the case: In some cases, they either i) just mentioned Figure and Ground without any other linguistic devices (3a for TİD and 3b for Turkish) or ii) used a verb which does not encode explicitly the spatial relation between the entities (4a for TİD and 4b for Turkish).
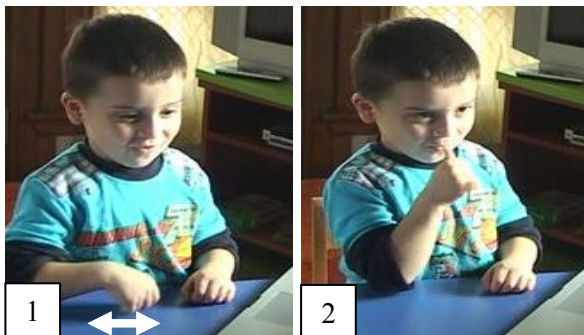
(3a)   (age 4;0)

LH:

RH: PENCIL   CUP

"There is a pencil, there is a cup."

(3b) Bi(r)   tane   kedi   var,   bi(r) tane   de   gemi   var.   (boy, age 5;4)

    One   item   cat   there_is, one   item also   ship   there_is

"There is one cat. There is one ship."

(4a) 1   2   3   (age 5;1)

LH: PEN   CUP

RH: THROW

"There is a pencil. There is a cup. The pencil is thrown."

(4b) Zürefa   kapı+yı   aç+mış   bak+ıyor.   (boy, age 5;4)

    Giraffe   door+ACC   open+PAST   look+PROG

    "Giraffe has opened the door and is looking."

One of these linguistic devices deserves further attention; namely, use of a lexical verb. In the data, it was observed that the use of lexical verbs by TİD signers may or may not encode an explicit spatial relation. In sign languages, verbs can be localized in the signing space, and encode the spatial relation between entities. However, the verb meaning "to throw" used by the signing child in (4a) above was articulated in the neutral signing space without being directed towards the location of the Ground (i.e.,

69

cup, 2nd still). So, such cases where the lexical verbs are not signed towards the Ground do not encode an explicit spatial relation between the entities – similar to the Turkish verbs that do not convey any relational meaning (4b). However, as mentioned at the beginning of the paragraph, verbs in a sign language can be localized in signing space indicating the spatial relation between Figure and Ground. In example (13), 3rd still, an adult TİD signer uses the same verb (i.e., to throw), but in a localized way by directing it towards the Ground. Such cases were considered to encode a spatial relation between Figure and Ground, and will be mentioned in the following section (4.4.2).

In this section, I have described patterns observed in the picture descriptions of the adults and children in TİD and Turkish, and a schematized presentation is given in Figure 4.3 below.
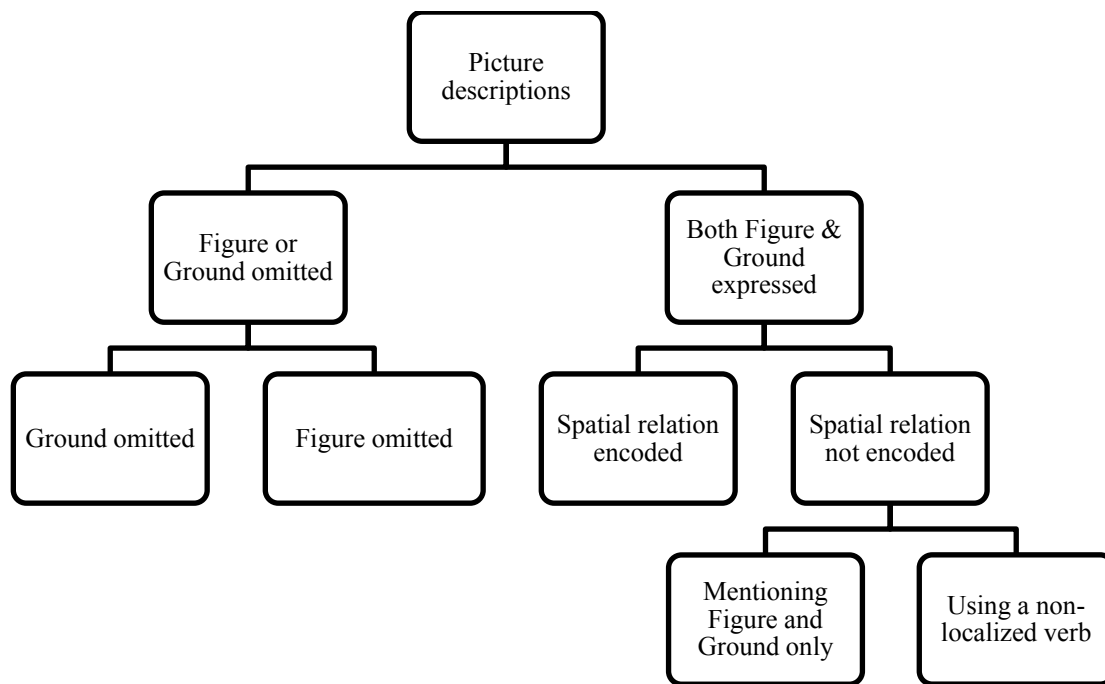
Figure 4.3: A schematic view of the patterns that emerged in the TİD and Turkish data for the mention of Figure and/or Ground.

In the next analyses, I examine the descriptions where signers and speakers mentioned both Figure and Ground, and also expressed the spatial relation between them. Within these encodings, I further categorized the linguistic devices that signers and speakers used to encode the spatial relations.

4.4.2 Linguistic devices in encoding spatial relations in TİD and Turkish

TİD signers and Turkish speakers can use different sorts of linguistic devices to encode the spatial relation between Figure and Ground. In Chapter 2 (2.3), information about possible ways of such relational encoding in TİD and Turkish was presented. The current section reports whether these devices also occurred in the current data and examines if there are any other locative devices that occurred.

4.4.2.1 Linguistic devices in encoding spatial relations in TİD

In their relational encodings, TİD signers were observed to use a variety of linguistic devices. Some of them such as classifier predicates carry more visual resemblance to the real spatial configuration than others (e.g., relational lexemes). I categorized the devices that TİD signers employed to encode a spatial relation into types to be able to quantify them more easily and to address the issue of whether more iconic forms are learned earlier than less iconic ones. These categories are i) analogue constructions that include linguistic devices that carry visual resemblance to the real spatial configuration, and convey iconic information about Figure and Ground (e.g., their shape, size); ii) categorical constructions that include linguistic devices that carry less visual resemblance to the real spatial configuration, and *do not* convey any information about Figure and Ground or the specific location of Figure in relation to Ground; and iii) other constructions that comprise linguistic devices that could not be categorized easily as either analogue or categorical.

i) *Analogue constructions*: This category contains the kind of linguistic devices where signers use their hands to represent certain salient features of the objects, and map them onto the signing space in an analogue way to the spatial configuration as shown in the stimulus pictures. These forms include classifier predicates (5, 3rd still), lexical sign placements[17] (6, 2nd still), and SASS placements (7, 3rd still), as also explained in 2.3.2 in Chapter 2. Below I present examples for each of these three categories respectively:

---

[17] All lexical signs used in the TİD data carried visual resemblance to Figures in terms of shape, size, or how they are manipulated.
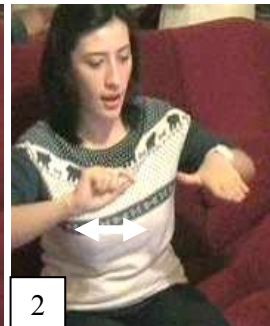
(5)

LH:	TABLE	-------HOLD-------	CL(flat)$_{loc}$
RH:	TABLE	PENCIL	CL(long)$_{loc}$

"There is a table. There is a pencil. The pencil is on the table."

(6)

LH:	BOWL	-------HOLD---------
RH:	BOWL	BALL$_{loc}$

"There is a bowl. The ball is in the bowl."

(7) (age 6;10)

| LH: | CUP | | ------------------ HOLD ------------------- | |
| RH: | CUP | TOOTHBRUSH | SASS (long)$_{loc}$ |

"There is a cup. There is a toothbrush. The toothbrush is on the cup."

It was sometimes difficult to differentiate a classifier handshape and a lexical handshape since signers used the same handshape in these forms for certain referents. In such cases, I examined if there was a pause after the introduction of the referents or not. For example, in (8), the handshape in the lexical sign "ball" (2nd still), used to introduce the Figure, is the same as the handshape in the classifier predicate for ball, used to localize the Figure (3rd still). In this description, the signer first introduces the Figure (i.e., ball) by holding it shortly. Then, he localizes it with respect to the Ground (i.e., bowl). This is quite contrary to what happens in (6) where the signer directly localizes the lexical sign for the Figure (i.e., ball) in relation to the previously localized Ground (i.e., bowl) without holding it in the signing space. I considered the lack of pause as an indicator of direct lexical sign placement. Note that this needs further analysis that considers other possible indicators such as mouthing.

(8)

LH:	BOWL	-------------------- HOLD --------------------		IN
RH:	BOWL	BALL	CL(round)$_{loc}$	IN

"There is a bowl. There is a ball. The ball is in the bowl."

However, problems with these subtle distinctions in categorizing linguistic forms did not matter too much for the present study since I included classifier predicates, SASSes and lexical sign placements under the category of analogue constructions. In these forms, signers not only represent the spatial configuration in the signing space in a visually-motivated way, but they also encode visually-motivated information (e.g., shape, size) about the entities represented. Now, I will report on the linguistic forms that are more categorical than the analogue constructions described above.

ii) Categorical Constructions: These constructions mainly include relational lexemes that are used to categorically express support, containment and occlusion relations, as exemplified in (9a) for "in", (9b) for "on", and (9c) for "under".[18] Compared to the more analogue constructions, they carry less visual resemblance to the real spatial configuration since handshapes in these lexemes do not contain specific shape and size information about Figure and Ground. Moreover, the exact spatial relation that they depict is also a less analogue representation of the spatial configuration itself (Emmorey, 2002; Arık & Wilbur, 2008; Özyürek, et al., 2010; Arık, 2013b). This category of linguistic devices has been largely ignored in the sign language literature due to assumed but not verified claims on their status as being borrowings from spoken languages or their infrequent use.

---

[18] There is no separate semantic analysis of these forms in TİD to claim that they indeed categorically divide the semantic space. However, based on previous research on sign language relational lexemes, I assume so. Such an in-depth analysis is needed to claim their categorical nature with more certainty.

(9a)

LH: ORANGE   IN
RH: CUP   ORANGE   IN

"There is a cup. There is an orange. It is in the cup."

(9b)

LH: HOUSE   HORSE   ON
RH: HOUSE   HORSE   ON

"There is a house. There is a horse. It is on the house."
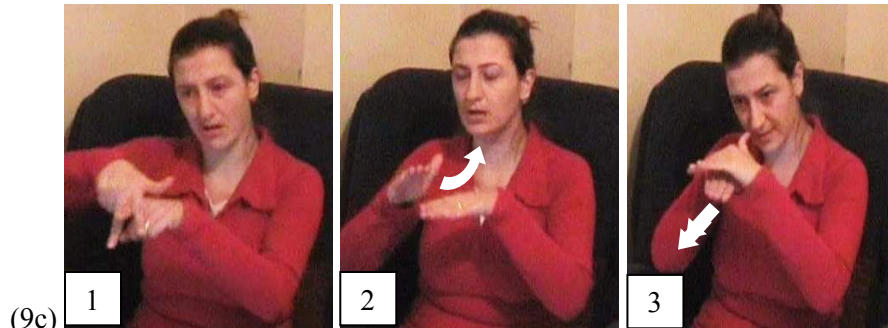
(9c)

LH:	HORSE	CAT	UNDER
RH:	HORSE	CAT	UNDER

"There is a horse. There is a cat. It is under the horse."

It is important to note here that in some cases TİD signers used one of their hands for Ground (either as a classifier or lexical sign) and used a component of a relational lexeme with the other hand to express the location of Figure. In such cases, the handshape for the Figure does not reflect any features of the Figure object (Sümer et al., 2013a). In the example (10) below, the TİD signer first uses a relational lexeme "in" (2nd still) in both hands, he articulates a classifier predicate for the Ground (i.e., bowl) with his left hand while the right hand again expresses the relational lexeme for "in" (3rd still). In the current analysis, such cases were considered to be categorical ways of spatial encoding since the handshape showing the location of the Figure does not encode any further information about the Figure such as its shape and size. However, I should note that they are somewhat "fused" forms of analogue and categorical constructions since in their encoding, they somewhat preserve the analogical aspect of the relative spatial relation between the entities. However, since there was no information regarding, for example, the shape of the Figure, these were subsumed under categorical constructions rather than analogical ones.[19] Note that both adults and children used these types of constructions (see Zwitserlood, Sümer, &

---

[19] The description in (10) was coded as having both a categorical construction (3rd still) and an analogue construction (4th still). In the quantitative analysis, this picture description was counted as exhibiting the use of double linguistic devices.

Özyürek, 2014), and such cases have not been reported elsewhere in the literature to my knowledge.

(10) (age 9;4)

LH:	BOWL	IN	CL(round)$_{loc}$ ------HOLD-----
RH:	BOWL	IN	IN CUP

"There is a bowl, and inside, inside the bowl there is a cup."

iii) *Other*: TİD signers sometimes preferred linguistic devices *other* than classifier predicates, lexical signs, SASSes, or relational lexemes. They included cases where signers pointed towards the location of the Figure with the index finger (11), used signs meaning "up" or "down" (i.e., spatial nouns) (12),[20] or used a lexical verb that is localized in the signing space to encode the spatial relation between the Figure and the Ground (13). Since each type includes only a few cases they were collapsed in the "other" category. In these forms, Figure representations did not include specific information about the Figure such as its size or shape – unlike in the analogue constructions.[21] They also do not categorize spatial relations as in relational lexemes.

---

[20] Spatial nouns "up" and "down" are included in this category, and not in categorical constructions since they do not encode contain, support, and occlusion type of spatial relations, which constitute the core interest of the current chapter.

[21] One might assume that in the lexical verb in (13), the signer encodes the shape of the Figure (i.e., ball), and that this might thus be considered to be an analogue construction (i.e., classifier predicate). However, note that the signer opens her hand at the end of sign (3rd still) as in the case of lexical sign THROW.

(11)
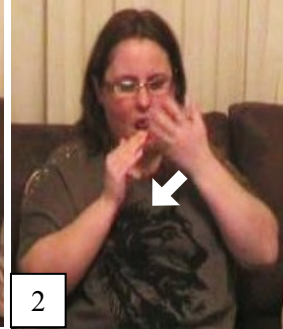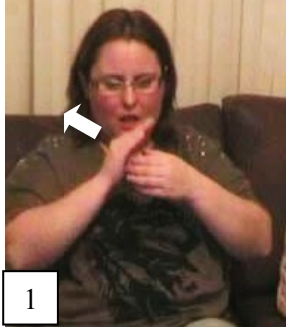
LH:	BOX	APPLE	IX_{loc}

RH: BOX   ---------------------- HOLD -------------------

"There is a box. There is an apple. The apple is (t)here."

(12)

LH:	HOUSE	HORSE	
RH:	HOUSE	HORSE	UP

"There is a house. There is a horse. It is up."

(13)

| LH: | CUP | ----------------------------- HOLD ----------------------------- |
| RH: | BALL | THROW_{loc} |

LH: CUP   ----------------------------- HOLD -----------------------------

RH: BALL   THROW$_{loc}$

"There is a cup. There is a ball. The ball is thrown into the cup."

I would like to note a final observation regarding the use of linguistic devices in the locative expressions in TİD. Signers, both adults and children, sometimes used two different devices in the same picture description (i.e., double linguistic devices) for encoding the spatial relation between the entities. For example, a TİD signer in (14) below is describing the picture showing a bowl under a table. After introducing the Ground (i.e., table) and the Figure (i.e., bowl) by their lexical signs, she indicates the location of the Figure (i.e., bowl) in a classifier predicate (3rd still), and then she also uses a spatial noun meaning "down". Thus, she describes the location of the Figure by means of two different linguistic devices (also see the examples (8) and (10) above). These descriptions were then coded as having two types of linguistic devices, and counted as contributing to each category.

(14)

LH:	TABLE	CL(flat)$_{loc}$	----------------- HOLD ----------------------
RH:	TABLE	CUP	CL(round)$_{loc}$	DOWN

"There is a table. There is a cup. The cup is under the table. It is down."

4.4.2.2 Linguistic devices in encoding spatial relations in Turkish

In the Turkish data, speakers either used i) the locative case marker (i.e., "-de/-da" – *at*) attached to the noun for Ground to express a general locative relationship, or ii) the locative case marker attached to a spatial noun. The first one henceforward will be called "general locative case marker" and the latter "spatial noun", respectively. In the first one, the general locative case marker "-de/-da - *at*", which is affixed to the noun for the Ground, indicates that a Figure is localized in relation to a Ground, without specifying the exact nature of this locative relation (e.g., support, containment, or occlusion) (15a). In order to specify the nature of the spatial relation between the entities, Turkish speakers employ a spatial noun, to which the locative case marker is affixed (i.e., iç+in+de - *inside+POSS+LOC*; üst+ün+de - *top+POSS+ LOC*; alt+ın+da - *bottom+POSS+LOC*). Note that the spatial noun should also be inflected for the possessive marker "-in/-ın" so that the locative case marker can be attached to it. This possessive marker indicates a semantic relation, especially one of possession, with the noun for the Ground, which is also affixed with genitive case marker "-nin/- nın" (15b). In this respect, it is morphologically more complex than the general locative case marker. None of the Turkish speakers used both of these forms (i.e., double linguistic devices) in the same picture description.

(15a) *Masa+da   kalem   var.*

      Table+LOC   pencil   there_is

"There is a pencil at the table."

(15b) *Masa+nın   üst+ün+de   kalem   var.*

      Table+GEN   top+POSS+LOC   pencil there_is

"There is a pencil at the top of the table." (lit. There is a pencil on the table.)

In this section, different types of linguistic devices that signers and speakers used to express the spatial relation between Figure and Ground (when they are both mentioned) were presented. A schematic summary of these devices is presented in Figure 4.4 below. In the next section, I focus on the representation of Figure and Ground in analogue constructions and investigate the simultaneity patterns that emerged in these constructions in expressing Figure and Ground in TİD only.
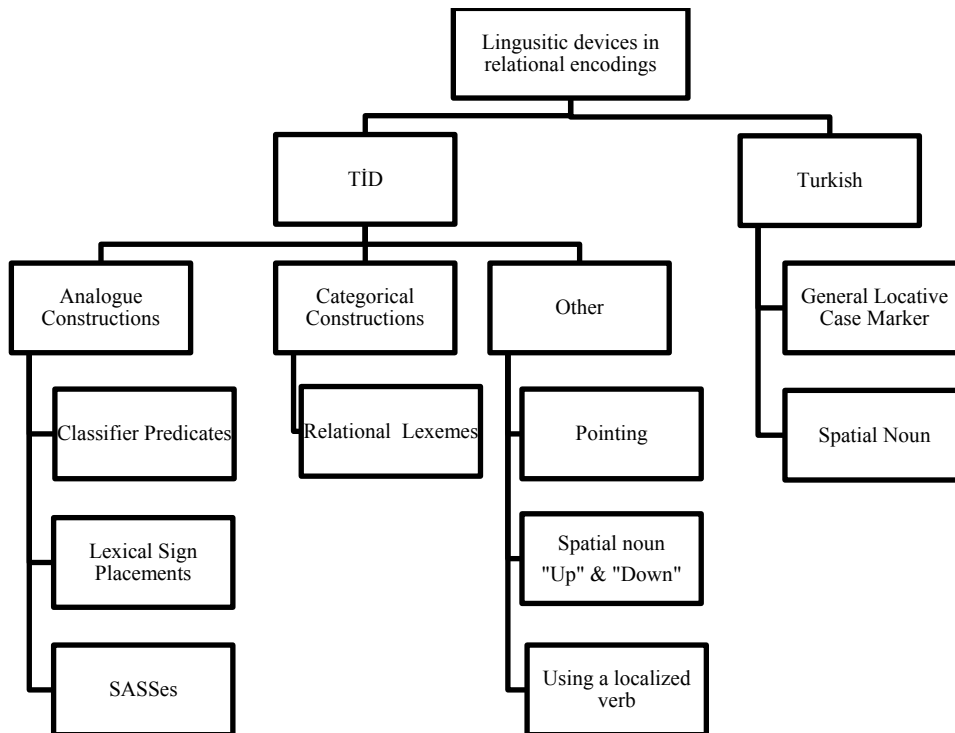

Figure 4.4: A schematic view of the different types of linguistic devices used in the TİD and Turkish data to encode topological spatial relations.

4.4.3 Types of simultaneity in expressing Figure and Ground (TİD only)

One source of difficulty for signing children in acquiring spatial language has been reported to stem from the simultaneous expression of Figure and Ground in the use of classifier predicates, and the mastery of this aspect may take beyond 10 years of age (Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). In this analysis, I concentrate on the analogue constructions to see whether signing children master these constructions in terms of simultaneity as late as has been reported in the previous literature. The reason why the current analysis is on analogue constructions, in general, and not only on classifier constructions (unlike previous research) is because lexical signs can also be combined with a locative predicate; can carry visual resemblance to the objects in the spatial configuration; and can occur in a simultaneous construction, as shown in previous sections. Thus, they can be used in a similar way to classifier predicates in terms of being located in space (see 4.4.2.1). SASSes also depict the spatial relation between entities in an analogue way to the real spatial configuration, and also convey information about the size and/or shape of the entities. Therefore, the focus is on the locative expressions where signers used an analogue construction (i.e., classifier predicates, lexical sign placements, SASSes) to encode the spatial relation between entities.

In the TİD data, there were different ways of representing the spatial relationship when Figure and Ground are expressed in analogue constructions: Signers represented Figure and Ground simultaneously or not (i.e., non-simultaneously). Further within simultaneous constructions, they either produced two forms (one for the Figure and one for the Ground) in the signing space at the same time (Simultaneous-Simultaneous), or localized the Ground first (e.g., in a classifier predicate or by a lexical sign), and while holding the Ground, localized the Figure in relation to it (Simultaneous-Consecutive) (see Perniss, 2007 for the distinction between these two types of simultaneity). In the schematic representations of different types of simultaneity given below, the parts indicated with brackets show how Figure and Ground are expressed (i.e., simultaneous versus non-simultaneous). Note that introduction of Figure and Ground may be optional since signers sometimes prefer to localize them by their lexical signs immediately, as explained in 4.4.2.1. So, they are indicated in the brackets to mark their optionality.

i) **Sim**ultaneous-**Sim**ultaneous (SimSim): In this type, TİD signers introduce the Ground and the Figure. They then localize both of them by using two hands simultaneously with analogue constructions (16a).

> (Ground NP) (Figure NP) [Localization of Ground + Localization of Figure]

(16a)   1   2   3   (age 7;10)

LH: CL(long)$_{loc}$

RH: CUP   TOOTHBRUSH   CL(round)$_{loc}$

"There is a cup. There is a toothbrush. The toothbrush is on the cup."

ii) **Sim**ultaneous-**Con**secutive (SimCon): In these constructions, signers typically first mention the Ground, and localize it with an analogue form. While they hold the Ground in the signing space, they mention the Figure, and then localize it with respect to the Ground with another analogue form (16b). This structure can be schematized as below:

> (Ground NP) [Localization of Ground]   -----------------hold----------------
>
>   (Figure NP) [Localization of Figure]

| (16b) 1 | 2 | 3 | 4 | (age 6;6) |

LH: CUP   CL(round)_{loc}   ----- HOLD -----   CL(round)_{loc}

RH: TOOTHBRUSH   CL(thin)_{loc}

"There is a cup. The cup is here. There is a toothbrush. The toothbrush is on the cup."

iii) **Non-Sim***ultaneous (NonSim)*: The mention of the Ground is followed by its localization in an analogue form in the signing space, but it is not held there. Then, the Figure is mentioned and localized in another analogue form, with respect to the previously indicated location of the Ground (16c). Its structure is schematized as:

(Ground NP) [Localization of Ground]

(Figure NP) [Localization of Figure]
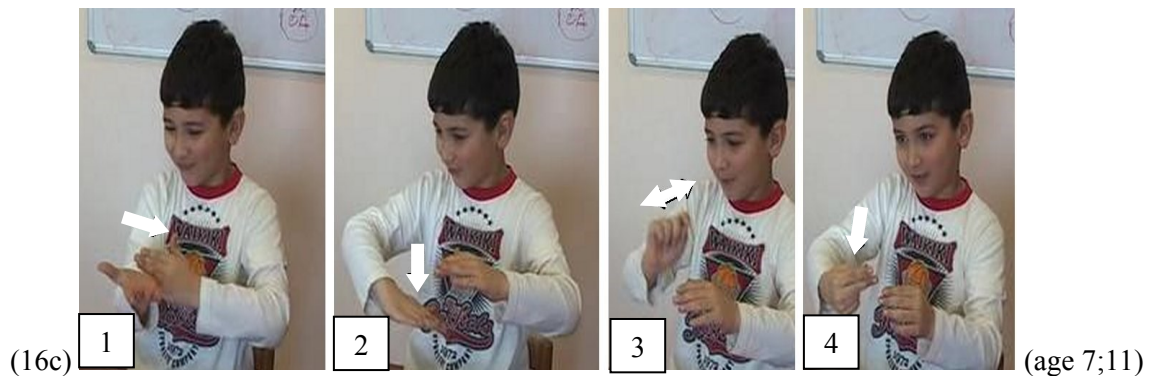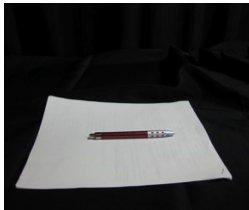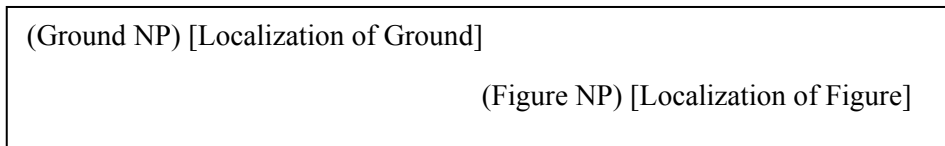
| (16c) 1 | 2 | 3 | 4 | (age 7;11) |

LH: PAPER

RH: PAPER   CL(flat)_{loc}   PEN   CL(long)_{loc}

"There is paper. The paper is here. There is a pen. The pen is on the paper."

In section 4.4, the patterns of relational encoding, linguistic devices used to encode spatial relations and types of simultaneous representation of Figure and Ground in analogue constructions (in TİD only) have been presented. The aim of this section has been to describe the data in terms of the types of linguistic expression of space. The next section focuses on how frequently these devices are used by children and adults in order to understand the developmental trajectory of learning to express topological spatial relations.

4.5 Quantitative findings

After finding out the types of language patterns in TİD and Turkish, I conducted quantitative analyses where I investigated how frequently each pattern was used by adults and children in each language. Since the linguistic devices between languages are very different from each other, most comparisons are conducted within languages, rather than across, to see if and when children reach the target patterns in each language. Before the statistical analyses were performed, arcsine transformations were applied to all the data since mean proportions of different types of descriptions from all relevant descriptions were used as the dependent measures. However, the mean proportions and standard errors/deviations reported in the tables and graphs reflect the untransformed data. Corrections in the degrees of freedom were also made whenever the sphericity assumption was violated for repeated-measures ANOVA analyses.[22]

First, I investigated the spatial descriptions elicited from adults and children in TİD and Turkish to see how likely children and adults were to express Figure or Ground, and when they expressed both, how likely they were to encode a spatial relation between them (4.5.1). Next, I focused on the locative expressions where the TİD signers and the Turkish speakers encoded a spatial relation between Figure and Ground, and analysed to what extent children were adult-like in each language in using different types of linguistic devices (4.5.2). Finally, in TİD only, I examined the

---

[22] In the present study, statistical analyses by items was not considered to be critical (although might still be informative, H. Clark, 1973b) since the scope of current analysis covers three topological spatial relations which were sampled in the stimulus materials (Bedny, Aguirre, & Thompson-Schill, 2007).

frequency of using different types of simultaneous representation of Figure and Ground by children and adults (4.5.3).

4.5.1 Frequency of encoding Figure and/or Ground, and spatial relation between Figure and Ground when both were mentioned in TİD and Turkish

As presented in 4.4.1, the findings of the qualitative analyses about relational encoding have revealed two major categories: i) Encodings where Figure or Ground is absent[23] and ii) encodings where both Figure and Ground are expressed.

i)   Frequency of encodings where Figure or Ground is absent

The total number of picture descriptions in each language is presented in Table 4.1 for TİD and Table 4.2 for Turkish. There is variation between the two languages in terms of the total number of picture descriptions, which is a result of technical problems experienced during data collection (unclear speech/image) or, in the case of children, not being willing to describe certain pictures.

Table 4.1: Total number of picture descriptions from each age group and mean proportions (SD) of these descriptions with Ground or Figure omitted in TİD.

TİD Signers	No. of Picture Descriptions	Ground Omitted	Figure Omitted
Deaf Adults	210	.01 (.02)	.01 (.02)
Deaf Older Children	207	.04 (.06)	.03 (.08)
Deaf Younger Children	201	.23 (.24)	.18 (.20)
TOTAL	618	.09 (.14)	.07 (.17)

---

[23] The cases with both Figure and Ground omitted, but with a spatial relation encoded were very rare (4 out of 618 cases) in the TİD data, and thus were not included in the current analysis. Such cases did not surface in the Turkish data.

Table 4.2: Total number of picture descriptions from each age group and mean proportions (SD) of these descriptions with Ground or Figure omitted in Turkish.

Turkish Speakers	No. of Picture Descriptions	Ground Omitted	Figure Omitted
Hearing Adults	209	.00 (.00)	.00 (.00)
Hearing Older Children	207	.01 (.02)	0 (.00)
Hearing Younger Children	210	.04 (.09)	.01(.04)
TOTAL	626	.02 (.05)	.01 (.02)

Subject-based mean proportions of picture descriptions with Figure or Ground omitted were calculated out of subject-based mean proportions of all picture descriptions as the dependent measure, and turned out to be quite low in each subgroup. The effects of age, language, and type of omission as independent measures were analysed in a 3 (Between subjects, Age: adults, older children, younger children) by 2 (Between subjects, Language: TİD, Turkish) by 2 (Within subjects, Type of omission: Ground omitted, Figure omitted) mixed ANOVA. The results yielded no main effect of type of omission, $F(1, 54) = 3.02$, $p = .09$, $\eta^2_p = .05$, but a main effect of age, $F(2, 54) = 8.30$, $p = .001$, $\eta^2_p = .24$, and main effect of language, $F(1, 54) = 8.38$, $p = .005$, $\eta^2_p = .13$. There was no interaction between type of omission and age, $F(2, 54) = 3.02$, $p = .06$, $\eta^2_p = .10$, or type of omission and language, $F(1, 54) = .50$, $p = .49$, $\eta^2_p = .009$, but there was an interaction between age and language, $F(2, 54) = 4.70$, $p = .01$, $\eta^2_p = .15$. There was no 3-way interaction among them, $F(2, 54) = .19$, $p = .83$, $\eta^2_p = .007$.

The lack of main effect of type of omission and its interaction with either language or age indicates that both age groups of children in both languages omitted either Figure or Ground from their picture descriptions in similar amounts. So, regardless of the language being acquired, both younger and older children do not show a strong preference to drop the Ground as opposed to Figure.

Due to the interaction found between language and age, I conducted one-way ANOVAs for each language. In TİD, there was a main effect of age for both Figure omissions, $F(2, 29) = 5.69$, $p =$

.009, and Ground omissions, $F(2, 29) = 6.92$, $p = .004$. Post hoc comparisons (Bonferroni) showed that signing older children were similar to adult signers in Figure omissions ($p = 1.00$) and Ground omissions ($p = 1.00$), but that younger signing children omitted Figure or Ground more frequently than signing adults ($p = .01$ for Figure omission and $p = .006$ for Ground omission) and than signing older children ($p = .04$ for Figure omission and $p = .02$ for Ground omission). In Turkish, there was no effect of age for either Figure omissions, $F(2, 29) = .68$, $p = .51$, or Ground omissions, $F(2, 29) = 2.41$, $p = .11$.

Thus, neither TİD- nor Turkish-acquiring children showed a strong tendency to omit Ground as opposed to Figure – contrary to the previous studies with signing and speaking children that report a high incidence of Ground omission (Supalla, 1982; Ehrich, 1982; Weissenborn, 1986; Lloyd, 1991; Hickmann, 2003; Slobin et al., 2003; Engberg-Pedersen, 2003; Hickmann, 2003; Tang et al., 2007; Morgan et al., 2008). However, while Turkish-acquiring children in all ages were similar to adults in how frequently they omitted either Figure or Ground; this was not the case for the younger age group signing children who tended to omit either Figure or Ground more frequently than the signing adults.

ii) Frequency of encodings where both Figure and Ground are expressed

Now I turn to the cases where signers and speakers expressed both Figure and Ground, and investigate how frequently they encoded the spatial relation between them. A total of 1155 picture descriptions included mention of both Figure and Ground (542 from TİD signers and 613 from Turkish speakers). Subject-based mean proportions of picture descriptions in which a spatial relation is encoded (with linguistic devices mentioned in 4.4.2) were calculated out of all picture descriptions with both Figure and Ground mentioned. In order to see possible effects of type of spatial relationship (Within subjects: containment, support, occlusion), age (Between subjects: adult, older children, younger children), and language (Between subjects: TİD, Turkish) as independent measures, a 3-way mixed ANOVA was conducted. The results showed no main effect of spatial type on how frequently a spatial relation is encoded, $F(2, 101) = 2.80$, $p = .08$, $\eta^2_p = .05$. However, the results yielded a main effect of language, $F(1, 54) = 11.18$, $p = .002$, $\eta^2_p = .17$, and a main effect of age, $F(2, 54) = 8.75$, $p = .001$, $\eta^2_p = .25$,

without any interaction between them, $F(2, 54) = 3.07$, $p = .054$, $\eta^2_p = .10$. Additionally, spatial type did not interact with language, $F(2, 101) = .49$, $p = .60$, $\eta^2_p = .01$, or with age, $F(4, 101) = .96$, $p = .42$, $\eta^2_p = .03$. There was no 3-way interaction among type of spatial relation, language, and age, $F(4, 101) = .51$, $p = .71$, $\eta^2_p = .02$.

With respect to the main effect of age, post hoc comparisons (Bonferroni) showed that younger children were less likely to express a spatial relation than adults ($p = .001$) and older children ($p = .008$). Such a difference was not observed between adults and older age children ($p = 1.00$). The lack of interaction with language (although at a marginal level) suggests that this pattern holds true for both languages. As to the main effect of language, post hoc comparisons (Bonferroni) indicated that with all ages and spatial types collapsed, Turkish speakers in general encoded a spatial relation more frequently than TİD signers.
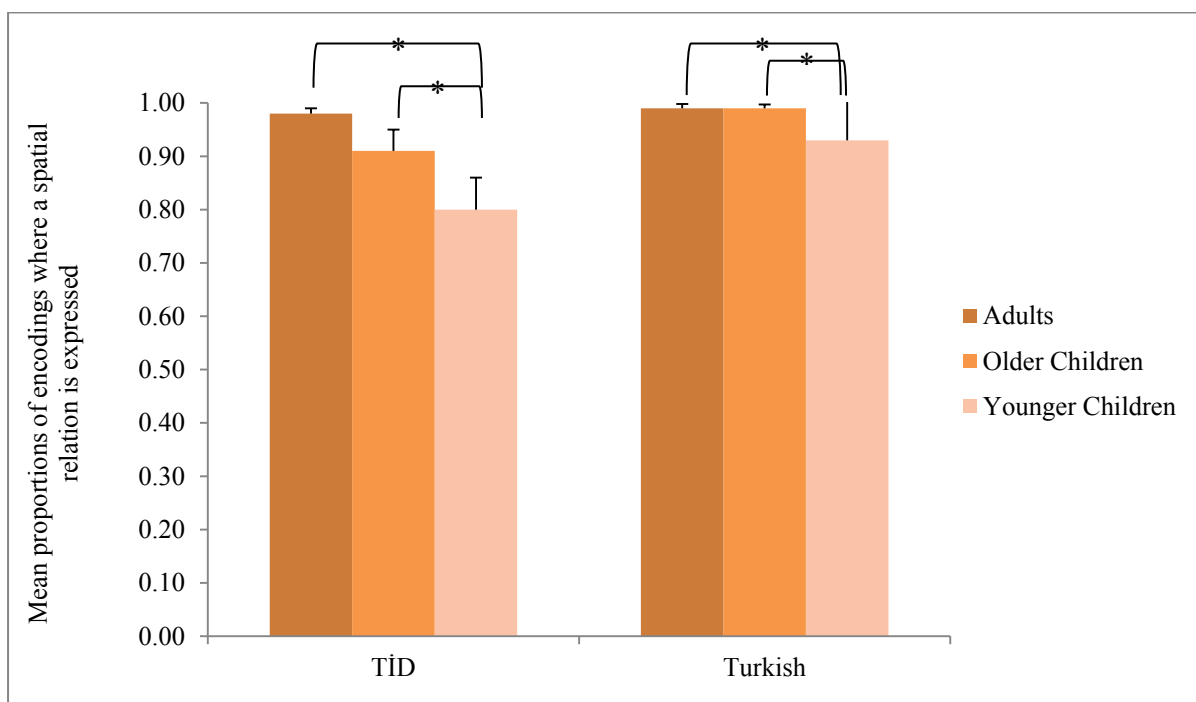
Figure 4.5: Mean proportions and error bars (representing SE) of descriptions that encode a spatial relation between Figure and Ground by all participants across age and language groups.

As the next step, the cases where no spatial relation was encoded were analysed to see what signers and speakers did instead (N=51 for TİD and N=18 for Turkish). Remember that in these cases, signers and speakers expressed both Figure and Ground, but not the spatial relation between them.

In most of these cases, signers and speakers just named Figure and Ground without using anything else (38 out of 51 cases for TİD and 17 out of 18 cases for Turkish; see 3a for TİD and 3b for Turkish). In TİD, this was rare for signing adults (4 out of 38 cases) and occurred mainly in the group of both younger (19 out of 38 cases) and older signing children (15 out of 38 cases). In Turkish, it was mainly younger children (12 out of 17 cases), but not older children (2 out of 17 cases) and adults (3 out of 17 cases), who produced such descriptions.

In other cases, signers and speakers sometimes used a verb that does not encode an explicit spatial relation between Figure and Ground (see 4a for TİD and 4b for Turkish): 13 out of 51 cases in TİD and one instance (by a young child) out of 18 cases in Turkish. In TİD, it was mostly children in the younger age group (9 out of 13 cases), rather than the older children (3 out of 13 cases) and adults (1 out of 13 cases), who used a lexical verb in this way.

To sum up, this section presented the tendencies for omission of Figure or Ground in the spatial descriptions, and when both Figure and Ground were mentioned how likely it was that the spatial relation was encoded. Irrespective of their language, neither older nor younger children showed a strong tendency to omit Ground more than Figure. However, age comparisons across languages showed that it was only signing younger children who omitted Figure or Ground more often than their signing adults. The results of the second analyses in terms of how frequently a spatial relation between Figure and Ground is expressed revealed similar developmental trajectories for TİD and Turkish. More specifically, in both languages, younger age groups encoded a spatial relation less frequently than adults and older children. Older children were adult-like in how likely they were to encode the spatial relation between Figure and Ground in both languages. In general, TİD signers encoded a spatial relation between Figure and Ground less frequently than Turkish speakers.

4.5.2 Frequency of linguistic devices in encoding spatial relations in TİD and Turkish

This analysis includes the descriptions in which Figure and Ground were introduced and the spatial relation between them was encoded (491 descriptions for the signing and 595 for the speaking

groups). While analysing the linguistic devices in these spatial descriptions, I focused on the constructions that specify the location of the Figure with respect to the Ground. In other words, linguistic devices for the localization of the Figure – not for the Ground – were taken into consideration. Since it is hard to equate these linguistic devices in TİD and Turkish, direct comparisons of age groups across languages were not conducted. Rather, comparisons of age groups were done within languages, and the general developmental patterns that emerged for each language were compared with each other. The results of the analyses for TİD are presented in section 4.5.2.1 and for Turkish in 4.5.2.2 below.

4.5.2.1 Frequency of linguistic devices in encoding spatial relations in TİD

For TİD, subject-based mean proportions of picture descriptions that included different types of linguistic devices (i.e., analogue, categorical, other) were calculated out of all picture descriptions with a spatial relation encoded as the dependent measure. In order to see to what extent signing children exhibited adult-like patterns in their use of linguistic devices to express a spatial relation between Figure and Ground in TİD, a 3 (Within subjects, Type of spatial relation: containment, support, occlusion) by 3 (Within subjects, Type of linguistic device: analogue, categorical, other) by 3 (Between subjects, Age: adult, older children, younger children) mixed ANOVA was conducted. The results yielded a significant main effect for type of linguistic device, $F(2, 54) = 47.40$, $p < .001$, $\eta^2_p = .64$, but not for age, $F(2, 27) = 2.73$, $p = .08$, $\eta^2_p = .17$, or type of spatial relation, $F(2, 54) = 2.28$, $p = .11$, $\eta^2_p = .08$. There was no interaction between the type of linguistic device with age, $F(4, 54) = 1.70$, $p = .16$, $\eta^2_p = .11$, but there was an interaction between type of linguistic device with type of spatial relation, $F(2, 60) = 15.46$, $p < .001$, $\eta^2_p = .36$. The results did not show a 3-way interaction among these three variables, $F(8, 108) = 1.66$, $p = .11$, $\eta^2_p = .11$. Importantly, there was no main effect of age and it did not interact with other variables. This indicates that while encoding a spatial relation, signing adults and children used different types of linguistic devices available in TİD in quantitatively similar ways (see Figure 4.6).
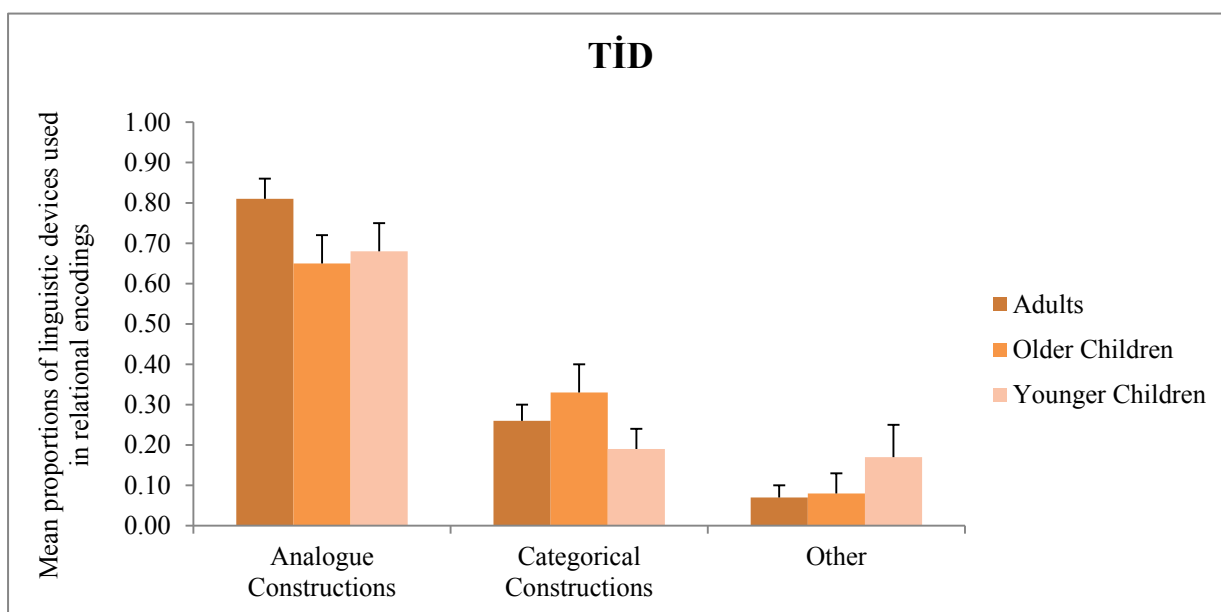
Figure 4.6: Mean proportions and error bars (representing SE) of descriptions with different linguistic devices across the age groups in TİD.[24]

Post hoc comparisons (Bonferroni) for the main effect of linguistic devices showed that using analogue constructions was the most preferred type compared to categorical constructions and the other category ($ps < .001$). TİD signers also used categorical constructions more frequently than the linguistic devices in the "other" category ($p = .007$). The lack of interaction between linguistic device and age indicates that signing children exhibited adult-like patterns in the choice of linguistic devices to encode a spatial relation.

Due to the interaction between type of linguistic device and type of spatial relation, I performed separate one-way repeated-measures ANOVAs. The results of post hoc comparisons (Bonferroni) showed that signers described containment and support relations using analogue constructions ($p = .10$) more frequently than with linguistic devices from the other two categories (i.e., categorical and "other") ($ps < .001$). However, encoding an occlusion type of spatial relation was more likely to elicit the use of categorical devices like relational lexemes. They were preferred to encode occlusion relations more frequently than for containment ($p = .005$) and support ($p < .001$). In

---

[24] Due to the use of double linguistic forms within the same picture descriptions, the proportions do not necessarily add up to 1.00.

short, TİD signers differentiated their choice of linguistic devices for encoding different types of spatial relations – using analogue constructions more for containment and support, but categorical ones for occlusion (see Figure 4.7).
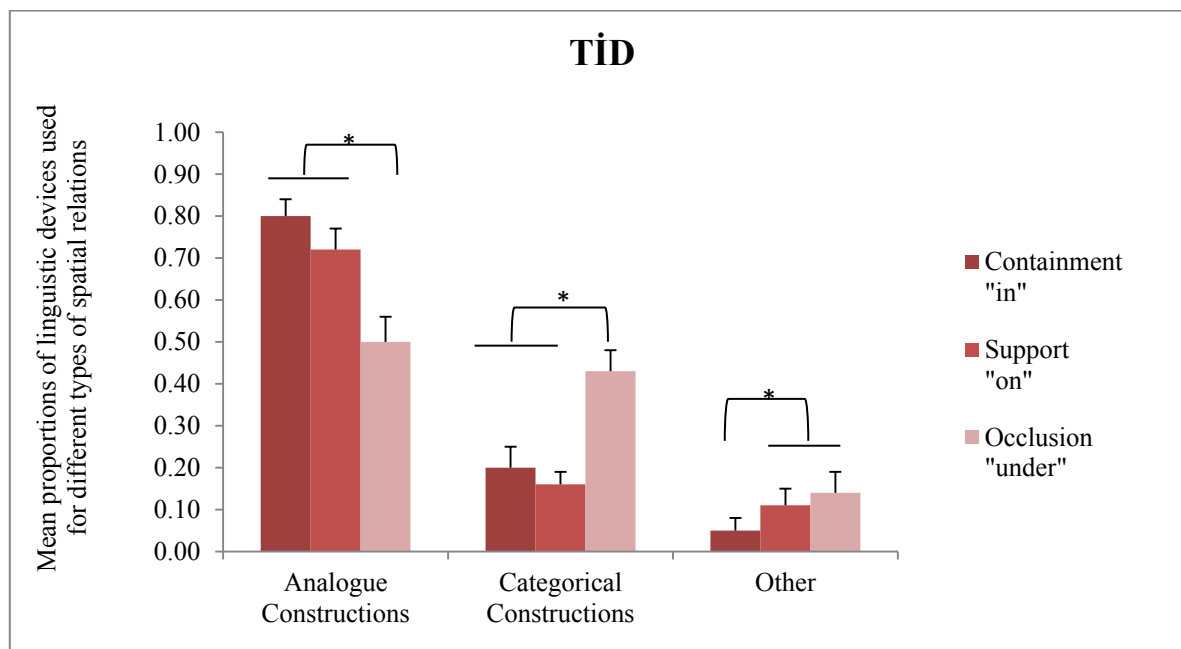
Figure 4.7: Mean proportions and error bars (representing SE) of linguistic devices for three spatial relations in TİD. Age groups collapsed.

As explained in (4.4.2.1), the three main categories in this analysis (i.e., analogue constructions, categorical constructions, and other) represent different linguistic devices. Table 4.3 below shows the raw numbers of spatial responses with different types of linguistic devices and the mean proportions of use of different types of these devices out of the total number of them in each category. Since within each category numbers are small (besides the category of classifier predicates), no further statistical comparisons were conducted. The tendencies show that classifier predicates are the most preferred form of analogue constructions. For the categorical category, adults and older children used relational lexemes and fused forms equally often, while younger children used relational lexemes more often than fused forms. Finally, the use of pointing to encode the location of the Figure was a prominent strategy from the "other" category among younger children, but not older ones and adults.

Table 4.3: Raw numbers and (mean proportions) of how frequently different linguistic devices were used by TİD signers across age groups (out of the total number of all linguistic devices within each category).

Age Groups	Analogue				Categorical			Other			
	Class. Pred.	Lex. Sign	SASS	Total	Rel. Lexeme	Fused Form	Total	Spa. Noun	Point	Verb	Total
Adults	158 (.86)	6 (.04)	0 (.00)	164	26 (.44)	33 (.56)	59	11 (.46)	9 (.38)	4 (.16)	24
Older Children	94 (.86)	13 (.12)	2 (.02)	109	35 (.60)	23 (.40)	58	6 (.30)	9 (.45)	5 (.25)	20
Younger Children	66 (.90)	7 (.09)	1 (.01)	74	15 (.75)	5 (.25)	20	2 (.07)	25 (.90)	1 (.01)	28

Use of Double Linguistic Devices in TİD

As explained in (4.4.2.1), TİD signers sometimes expressed spatial relations by using an analogue construction together with a categorical construction in the same picture description. In other words, they used two different linguistic devices to encode the location of the Figure. Out of 491 TİD picture descriptions with a spatial relation encoded, 60 exhibit the use of double linguistic devices (Table 4.4). Since the numbers are small, no statistical tests were conducted. Adult signers showed a stronger tendency to employ double linguistic devices for all types of spatial relations compared to both groups of signing children.

Table 4.4: Raw numbers and (mean proportions) of descriptions by type of spatial relation in which both analogue and categorical linguistic devices were used by TİD signers across age groups.

TİD Signers	Number of Descriptions with Spatial Relations Expressed	Containment "in"	Support "on"	Occlusion "under"	TOTAL
Deaf Adults	204	8 (.04)	9 (.04)	23 (.11)	40 (.19)
Deaf Older Children	173	6 (.03)	1 (.005)	4 (.02)	11 (.06)
Deaf Younger Children	114	2 (.02)	3 (.02)	4 (.04)	9 (.08)
TOTAL	491	16 (.03)	13 (.03)	31 (.06)	60 (.12)

To sum up, the results of the analyses of the types of linguistic devices used to encode a spatial relation by TİD signers across age groups show that signing children in both age groups have become adult-like in how frequently they use different types of linguistic devices (i.e., analogue, categorical, other). Among the three types of linguistic devices (i.e., analogue, categorical, other), analogue forms were used more frequently than categorical forms, and than the ones from the "other" category by all age groups. TİD signers also varied their choice of linguistic devices depending on the type of the spatial relation: They preferred analogue constructions mostly for containment and support type of spatial relations. Categorical forms, on the other hand, were used in the relational encodings for occlusion more frequently than for containment and support. Finally, adult signers of TİD showed a slight tendency to use two types of linguistic devices in their picture descriptions with a relational encoding when compared to children in both age groups.

4.5.2.2 Frequency of linguistic devices in encoding spatial relations in Turkish

As described before, Turkish offers two ways of expressing a topological spatial relationship. One way is to simply use the locative case marker "-de/da", which is suffixed to the Ground object (15a), which indicates that there is a spatial relation between Figure and Ground, but the nature of this spatial relation is not specified. In order to specify the type of the spatial relation, Turkish speakers must use a spatial noun (together with the locative case marker), as in (15b).

Subject-based mean proportions of picture descriptions for which a spatial relation was encoded with different types of linguistic devices out of all picture descriptions with a spatial relation encoded were calculated as the dependent measure. In order to see to what extent speaking children exhibited adult-like patterns in their use of linguistic devices to express a spatial relation between Figure and Ground in Turkish, a 3 (Within subjects, Type of spatial relation: containment, support, occlusion) by 2 (Within subjects, Type of linguistic device: general locative case marker, spatial noun) by 3 (Between subjects, Age: adults, older children, younger children) mixed ANOVA was conducted. The results yielded a main effect of type of spatial relation, $F(1, 39) = 4.18$, $p = .04$, $\eta^2_p = .13$, and type of linguistic device, $F(1, 27) = 1343.28$, $p < .001$, $\eta^2_p = .98$, but there was no main effect

of age, $F(2, 27) = 1.61$, $p = .22$, $\eta^2_p = .11$. There was no interaction between age and type of linguistic device, $F(2, 27) = 2.00$, $p = .155$, $\eta^2_p = .13$, or between age and type of spatial relation, $F(3, 39) = 1.32$, $p = .284$, $\eta^2_p = .09$, but there was an interaction between type of linguistic device and type of spatial relation, $F(2, 54) = 4.99$, $p = .01$, $\eta^2_p = .16$. There was no 3-way interaction between the variables in the analysis, $F(4, 54) = 1.28$, $p = .29$, $\eta^2_p = .09$. The lack of main effect of age and the lack of any interaction with the type of linguistic device and the type of spatial relation shows that Turkish-speaking children employed different linguistic devices as frequently as adult speakers for all spatial types (see Figure 4.8).
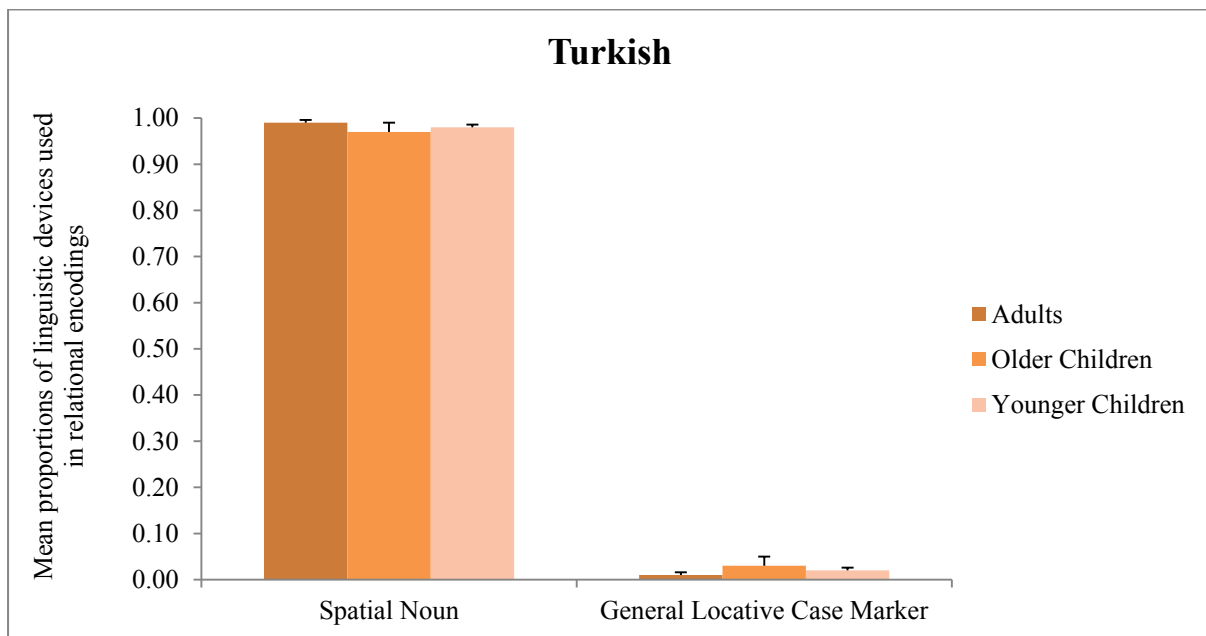
Figure 4.8: Mean proportions and error bars (representing SE) of descriptions with different linguistic devices across the age groups in Turkish.

I conducted repeated-measures ANOVA for the interaction found between type of linguistic device and type of spatial relation. Please note that this analysis was only conducted for the use of a spatial noun and not for the general locative case marker, which was hardly used by Turkish speakers since this linguistic device cannot be used for encoding occlusion type of spatial relations in Turkish, and was thus taken out of the current analysis. The results of the analysis for the use of a spatial noun did not reveal a main effect of type of spatial relation, $F(1, 29) = 4.36$, $p = .05$, $\eta^2_p = .13$, which indicates

that Turkish speakers used a spatial noun for three types of spatial relations in similar amounts (see Figure 4.9).
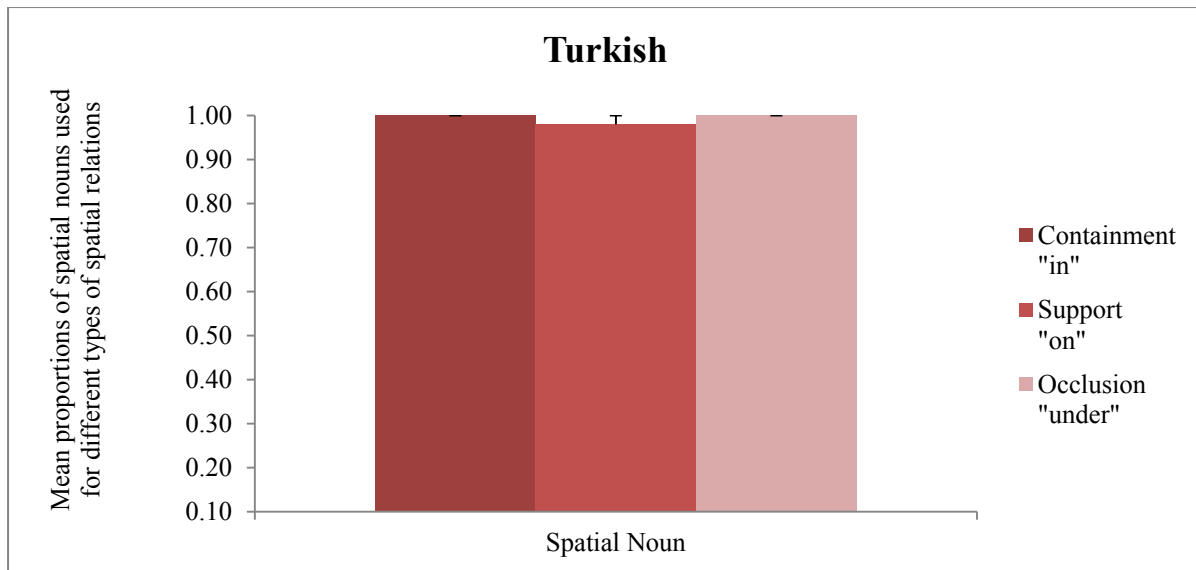
Figure 4.9: Mean proportions and error bars (representing SE) of using a spatial noun for three types of spatial relations in Turkish. Age groups collapsed.

The results of the analyses of linguistic devices used to encode spatial relations in Turkish reveal that Turkish-acquiring children in both age groups showed adult patterns, and that they use spatial nouns as frequently as adults in their locative expressions. Moreover, Turkish speakers in this task prefer to use a spatial noun rather than the general locative case marker when describing the spatial relations between the entities.

4.5.3 Frequency of different types of simultaneity in expressing Figure and Ground (TİD only)

Subject-based mean proportions of picture descriptions with different types of simultaneity (SimSim, SimCon, NonSim) were calculated out of all picture descriptions where the spatial relation was encoded with analogue constructions. A 3 (Between subjects, Age: adult, older children, younger children) by 3 (Within subjects, Type of spatial relation: containment, support, occlusion) by 3 (Within subjects, Type of simultaneity: SimSim, SimCon, NonSim) mixed ANOVA was conducted. The results yielded no main effect of age, $F(2, 27) = .33$, $p = .72$, $\eta^2_p = .02$, no main effect of type of spatial relation, $F(2, 54) = .75$, $p = .48$, $\eta^2_p = .03$, and no interaction between them, $F(4, 54) = 1.93$, p

= .12, η^2_p = .13. There was a main effect of type of simultaneity, $F(2, 42) = 10.33$, $p = .001$, $\eta^2_p = .28$, without any interaction with age, $F(4, 54) = .69$, $p = .60$, $\eta^2_p = .05$, or type of spatial relation, $F(4, 108) = 1.82$, $p = .13$, $\eta^2_p = .06$. There was no 3-way interaction between the variables, $F(8, 108) = .75$, $p = .65$, $\eta^2_p = .05$.

Post hoc comparisons (Bonferroni) for the main effect of simultaneity type indicate that there was no statistical difference for the preference of SimSim or SimCon ($p = .80$), but that NonSim was used less frequently than SimSim and SimCon ($ps < .001$). This pattern holds true for all age groups of TİD users and for all spatial types since it did not interact with age and type of spatial relation, and there were no main effects of age and type of spatial relation. In other words, signing children in both age groups were similar to adults in representing the Figure and the Ground more with simultaneous than non-simultaneous constructions, and did not differentiate between the two types of simultaneity.

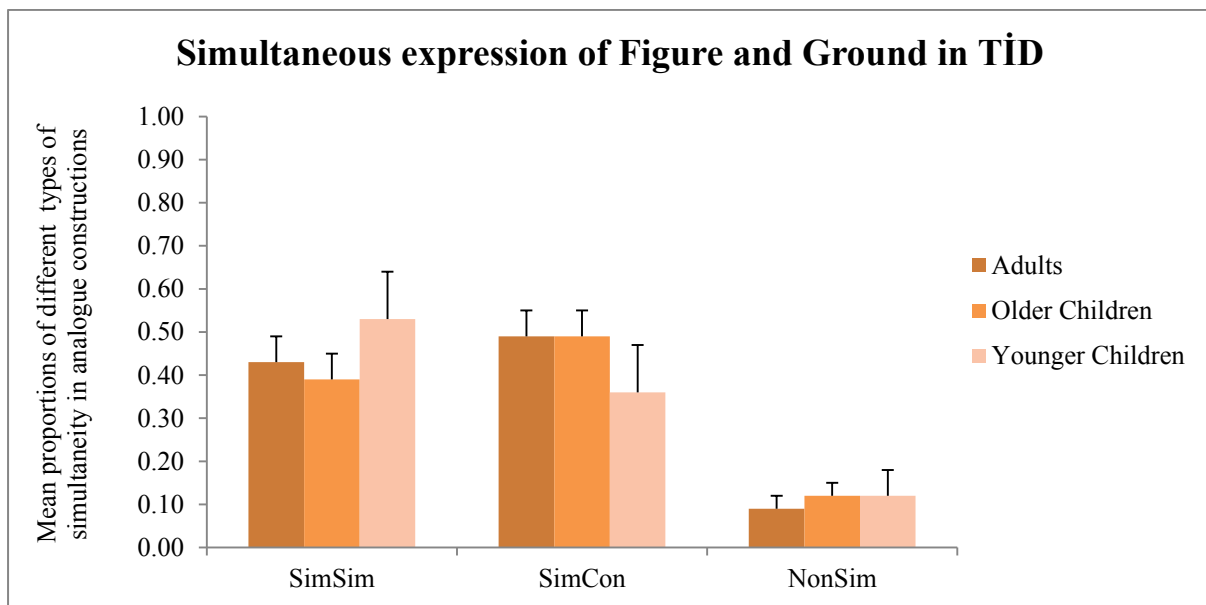
Figure 4.10: Mean proportions and error bars (representing SE) of different simultaneity types used in analogue constructions in TİD.

4.6 Summary & Discussion

In this study, the developmental trajectory of learning to encode topological spatial relations in a sign (TİD) versus spoken language (Turkish) has been examined by focusing on the mastery of different

aspects of the locative expression. In general, three hypotheses were tested; namely, a facilitating effect, a hindering effect, or a neutral effect of the visual-spatial modality. The findings in general showed that there is not a major effect of modality on the acquisition of different aspects of topological spatial expressions. In addition, qualitative and quantitative analyses of different types of linguistic devices as used by adult and child signers of TİD have been offered for the first time for the expressions of topological spatial relations. The findings are summarized and discussed in relation to the previous literature and how they pertain to discussions of modality effects on spatial language development below.

i)   Figure - Ground expression

In the first analysis, I explored how likely children and adults were to express Figure and Ground in their descriptions in both languages. Previous studies with signing children report that they usually drop the Ground in their narrations of motion events, and it takes beyond 10 years of age for them to acquire encoding of the Ground in these expressions, and this has been considered as a modality-specific aspect of sign language development (Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). However, previous research with children acquiring different spoken languages (English, French, German, and Mandarin Chinese) has presented evidence that spoken language acquiring children also have difficulty in expressing the Ground in their narratives even beyond 10 years of age, and had a tendency to drop the Ground in their narrations (Ehrich, 1982; Weissenborn, 1986; Llyod, 1991; Hickmann, 2003). However, this previous research has not examined the expression of static topological spatial relations in the same task in a sign and a spoken language.

The current data firstly show that omissions of Figure or Ground were rather infrequent in the child data in both languages. Secondly, there was not a strong preference for the omission of Ground compared to Figure by TİD- or Turkish-acquiring children. Finally, in both languages, children around 7 years of age were able to mention both Figure and Ground. Thus, with respect to Ground omission, there does not seem to be a modality-specific effect in learning to mention Figure and Ground – unlike previous research with signing children.

The difference with regard to the previous studies might be explained in terms of task difference (description of single pictures versus narration of a picture story), discourse complexity (short descriptions versus longer narrations), or event type (location versus motion). In the previous studies, in contrast to the current study, descriptions of primarily motion events were collected, based on narrations of picture stories (e.g., Frog Story, Horse Story). Motion events are more complex than locative spatial relations, since they usually involve more semantic elements (e.g., combinations of Figure, Ground, Path, Manner), whereas static locative relations usually involve only Figure and Ground objects. In a study with 7-12 month-old infants acquiring English, Göksun, Hirsh-Pasek, & Golinkoff (2009) show that Grounds were better noticed in the absence of Motion, and they suggest that the motion of a Figure object diminishes attention to other aspects of a motion event when compared to a static one. Chapter 6 of this dissertation investigates the expression of Figure and Ground in motion event descriptions in Turkish and TİD to see whether there is indeed a tendency for Ground omissions.

Note that there was a difference for younger age group across languages: Signing children in this age group omitted Figure or Ground more frequently than older signing children and signing adults whereas their speaking peers were similar to older children and adults. Unfortunately, it is not possible to extract from previous research on sign languages whether Grounds were omitted more than Figures, or whether signing children made such omissions more frequently than adults. I assume that Figures were not omitted, and were expressed as incorporated to the classifier handshape since Ground omissions were observed when classifier predicates were used.

Relational encoding

In the descriptions in which Figure and Ground are both mentioned, the comparisons of age groups within each language revealed that signing and speaking children become adult-like at similar ages (older age group) in how frequently they encode a spatial relation between the entities. Thus, a similar developmental trajectory was found in both TİD and Turkish in learning to encode spatial relations between Figure and Ground. It suggests again that the modality of the language being acquired (i.e.,

visual-spatial versus auditory-vocal) does not have an effect (i.e., neither facilitating nor hindering) in learning to express topological spatial relations.

Although there is a similar developmental pattern in learning to express a spatial relation between objects in both languages, all Turkish speakers (age collapsed) encoded the location of the Figure with respect to the Ground more frequently than all TİD signers. The reason for this might be that some signers could not find the appropriate classifier handshape to represent certain objects shown in the stimulus pictures. This needs further investigation.

ii) Linguistic devices that encode a spatial relation between Figure and Ground

In order to analyse the development of use of adult-like linguistic devices for spatial relation encodings, I formed three main categories in TİD (i.e., analogue constructions, categorical constructions, and other), and two in Turkish, (i.e., spatial noun and general locative case marker). Comparisons of signing children to adult TİD signers show that children do not differ from adults in how frequently they prefer specific types of linguistic devices available in their languages. The Turkish data also reveal parallel findings for Turkish-acquiring children, who use spatial nouns and general locative case markers as frequently as Turkish-speaking adults. These results suggest no hindering or facilitating role of the modality in learning to use language-specific forms to encode a spatial relation between Figure and Ground. Turkish and TİD-acquiring children, even in the younger age group, have tuned in to the preferred linguistic devices in their languages.

One of the main findings of this analysis is that adult and child signers in general use relational lexemes to describe spatial scenes (between .20 and .30 of all picture descriptions with a spatial encoding) to a higher degree than what has been suggested in the previous literature suggested (i.e., almost no use of relational lexemes). Previous studies report that although such specific signs do exist in sign languages, signers do not prefer to employ them in their locative expressions (Emmorey, 2002 for ASL; Arık & Wilbur, 2008; Arık, 2009; Özyürek et al., 2010; Arık, 2013b for TİD). However, in the current study, both adult and child signers used relational lexemes to provide the spatial information between Figure and Ground to a considerable extent – albeit less frequently than analogue forms.

The relatively high use of these relational lexemes might be due to the inclusion of occlusion type of spatial relations, compared to containment and support. The Özyürek et al. (2010) study investigated only support (i.e., "on") and "next to" type of spatial relations. Similarly, Arık & Wilbur (2008) and Arık (2009) included containment (i.e., "in") and support (i.e., "on") in addition to viewpoint-dependent spatial relations such as "left", "right", "front", and "behind" in their study. The relatively higher use of relational lexemes in our study might thus be due to the inclusion of expressions with occlusion type of relations which elicited relational lexemes more than other types (i.e., containment and support). Interestingly, signing children in both age groups were sensitive to this distinction. One speculation about the frequent occurrence of the relational lexeme for occlusion might be that the concept of occlusion might have hindered signers to use a classifier predicate for the location of the Figures – although the Figures were always visible in the stimulus pictures. It is also possible that the Figures may look less visible to the signers because there is an occlusion type of spatial relation, and they might have preferred a relational lexeme as a device which does not provide more specific (e.g. shape) information about the Figure object.

Another reason for the higher use of relational lexemes by TİD signers in the present study than the ones reported in previous studies (Arık & Wilbur, 2008; Arık, 2009; Özyürek et al., 2010; Arık, 2013b for TİD) could also be caused from the existence of contrastive spatial configurations shown at the same time with the target spatial configuration. In this way, the signers in the present study might have wanted to emphasize such a contrastive nature of the task by using relational lexemes, but that was not the case with the previous studies where the signers were presented with only one picture to describe.

In the data, it was found that Turkish-acquiring children used a spatial noun, which is morphologically more complex than the general locative case marker – to a similar extent as adult speakers of Turkish. This might be due to the contrastive nature of the spatial configurations in the stimuli, which might have increased the use of spatial nouns rather than the general locative case marker.

It is interesting to note that both TİD- and Turkish-acquiring children preferred the linguistic devices that are more complex in form: Classifier predicates rather than relational lexemes in TİD and

102

spatial nouns rather than general locative case marker in Turkish. These findings are not in line with Supalla's (1982) earlier claims about the simultaneous morphological complexity being a source of difficulty for signing children in acquiring these forms. However, this effect could still be there in the younger ages that Supalla looked at (three children whose age ranges were between 3;6-5;11 years of age), and the current study draws its conclusions from older age groups and from location type of events rather than motion event narrations.

The affordances of analogue form-meaning mappings do not seem to facilitate spatial language acquisition for sign language-acquiring children. Signing children even in the younger age group used categorical forms such as relational lexemes as frequently as adults. When compared to analogue constructions, these forms are more categorical and convey less visual resemblance to the real spatial configuration (see 4.4.2.1). It seems that the visual resemblance between the linguistic form and the real spatial configuration did not modulate the acquisition of locative devices in sign languages. The finding that different types of linguistic devices were used by children as frequently as by adults in both languages indicate a neutral effect of modality on their acquisition since children in both languages have been found to use the preferred linguistic devices in adult-like ways at similar ages.

iii) Simultaneous expression of Figure and Ground in analogue *constructions*

Simultaneous expression of Figure and Ground in analogue constructions has been suggested to be an area of challenge for signing children, especially due to the articulatory difficulties of the simultaneous combination of two classifiers (Supalla, 1982; Slobin et al., 2003). However, in this study, signing children acquiring TİD were able to express Figure and Ground simultaneously in their picture descriptions with analogue constructions as frequently as adults.

The difference between the findings of the present study and those of previous studies might be related to the fact that previous studies analysed the simultaneous expression of Figure and Ground in motion event narrations (Supalla, 1982; Engberg-Pedersen, 2003; Slobin et al., 2003; Tang et al., 2007) – unlike the present study that focused on short descriptions of static location events.

Another source of difference between the findings of the current study and those of previous ones might be coming from how (non)-simultaneity was defined. In the previous studies, non-simultaneity may have included the cases where the signing children did not mention Figure or Ground and/or the cases where they mentioned them, but did not produce a classifier predicate (Supalla, 1982; Engberg-Pedersen, 2003; Slobin et al., 2003; Tang et al., 2007). The current analysis of analogue constructions in terms of simultaneous expression of Figure and Ground does not suggest a hindering effect of modality for signing children.

4.7 Conclusion

This chapter provides a first account of the developmental patterns in the encoding of static topological spatial relations in children acquiring TİD. It is also the first study in which the acquisition of topological spatial relations in a sign language is directly compared to adult patterns and to age-matched hearing children acquiring a spoken language, Turkish. It also went beyond previous research by focusing on a subset of spatial relations (i.e., topological), rather than generalizing from a mixed set of spatial events (i.e., location versus motion). In doing so, it also provided extensive qualitative and quantitative analyses of linguistic devices available in both languages. Moreover, the present study took varying levels of iconicity of linguistic devices in TİD into account, and factored it in the investigation of the developmental trajectory for signing children in learning to express topological spatial relations. The results show many similarities in the developmental patterns of signing and speaking children's acquisition of static topological locative expressions – in spite of the differences in modality and structure of Turkish and TİD.

As a result of these findings, I conclude that the modality of the language being acquired does not seem to have a clearly hindering or facilitating effect on learning to encode static topological spatial relations since similar developmental trends were found for age-matched signing and speaking children. The results of this study question the generalization of the claim that spatial language poses difficulties for signing children, at least for the acquisition of topological static spatial relations.

This chapter focused on only a subset of static spatial relations (i.e., topological spatial relations). The following Chapter 5 will provide results regarding expressions of viewpoint-dependent spatial relations (i.e., those that can be expressed by "left", "right", "front", "behind" in English).

Stimulus pictures used to elicit expressions of topological spatial relations

The final stimulus set for the current study comprises 21 sets of picture. Each set is a four-picture array in which one of the pictures is the target picture as indicated by the red frame. The pictures are grouped into three categories, according to the type of target spatial relation: i) Containment; ii) support; iii) occlusion. These pictures were originally developed by Dr. Jennie Pyers for the acquisition of spatial language in ASL, and were adapted for the current study.

i) Containment:
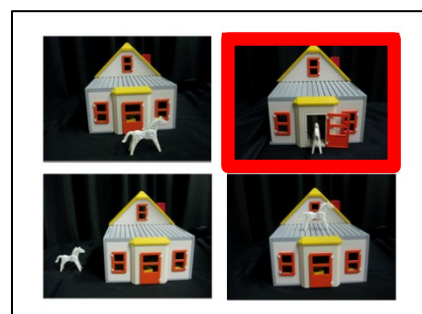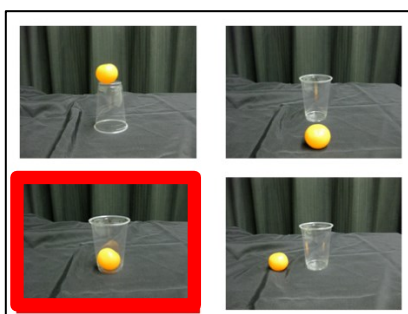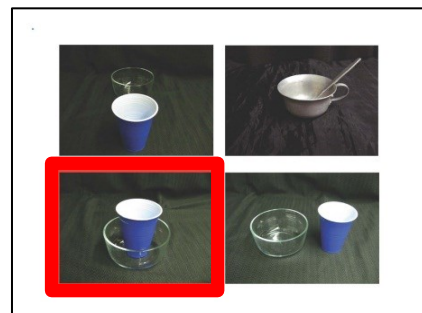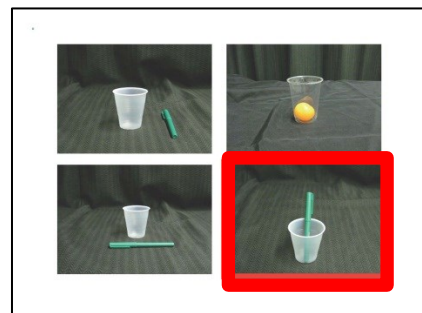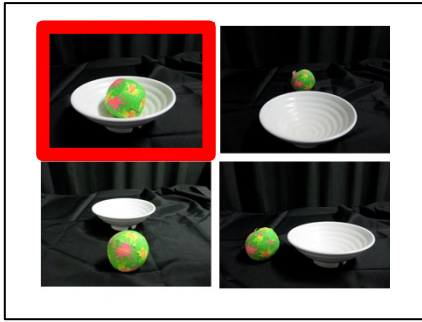
ii) Support:
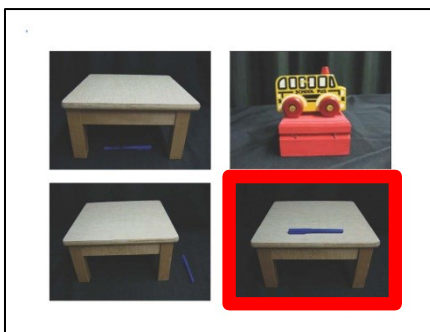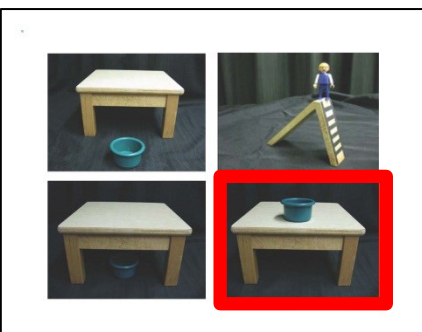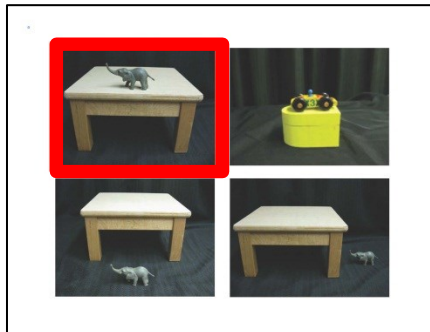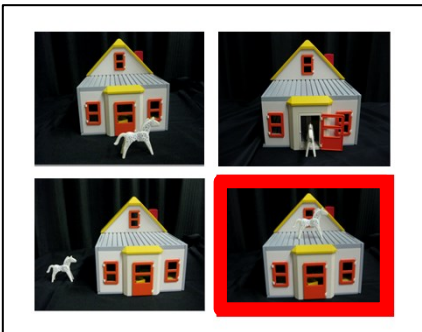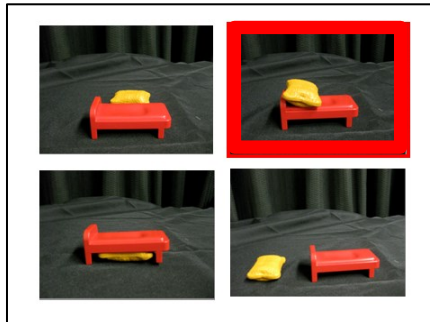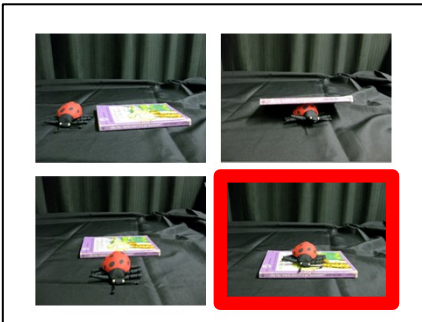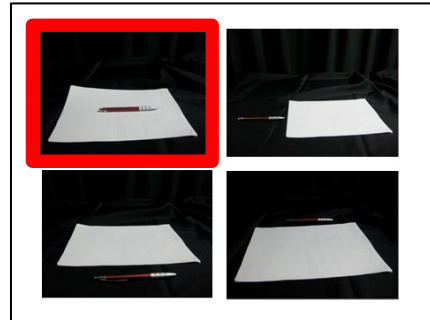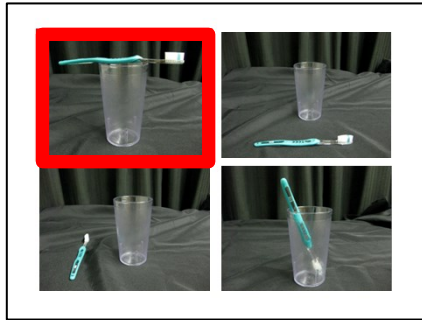
iii) Occlusion:
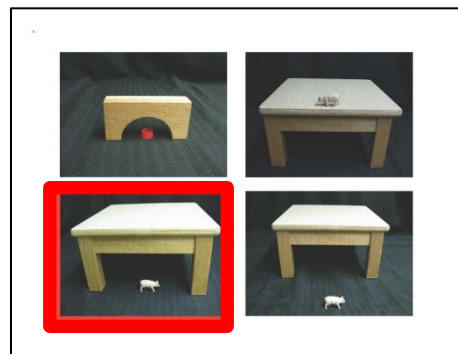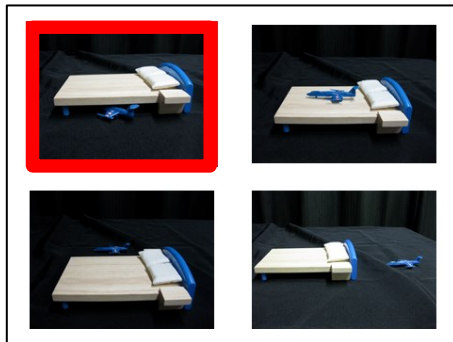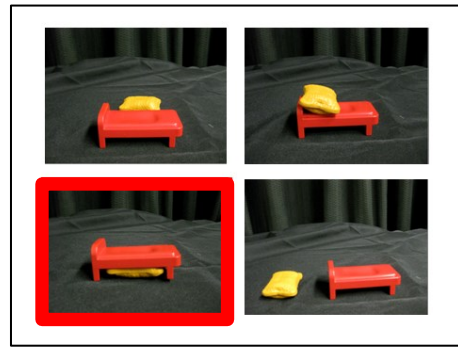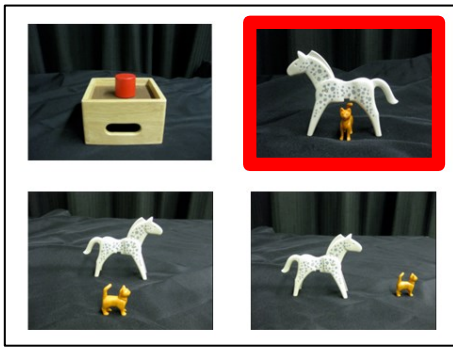
CHAPTER 5

Learning to Encode Viewpoint-Dependent Spatial Relations in TİD and Turkish

This chapter is a slightly revised version of:

A version of this chapter appeared as Sümer, B., Perniss, P. M., Zwitserlood, I., & Özyürek, A. (2014). Learning to express "left-right" & "front-behind" in a sign versus spoken language. In P. Bello, M. Guarini, M. McShane, & B. Scassellati (Eds.), *Proceedings of the 36th Annual Meeting of the Cognitive Science Society (CogSci 2014)* (pp. 1550-1555). Austin, Tx: Cognitive Science Society.

5.1 Introduction

The findings presented in the previous chapter showed that in acquiring static topological spatial expressions such as those for containment, support and occlusion, the modality in which language is conveyed does not seem to modulate the course of acquisition. The current chapter investigates further whether modality might play a role in development of linguistic encoding for another type of spatial relation, namely viewpoint-dependent spatial relations, which require interlocutors to impose a frame of reference (i.e., relative frame of reference) and specifically a "viewpoint", as described in detail in Chapter 2 (Levinson, 2003). In encoding viewpoint-dependent spatial relations, English speakers, for example, can choose spatial terms such as "left" or "right" to describe the relative location of the objects placed on a lateral axis (e.g., pencil is to the left of the paper), or "front" or "behind" for the ones located on the sagittal axis. While previous research on spoken language development has shown different developmental trajectories for the acquisition of topological versus viewpoint-dependent spatial relations, previous research on sign language development has not studied these spatial relations separately. This chapter reports on a study that investigates the acquisition of spatial expressions of viewpoint-dependent relations by the same Turkish and TİD-acquiring children and adults that participated in the study reported in Chapter 4.

Developmental studies on spoken languages show that the acquisition of viewpoint-dependent spatial relations is a late aspect of language development (until age 10 and even beyond) compared to

the acquisition of topological spatial relations (Piaget & Inhelder, 1971; Piaget, 1972; Johnston, 1985; 1988; Harris, 1972; Harris & Strommen, 1972; Bowerman, 1996a, b). However, these studies are restricted to spoken languages. There are only few studies on sign languages, which have so far focused only on the comprehension of viewpoint-dependent spatial terms (Martin & Sera, 2006; Morgan et al., 2008). These studies showed that deaf children acquiring a sign language were found to lag behind hearing children acquiring a spoken language in comprehending these spatial terms (Martin & Sera, 2006). Production studies comparing signing and speaking children in how they learn to express viewpoint-dependent spatial relations in similar tasks are missing.

As mentioned in Chapter 2 (2.3.2), signers express viewpoint-dependent spatial relations mainly through classifier constructions that contain analogue representations of the real spatial configuration (1a) (e.g., Emmorey, 2002). In these constructions, there is a one-to-one correspondence between the signer's view of the entities in real space and how they are represented in the signing space, in addition to the information about the entities themselves (i.e., size and shape). Though much less studied, signers can also use categorical lexical signs (i.e., relational lexemes) in describing viewpoint-dependent relations. In TİD, for example, the forms of these signs are directly anchored to the coordinates of the signers' body rather than being located in the signing space (Sümer et al., 2014).[25] In (1b), the signer uses a relational lexeme meaning "left" to describe the location of the pen in relation to the paper (see 2a, b, c for examples of other relational lexemes in TİD).[26] Spoken languages, on the other hand, express spatial relations mainly through abstract labels, as shown in (3). The difference in the linguistic expression of these spatial relations in a sign versus spoken language raises interesting questions about whether viewpoint-dependent spatial relations can be acquired earlier in sign languages than in spoken languages due to the iconic correspondences between form and meaning in classifier predicates and the use of relational lexemes when they are anchored directly on body coordinates, as in TİD (i.e., tapping on the left arm to mean "left" or on the chest to mean "front").

---

[25] It is important to note that relational lexemes are not always body-anchored in other sign languages. For example, NGT relational lexemes for "front" and "behind" are not signed on the body of the signer, but instead signed in the signing space (see https://en.gebarencentrum.nl/signs/signdictionary for examples).
[26] In the utterances from which these examples were taken, the classifier predicates and relational lexemes were preceded by lexical signs first for the Ground, and then for the Figure.

(1a)		(1b)	*TİD*
LH:	CL(long)_{loc}	LH:	LEFT
RH:	CL (flat)_{loc}	RH:	LEFT
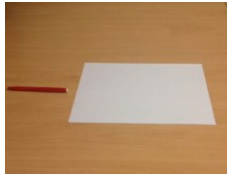
(1a) LH: CL(long)$_{loc}$ RH: CL (flat)$_{loc}$
(1b) LH: LEFT RH: LEFT *TİD*
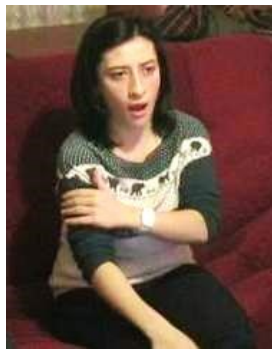
(2a) RIGHT   (2b) FRONT   (2c) BEHIND   *TİD*

(3) Kalem   kağıd+ın   <u>sol+un+da</u>   *Turkish*
    Pen   paper+GEN   left+POSS+LOC
    "Pen is to the left of the paper."

Section (5.2) presents background information about the acquisition of viewpoint-dependent spatial relations by signing and speaking children. After providing information about the present study in section (5.3), I proceed to reporting the findings of the qualitative analyses and describe language patterns in the expression of viewpoint-dependent spatial relations in TİD and Turkish in section (5.4). The next section (5.5) presents the findings of the quantitative analyses where I examined how frequently these language patterns occurred in the data elicited from the children and adults in both languages. The results are discussed in relation to previous studies and findings on the acquisition of

viewpoint-dependent spatial relations in section (5.6). General conclusions are presented and discussed in section (5.7).

5.2 Learning to encode viewpoint-dependent spatial relations

This section reviews the previous literature on the acquisition of viewpoint-dependent spatial relations in spoken (5.2.1) and sign languages (5.2.2).

5.2.1 Learning to encode viewpoint-dependent spatial relations in spoken languages

Despite differences in elicitation tasks, reports from various spoken languages present a remarkably consistent developmental picture in the acquisition of spatial terms. Johnston (1988) presents a list of 19 studies by different researchers who focus on the acquisition of locatives in English, German, Hebrew, Italian, Japanese, Portuguese, Russian, Serbo-Croatian, and Turkish. The age of the children who participated in these studies ranges from 2;0 to 4;8 years. The developmental trajectory found by these studies shows that expressions of topological spatial relations appear earlier than viewpoint-dependent ones. Within the group of viewpoint-dependent spatial relations, further developmental differences are found with regard to acquisition of "left-right" versus "front-behind".

In the acquisition of "left-right", it has been shown that children acquire them first as labels for the parts of their own body (Howard & Templeton, 1966). Young children can identify their left and right hands/legs before learning to identify the left and right hands/legs of other people (Howard & Templeton, 1966; Piaget, 1972). Using these terms to refer to the spatial relationship between objects, though, does not appear until the age of 10-12 years (Benton, 1959; Piaget, 1972; Harris, 1972; Corballis & Beale, 1976). In using "left-right" terms to refer to spatial relations between entities, children need to employ a certain viewpoint in their relational encodings. Previous studies show that children frequently make errors in inferring what a scene would be like from other viewpoints (Piaget & Inhelder, 1971; Coie, Costanzo, & Farnill, 1973; Cox & Willets, 1982). For example, Coie et al. (1973) asked 90 English speaking children aged between 5-11 years to describe an array of three houses from their own viewpoint and from the viewpoint of another person (a doll in

this case) sitting in front of them and facing the same array. Their results show that these children produced more errors in the descriptions that involved taking another's perspective than in descriptions from their own perspective. Similarly, Roberts & Aman (1993) asked 28 English-speaking children aged 6-8 years to instruct a puppet facing them to move to the "left" or "right" of the puppet, thus forcing them to take the viewpoint of the puppet. They found that children used themselves, but not the puppet, as the reference point, and failed to produce correct instructions most of the time.

Concerning the acquisition of terms such as "front-behind", previous studies have shown that these are first used for objects that have inherent fronts and backs (e.g., cars), using an intrinsic frame of reference. When children need to refer to featureless Grounds (e.g., trees) to indicate the location of a Figure, they need to impose a viewpoint and describe the scene from either their own viewpoint or that of another. This causes difficulty in encoding the spatial relation (Kuczaj & Maratsos, 1975; Johnston & Slobin, 1979; Johnston, 1984). However, children seem to acquire "front-behind" earlier than "left-right", (Piaget & Inhelder, 1971; Harris, 1972; Shepard & Hurwitz, 1984; Johnston & Slobin, 1979; Choi & Bowerman, 1991; Shusterman & Li, under review). Why does the acquisition of "left-right" pose such difficulty relative to "front-behind"?

This might be related to the bilateral symmetry of many objects (Howard & Templeton, 1966; Corballis & Beale, 1976; Piaget & Inhelder, 1971; Shepard & Hurwitz, 1984). For example, humans' (in addition to many other animate and inanimate beings) front and back sides are physically different from each other, while left and right sides are symmetrical. Also, humans face and walk forwards rather than sideways, so the sagittal axis is more salient because it determines what we see (or what we cannot see) and where we are going (Li, Shusterman, & McNaughton, under review). On these grounds, the lateral axis (i.e., "left-right") seems to be the secondary, while the sagittal axis (i.e., "front-behind") is the primary one. One first needs to know which sides are front and back in order to determine "left" and "right" sides. Then, it is plausible to argue that children acquire "front-behind" earlier than "left-right" because learning "left-right" requires knowledge of "front-behind" (Roberts & Aman, 1993; Li, et al., under review). In a recent study, Li et al. (under review) studied learning "left-right" in the speech of 20 children (mean age=4;6) by providing body-centric instructions. In this

113

experiment, the children were taught novel words that were associated with a particular side of their body ("ziv" or "kern"). They emphasized from the beginning that the meaning of the novel words is body-centric (i.e., associated with sides of the body). In addition to these body-centric instructions, the children were given a bracelet to wear on just one hand (i.e., explaining that the side with the bracelet is the "ziv/kern" hand) in order to differentiate and break the symmetry between the left and right sides. The bracelet was removed after a while. In the task, identical-looking envelopes were placed on the left or the right side of the child. They were told that one of these envelopes had a sticker in it, and one did not. They were given instructions with the novel words "ziv" or "kern" (e.g., the sticker is in the envelope on the ziv side), and were asked to point to the envelope. They were not, though, allowed to open the envelopes to avoid giving any feedback as to whether they were correct or not. Their results show that when children are taught that these terms are body-centric, they can also figure out their relative uses – referring to objects at their sides (i.e., "my left/right hands" versus "the envelope is on my left/right").

The findings on the acquisition of viewpoint-dependent spatial relations reported so far have been confined to the studies conducted with speaking children who acquire arbitrary labels for these spatial relations. These findings seem to suggest that children initially use "front-behind" and "left-right" to refer to their bodies, and then extend their use for other objects and people. Because in TİD the lexical signs "LEFT" (1b), "RIGHT" (2a), "FRONT" (2b), and "BEHIND" (2c) are body-anchored, TİD-acquiring children learn them by referring to their own bodies first, which might help the acquisition of these terms. Moreover, the analogue nature of linguistic representation of spatial relations in sign languages (e.g., through the use of classifier predicates) may be assumed to facilitate the acquisition of viewpoint-dependent spatial relations.

5.2.2 Learning to encode viewpoint-dependent spatial relations in sign languages

Compared to the number of studies conducted with spoken languages, there are fewer studies with sign languages on the acquisition of viewpoint-dependent spatial relations, and they focus only on the comprehension of these spatial relations. In one of these studies, Martin & Sera (2006) compared the comprehension of topological and viewpoint-dependent spatial relations by ASL-acquiring children

(between 4;11-9;0) to age-matched English-acquiring children. In their study, the participants were given a set of two pictures depicting two entities localized with respect to each other, and were asked to identify the picture described by the ASL signing experimenter. Their results show that ASL-acquiring children had difficulty in comprehending the constructions with viewpoint-dependent spatial relations because the comprehension of these spatial relations involves comprehension from the other's viewpoint. These children learned these spatial relations (i.e., "left-right", "front-behind") later than topological ones (i.e., "on", "above"), and they lagged behind age-matched children acquiring English. In another study, Morgan et al. (2008) examined two age groups of children (3;0-3;11 & 4;0-4;11) acquiring BSL. After being given a set of four pictures, these children saw a video in which one of these pictures was described by an adult BSL signer, and were asked to identify the described picture. As a result, the researchers observed that the understanding of viewpoint-dependent spatial relations continues to be difficult for these children beyond 5 years of age.

These two studies show that the comprehension of viewpoint-dependent spatial relations is delayed in sign language acquisition when compared to spoken language acquisition. One might assume that the visual resemblance between form-meaning mappings in sign languages may not be helping the comprehension of these terms by children acquiring a sign language. However, note that in comprehending these terms, viewpoint convergence between interlocutors (i.e., giving up one's own viewpoint and adopting that of the other person) is necessary to enable successful communication (Pyers et al., accepted). Thus, this might delay the acquisition of this skill for signing children. As to their production, there have been no previous studies done with signing children in the domain of viewpoint-dependent spatial relations.

5.3 The present study

The current study investigates how children learn to express viewpoint-dependent spatial relations in a sign (i.e., TİD) and a spoken (i.e., Turkish) language in order to understand whether and how use of the spatial modality may shape spatial language development. Below I present the motivations in section (5.3.1) and the general hypotheses for the present study in section (5.3.2). Then, I will

continue with providing general information about the methodology in section (5.3.3). Finally, I will give information on data coding and analysis in section (5.3.4).

5.3.1 Motivation

Due to the lack of studies on the production of viewpoint-dependent spatial relations by signing children, there is not much known about the possible effects of the visual-spatial modality on learning to encode this type of spatial relations.

In exploring the developmental pathways in learning to express viewpoint-dependent spatial relations, I focused on different aspects of encoding the spatial relation, parallel to the aspects examined for the encoding of topological spatial relations in Chapter 4. These constitute i) Figure and/or Ground mentions and encoding of the spatial relation when both entities are mentioned; ii) the linguistic devices used to encode the spatial relation; and iii) the use of simultaneity in expressing Figure and Ground (for TİD only). The focus on these domains is motivated by the claims made in previous research mentioned in Chapter 4, as these are the aspects that are considered to hinder the acquisition of spatial language for signing children.

Furthermore, what is specific to the encoding of viewpoint-dependent relations is in fact the encoding of the viewpoint. Therefore, as a new aspect of analysis in this chapter, the absence/presence of viewpoint was examined. Please note that this analysis is specific to TİD only, for which the reasons will be discussed further in section (5.4.3).

As the name suggests, encoding viewpoint-dependent spatial relations requires encoding a "viewpoint" (e.g., from my viewpoint as a *speaker/signer* or from your viewpoint as an *addressee*). Previous studies with sign languages report that spatial descriptions are primarily expressed from the signer's viewpoint (Emmorey, 1996; Emmorey et al., 1998; Perniss, 2007; Pyers et al., accepted). However, Emmorey (1996) also observed ASL signers describing the location of objects (using classifier constructions) from the viewpoint of their addressees, especially for objects located on a sagittal axis. The reasons for such a shift in viewpoint in such encodings have remained unexplained so far. Also, it is not known whether such a shift might be found in other sign languages and what the consequences are for the acquisition of sign languages since there are no developmental studies

116

conducted with signing children on which viewpoint they use to express the spatial relations between objects. There are, however, previous studies done with speaking children, which have presented evidence that children frequently make errors in comprehending what a scene would look like from others' viewpoints until 10-11 years of age (Coie et al., 1973; Cox & Willets, 1982).

5.3.2 Hypotheses

As in Chapter 4, three different hypotheses are considered regarding the acquisition of viewpoint-dependent spatial relations by signing and speaking children:

i) *Facilitating effect of modality*: Iconic properties of the sign language constructions through which spatial relations are encoded (i.e., classifier predicates) and their relative positioning in space, and the use of body-anchored lexical signs may facilitate learning to express these spatial relations in a sign language. On the other hand, having to learn arbitrary mappings between linguistic labels and spatial relations might present challenges for speaking children. In this case, TİD-acquiring children will learn to express these terms in adult-like ways earlier than children acquiring Turkish.

ii) *Hindering effect of modality*: Due to the use of classifier predicates and simultaneous expression of Figure and Ground, the challenges of acquiring linguistic structures specific to the visual modality might have a hindering effect in learning to encode spatial relations in TİD compared to Turkish. Furthermore, the possible difficulties encountered by sign language acquiring children in comprehending viewpoint-dependent spatial relations might also hinder their production (i.e., learning) in a sign language. In this case, TİD-acquiring children will learn to express these terms in adult-like ways later than children acquiring Turkish.

iii) *Neutral effect of modality*: In line with the literature that suggests a universal pattern for the late emergence of viewpoint-dependent spatial relations in a spoken language, one might assume a similar developmental pattern for a sign language. In this case, TİD-acquiring children will learn to express these spatial relations at similar ages as Turkish-acquiring children. Thus, there will be no effect of the modality on when signing and speaking children

become adult-like, that is, in how likely they are to encode a spatial relation and in their preference for language-specific linguistic devices.

5.3.3 Stimulus materials

In order to elicit locative expressions with viewpoint-dependent spatial relations from children and adults in both languages, a picture description task was used. All participants were asked to describe a target picture with three other pictures in the same set. In these pictures, a Figure object was situated in relation to a Ground object (e.g., pen to the left of a paper, ball in front of a bowl). The two objects in the target pictures were placed either on the lateral or sagittal axis. None of the pictures show people acting upon objects; all present objects in a static situation.

The stimuli picture sets were originally developed by Dr. Jennie Pyers to study the acquisition of spatial language by ASL-acquiring children. In the original study, the focus was on eliciting spatial descriptions that are topological, and the pictures that show objects in a viewpoint-dependent spatial relation ("left-right" or "front-behind") were not designed as targets, but as fillers. Since the initial observation of the data yielded interesting trends in the current data, they were included as the main part of the current investigation of children's spatial language in this dissertation. Due to this post hoc inclusion of the stimulus materials, not all aspects of the stimulus materials are balanced.

In this study, participants were shown a total of 16 sets of pictures: Each set contained four pictures, of which one was the target picture. There were five sets with a target picture for "left" (i.e., Figure to left of Ground), three sets with a target picture for "right", four for "front", and four for "behind". However, during data coding, four of these picture sets (one for each spatial relation) were eliminated since three of them elicited mostly motion descriptions, and one has a Ground object (i.e., sofa) with an intrinsic front, thus eliciting descriptions where it is difficult to determine if there is a specific viewpoint expressed in the relevant locative expressions. Thus, in the end, six picture sets were analysed for "left-right" (four for "left" and two for "right") and six for "front-behind" (three for "front" and three for "behind"), with a total of 12 picture sets. In each set, the target picture is indicated with a red frame (see the Appendix 5.1).
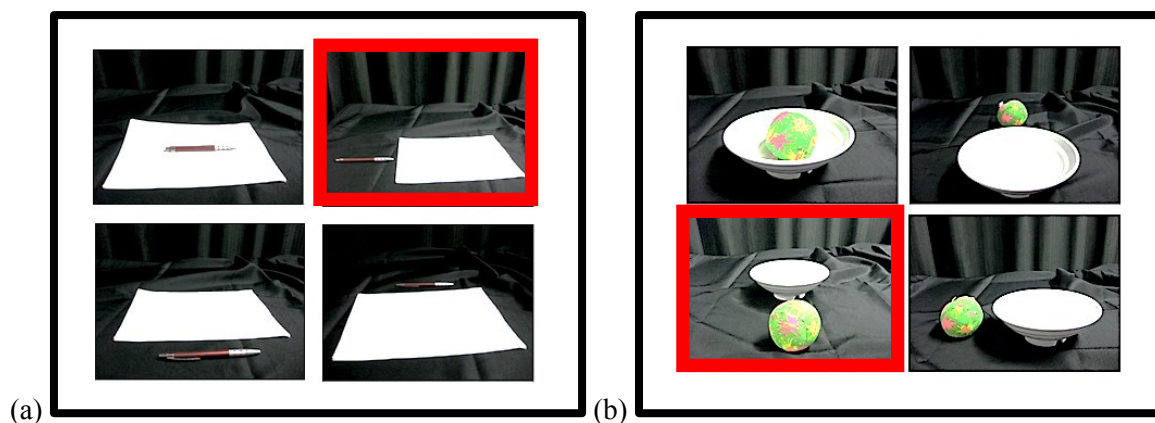
Figure 5.1: Examples of the picture sets used in the study. Target items are indicated with a red frame.

As mentioned above, in addition to the picture showing the target spatial relation, there were three other pictures showing different spatial relations, which I call "contrasts". These contrast pictures display the same objects in different spatial configurations in each picture set. For example, the target spatial relation is "left" in the Figure (5.1a), and it has contrast pictures showing "support", "front", and "behind" spatial relations.

The types of contrasts were unbalanced across sets, however, due to the reason mentioned earlier. Pictures showing objects on a sagittal axis had always one contrast showing the opposite spatial relation to the target picture. For example, in (5.1b), the target spatial relation is "front", and one of the contrast pictures displays a "behind" relation. Unfortunately, this was not the case for pictures that displayed objects on the lateral axis. In other words, when the target picture showed a Figure to the left of the Ground (5.1a), none of the contrast pictures in that set depicted another Figure to the right of the Ground.

5.3.4 Data coding and analysis

A total of 711 picture descriptions (353 from signers and 358 from speakers) for the pictures showing viewpoint-dependent spatial relations were coded. These descriptions exclude cases where signers/speakers provided a second description, or repeated their descriptions upon being asked by the interlocutor since this introduced uncontrolled variability. For each picture description, all signs were transcribed with Turkish and English glosses on separate tiers for the left and right hand in ELAN

(Wittenburg et al., 2006) by two hearing researchers who have knowledge of TİD. These annotations were checked by a deaf TİD signer, as well. Turkish data were also coded for each picture description by a Turkish speaking research assistant.

Below I present the findings of the qualitative and quantitative analyses. Finding patterns in the data through qualitative analyses formed a basis for the quantitative analyses where the frequencies of these patterns were examined.

5.4 Qualitative findings

Qualitative analyses in which I provided a descriptive classification and justifications for this classification of spatial constructions in TİD and Turkish were conducted in four areas: i) Encoding Figure and/or Ground, and the spatial relation between them when both were mentioned (5.4.1); ii) linguistic devices used in relational encodings in TİD and Turkish (5.4.2); iii) viewpoint expression in the linguistic devices in TİD only (5.4.3); and iv) types of simultaneity in representing Figure and Ground in TİD only (5.4.4).

5.4.1 Encoding Figure and/or Ground, and spatial relation between Figure and Ground when both were mentioned in TİD and Turkish

In describing the stimulus pictures showing objects on the lateral and sagittal axis, TİD signers and Turkish speakers used two general patterns: i) They omitted either Figure or Ground (i.e., encodings where Figure or Ground is absent) and ii) they expressed both the Figure and the Ground (i.e., encodings where both Figure and Ground are expressed).

i) Encodings where Figure or Ground is absent

In the current data, signers and speakers sometimes expressed the Ground only and omitted the Figure (i.e., Figure omission; see 4a for TİD and 4b for Turkish). Also, they sometimes expressed the Figure only and omitted the Ground (i.e., Ground omission; see 5a for TİD and 5b for Turkish). Please note that I examined the relational encoding for the descriptions that included mention of both Figure and

Ground, as will be explained below. However, it does not necessarily imply that only descriptions that mention both Figure and Ground encode the spatial relation. Some encodings where Figure or Ground is absent included the expression of a spatial relation (see 4a, b).
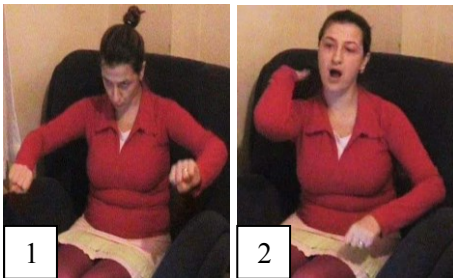
(4a)

LH: MOTORBIKE

RH: MOTORBIKE   BEHIND

"There is a motorbike. [Something] is behind."

(4b) Motorsiklet+in   arka+sı+nda.

   Motorbike+GEN   back+POSS+LOC

"At the back of the motorbike."

(5a)   (age 3;5)

LH:

RH: PENCIL

"Pencil"

(5b) Araba.   (boy, age 3;8)

   Car

  "Car"

   ii) Encodings where both Figure and Ground are expressed

When children and adults in both languages mentioned both Figure and Ground, they usually encoded the spatial relation between them, using linguistically appropriate locative devices. I explain these forms in more detail in the following section (5.4.2). However, they sometimes did not encode a spatial relation even if they expressed both Figure and Ground. In these cases, they either i) just named Figure and Ground objects, without adding anything else to their descriptions (see 6a for TİD and 6b for Turkish) or ii) they used a verb that does not specify the location of the Figure with respect to the Ground (see 7a for TİD and 7b for Turkish).

(6a)   (age 4;10)

LH: BOAT   CAT

RH: BOAT   CAT

  "There is a boat, there is a cat."

 (6b) Bi(r) tane kayık   var,   kedi   var   bir de.   (girl, age 5;8)

   One item boat there_is,   cat   there_is item also

   "There is one boat, there is one cat."

(7a)

LH:	BOWL	--------------------- HOLD ----------------------
RH:	BOWL	BALL	FALL

"There is a bowl. There is a ball. The ball has fallen down."

(7b) Kedi   kayığ+a   bak+ıyor.   (girl, 9;11)

   Cat   boat+DAT   look+PROG

 "The cat is looking at the boat."

As mentioned in Chapter 4, lexical verbs in a sign language can be localized in signing space; however, the verb in (7a) above does not convey the spatial relation between the Figure (i.e., ball) and the Ground (i.e., bowl). In the 3rd still, the beginning location of the sign FALL begins from his chest, and seems to describe an action of the Figure (i.e., falling) rather than its being located with respect to the Ground. Similarly, a Turkish speaking child in (7b) mentions both the Figure and the Ground together with the action of the Figure object (bakmak - *to look at*). However, this action does not specify an explicit spatial relation between the entities.

In this section, I have described patterns observed in the picture descriptions of the adults and children in TİD and Turkish, and a schematized presentation is given in Figure 5.2 below.
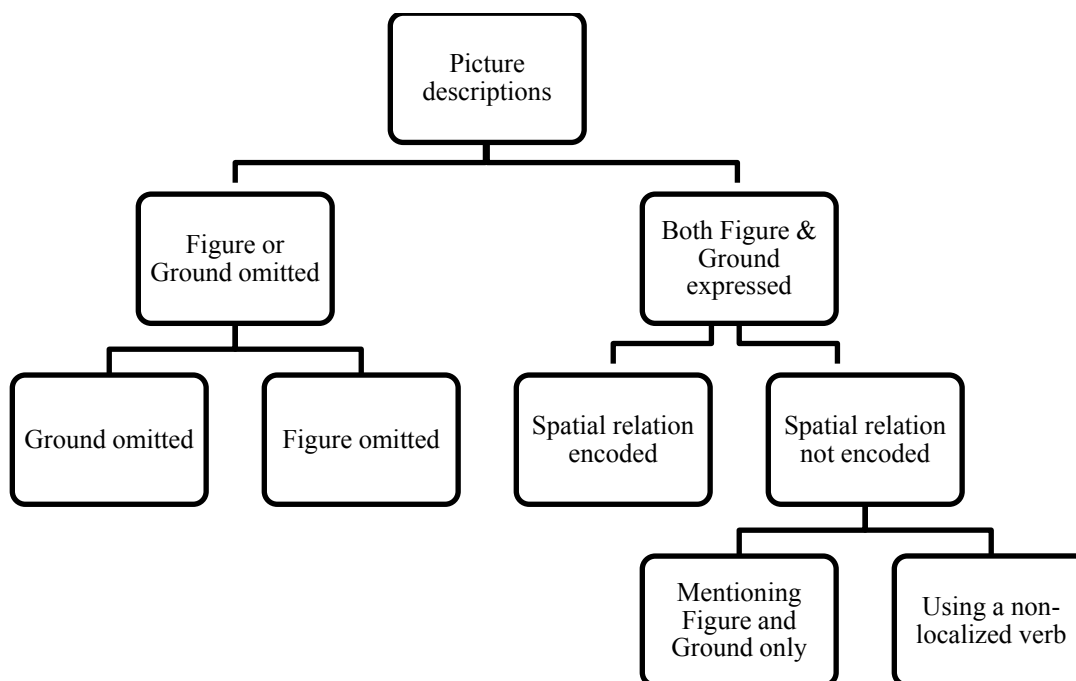
Figure 5.2: A schematic view of the patterns that emerged in the TİD and Turkish data for the mention of Figure and/or Ground.

5.4.2 Linguistic devices in encoding spatial relations in TİD and Turkish

The aim of this section is to present the types of linguistic devices used in the locative expressions where signers and speakers expressed both Figure and Ground and the spatial relation between them.

5.4.2.1 Linguistic devices in encoding spatial relations in TİD

TİD signers used different types of linguistic devices in their locative expressions to encode viewpoint-dependent spatial relations. In some of them, handshapes that are used to locate objects reflect certain properties of Figure and Ground (e.g., shape), and the configuration in the signing space bears visual resemblance to the spatial configuration being described. Some other forms encode the spatial relation in a less analogue and more categorical way, and lack visual information about the entities or the spatial configuration. Below, I describe these linguistic devices used in the relational encodings in TİD in more detail. I present them in three categories for the subsequent quantitative

analysis:[27] i) Analogue constructions that consist of linguistic devices which encode the spatial relation in an analogue way to the real spatial configuration and in which the handshapes reflect certain visual properties of Figure and Ground (e.g., size and shape); ii) categorical constructions where the spatial relation is encoded in a categorical way − similar to spatial nouns in spoken languages, and the handshapes do not provide information about the entities involved in the spatial configuration; and iii) other forms that are neither analogue nor categorical. Please note that this analysis aims to identify and categorize linguistic devices used to encode viewpoint-dependent spatial relations in TİD. In these forms, signers can describe the spatial configuration from their own viewpoint or from that of their addressee. However, viewpoint expression will not be taken into consideration for the moment, but will be dealt with in the following section.

i) *Analogue constructions*: In these linguistic representations, Figure and Ground are located in signing space in an analogue way to the spatial configuration as shown in the picture, and certain properties of the objects (e.g., flatness, thinness) are reflected. In order to describe the spatial relations in this way, TİD signers mainly use classifier predicates (8a), lexical sign placements (8b), and SASSes (8c). In (8a) below, the signer describes the location of the pen with respect to the paper in a classifier construction where she localizes the pen (her left hand) and the paper (her right hand) in classifier predicates (3rd still). In (8b), the signer encodes the location of the ball by directly localizing its lexical sign (her right hand in the second still). This differs from the previous example (8a) in the sense that the signer here does not employ a classifier for the Figure, but directly localizes its lexical sign in the signing space. Finally, in (8c) the signer describes the location of the cake through a linguistic form where she traces the shape of the cake by moving her right hand upward (i.e., with a SASS) (4th still). The critical point here is that the signer localizes the SASS for the cake with respect to the rectangular shape (i.e., the Ground) in the signing space.

---

[27] I aim for each chapter in this dissertation to be able to stand on its own as much as possible. For this reason, the part on different types of linguistic devices here bears a high degree of similarity with the corresponding section (4.4.2.1) in Chapter 4.

(8a)

LH:		PEN	CL(long)_loc
RH:	PAPER	CL(flat)_loc	-------- HOLD --------

"There is a paper. There is a pen. The pen is to the left of the paper."

(8b)

LH:	BOWL	--------- HOLD ---------
RH:	BOWL	BALL

"There is a bowl. The ball is in front of the bowl."

(8c)	1	2	3	4
LH:	RECTANGULAR	CL(rectangular)$_{loc}$	CAKE	CL(rectangular)$_{loc}$
RH:	RECTANGULAR	CL(rectangular)$_{loc}$	CAKE	SASS(cylinder)$_{loc}$

"There is a rectangular-shaped object. It is here. There is a cake. The cake is to the right of the rectangular-shaped object."

As was explained in Chapter 4, the form of some lexical signs is identical to that of the classifier for certain objects, so it was not always easy to differentiate them. Recall that for the present study, I analysed such ambiguous forms as (localized) lexical signs if they were articulated in the signing space as in (8b). These forms were usually accompanied by mouthing of the Turkish word for the referent, confirming their status as lexical signs.

In (9) below, following the introduction of the Ground (i.e., bowl), the TİD signer introduces the Figure (i.e., ball) by producing the lexical sign for "ball", and then there is a short pause (a hold of the hand) before she proceeds to localize it with respect to the Ground. The classifier for the Figure (right hand, 3rd still) has the same handshape as the lexical sign for the Figure (2nd still). Therefore, one might consider it to be "lexical sign placement" – similar to (8b). But note that the encodings in (8b) and (9) differ in whether the Figure is introduced separately or not. In (8b), the signer directly localizes the lexical sign while in (9) the signer first introduces the Figure with the lexical sign, and after a little pause, localizes it in the signing space. These differences are presented in the qualitative analysis, but in the following quantitative analysis, these two types of expression will both be analysed under the category of analogue constructions.

127

(9)	1	2	3
LH:	BOWL	CL(round)$_{loc}$	------ HOLD ------
RH:	BOWL	BALL	CL(round)$_{loc}$

"There is a bowl. There is a ball. The ball is in front of the bowl."

ii) *Categorical Constructions*: These constructions mainly include relational lexemes, in which the handshapes do not reflect properties of Figure and Ground (such as their shape), and the visual form of the spatial relation that they depict is not specific to the spatial configuration itself. In other words, they are less analogue to the real spatial configuration. TİD has specific signs meaning "left" (10a), "right" (10b), "front" (10c), and "behind" (10d).[28, 29] As exemplified below, these are mostly body-anchored signs, where the location of the Figure is mapped directly onto corresponding part of the signer's body. As shown in (10c), signers sometimes used an analogue construction (i.e., classifier predicates) and a categorical construction (i.e., relational lexeme) within the same picture description. Such cases of using double linguistic devices will be further discussed at the end of the current section.

---

[28] There is no separate semantic analysis of these forms to claim that they indeed categorically divide the semantic space. However based on previous research on sign language relational lexemes in general, I assume so. Such an in-depth analysis is needed to claim their categorical nature with more certainty.

[29] Also see (1b) and (2a, b, c) for further examples. However, in those examples, the use of relational lexemes are shown out of context whereas their use is exemplified within a larger context here (i.e., introduction of Figure and Ground).

(10a)

LH: PEN   LEFT

RH: PAPER   CL (flat)$_{loc}$ ------ HOLD ------   LEFT

"There is a paper. The paper is here. There is a pen. The pen is to the left of the paper."
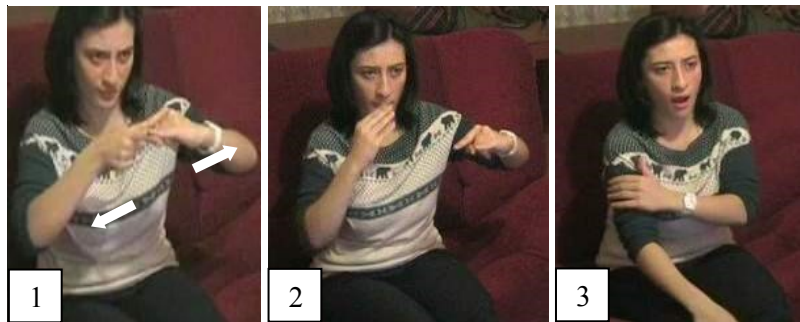
(10b)

LH: RECTANGULAR   ------- HOLD -------   RIGHT

RH: RECTANGULAR   CAKE   RIGHT

"There is a rectangular-shaped object. There is a cake. The cake is located to the right of the rectangular-shaped object."

(10c)

LH:	BOWL	-------------------- HOLD -------------------		FRONT
RH:	BOWL	BALL	CL(round)$_{loc}$	FRONT

"There is a bowl here. There is a ball. The ball is in front of the bowl."

(10d)

LH:	TABLE	--------------------HOLD -----------------------	
RH:	TABLE	CUP	BEHIND

"There is a table. There is a cup. The cup is behind the table."

I would like to note that there is some variation found in the form of the relational lexemes that mean "right" and "left" in TİD. In these variant forms, which were observed to be rare, signers indicate the space at the left/right side of their body by moving their left/right hand to the left/right side of space rather than by touching their left/right arm (11a and 11b).[30] In these forms, one might think that the signers indicate "at the right side" or "at the left side"; however it is not possible to answer such a question with the current data, and further investigation is required to understand to what extent differences in the form of relational lexemes lead to differences in their semantics.

---

[30] These forms are preceded by the lexical signs for the Ground and the Figure (not shown in the examples).

(11a)

LH: LEFT

RH:

(11b)

LH:

RH: RIGHT

Another observation about the relational lexemes is related to encoding spatial relations on the sagittal axis. TİD signers sometimes used another kind of lexical sign that encodes the spatial relations in a categorical way and that does not convey information about certain features of Figure and Ground such as shape, as in the case of relational lexemes "FRONT" and "BEHIND" (12a, 3rd still; 12b, 3rd still). These were annotated as "towards me" or "away from me". However, this does not mean that signers necessarily indicate the location of the Figure with respect to their bodies; they may be referring to the Ground, which is still held in the signing space. For the purposes of the present study, these cases are analysed as categorical constructions, but further analyses are required to understand if and to what extent they differ from the "FRONT" and "BEHIND" relational lexemes.

(12a)
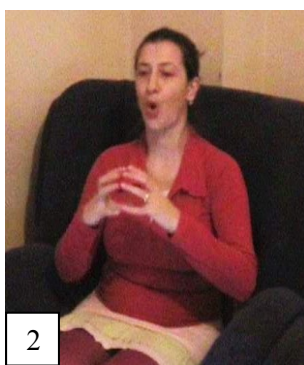
	1	2	3
LH:	BOWL	BALL	CL(round)$_{loc}$
RH:	BOWL	BALL	TOWARDS_ME

"There is a bowl. There is a ball. The ball is towards me."

131

(12b)

	1	2	3
LH:		CL(flat)$_{loc}$	---------HOLD----------
RH:	PAPER	PEN	AWAY_FROM_ME

"There is a paper. There is a pen. The pen is away from me."

iii) Other: TİD signers sometimes used a linguistic form that is neither a classifier predicate, lexical sign, SASS, nor a relational lexeme. In these cases, they indicated the location of the Figure either with index finger pointing (13a); through the enactment of the Figure where they localized their body with respect to the Ground (13b);[31] or with a lexical verb that is localized in the signing space (13c). Since each type includes only a few cases, they were collapsed into an "other" category.

---

[31] In (13b), the signer assumes the role of the Figure (i.e., cat), and changes the position of her body by moving to the right in the signing space so that it becomes next to the previously located classifier of the Ground (i.e., boat).

(13a)

LH:	BOAT	CAT	CL(flat)$_{loc}$
RH:	BOAT	CAT	IX$_{loc}$

"There is a boat. There is a cat. The cat is (t)here."

(13b)

LH:	BOAT	CL(boat)$_{loc}$	CAT	ENACT
RH:	BOAT	CL(boat)$_{loc}$	CAT	ENACT

"There is a boat. The boat is here. There is a cat. The cat is standing next to the boat."

(13c)	1	2	3	4	5	6

LH: BOAT SASS(long)$_{loc}$ ------------------------- HOLD -----------------------------

RH: BOAT SASS(long)$_{loc}$ BEHIND MAN SIT$_{loc}$ CL(man)$_{loc}$

"There is a boat. It is at the back. There is a man. The man is sitting in front of the boat."

The use of these forms, however, was not mutually exclusive in a description. In other words, the signers sometimes were observed to use double linguistic devices, as in Chapter 4. In (14), an adult signer of TİD uses two different linguistic devices to encode the location of the Figure (i.e., ball) with respect to the Ground (i.e., bowl). First, he localizes the ball in a classifier predicate (3rd still, his right hand), and follows this by the use of a relational lexeme "front" (4th still). The use of relational lexemes and classifier predicates in the same picture description and a discussion of whether using such double linguistic devices influences signers' spatial descriptions in terms of viewpoint preferences will be further discussed in section (5.6).

(14)	1	2	3	4

LH: BOWL$_{loc}$ ------------------ HOLD ------------------

RH: BOWL$_{loc}$ BALL CL (round)$_{loc}$ FRONT

"There is a bowl here. There is a ball. The ball is in front of the bowl. It is at the front."

134

5.4.2.2 Linguistic devices in encoding spatial relations in Turkish

In describing viewpoint-dependent spatial relations between entities, Turkish speakers preferred one of two ways: They were either specific about the type of spatial relation and used a specific spatial noun (i.e., sağ - *right*, sol - *left*, ön - *front*, arka - *behind*), or they used a general relational noun (i.e. "yan" or "kenar", which both mean "*side*"). For example, while describing the spatial configuration in the picture below, one adult Turkish speaker uses the specific spatial noun (i.e., sol - *left*) in (15a), while another speaker prefers the general relational noun "yan - *side*" which is affixed with a locative case marker "-de/-da - *at*" (15b). Note that while the specific spatial nouns encode a viewpoint, the general relational noun is a viewpoint free label.

In some cases, speakers also used spatial nouns for a different axis than the one they saw in the picture (i.e., labelling configurations as "left-right" for objects placed on sagittal axis, which would normally require use of the labels for "front-behind"). These will be called "non-target" spatial nouns in the quantitative analysis.[32] Since they are still encoding a spatial relation between Figure and Ground, such cases were also included in the current analyses. Moreover, through analysis of the data, it will be possible to see if Turkish-acquiring children prefer one type of spatial encoding (i.e., sagittal ones over lateral ones, or vice versa) in their picture descriptions. Turkish speakers used only one linguistic device at a time in their picture descriptions.

(15a) Kağıd+ın   sol+un+da   kalem   (male, adult)
      Paper+GEN   left+POSS+LOC   pen
"Pen is to the left of the paper."

(15b) Kağıd+ın   yan+ın+da   kalem   (male, adult)
       Paper+GEN   side+POSS+LOC   pen
"Pen is at the side of the paper."

---

[32] Such cases were rarely observed in TİD.

In this section, I presented the types of linguistic devices as used by TİD signers and Turkish speakers to describe the location of Figure and Ground objects placed on the lateral and sagittal axes. A schematic view of these forms is given in Figure 5.3 below. However, I did not present from whose viewpoint signers describe the spatial relations in these linguistic representations yet. In the next section, I deal with the issue of viewpoint-expression in these representations.
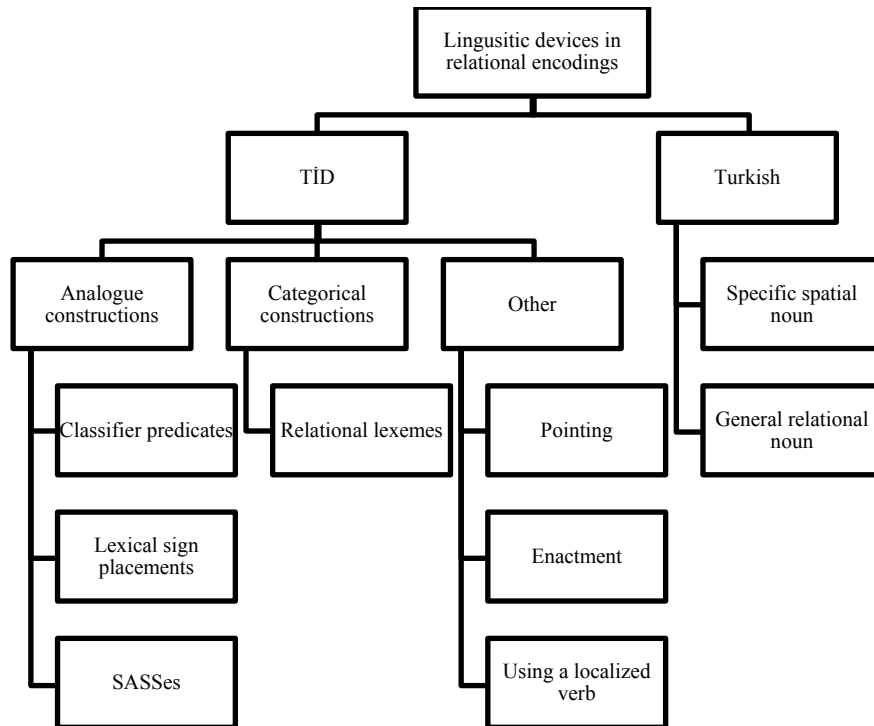
Figure 5.3: A schematic view of the different types of linguistic devices used in the TİD and Turkish data to encode viewpoint-dependent spatial relations.

5.4.3 Encoding viewpoint in expressing spatial relations (TİD only)

Expression of viewpoint becomes important when signing interlocutors use space to encode locations of objects in a non-jointly-viewed spatial configuration – as in the current data, where interlocutors see the same scene, but – crucially – on different pictures (i.e. not jointly viewed). If a TİD signer uses a relational lexeme, the addressee does not have to adapt a different (i.e. the signer's) viewpoint, because "left", for example, in the picture of the signer/speaker is also "left" in the picture of the

addressee.[33] However, when TİD signers use space, as with analogue constructions, viewpoint becomes an issue since the locations of the signer's hands representing Figure and Ground in the signing space match the locations of Figure and Ground for the signer (i.e. with respect to the signer's picture), but are mirror images of the locations of the Figure and Ground for the addressee (i.e. with respect to the addressee's picture). Therefore, the current analysis is specific to TİD, and includes the picture descriptions by TİD signers with a spatial relation encoded with analogue constructions, which may or may not be accompanied by other forms such as relational lexemes.

In this study, the focus is on the production of relational encodings, without examining how they are perceived by the addressee. Further research is necessary to determine and confirm the conventionalization of viewpoint for a successful communication about viewpoint-dependent spatial relations to be possible between the interlocutors in TİD. Viewpoint conventionalization could be from the signer's or addressee's viewpoint, but the expectation is that sign languages conventionalize the use of signer's viewpoint (Pyers et al., accepted). In the current study, the "signer viewpoint" will refer to linguistic representations in which the position of the hands corresponds to the locations of entities in the way the signer sees the spatial configuration in the picture (16a). For example, when you take the role of the signer as a reader and describe the spatial configuration between the pen and the paper below from your viewpoint, you will place your hand representing the pen to your left and the hand for paper to your right, thus the positions of your hands in space match to the locations of the corresponding entities in the picture. The signer in (16a) is describing the spatial configuration from her own viewpoint. If you imagine being the addressee facing her, you will notice that the position of her hands as you see them do not match the location of the entities shown in the picture. Such a match is only possible if the signer takes the "addressee viewpoint" as in (16b).

---

[33] For speakers, such viewpoint coordination problems arise when interlocutors are jointly viewing a scene (see Emmorey 2002; Pyers et al., accepted). Thus, if interlocutors had been in communication about objects in front of them to which they both had been looking at together, viewpoint analysis could have been done for Turkish, as well.

(16a)

LH: PEN   CL(long)_{loc}

RH: PAPER   CL(flat)_{loc}   --------- HOLD ---------

"There is a paper. There is a pen. The pen is to the left of the paper [from my point of view]."
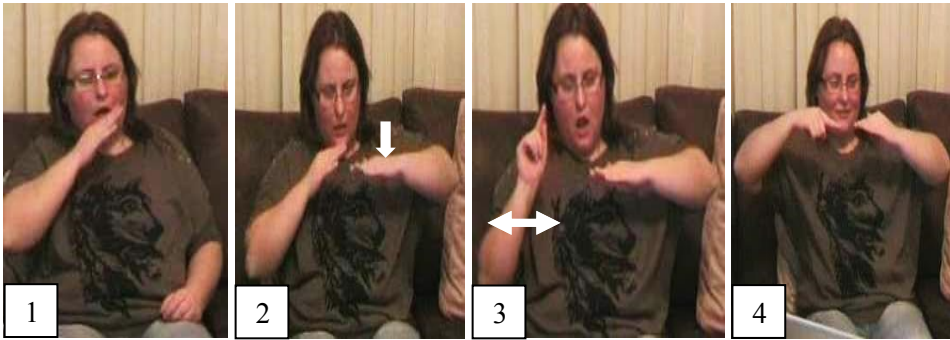
(16b)

LH: CL(flat)_{loc}   ------------------ HOLD ----------------

RH: PAPER   PEN   CL(long)_{loc}

"There is a paper. There is a pen. The pen is to the left of the paper [from your point of view]."

5.4.4 Types of simultaneity in expressing Figure and Ground (TİD only)

In the current section, I report the types of the simultaneity found in representing Figure and Ground in descriptions using analogue constructions (i.e., classifier constructions, lexical sign placements, SASSes). In the data, signers localized Figure and Ground in the signing space either simultaneously or sequentially (i.e., non-simultaneously). In the case of simultaneous representations, they sometimes localized both analogue forms at the same time (Simultaneous-Simultaneous), or localized the form for the Ground first, and held it while localizing the linguistic form for the Figure (Simultaneous-Consecutive). In the schematic representations of different types of simultaneity given below, the

138

parts indicated with brackets show how Figure and Ground are expressed (i.e., simultaneous versus non-simultaneous). Note that introduction of Figure and Ground may be optional since signers sometimes prefer to localize them by their lexical signs immediately, as explained in 5.4.2.1. So, they are indicated in the brackets to mark their optionality.

i) **Sim***ultaneous*-**Sim***ultaneous (SimSim)*: In this type of simultaneous expression of Figure and Ground, TİD signers mention Ground first, which is followed by the mention of Figure. They, then, localize them in analogue constructions simultaneously in the signing space (17a). A schematic representation of such a structure is given below:

> (Ground NP) (Figure NP) [Localization of Ground + Localization of Figure]

(17a)

	1	2	3
LH:	HOUSE	HORSE	CL(animal)$_{loc}$
RH:	HOUSE	HORSE	CL(house)$_{loc}$

"There is a house. There is a horse. The horse is to the left of the house."

ii) **Sim***ultaneous*-**Con***secutive (SimCon)*: In these cases, signers first mention the Ground, and localize it in an analogue construction. While they hold it in the signing space, they mention the Figure, and also localize it with respect to the Ground (17b). This structure is schematized as below:
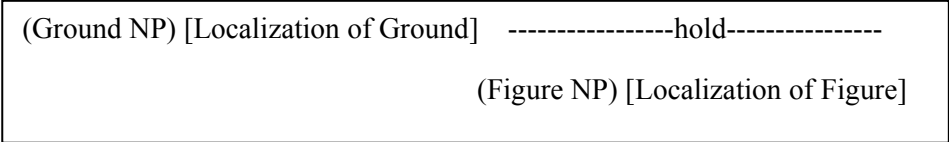
```
(Ground NP) [Localization of Ground]    -----------------hold----------------

                                  (Figure NP) [Localization of Figure]
```


(17b)

```
LH:                                      PEN              CL(long)loc
RH:          PAPER              CL(flat)loc   ----------------- HOLD -----------------
```

"There is a paper. The paper is here. There is a pen. The pen is to the left of the paper."

iii) **Non-Sim***ultaneous (NonSim)*: Here, the mention of the Ground is followed by its localization by means of an analogue construction, but it is not held there and dropped. Then, the Figure is mentioned and localized in another analogue construction with respect to the previously located one for the Ground, as seen in (17c). Its structure is schematized as:

```
(Ground NP) [Localization of Ground]

                          (Figure NP) [Localization of Figure]
```

(17c)
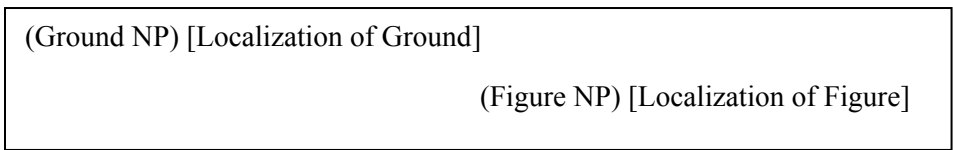
LH:	WOOD	TABLE$_{loc}$	
RH:	WOOD	TABLE$_{loc}$	CAKE	CL(round)$_{loc}$

"There is a wooden table. There is a cake. The cake is to the right of the table."

5.5 Quantitative findings

In this section, the focus will be on the analysis of how frequently different linguistic patterns were observed for adults and children in both languages to see whether and to what extent age differences exist across languages. As in Chapter 4, since the linguistic devices were not comparable cross-language comparisons were avoided and age groups were compared to adult targets in each language.

In the first analysis, I examined the picture descriptions in TİD and Turkish to see how likely children and adults were to encode Figure and/or Ground, and the spatial relation between them (i.e., frequency of encoding Figure, Ground, and spatial relation in TİD and Turkish, see 5.5.1). Next, I focused on the locative expressions where the spatial relation between Figure and Ground was encoded, and compared the frequency of different linguistic devices in the child data to the adult data within each language (5.5.2). For TİD, I also compared children and adults in their encoding of a viewpoint in their relational encodings (5.5.3). Finally, I focused on the analogue constructions in TİD only, and examined the frequency of different types of simultaneity in representing Figure and Ground as used by signing children and adults (5.5.4). Before the statistical analysis, arcsine transformation was applied to all the data since mean proportions of different description types out of all relevant descriptions were used as the dependent measures. However, the mean proportions and standard errors/deviations reported in the tables and graphs reflect the untransformed data.

Corrections in the degrees of freedom were also made whenever the sphericity assumption was violated for repeated-measures ANOVA analyses.[34]

5.5.1 Frequency of encoding Figure and/or Ground, and spatial relation between Figure and Ground when both were mentioned in TİD and Turkish

The qualitative analyses revealed two major categories: i) Figure or Ground is omitted,[35] and ii) both Figure and Ground are expressed. Below I present the results of the comparisons of children to adults in both languages for these two major categories.

i)   Frequency of encodings where Figure or Ground is absent

The total number of picture descriptions in each language is presented in Table 5.1 for TİD and in Table 5.2 for Turkish. There is minor variation between the two languages in terms of the total number of picture descriptions, which is a result of technical problems experienced during data collection (unclear speech/image), or due to some children refusing to describe certain pictures.

Table 5.1: Total number of picture descriptions from each age group and mean proportions (SD) of these descriptions with Ground or Figure omitted in TİD.

TİD Signers	No. of Picture Descriptions	Ground Omitted	Figure Omitted
Deaf Adults	120	.01 (.03)	.01 (.03)
Deaf Older Children	118	.01 (.03)	.04 (.04)
Deaf Younger Children	115	.12 (.13)	.10 (.11)
TOTAL	353	.04 (.09)	.05 (.08)

---

[34] In the present study, statistical analyses by items was not considered to be critical (although might still be informative, H. Clark, 1973b) since the scope of current analysis covers four viewpoint-dependent spatial relations which were sampled in the stimulus materials (Bedny, Aguirre, & Thompson-Schill, 2007).
[35] There were no picture descriptions where signers and speakers omitted both Figure and Ground, and expressed just a spatial relation.

Table 5.2: Total number of picture descriptions from each age group and mean proportions (SD) of these descriptions with Ground or Figure omitted in Turkish.

Turkish Speakers	No. of Picture Descriptions	Ground Omitted	Figure Omitted
Hearing Adults	119	.00 (.00)	.02 (.05)
Hearing Older Children	119	.00 (.00)	.00 (.00)
Hearing Younger Children	120	.06 (.11)	.03 (.06)
TOTAL	358	.02 (.07)	.01 (.04)

Subject-based mean proportions of picture descriptions with Figure or Ground omitted were calculated out of subject-based mean proportions of all picture descriptions as the dependent measure. The effects of age, language, and type of omission as independent measures were analyzed in a 3 (Between subjects, Age: adults, older children, younger children) by 2 (Between subjects, Language: TİD, Turkish) by 2 (Within subjects, Type of omission: Figure omitted, Ground omitted) mixed ANOVA. Its results showed a main effect of age, $F(2,54) = 8.48$, $p = .001$, $\eta^2_p = .24$, but not language, $F(1,54) = 4.09$, $p = .05$, $\eta^2_p = .07$, or type of omission, $F(1,54) = .03$, $p = .86$, $\eta^2_p = .001$. There was no interaction between language and age, $F(2,54) = 1.78$, $p = .18$, $\eta^2_p = .06$, type of omission and language, $F(1,54) = .83$, $p = .37$, $\eta^2_p = .02$, or type of omission and age, $F(2,54) = 3.15$, $p = .05$, $\eta^2_p = .10$. No 3-way interaction was observed among the variables, $F(2,54) = .84$, $p = .44$, $\eta^2_p = .03$.

Post hoc comparisons (Bonferroni) for the main effect of age showed that younger children omitted Figure or Ground more frequently than adults ($ps = .002$) and older children ($p = .003$). The lack of main effect of language further indicates that this pattern holds true for both languages.

The results above suggest that younger children, regardless of the modality of language that they acquire, omit Ground or Figure in their picture descriptions in similar amounts since there was not a main effect of omission type. Moreover, children in both languages are able to express both Figure and Ground by age 4 most of the time – earlier than what some of the previous studies reported

for signing and speaking children's spatial descriptions (Slobin et al., 2003; Engberg-Pedersen, 2003; Hickmann, 2003; Tang et al., 2007).

ii) Frequency of encodings where both Figure and Ground are expressed

Now, I turn to the encodings where participants mentioned both Figure and Ground, and analyse how many of them included the expression of the spatial relation between them. There are a total of 319 responses from signers and 344 from speakers where Figure and Ground were both encoded. Subject-based mean proportions of picture descriptions in which a spatial relation was encoded (with any linguistic devices mentioned in 5.4.2) were calculated out of all descriptions with both Figure and Ground mentioned. In order to see possible effects of axis type (Within subjects: lateral, sagittal), age (Between subjects: adult, older children, younger children), and language (Between subjects: TİD, Turkish) as independent measures, a 3-way mixed ANOVA was conducted. The results did not show any main effect for axis type, $F(1,54) = .85$, $p = .36$, $\eta^2_p = .02$, or for language, $F(1,54) = .69$, $p = .41$, $\eta^2_p = .01$. However, the results yielded a main effect of age, $F(2,54) = 8.83$, $p < .001$, $\eta^2_p = .25$. There was no interaction between axis type and language, $F(1,54) = 1.23$, $p = .27$, $\eta^2_p = .02$; axis type and age, $F(2,54) = 1.09$, $p = .34$, $\eta^2_p = .04$; or between language and age, $F(2,54) = .11$, $p = .89$, $\eta^2_p = .004$. There was no 3-way interaction between the variables, $F(2,54) = .31$, $p = .74$, $\eta^2_p = .01$. Post hoc comparisons (Bonferroni) for the main effect of age indicated that older children expressed the relational encoding between Figure and Ground as frequently as adults ($p = .63$), while younger children expressed the spatial relation significantly less frequently than adults ($p < .001$) and older children ($p = .02$) (Figure 5.4).
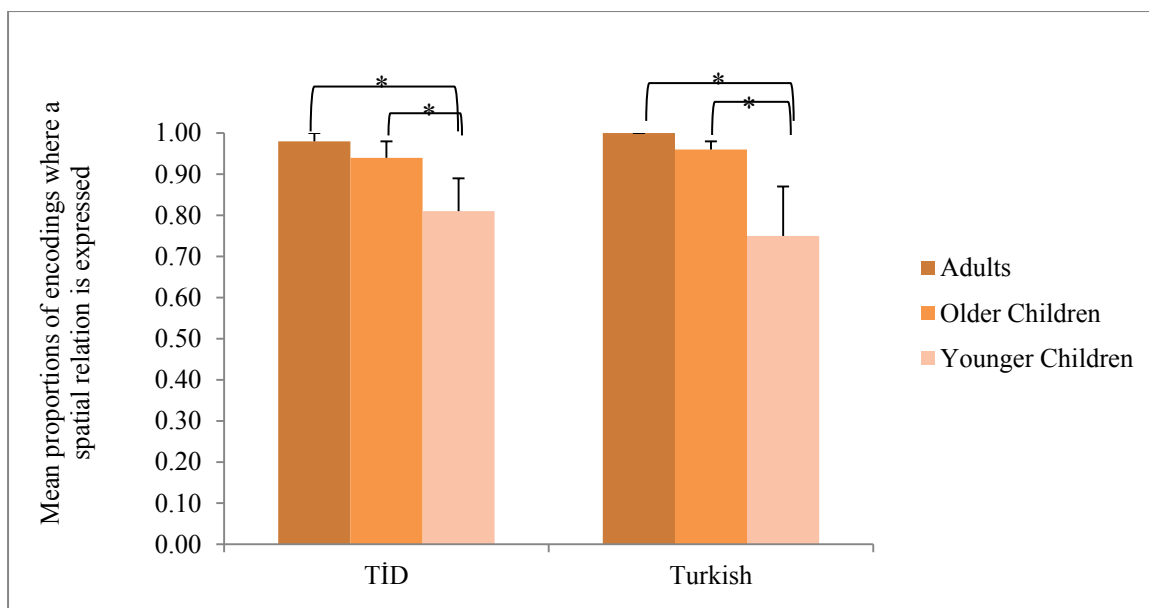
Figure 5.4: Mean proportions and error bars (representing SE) of descriptions that encode a spatial relation between Figure and Ground by all participants across age and language groups.

Next, the cases in which no spatial relation was encoded between Figure and Ground were examined out of picture descriptions where signers and speakers encoded both Figure and Ground (N=24 out of 319 in TİD and N=19 out of 344 in Turkish). In these cases, signers and speakers, in all age groups, mentioned both Figure and Ground, but not the spatial relation between them. Rather they either just named Figure and Ground, and did not produce anything else (19 out of 24 cases in TİD and 6 out of 19 cases in Turkish; see 6a for TİD and 6b for Turkish), or used a lexical verb that does not denote a spatial relation after mentioning Figure and Ground (5 out of 24 cases in TİD and 13 out of 19 cases in Turkish; see 7a for TİD and 7b for Turkish).

Mentioning Figure and Ground only without expressing the spatial relation between them (a total of 19 cases for TİD and 6 cases for Turkish) has been observed to be a general tendency among TİD-acquiring children, especially for the younger age group (11 cases for younger children; 6 cases for older children, and 2 cases for adults). In Turkish, it was only the younger children who did not encode a spatial relation after mentioning both Figure and Ground (6 out of 6 cases). Using a verb that does not denote an explicit spatial relation between the entities (a total of 5 cases for TİD and 13 cases for Turkish) was, on the other hand, more common among Turkish-acquiring younger children

compared to Turkish-acquiring older children (10 cases for younger children; 2 cases for older children; and only one for adults) or TİD-acquiring children (2 for younger children; 2 for older children, and 1 for adults).

5.5.2 Frequency of linguistic devices in encoding spatial relations in TİD and Turkish

In this section, I examine the frequency of linguistic devices used to encode viewpoint-dependent spatial relations. This analysis also takes different types of viewpoint-dependent spatial relations into account; namely the ones for objects placed on a lateral axis and a sagittal axis since different developmental patterns were reported for their acquisition in spoken languages. Thus, it will be possible to determine whether a similar split also exists for their acquisition in TİD and Turkish, as well.

Since it is hard to equate these forms in TİD and Turkish, direct comparisons of age groups across languages are not conducted. Rather, comparisons of age groups were done within languages, and the general developmental patterns that emerged for each language were compared to each other. The results of the analyses for TİD are presented in section 5.5.2.1, and for Turkish in 5.5.2.2 below.

5.5.2.1 Frequency of linguistic devices in encoding spatial relations in TİD

TİD signers sometimes described the location of Figure and Ground using a different axis than the one shown in the real spatial configuration. However, such cases occurred very infrequently in the TİD data (13 cases in a total of 295 relational encodings where a spatial relation was encoded), and inclusion of them did not change the current findings. For this reason, they were excluded from the current analysis.

Subject-based mean proportions of picture descriptions in which a spatial relation was encoded with different types of linguistic devices were calculated out of all picture descriptions with a spatial relation encoded as dependent measure. In order to see to what extent signing children exhibit adult-like patterns in their use of linguistic devices to express a spatial relation between Figure and Ground in TİD, a 2 (Within subjects, Axis type: lateral and sagittal) by 3 (Within subjects, Type of linguistic device: analogue, categorical, other) by 3 (Between subjects, Age: adult, older children,

younger children) mixed ANOVA was conducted. The results yielded a main effect for axis type, $F(1,27) = 4.89$, $p = .04$, $\eta^2_p = .15$, type of linguistic device, $F(2,48) = 56.62$, $p < .001$, $\eta^2_p = .68$; and age $F(2,27) = 13.39$, $p < .001$, $\eta^2_p = .50$. I also observed an interaction between type of linguistic device and axis type, $F(1, 36) = 7.08$, $p = .007$, $\eta^2_p = .21$. Age did not interact with type of linguistic device, $F(4,54) = .66$, $p = .62$, $\eta^2_p = .05$, or with axis type, $F(2,27) = 3.07$, $p = .06$, $\eta^2_p = .19$. There was no 3-way interaction among them, $F(4,54) = .61$, $p = .66$, $\eta^2_p = .04$.

After observing an interaction between axis type (i.e., lateral and sagittal) and type of linguistic device (i.e., analogue, categorical, other), separate analyses were conducted for relational encodings for each axis in TİD.

i) Frequency of linguistic devices in encoding spatial relations for objects configured on the lateral axis in TİD

This section presents results on how frequently signing children and adults employed different sorts of linguistic devices to describe the locations of entities positioned on the lateral axis, and examines whether signing children are similar to adults in this respect. Subject-based mean proportions of picture descriptions where a spatial relation was encoded with different linguistic devices for the lateral axis were calculated out of all picture descriptions with a spatial relation encoded for the lateral axis as dependent measure, and the effects of age and type of linguistic device was analysed in a 3 (Between subjects, Age: adult, older children, younger children) by 3 (Within subjects, Type of linguistic device: analogue, categorical, other) mixed ANOVA. The results showed no main effect for age, $F(2,27) = 1.66$, $p = .21$, $\eta^2_p = .11$, but a main effect of the type of linguistic device, $F(1,38) = 60.56$, $p < .001$, $\eta^2_p = .69$. There was no interaction between them, $F(4,54) = .10$, $p = .98$, $\eta^2_p = .008$. The contrasts for the main effect of type of linguistic device showed that analogue constructions were preferred over categorical ones ($p < .001$) and over constructions in the "other" category ($p < .001$). The forms analysed in the categorical and "other" categories were found to be similar to each other in their frequency of use ($p = .65$). The lack of main effect for age in the data indicates that the patterns reported as a result of the contrasts hold true for each age group in TİD, and signing children in both age groups used linguistic devices in the three different categories as frequently as signing adults.

Figure 5.5: Mean proportions and error bars (representing SE) of descriptions with different types of linguistic devices in TİD to describe the location of Figure and Ground located on the lateral axis.[36]

ii) Frequency of linguistic devices in encoding spatial relations for objects configured on the sagittal axis in TİD

Subject-based mean proportions of picture descriptions where a spatial relation was encoded with different types of linguistic devices for the sagittal axis were calculated out of all picture descriptions with a spatial relation encoded for the same axis as dependent measure, and the effects of age and type of linguistic device was analysed in a 3 (Between subjects, Age: adult, older children, younger children) by 3 (Within subjects, Type of linguistic device: analogue, categorical, other) mixed ANOVA. As a result, I observed a main effect of age, $F(2,27) = 14.17$, $p < .001$, $\eta^2_p = .51$, and main effect of type of linguistic device, $F(2,46) = 29.12$, $p < .001$, $\eta^2_p = .52$, without any interaction between them, $F(4,54) = 1.03$, $p = .40$, $\eta^2_p = .07$.

Post hoc analyses (Bonferroni) for the main effect of age showed that both older ($p < .001$) and younger ($p = .001$) signing children were different from adults in the frequency of employing

---

[36] Due to the use of double linguistic forms within the same picture descriptions, the proportions do not necessarily add up to 1.00.

different types of TİD linguistic devices to describe the location of the objects placed on the sagittal axis. There was no such difference between the two age groups of children ($p = 1.00$). In particular, adults used analogue constructions and categorical constructions more frequently than both age groups of signing children (Figure 5.6).

The contrasts for the main effect of type of linguistic device show that the use of analogue constructions is the most preferred form in TİD. They were employed more frequently than categorical constructions ($p = .001$), and than constructions in the "other" category ($p < .001$). Categorical ones were observed to be more frequent than the linguistic devices in the "other" category, as well ($p < .001$).
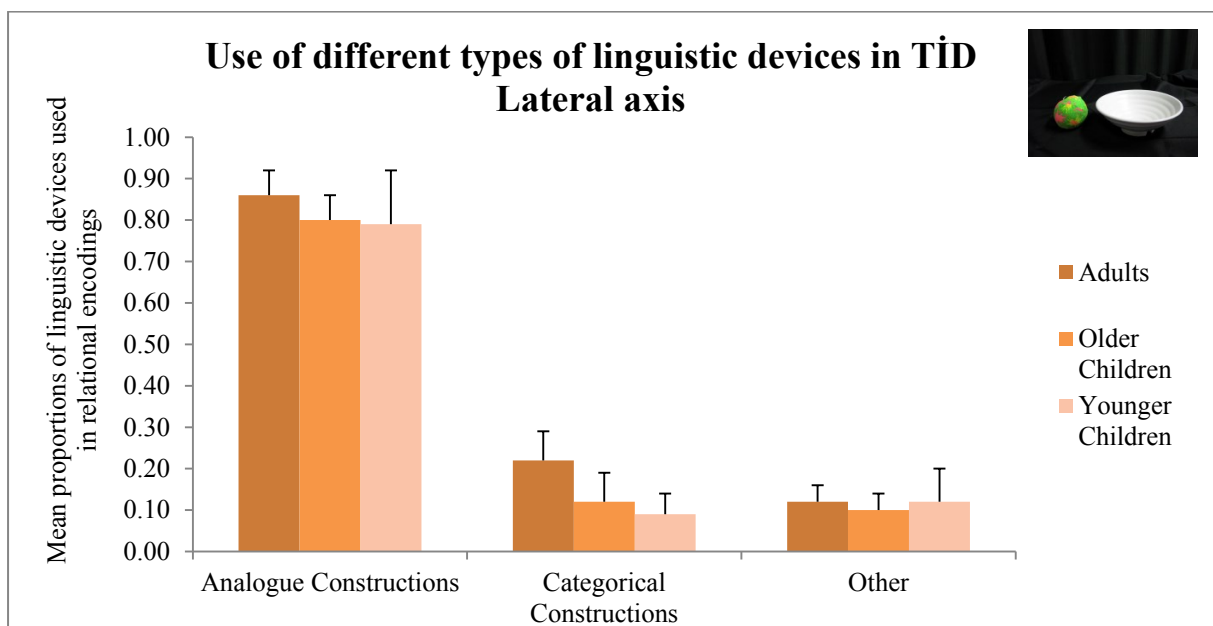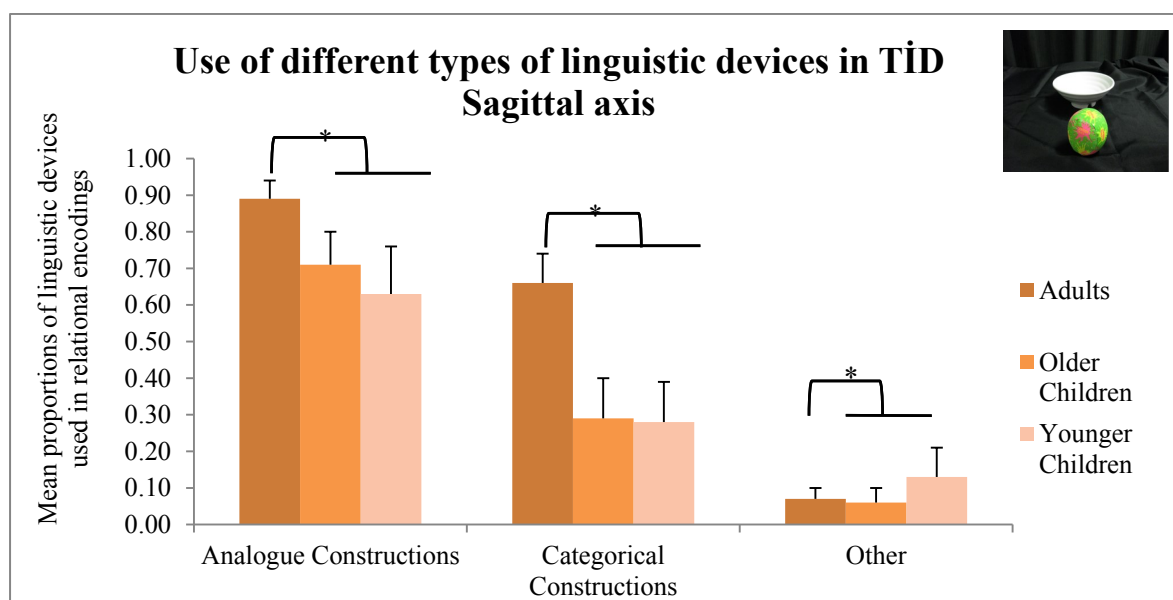

Figure 5.6: Mean proportions and error bars (representing SE) of descriptions in TİD with different types of linguistic devices to describe the location of Figure and Ground located on the sagittal axis.[37]

As a result of these analyses, the preference for using analogue constructions has been attested in relational encodings that describe the location of Figure and Ground on the lateral and the sagittal axes in TİD. Separate analyses for the two axes revealed a developmental split for TİD-acquiring children. Specifically, both younger and older signing children were similar to signing adults in how

---

[37] Due to the use of double linguistic forms within the same picture descriptions, the proportions do not necessarily add up to 1.00.

likely they were to use different sorts of linguistic devices to encode the spatial relation for objects located on the lateral axis. However, this was not the case in their relational encodings for objects located on the sagittal axis, where both age groups of signing children produced analogue constructions and categorical forms significantly less frequently than signing adults.

After finding this difference in the frequency of productions of analogue and categorical forms between signing children and adults in TİD, I examined the data further for a possible explanation. As a result, I realized that signing adults used double linguistic devices in the same description (e.g., a classifier construction and a relational lexeme), as explained in 5.4.2.1. Therefore, I calculated the frequency of using double linguistic devices by different age groups out of all picture descriptions with a relational encoding. In these encodings, I observed that signing adults used double linguistic devices more frequently while describing the location of the objects on the sagittal axis than for the lateral axis. However, signing children in both age groups preferred to use a single linguistic device for the relational encodings for both axis types (see Table 5.3 below). Thus, the reason why children differed from adults on the sagittal axis as shown by the previous analysis could be due to the fact that adult signers used double linguistic devices for the pictures showing objects on the sagittal axis more frequently than did the children in their descriptions. Note that the order of the use of these devices varies in the data and there was no systematicity (i.e., classifier construction followed by a relational lexeme or relational lexeme followed by a classifier construction).

Table 5.3: Mean proportions (SD) of the locative expressions where double linguistic devices were used by TİD signers.

TİD Signers	Relational encodings on lateral axis	Relational encodings on sagittal axis	Total (Relational encodings with double linguistic devices)
Deaf Adults	.21(.27)	.45(.21)	.35(.21)
Deaf Older Children	.05(.11)	.04(.13)	.05(.12)
Deaf Younger Children	.03(.06)	.08(.13)	.05(.06)
TOTAL	.11(.18)	.21(.24)	.16(.19)

5.5.2.2 Frequency of linguistic devices in encoding spatial relations in Turkish

Subject-based mean proportions of picture descriptions in which a spatial relation was encoded with different types of linguistic devices out of all picture descriptions with a spatial relation encoded were calculated as dependent measure. In order to see if Turkish-acquiring children are similar to Turkish-speaking adults in how frequently they used different types of linguistic devices for encoding viewpoint-dependent spatial relations, a 2 (Within subjects, Axis type: lateral, sagittal) by 3 (Within subjects, Type of linguistic device: specific spatial noun, general relational noun, non-target spatial noun) by 3 (Between subjects, Age: adult, older children, younger children) mixed ANOVA was conducted. The results showed main effects of the type of linguistic device, $F(1,33) = 19.17$, $p < .001$, $\eta^2_p = .42$, and axis type, $F(1,27) = 10.03$, $p = .004$, $\eta^2_p = .27$, but there was no main effect of age, $F(2,27) = 2.97$, $p = .07$, $\eta^2_p = .18$. There was an interaction between the type of linguistic device and age, $F(4,54) = 11.99$, $p < .001$, $\eta^2_p = .47$, and between the type of linguistic device and axis type, $F(1,34) = 14.83$, $p < .001$, $\eta^2_p = .36$. There was no 2-way interaction between age and axis type, $F(2,27) = 1.38$, $p = .27$, $\eta^2_p = .09$. However, I observed a 3-way interaction among age, axis type, and the type of linguistic device, $F(4,54) = 2.83$, $p = .03$, $\eta^2_p = .17$. After seeing a main effect for axis type,

which also interacts with the type of linguistic device and age, I conducted separate analyses for the relational encodings on the different axes.

i)   *Frequency of linguistic devices in encoding spatial relations for objects configured on the lateral axis in Turkish*

Subject-based mean proportions of picture descriptions where a spatial relation was encoded with different linguistic devices for the lateral axis were calculated out of all picture descriptions with a spatial relation encoded for the same axis as dependent measure, and the effects of age and type of linguistic device was analysed in a 3 (Between subjects, Age: adults, older children, younger children) by 3 (Within subjects, Type of linguistic device: specific spatial noun, general spatial noun, non-target spatial noun) mixed ANOVA on the subject-based mean proportions of expressions with relational encodings for objects located on the lateral axis. The analysis did not yield a main effect of age, $F(2,27) = 3.26$, $p = .05$, $\eta^2_p = .20$, but a main effect of type of linguistic device, $F(2,47) = 9.27$, $p = .001$, $\eta^2_p = .26$, with an interaction between them, $F(4,54) = 10.71$, $p < .001$, $\eta^2_p = .44$. As a result of the interaction between the type of linguistic device and age, I conducted separate one-way ANOVAs of the data. Figure 5.7 below presents a general overview of the results.

Turkish-acquiring children in both age groups employed the specific spatial nouns that encode a viewpoint (i.e., sağ - *right* and sol - *left*) less frequently than Turkish-speaking adults ($p = .007$ for older children and $p = .006$ for younger children). There was no difference between the older and younger children in the use of specific spatial nouns ($p = .80$). For the general "viewpoint-free" relational noun (i.e., yan - *side*), the older children were more likely to use these in their descriptions compared to adults ($p = .003$), but used them to a similar extent as younger children ($p = .12$). There was no difference between adults and younger children in this respect ($p = .36$). Finally, mean proportions of relational encodings where speakers preferred spatial nouns for the non-target axis (i.e., "front-behind") were more frequently used by younger children than adults ($p = .03$). Older children and adults ($p = 1.00$), and older and younger children ($p = .14$) were similar to each other in this respect.

Figure 5.7: Mean proportions and error bars (representing SE) of descriptions with different types of linguistic devices in Turkish to describe the location of Figure and Ground located on the lateral axis.

ii) Frequency of linguistic devices in encoding spatial relations for objects configured on the sagittal axis in Turkish

Subject-based mean proportions of picture descriptions where a spatial relation was encoded with different linguistic devices for the sagittal axis were calculated out of all picture descriptions with a spatial relation encoded for the same axis as dependent measure, and the effects of age and type of linguistic device was analysed in a 3 (Between subjects, Age: adults, older children, younger children) by 3 (Within subjects, Type of linguistic device: specific spatial noun, general relational noun, non-target spatial noun) mixed ANOVA. The results yielded no main effect of age, $F(2,27) = .25$, $p = .78$, $\eta^2_p = .02$, but a main effect of the type of linguistic device, $F(1,29) = 22.05$, $p < .001$, $\eta^2_p = .45$. There was a 2-way interaction between them, $F(4,54) = 5.67$, $p = .007$, $\eta^2_p = .30$. Thus, separate one-way ANOVAs were conducted for each type of linguistic device. These results indicate that older speaking children employed specific spatial nouns (i.e., ön - *front* & arka - *behind*) as frequently as adults ($p = .26$) and younger speaking children ($p = .30$). Younger speaking children, on the other hand, used

these nouns less frequently in their spatial expressions compared to adults ($p = .008$). In using the general relational noun (i.e., yan - *side*), older children were similar to adults ($p = .36$) and younger children ($p = .26$). Younger children used this type of encoding more frequently than adults ($p = .007$). Finally, there were no differences among the age groups (*ps* >.05) in using spatial nouns for the non-target axis (i.e., left-right).
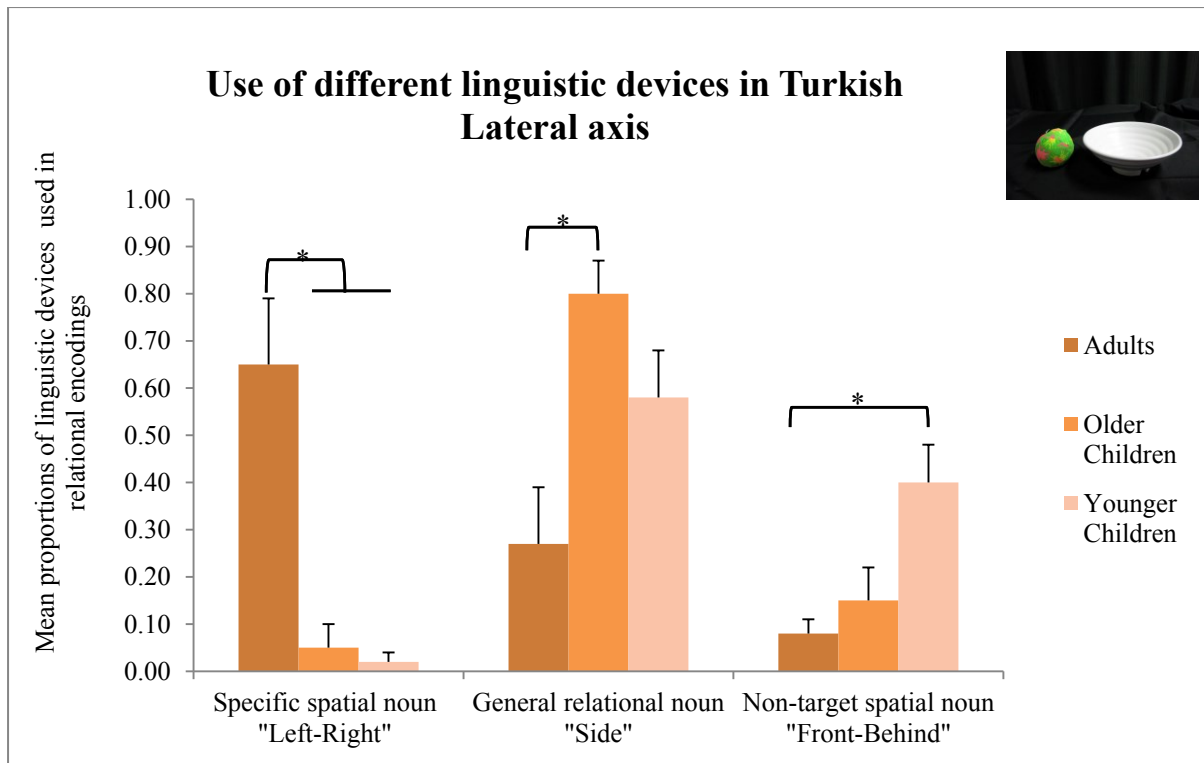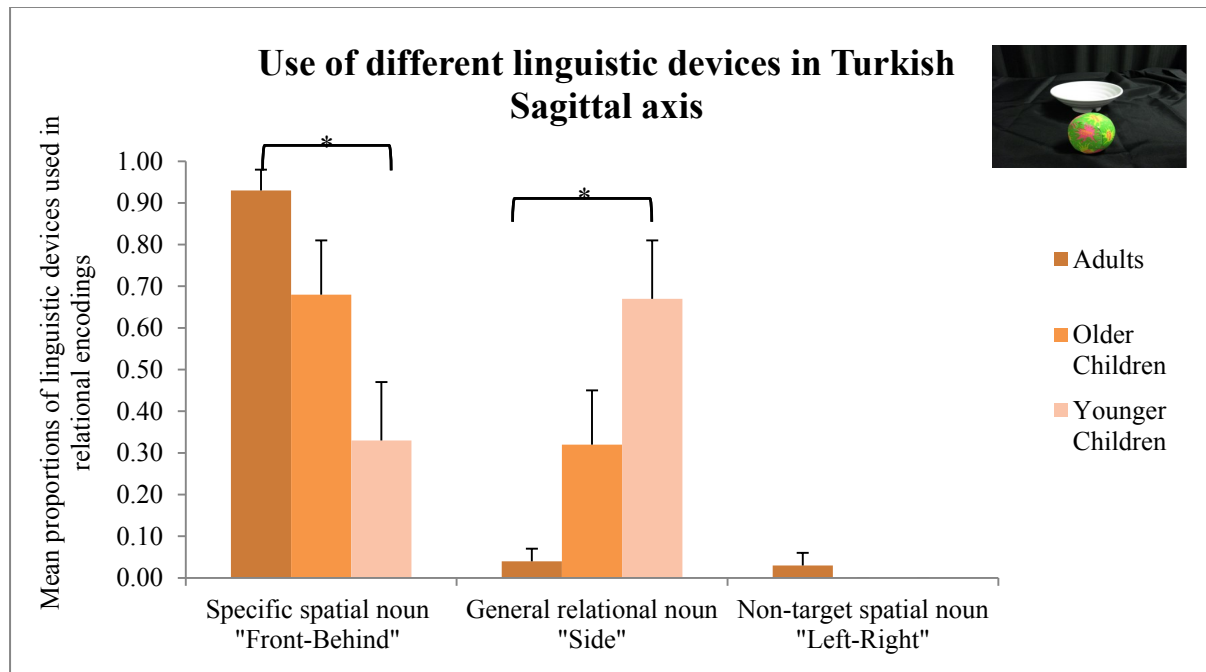

Figure 5.8: Mean proportions and error bars (representing SE) of descriptions with different types of linguistic devices in Turkish to describe the location of Figure and Ground located on the sagittal axis.

To sum up, compared to adults, Turkish-acquiring children of both age groups are less likely to use the specific spatial nouns "sağ - *right*" and "sol - *left*" in encoding relative locations of objects on the lateral axis. However, in describing the location of Figure and Ground placed on the sagittal axis, older children employed spatial nouns "ön - *front*" and "arka - *behind*" as frequently as adults, although younger children still preferred "yan - *side*" in their encodings.

5.5.3 Frequency of viewpoint types (TİD only)

The viewpoint analysis presented in this section aims to understand the viewpoint preference (i.e., signer viewpoint or addressee viewpoint) of signers, and examines whether there is an effect of age on this preference. As explained earlier in (5.4.3) this analysis includes the relational encodings of TİD signers with analogue constructions, which may or may not be used together with relational lexemes.

Subject-based mean proportions of picture descriptions where a spatial relation was encoded with at least one analogue construction from each viewpoint were calculated out of all picture descriptions where a spatial relation was encoded with at least one analogue construction as dependent measure. The effects of age, axis type, and type of viewpoint, as independent measures, were analysed in a 3 (Between subjects, Age: adults, older children, younger children) by 2 (Within subjects, Axis type: lateral, sagittal) by 2 (Within subjects, Type of Viewpoint type: signer, addressee) mixed ANOVA. The results showed a main effect of axis type, $F(1,27) = 183.20$, $p < .001$, $\eta^2_p = .87$, but no main effect of age, $F(2,27) = 3.41$, $p = .05$, $\eta^2_p = .20$, and viewpoint type, $F(1,27) = 1.32$, $p = 26$, $\eta^2_p = .05$. However, axis type interacted with viewpoint type, $F(1,27) = 19.70$, $p < .001$, $\eta^2_p = .42$, and with age, $F(2,27) = 27.1$, $p < .001$, $\eta^2_p < .67$. There was no 2-way interaction between viewpoint type and age, $F(2.27) = .34$, $p = .71$, $\eta^2_p = .03$. There was also a 3-way interaction among these three variables, $F(2,27) = 15.08$, $p < .001$, $\eta^2_p = .53$.

After finding a 3-way interaction, and also a main effect of axis type interacting with age and viewpoint type, I conducted one-way ANOVAs for each axis type (i.e., lateral versus sagittal). The results of the one-way ANOVA analyses for relational encodings for objects on the lateral axis revealed a main effect of viewpoint type only, $F(1, 27) = 187.19$, $p < .001$, $\eta^2_p = .87$, but not of age, $F(2,27) = .77$, $p = .47$, $\eta^2_p = .05$, without an interaction between them, $F(2,27) = 1.96$, $p = .16$, $\eta^2_p = .13$. Post hoc analyses (Bonferroni) for the main effect of viewpoint type for the encodings on the lateral axis indicate that signers (ages collapsed) are more likely to represent the lateral axis spatial configurations from their own viewpoint than from their addressee's viewpoint ($p < .001$). The lack of main effect of age further shows that signing children are similar to adults in how likely they are to prefer "signer" or "addressee" viewpoint in their lateral axis encodings.

Figure 5.9: Mean proportions and error bars (representing SE) of descriptions with different viewpoints in relational encodings for the lateral axis in TİD across age groups.

The results of one-way ANOVA analyses for relational encodings for objects on the sagittal axis, however, revealed a different pattern. The results did not show a main effect of age, $F(2,27) = 2.18$, $p = .13$, $\eta^2_p = .14$. However, there was a main effect of viewpoint type, $F(1,27) = 47.22$, $p < .001$, $\eta^2_p = .64$, and it interacted with age, $F(2,27) = 38.38$, $p < .001$, $\eta^2_p = .74$. As a result, I further conducted separate one-way ANOVAs for each viewpoint within the relational encodings for objects on the sagittal axis. In encoding "signer viewpoint" and "addressee viewpoint", signing children in both age groups differed from signing adults: They encoded sagittal spatial relations from "signer viewpoint" more frequently than adults ($ps < .05$), while their preference for "addressee viewpoint" is less frequent than in signing adults ($ps < .05$) (see Figure 5.10).
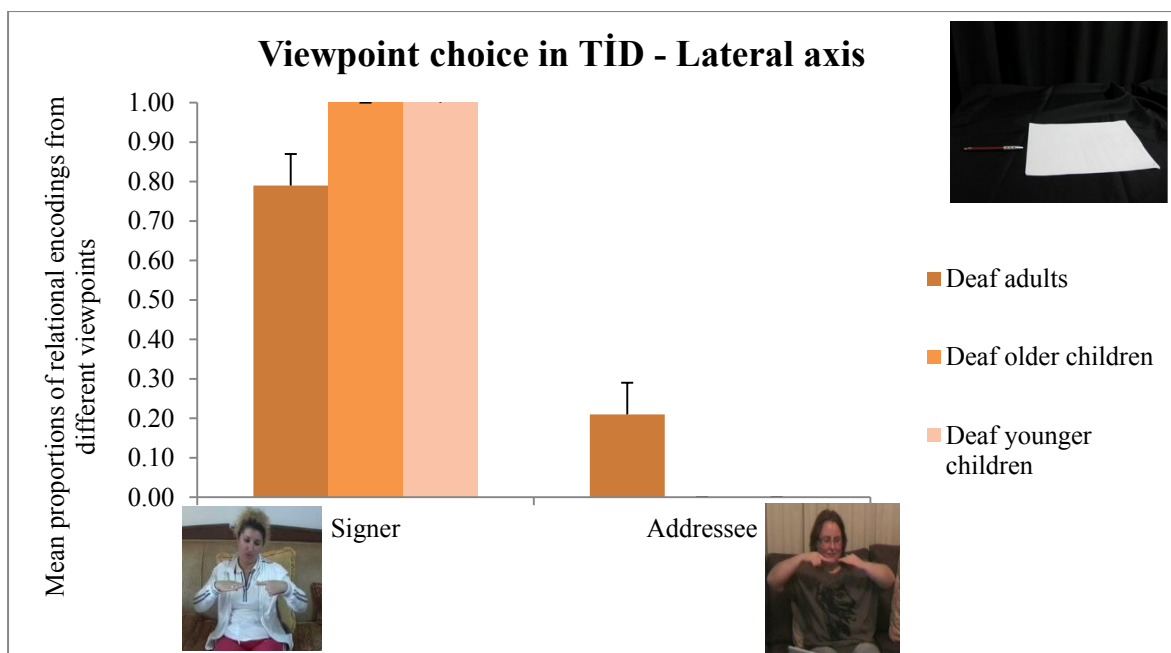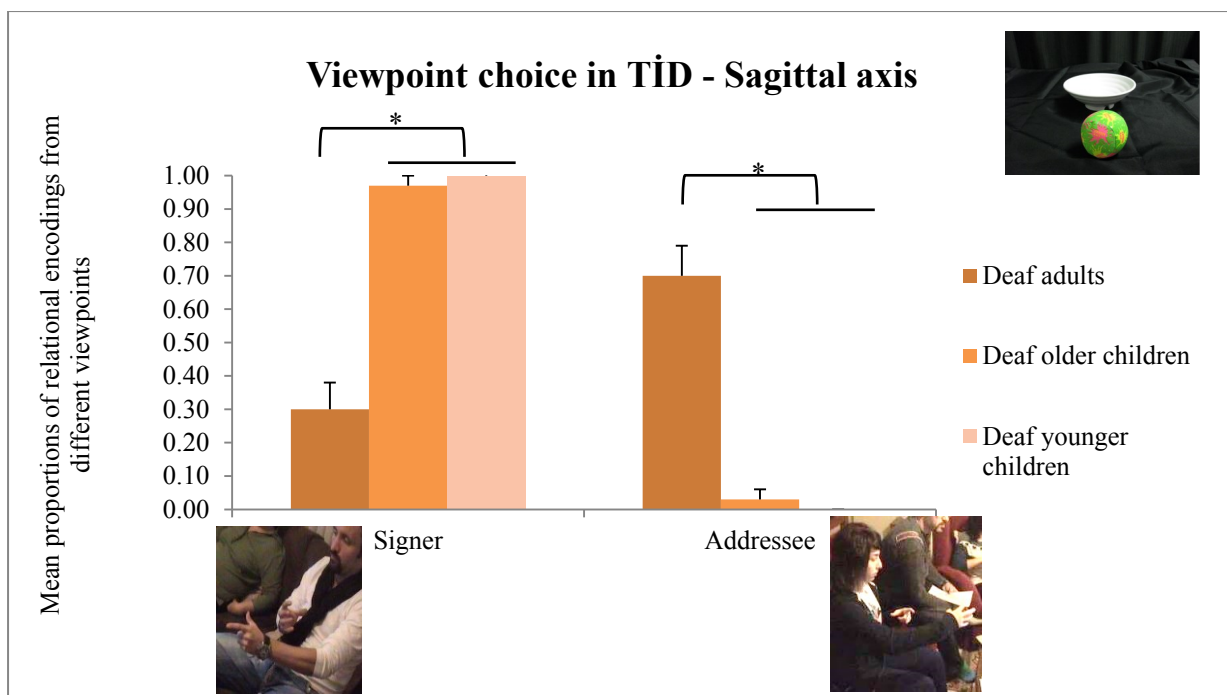
Figure 5.10: Mean proportions and error bars (representing SE) of descriptions with different viewpoints in relational encodings for the sagittal axis in TİD across age groups.

To sum up TİD-signing adults differentiated their viewpoint choice between encodings for the lateral versus sagittal axis. For the lateral axis encodings, their linguistic representations reflect the spatial configuration in the way they see it, that is from the signer viewpoint. However, for the sagittal axis they preferred the addressee viewpoint in more than half of the cases. TİD-signing children, however, used the signer viewpoint irrespective of the axis being encoded. The reasons for such a shift in the adult pattern are discussed in detail in (5.6) of the current chapter, where I also suggest explanations linked to the use of double linguistic devices in addressee viewpoint encodings for objects located on the sagittal axis.

5.5.4 Frequency of different types of simultaneity in expressing Figure and Ground (TİD only)

Finally, the relational encodings in TİD were examined in terms of how frequently different types of simultaneity in expressing Figure and Ground were used in analogue constructions by signing adults and children. Since the visual-spatial modality of sign languages, but not spoken languages, allows such simultaneous expressions of these elements, this analysis is specific to TİD only.

157

Subject-based mean proportions of picture descriptions where a spatial relation was encoded between Figure and Ground in different types of simultaneous constructions were calculated out of all picture descriptions in which a spatial relation was encoded between Figure and Ground in analogue constructions as dependent measure. The effects of age and type of simultaneity was analysed in a 3 (Between subjects, Age: adult, older children, younger children) by 2 (Within subjects, Axis type: lateral, sagittal) by 3 (Within subjects, Type of simultaneity: SimSim, SimCon, NonSim) mixed ANOVA. The results yielded a main effect only for type of simultaneity, $F(2,54) = 15.29$, $p < .001$, $\eta^2_p = .36$, but not for axis type, $F(1,27) = .008$, $p = .93$, $\eta^2_p = .01$, or age, $F(2,27) = .28$, $p = .76$, $\eta^2_p = .02$. There was a 2-way interaction between type of simultaneity and age, $F(4,54) = 3.63$, $p = .01$, $\eta^2_p = .21$, but there was no interaction between axis type and age, $F(2,27) = .66$, $p = .53$, $\eta^2_p = .05$, or between type of simultaneity and axis type, $F(2,54) = .47$, $p = .63$, $\eta^2_p = .02$. There was no 3-way interaction, $F(4,54) = 1.73$, $p = .16$, $\eta^2_p = .11$.

The lack of main effect of axis type without any interaction with age and simultaneity type indicates that all three types of simultaneity have been used in similar amounts in relational encodings for objects located on the lateral and the sagittal axes.

Due to the 2-way interaction found between type of simultaneity and age, I investigated effect of age for each type of simultaneity in separate one-way ANOVAs. The results did not show any effect of age for different types of simultaneity, $F(2,29) = .36$, $p = .70$ for SimSim, $F(2,29) = 2.07$, $p = .15$ for SimCon, and $F(2,29) = 3.31$, $p = .05$ for NonSim. It indicates that both age groups of signing children were able to produce three types of simultaneous constructions as frequently as adults. Among these three types, "SimCon" (17b) was found to be more preferred than "SimSim" (17a) ($p = .003$) and "NonSim" (17c) ($p = .02$) (Figure 5.11).

Simultaneous expression of Figure and Ground in TİD
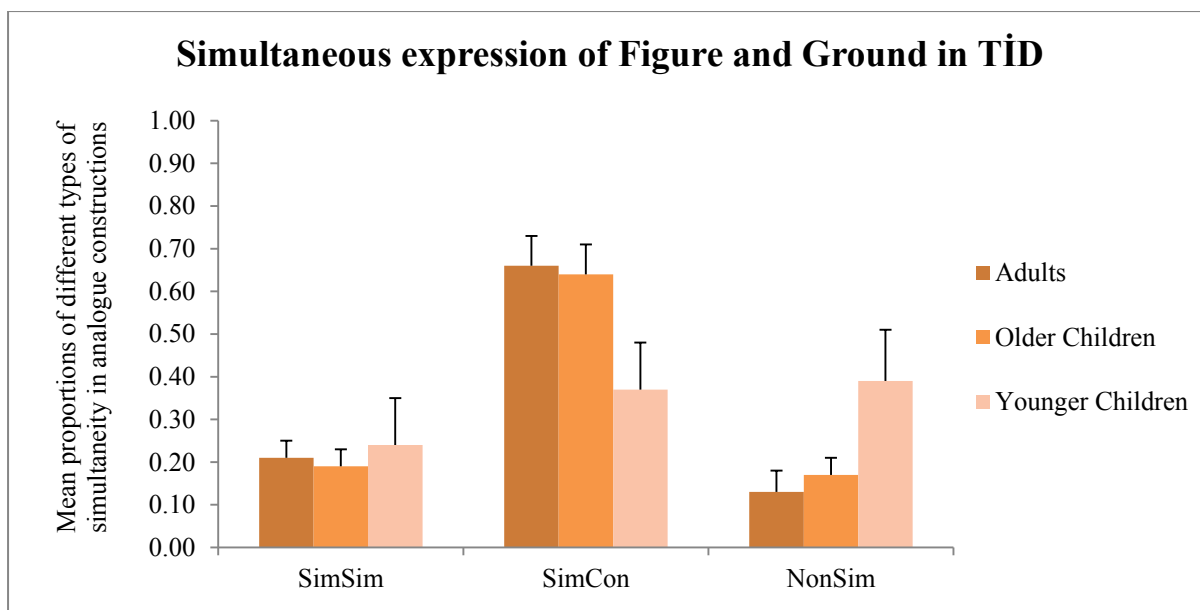
Figure 5.11: Mean proportions and error bars (representing SE) of different simultaneity types used in analogue constructions in TİD.

5.6 Summary & Discussion

This chapter investigated the developmental trajectory of learning to encode viewpoint-dependent spatial relations in TİD and Turkish. Encoding such relations is known to develop later than encoding topological relations in speaking children in general. Even though previous research has also found evidence for late mastery of this skill for sign language learning children in a comprehension task (Martin & Serra, 2006; Morgan et al., 2008), the current chapter offers the first study that has investigated the development of the expressions of such relations in signing children as well as in speaking children, and directly compared to adult targets.

As in Chapter 4, three hypotheses regarding the effects of the visual-spatial modality on their development were considered; namely, a facilitating effect, a hindering effect, or a neutral effect of modality. Different aspects of encoding viewpoint-dependent relations were found to be differentially influenced by the modality and also differences were observed in learning to express these relations depending on the axis on which objects were placed in relation to each other (i.e., lateral versus sagittal). Findings with regard to different aspects of encoding the spatial relations will be

summarized and discussed below. Note that detailed comparisons of findings between Chapter 4 and 5 will be presented in the general discussion in Chapter 7.

i) Figure-Ground expression

Firstly, I examined how likely children and adults were to mention Figure and Ground in their descriptions of viewpoint-dependent relations in both languages. Ground omission was reported to be observed in the motion event narrations of sign language acquiring children, and these children had difficulty in learning to express Ground until even 13 years of age (Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). Previous research with children acquiring different spoken languages (English, French, German, and Mandarin Chinese) also presented evidence that spoken language acquiring children have difficulty in expressing the Ground in their narratives even beyond 10 years of age, and had a tendency to drop the Ground in their narrations (Ehrich, 1982; Weissenborn, 1986; Llyod, 1991; Hickmann, 2003). However, previous research has not examined the expression of static viewpoint-dependent spatial relations in the same task in a sign and a spoken language.

The analyses of the current data show that both signing and speaking younger children omitted Figure or Ground more than the adults and older children. Moreover, there was not a strong preference for the omission of Ground compared to Figure by TİD- or Turkish-acquiring children. The overall encoding of Ground and Figure was similar between children and adults in both languages, in which children around 7 years of age were able to mention both Figure and Ground. Even for sign language-acquiring children, this does not seem to be posing a difficulty. Thus, with respect to Ground omission, there does not seem to be a modality-specific effect

The difference with regard to the previous studies might be explained in terms of task difference (i.e., description of single pictures versus narration of a picture-story), discourse complexity (i.e., short descriptions versus longer narrations), or event type (i.e., location versus motion). In these studies, in contrast to the current study, descriptions of primarily motion events were collected, based on narrations of picture stories (e.g., Frog Story, Horse Story). Motion events are

more complex than locative spatial relations, since they usually involve more semantic elements (e.g., combinations of Figure, Ground, Path, Manner), whereas static locative relations usually involve only Figure and Ground objects. Chapter 6 of this dissertation investigates the Figure and Ground expression in motion descriptions in Turkish and TİD to see whether there is indeed a tendency for Ground omissions.

Relational encoding

When both the Figure and the Ground were expressed, signing and speaking older children expressed the spatial relation between entities as frequently as adults. However, younger children in both languages provided such relational encodings less frequently than adults and older children. Therefore, these findings also suggest a similar developmental pattern in spatial relationship encoding for both languages, and thus no effect of modality can be detected in this regard.

ii) Linguistic devices in encoding a spatial relation between Figure and Ground

Some effects of modality were found with regard to how adult-like each group of children was in their use of linguistic devices. Furthermore, these developmental patterns showed variation in both languages with respect to the axis on which objects were configured: In TİD, both younger and older children were adult-like in how likely they were to use certain types of linguistic devices to encode the spatial relation between objects located on the lateral axis, but not for the sagittal axis. In Turkish, there was an opposite pattern: Older children (but not younger ones) used linguistic devices to encode spatial relations on the sagittal axis in adult-like ways, but showed differences compared to adults for objects on the lateral axis. However, Turkish-acquiring younger children were less likely to be adult-like with respect to the use of linguistic devices in relational encodings for objects configured on both axes.

Therefore, for the lateral axis it is possible to think that the visual modality had a facilitating effect on encoding spatial relations. TİD-acquiring children not only used classifier predicates as often as adults did, but also the relational lexemes LEFT and RIGHT were used equally often. So, considering the adult-like use of relational lexemes, TİD-acquiring deaf children learn to express "left-right" much

earlier than their age-matched peers acquiring Turkish. This might be related to the body-anchored nature of these relational lexemes in TİD – in contrast to arbitrary form-meaning mappings as in Turkish. Previous studies have shown that speaking children initially use the labels "left-right" to refer to their own left and right hands/legs. At later stages, they start using them to refer to "left-right" of other people, objects, and then they use them in a relational sense and to refer to relative locations (Piaget & Inhelder, 1971; Piaget, 1972; Roberts & Aman, 1993). Thus, children acquiring a spoken language also start learning these terms by referring to their own body, but need to abstract away from referring to their own body to be able to use them in relational sense (i.e., to refer to the spatial relations between the entities). In a recent study, Li et al. (under review) found evidence that children can learn the labels for "left-right" when these terms are body-anchored. Thus, for sign language acquiring children, referring to their own body in TİD relational lexemes for "left-right" might be a facilitating factor in learning these spatial relations.

However, in the encodings for the spatial relation between objects located on the sagittal axis, signing children were not adult-like: They used classifier constructions and relational lexemes less frequently than their adults. Considering the fact that the relational lexemes for "front-behind" are also body-anchored in TİD, it is surprising not to see a similar facilitating effect of modality in their acquisition by signing children. One might think that this facilitating effect may be hindered by another factor that characterizes adult encodings of spatial relationships on the sagittal axis. This factor might be related to the adults' use of double linguistic devices in their relational encodings in the same picture description – unlike signing children who almost always used a single linguistic form (analogue or categorical construction). The reason for adults' choice of double linguistic devices might be related to the issue of viewpoint encoding, which will be discussed below.

In Turkish, unlike in TİD, learning to use spatial nouns "left-right" for objects configured on the lateral axis has been found to be challenging for both age groups. Turkish children in both age groups instead used the general spatial noun ("yan - *side*"), which does not encode a viewpoint more than the adults. This suggests that Turkish speaking children, even between 7-10 years of age, have not achieved adult-like use of these terms to refer to these types of spatial relations between entities. This would be in line with the previously reported late mastery of these terms by speaking children.

162

However, the reason for children's lack of specification of these relations might be linked to the fact that the target pictures where "left-right" type of spatial relations are shown lacked contrasts that show an opposite spatial relation (e.g., left versus right) due to post hoc decisions concerning the choice of our picture sets where left-right contrasts (unlike for "front versus behind") were not balanced (as explained in section 5.3.3). Thus, unlike adults, children might not have felt the pragmatic need to specify the left and right relation – finding it sufficient to express only the sideness of the relations. Further research with stimulus pictures with such contrasts are needed to tease apart these two possibilities.

However, Turkish-acquiring older children (but not younger children) were adult-like in encoding relations on a sagittal axis. These findings are consistent with the previous literature that suggests a late mastery for "left-right" (Piaget & Inhelder, 1971; Benton, 1959; Harris, 1972; Corballis & Beale, 1976; Shepard & Hurwitz, 1984; Johnston & Slobin, 1979; Choi & Bowerman, 1991). Since "front-behind" distinctions are usually identifiable by distinct perceptual features, but "left-right" distinctions are often more difficult to identify due to the bilateral symmetry of many objects (Shepard & Hurwitz, 1984), Turkish-acquiring children may have difficulty in learning to use these terms in their locative expressions.

Further understanding of the effects of modality in this domain requires an analysis of the use of co-speech gestures in such spatial descriptions by speakers – especially for the cases in Turkish where no viewpoint was encoded in speech (i.e., "yan - *side*"). Although not reported in the current dissertation, an analysis of the use of co-speech gestures where speakers used one hand to represent the location of the Figure and the other hand to represent the location of the Ground (similar to simultaneous classifier constructions) in descriptions employing a viewpoint-free general relational term "yan - *side*" revealed the following pattern: Younger children did not use their hands while they were speaking (i.e., they did not use gestures to depict the spatial configuration shown in the pictures). Interestingly, older children showed a tendency to use co-speech gestures more frequently than adults and younger children, although the difference did not reach a significant level (Sümer et al., 2014). Thus, the facilitating effect of the visual-spatial modality might be present not only in sign languages, but also in spoken languages through the use of co-speech gestures to encode viewpoint-dependent

spatial relations (Goldin-Meadow, 2003; 2004; 2010; Goldin-Meadow & Alibali, 2013). Even though cognitive development can be a strong driver in determining the acquisition of certain concepts in language (Piaget & Inhelder, 1971; Johnston, 1985; E. Clark, 2004), the development of spatial language can be modulated by modality of expression, as seen, for example, in TİD-acquiring children who used categorical, relational lexemes forms such as "left-right" earlier than Turkish-acquiring children.

iii) Viewpoint[38]

TİD adult signers' choice of viewpoint varied depending on the axis: They mostly adopted signer viewpoint in their relational encodings for the objects located on the lateral axis, but addressee viewpoint for the sagittal axis. A similar pattern was also reported for ASL signers by Emmorey (1996). Then, the following question comes to mind: Why do adult signers employ different "viewpoints" to encode a spatial relation between the Figure and the Ground located on the lateral versus sagittal axis?

The answer to this question might be related to the use of double linguistic devices in describing the locations of objects placed on the sagittal axis – even though more controlled elicitations might be needed to support this claim. In these encodings, adult signers mostly use a categorical construction (e.g., relational lexeme) before or after an analogue construction (e.g., classifier predicate). It is possible that employing a relational lexeme meaning "front-behind" that makes direct use of the signer's body coordinates influences how signers place classifier predicates for the Figure and the Ground in the signing space. In other words, the semantics of the relational lexemes may interfere with or shape the use of signing space in the classifier constructions.

In Figure 5.13 below, I try to schematize this interaction. When double linguistic devices are used in a relational encoding, the location of classifier predicates in the signing space parallels the spatial anchoring of the relational lexemes "front" and "behind" on the signer's body. It seems that due to the spatial semantics of the "front" and "behind" lexemes, the signing space closer to the signer

---

[38] The points raised in the discussion on viewpoint are the result of extensive and inspiring discussions with Dr. Pamela Perniss, in particular.

maps onto the "behind" space, while space further from the signer maps to the "front" space in placing the analogue constructions.
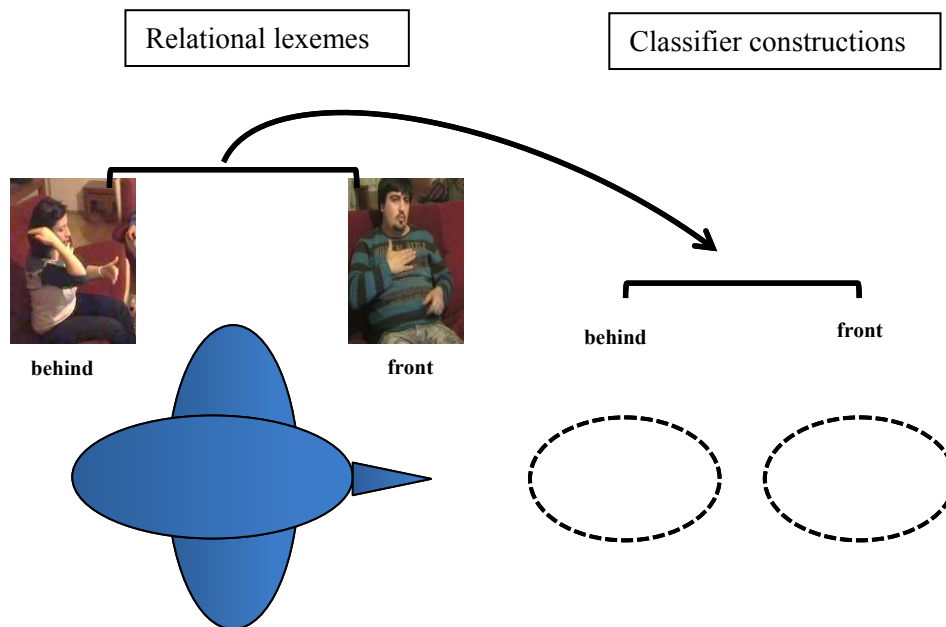
Figure 5.13: A schematic illustration of the spatial transposition of relational lexemes "front" and "behind" onto signing space to the localization of classifier predicates in TİD adult system.

In the following example (18), an adult TİD signer is describing the picture that shows a ball (i.e., Figure) in front of a bowl (i.e., Ground). After introducing the Ground by its lexical sign in the 1st still, she holds it in the signing space (thus localizing the Ground by direct lexical sign placement) and uses the relational lexeme for "front" in the 2nd still. Finally, she localizes the Figure with its lexical sign with respect to the previously localized Ground object. In her analogue construction, she uses the front area as indicated in Figure 5.13 above to encode the location of the Figure with respect to the Ground.

(18)

LH:	BOWL_loc		
		-------------------------- HOLD --------------------------	
RH:	BOWL_loc	FRONT	BALL_loc

"There is a bowl here. There is a ball in front of the bowl."

Similarly in (19) below, the location of the Figure (i.e., cup) is being expressed by two linguistic devices (i.e., relational lexeme followed by an analogue construction). After introducing and localizing the Ground (i.e., box) by its lexical sign (1st still), the signer uses the TİD relational lexeme "behind", in whose form the back of the body is indicated (2nd still). Then, she also localizes the lexical sign for the Figure with respect to the Ground in an analogue construction (3rd still). Note that the space that she uses to localize the Figure with respect to the Ground in the analogue construction corresponds to the "behind" area shown in the Figure 5.13.
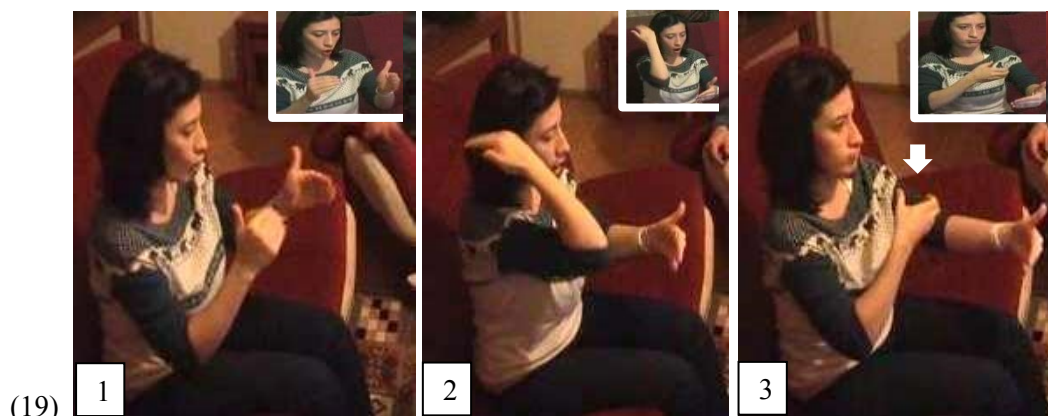
(19)

LH: BOX_{loc} ----------------------- HOLD --------------------------

RH: BOX_{loc} BEHIND CUP_{loc}

"There is a box. There is a cup behind it."

A closer look at the analogue construction in the last still of (18) reveals that the classifier for the ball is located behind (further from the body) the classifier for the bowl in the signing space, thus from the signer's viewpoint, the ball is behind the bowl – unlike how it is seen by the signer in the target picture. However, from the viewpoint of her addressee, the classifier for the ball is located in front of the classifier for the bowl, thus matching the spatial relation in the target picture. Similarly, the signer in (19) does not match the locations of the lexical signs for the box and the cup in signing space as she sees them in the picture. Thus, it seems as if these signers are describing the picture from the viewpoint of their addressees in terms of the use of space in their classifier constructions. However, based on the use of both relational lexemes and classifier constructions in these descriptions, I would suggest that their use of analogue forms does not actually reflect viewpoint encoding at all. Rather, the organization of the signing space in their analogue constructions is affected by the semantics of the relational lexemes for "front" and "behind".

This claim can be further supported by considering the "viewpoint" choices exhibited in descriptions that use classifier predicates with or without relational lexemes. Out of 58 relational encodings for the sagittal axis, 27 of them (.47) include the use of a classifier construction and a relational lexeme "front" or "behind" (i.e., double linguistic devices); 28 (.48) include the use of a classifier construction only; and 3 (.05) include the use of a relational lexeme "front" or "behind" only. In 27 relational encodings with double linguistic devices, 24 of them (.89) are from the so-called

167

"addressee viewpoint", and 3 (.11) from "signer viewpoint". When signers used a classifier construction only (N=28 cases), their use of "signer viewpoint" increases (N=11 cases (.39)), although there is still a higher preference of "addressee viewpoint" (N=17 cases (.61)).

In (20) and (21) below, two TİD signers are describing the same stimulus picture in which there is a pen located with respect to a paper on the sagittal axis. Both signers are describing this spatial configuration with a classifier construction only (i.e., without using a relational lexeme), but from different viewpoints. The higher use of "signer viewpoint" in relational encodings with classifier constructions only (.39) when compared to the ones with double linguistic devices (.11) indicates an influence of the (non)-use of relational lexemes with classifier constructions on the choice of viewpoint in TİD spatial descriptions. However, there is still a higher use of "addressee viewpoint" relational encodings even with classifier constructions only (.61) (when compared to the use of "signer viewpoint" (.39) within similar encodings). This can be interpreted in two ways: There might still be influence from the semantics of the relational lexemes (also the use of intrinsic features of the body) even when these relational lexemes are not used in the relational encoding at all. Thus, signers might be reflecting such an influence in their relational encodings – rather than merely visually mapping their hands in a way they correspond to the locations of the entities as shown in the picture. It is also possible that TİD signers express a viewpoint ("signer" versus "addressee") when they used classifier constructions only (when not using a relational lexeme), but their encodings might be influenced by the semantics of these relational lexemes when they use both a classifier construction and a relational lexeme.

(20) 1	2	3	4

LH: CL(flat)$_{loc}$ ---------------- HOLD -------------------

RH: PAPER   PEN   CL(long)$_{loc}$

"There is a paper. The paper is here. There is a pen. The pen is in front of the paper [from signer viewpoint]."

(21) 1	2	3	4

LH: PAPER   CL(flat)$_{loc}$ ---------------- HOLD -------------------

RH: PEN   CL(long)$_{loc}$

"There is a paper. The paper is here. There is a pen. The pen is in front of the paper [from addressee viewpoint]."

In encoding spatial relations for objects located on the lateral axis, adult signers, first of all, do not use double linguistic devices as frequently as for object relations on the sagittal axis. In terms of the semantics of the relational lexemes for "left" and "right", the left side of the body corresponds to the left side of the signing space and the right side of the body to the right side of the signing space in addition to the real spatial configuration space. Thus, in the case of relational encodings for the lateral axis, the semantics of the relational lexemes "left" and "right" do not interfere with the use of space in the analogue constructions.

Due to the fact that TİD-acquiring children mainly use a single form in their relational encodings for the sagittal axis, they did not reach the adult patterns in this domain. Thus, the location of the Figure with respect to the Ground ends up being differently organized in signing space in

analogue constructions produced by children compared to those produced by adults. In their descriptions for both axes, children prefer to encode the spatial configuration how they see it. It is possible that these children might be doing more of a visual mapping rather than an abstract semantic encoding. If this is indeed the case, this would then indicate a hindering influence of modality in sign language acquisition in the domain of viewpoint-dependent spatial relations.

iv) Simultaneous expression of Figure and Ground in analogue constructions

Simultaneous expression of Ground and Figure objects in classifier constructions has been suggested to be an area of challenge for sign language-acquiring children, especially due to the articulatory difficulties of simultaneously combining two classifiers and to the morphological complexity inherent to these forms (e.g., Newport & Supalla, 1980; Supalla, 1982; Slobin et al., 2003; Tang et al., 2007). However, in this study, deaf children acquiring TİD in both age groups were able to express Figure and Ground simultaneously in analogue constructions in their relational encodings as frequently as adults. Thus, learning simultaneous analogue constructions, at least for viewpoint-dependent static locations, did not seem to pose any problems for TİD-acquiring children. Moreover, "SimCon" was found to be the most preferred type of simultaneity across all age groups. A similar finding for preference of SimCon over SimSim in encoding viewpoint-dependent relations was also reported in another study by Perniss (2007), in which she asked adult DGS signers to describe two objects configured on either the lateral or sagittal axis.

5.7 Conclusion

This chapter provides a first account of developmental patterns in encoding static viewpoint-dependent spatial relations in deaf children acquiring TİD. It is also the first study in which the acquisition of these spatial relations in a sign language is directly compared to adult patterns and to age-matched hearing children acquiring a spoken language (i.e., Turkish). It also provided extensive qualitative and quantitative analyses of linguistic devices available in both languages. As in Chapter 4 for topological spatial relations, the present study took varying levels of iconicity of linguistic devices

to encode viewpoint-dependent spatial relations in TİD into account, and factored it into the investigation of the developmental trajectory for signing children while learning to express these spatial relations. Finally, it examined the use of analogue constructions and relational lexemes within the same description of a spatial configuration, and its consequences for the use of signing space in analogue constructions. Given the previous lack of linguistic/usage analysis of adult forms in encoding view-point dependent relations in TİD, it also offered an analysis of how relational lexemes influence the use of space in classifier constructions while locating hands representing relative positions of the entities in signing space for each axis type (i.e., lateral versus sagittal). I believe such an analysis has also not been conducted for other sign languages due to lack of interest in relational lexemes in encoding such relations or their infrequent usage in other sign languages. More comparative research is needed in this regard.

In sum, the results of the current study show a neutral effect on learning to express Figure and Ground and the spatial relation between the two while encoding viewpoint-dependent spatial relations. Furthermore, even the younger age group of signing children was found to exhibit adult patterns in the simultaneous expression of Figure and Ground in encoding these spatial relations in analogue constructions.

However, when it comes to using adult-like linguistic devices to express spatial relations for a certain axis and from a viewpoint also preferred by adults, facilitating and hindering modality effects have been found: Learning to use certain linguistic devices (i.e., relational lexemes) to express viewpoint-dependent spatial relations for the lateral axis (i.e., the left-right axis) in TİD might be facilitated by being able to directly map these lexemes onto the coordinates of the body. However, this advantage may manifest itself in production rather than in comprehension, especially considering the results of previous studies that showed that sign language acquiring children have difficulty and lag behind their speaking peers in understanding viewpoint-dependent spatial relations (Martin & Sera, 2006). However, in encoding spatial relations between objects placed on the sagittal axis for which adult signers use double linguistic devices, and expressing these spatial relations from so-called

"addressee viewpoint", the visual-spatial modality seems to hinder acquisition, especially due to having to learn to map the semantics of the body-anchored lexemes onto the signing space.

Thus, the visual-spatial modality seems to differentially influence the acquisition of different types of viewpoint-dependent spatial relations. There seems to be a combination of facilitating (i.e., linguistic devices to encode a spatial relation for the lateral axis), hindering (i.e., linguistic devices to encode a spatial relation for the sagittal axis; viewpoint choice for the sagittal axis), and neutral (i.e., Figure or Ground omission; encoding a spatial relation) effects of modality in learning to encode viewpoint-dependent spatial relations. Simultaneous expressions do not seem to pose a difficulty for signing children from 4-5 years of age onwards.

In the next chapter, I will test the effects of the modality in encoding motion events, the part of the spatial domain in which most previous research with signing and speaking children has been conducted. Compared to Chapters 4 and 5, the focus of analysis will be somewhat limited, that is, it will concentrate on Figure and Ground expressions and simultaneity in the expression of Figure and Ground – the areas where I found most discrepancy between results of locative descriptions and what is reported in previous research with regard to acquisition of spatial language.

Stimulus pictures used to elicit expressions of viewpoint-dependent spatial relations

The stimulus set for the current study comprises 12 sets of picture. Each set is a four-picture array in which one of the pictures is the target one as indicated by the red frame. Depending on the type of target spatial relation, the pictures are presented in two groups below; i) pictures showing the Figure and the Ground located on the lateral axis (left-right) and ii) pictures showing the Figure and the Ground located on the sagittal axis (front-behind). These pictures have been adapted from pictures originally developed by Dr. Jennie Pyers.

i) Pictures that show objects located on the lateral axis:

ii) Pictures that show objects located on the sagittal axis:
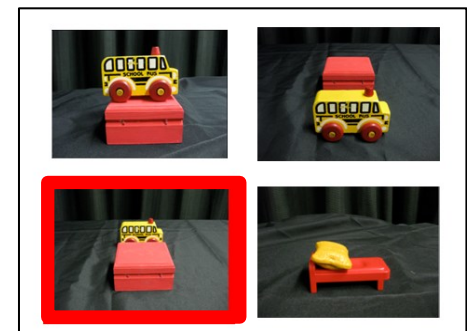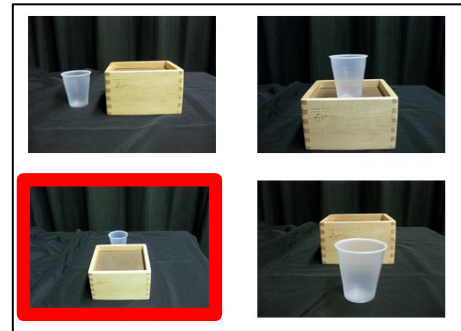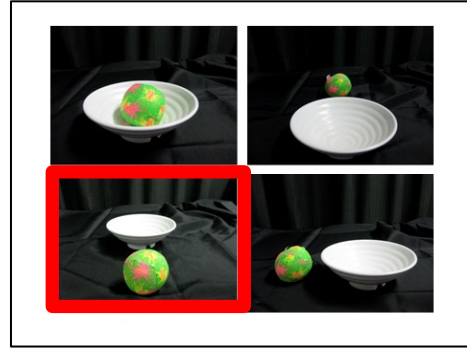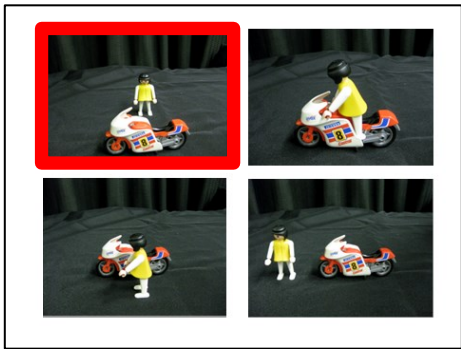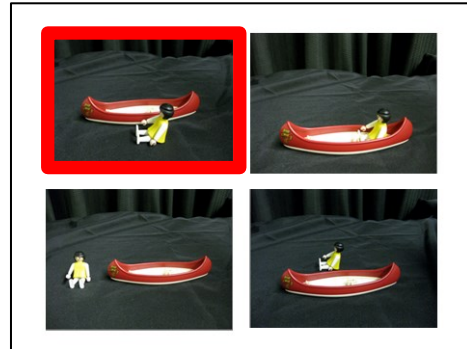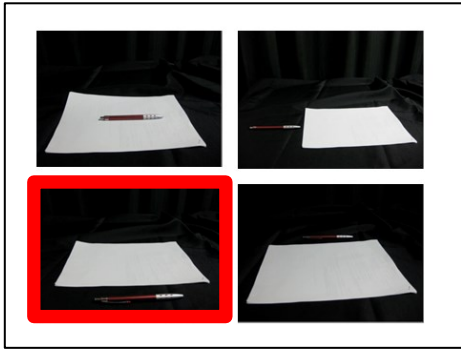
CHAPTER 6

Learning to Encode Motion Events in TİD and Turkish

6.1 Introduction

This chapter focuses on the domain of motion events (e.g., the man walked up the stairs), a domain studied more frequently in language acquisition both from a crosslinguistic perspective by children learning spoken languages and by children learning sign languages as mentioned in previous chapters. One aspect of motion event expression consistently reported in sign language research has been the children's tendency to omit Grounds and the difficulty that they experience in producing simultaneous classifier constructions – sometimes not mastering correct production until 10-13 years according to various reports (Newport & Supalla, 1980; Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). This has been attributed to a hindering effect of modality due to the morphological and/or articulatory difficulties associated with expressing simultaneous components of a motion event. Some difficulties in expressing Grounds have also been mentioned with regard to children learning different spoken languages, with mastery also taking up to 10 years of age (Hickmann, 2003). However, in making claims about late mastery of spatial language, sign language acquisition research has not taken the findings from spoken language literature into account or has not provided direct comparisons between sign and spoken language acquisition in this domain. These are also the two domains (i.e., Figure/Ground expressions and simultaneity) that I have *not* seen signing children to have difficulty within the analyses presented in previous chapters. The present findings, then, seem to contradict previous research. Thus, this chapter will focus on how signing and speaking children express Figure and Ground components while describing motion events in TİD and Turkish compared to their adult patterns.

Before continuing with the relevant previous acquisition literature on spoken and sign languages, I will briefly introduce the notion of a motion event and its semantic components as well as how these components are linguistically represented in spoken and sign languages in general. Even

though this information has been provided briefly in Chapter 2, I would like to elaborate a bit more

especially for sign language, since the literature has used different terminology and focused on

different aspects of motion predicates in ways that can sometimes be confusing.

According to Talmy (1985), a motion event has four main internal semantic components:

Figure, Ground, Path and Motion[39] as shown in (1a) below:

(1a) The man   moved   down   the hill.
    Figure   Motion Path   Ground

In this event description, the Figure is the object that moves. The Motion refers to the movement of

the Figure. The Ground is the reference object with regard to which the Figure moves. Path represents

the trajectory followed by the Figure with respect to the Ground. In addition to these internal

components, there can also be Manner (1b) or Cause[40] (1c) of Motion. Manner refers to the specific

way the Figure moves, and Cause is the event that makes the Figure move. Please note that the motion

events investigated in the present study include all of these components, but Cause.

(1b) The man   rolled   down   the hill.
    Figure   Motion+Manner   Path   Ground

(1c) The man   rolled   the ball   down   the hill.
    Agent   Motion+Cause   Figure   Path   Ground

Signers encode different components of a motion event (i.e., Motion, Figure, Ground, Path, Manner)

by using their body articulators (e.g., hands) and signing space, which allows them to exploit the

iconic and spatial affordances of the visual-spatial modality. In doing so, they mostly use classifier

---

[39] I would like to remind readers that motion with a lower case "m" refers to a type of spatial event (i.e., motion event) whereas Motion with a capitalized "M" refers to a component of a motion event.
[40] The Motion encodings with Cause are transitive in nature: The verb (i.e., roll) is related to at least two elements whose semantic roles are characteristically those of an agent (i.e., the man) and a patient/Figure (i.e., ball). The verb of intransitive motion events, on the other hand, has one argument only (e.g., the man rolled down the hill). In the current dissertation, I will focus on the expression of the intransitive motion events only.

predicates that express the Path, sometimes combined with Manner of Motion,[41] of a referent (e.g., Supalla, 1982; Engberg-Pedersen, 1993; Zwitserlood, 2003; Tang et al., 2007).[42] These linguistic devices can be considered as multi-morphemic structures that consist of discrete morphemes for Manner and/or Path of Motion, and classifiers for Figure and Ground, combined simultaneously in a classifier predicate (Supalla, 1982). These morphemes have visually-motivated relations to their meanings – unlike in spoken languages (Talmy, 2003), and sign languages seem to be quite homogenous in such visual motivation (Aronoff et al., 2003). However, not all researchers agree that all expressions of all components of a motion event are morphemic. According to Taub & Galvan (2001), DeMatteo (1977), Liddell (2003), and Schembri, Jones, & Burnham (2005), Path and Manner components in a motion event and the locations of Figure and Ground in signing space can be considered to be more iconic and analogue aspects of classifier predicates than the accounts where these components are claimed to be categorical, discrete, or morphological (Supalla, 1982).

In any account, motion event expressions differ from similar expressions in spoken languages due to the visual modality allowing simultaneous encoding of several motion event components and to the iconic and analogue correspondences between the form and the events they represent. In (1d) below, a TİD signer encodes the Figure (i.e., man) with a classifier, expressed by index and middle fingers, that incorporates Manner (i.e., rolling) and Path (i.e., down) information (3rd still, right hand), while the other hand represents the Ground (i.e., hill) localized in the signing space (3rd still, left hand).

---

[41] Note that encoding Manner of Motion in a classifier predicate by simultaneously expressing a referent's Path is not necessary, and sometimes not even possible. Instead, sometimes Manner is encoded by a separate verb (Supalla 1982 for ASL; Slobin & Hoiting 1994 and Zwitserlood 2003 for NGT; Kita, Senghas & Özyürek 2004 for NSL, and Perniss 2007 for DGS).

[42] As has been reported for NGT (Zwitserlood 2003), and as I will show in section 6.4.1, it is also possible to encode a motion event without a classifier predicate, e.g. with a lexical verb. In that case, the verb does not incorporate Figure information.

(1d) [1] [2] [3] *TİD*

LH: HILL$_{loc}$ -------------------- HOLD --------------------

RH: HILL$_{loc}$ MAN CL(man)$_{roll\_down}$

"There is a hill. There is a man. He is rolling down the hill."

This is quite different in spoken languages where expression of these different components is always distributed over one or more sentences and form-meaning mappings are arbitrary as exemplified in (1a, b, c) above for English. As explained in Chapter 2 (2.3.1), spoken languages exhibit different lexicalization patterns in encoding semantic elements of a motion event: In satellite-framed languages such as English, Manner and Motion are typically encoded in the main verb, while Path appears in a particle outside the main verb (2a) whereas in verb-framed languages such as Turkish, the main verb usually encodes Path and Motion, while Manner is optionally expressed with gerunds, adverbs or subordinate clauses (i.e., outside the main verb) (2b).

(2a) The rock   rolled   down   the hill.   *English*
        Figure   Motion+Manner Path   Ground

(2b) Kaya   yuvarlan+arak   tepe+den   düş+tü.[43]   *Turkish*
        Rock   roll+GER   hill+ABL   fall+PAST
        Figure   Manner   Ground   Motion+Path

  "The rock fell from the hill [rolling]" (Talmy, 1985; 1991; Özçalışkan & Slobin, 1999).

In some languages, different types of Grounds can be marked with case markers depending on their relation to Path (e.g., for Turkish ablative case marker "-den/-dan" if Ground is a Source, dative case marker "-a/-e" if Ground is a Goal, and a general locative case marker "-da/-de" if Ground is a

---

[43] More information on how motion events are linguistically encoded in Turkish, based on the data of the present study, will be provided in (6.4).

Surface). In other languages, these different Ground types are indicated by prepositions (e.g., "from", "to" and "at" in English, respectively)

In the following section (6.2), previous studies on how children learn to encode motion events in sign and spoken languages are reviewed. Next, information on the stimulus materials, data coding and the analysis in the present study is provided in section (6.3). I then describe the patterns that emerged in the motion event descriptions of TİD signers and Turkish speakers in section (6.4). Quantitative analyses of the frequencies of these patterns in the child and the adult data in both languages are provided in section (6.5). I summarize the main findings and discuss the results in relation to previous studies with signing and speaking children in section (6.6). The conclusions are given in section (6.7).

6.2 Learning to encode motion events

Previous literature on learning to encode motion events is reviewed separately for spoken (6.2.1) and sign languages (6.2.2).

6.2.1 Learning to encode motion events in spoken languages

There is a substantial body of research on how speaking children learn to encode motion events, and most of them focus on the acquisition of Path and Manner components since spoken languages differ in terms of their lexicalization patterns in how these components are encoded (i.e., satellite-framed versus verb-framed languages) (e.g., Allen et al., 2007 for Japanese; Choi & Bowerman, 1991 for Korean; Gullberg et al., 2008; Hickmann et al., 2009 for French; Hohenstein, 2013; McNeill, 2000 for Spanish; Papafragou et al., 2002, 2006, 2008 for Greek; Özçalışkan, 2005; 2007; 2009; Özçalışkan & Slobin, 1999, 2000a for Turkish). These studies provide overwhelming evidence showing that children display language-specific patterns in their speech about encoding Path and/or Manner at a very young age (at around 3 years) and that Path expressions (e.g., "up", "down") appear in children's earliest expressions.

The early attunement to language-specific patterns observed in the acquisition of Path and/or

Manner encoding has not been observed for encoding Figure and Ground in motion event narrations, however. Hickmann (2003) examined this issue by comparing the picture story narrations of adults and children (4 to 10 years old) in four different spoken languages (English, French, German, Mandarin Chinese), and she found a strikingly similar developmental progression where children showed a tendency for omitting Grounds in their narratives, and that learning to express both Figure and Ground in an adult-like way is apparently late aspect of language development, and is not mastered until 10 years of age.

Further evidence for a difficulty with Grounds also comes from a processing study done with infants. Göksun et al. (2009) found that English-reared infants (7-14 months) notice Figures earlier than Grounds in events where a Figure is moving towards a Ground (11 months for Figures and 14 months for Grounds). Also, Ground discrimination was earlier in static events (8 months) than in a motion event (14 months). This suggests that Grounds are better noticed in the absence of Motion, and that the movement of a Figure object diminishes attention to other aspects of a motion event (i.e., the Ground object).

These studies in general suggest that learning to encode Ground in motion event narration is a late aspect of language acquisition, and children, regardless of the language they acquire, seem to have difficulty in expressing this component while narrating motion events.

6.2.2 Learning to encode motion events in sign languages

Although the particular interest of the present study is to investigate whether Figure and/or Ground are expressed in motion event descriptions, and if so, whether this expression is simultaneous or not, I will also briefly mention the findings on the acquisition of other semantic components such as Path and Manner, as was done for the acquisition literature for spoken languages presented above.

A number of studies that focus on the acquisition of various aspects of classifier predicates in motion event narrations in sign languages report that signing children do not acquire these constructions in an analogue or holistic fashion – despite the visual resemblance between their linguistic forms and the real motion event (Newport & Supalla, 1980; Newport, 1981; Supalla, 1982; Newport & Meier, 1985). For sign languages (in particular ASL), there are some indications that

signing children learn to express different components of a motion event at different ages (Supalla, 1982).

Newport & Supalla (1980) and Newport (1981), investigating the acquisition of some movement morphemes in three ASL-acquiring children between the ages of 3;6 and 5;11, report that the youngest child (age 3;6) in their study was able to produce simple Path movements (e.g., linear, arc). These early productions did not convey information about the Manner component. However, a few months later, a small proportion of the productions conveyed Path and Manner information, but these were articulated sequentially rather than simultaneously (Newport, 1981).

Expression of Figure in motion event descriptions was found to appear earlier than the expression of Ground (Newport & Supalla, 1980; Supalla, 1982; Morgan et al., 2008). Supalla (1982) found some expression of Grounds in motion event descriptions of a 3;6-year-old ASL-acquiring child, but these were very infrequent. Morgan et al. (2008) also reports that a BSL-acquiring child between 2;0 and 2;6 had a tendency to refer to real objects around him as Grounds while describing motion events rather than using lexical signs or classifier predicates to refer to Grounds. The omission of Grounds was also reported for older signing children by Slobin et al. (2003) for ASL-acquiring children (between 5-12 ages), Tang et al. (2007) for HKSL-acquiring children (about age 12), and by Engberg-Pedersen (2003) for DSL-acquiring children (about 13 years).

The fact that signing children tended to omit the Ground in their classifier constructions was interpreted as "non-adult like", non-simultaneous representation of Figure and Ground in motion event descriptions. Simultaneous representation of these two components has been considered to be a source of either morphological or articulatory difficulty for signing children (Supalla, 1982; Engberg-Pedersen, 2003; Slobin et al., 2003; Morgan et al., 2008; Tang et al., 2007). In these studies, however, it is unclear whether children do not mention Ground at all in their narrations, or whether it is mentioned in another way than in a classifier predicate (e.g., with a lexical sign only). Thus, it remains unclear to what extent signing children leave the Ground unexpressed in motion event narrations.

6.3 The present study

6.3.1 Motivation

The main purpose of the present study is to track the developmental patterns of encoding Figure and Ground in the domain of motion events in a sign (i.e., TİD) and a spoken (i.e., Turkish) language. In Chapters 4 and 5, I have shown that there was no strong tendency to omit Ground compared to Figure in children compared to adults for signing or speaking children. Furthermore, when both were expressed, encoding them in simultaneous analogue constructions (both SimSim and SimCon) did not pose a serious challenge for TİD-signing children in terms of being adult-like even at the youngest ages I tested. I have argued that this might be due the fact that the focus was only on location events (i.e., location events can be simpler than motion events in terms of the number components of the events considered) or to the fact that my stimuli did not involve long narrations but expressions of simple events. Therefore, I, here, focus on whether children and adults encode Figure and/or Ground in their motion event descriptions, and if so, whether these components are represented simultaneously or not, to see whether motion poses a specific difficulty that is not visible in locative constructions. It is important to note here that to make the stimuli as similar as possible to the locative stimuli, they were kept as short vignettes – unlike longer stimuli such as the Frog Story or the Horse Story used in previous research (e.g., Engberg-Pedersen, 2003; Hickmann, 2003). Thus, the differences that might arise between the present study and the previous research could still be attributed to the differences in discourse complexity required by different types of stimuli.

I have also mentioned that in most of the previous studies with sign language acquiring children, comparisons with adult patterns were missing (Newport & Supalla, 1980; Newport, 1981; Supalla, 1982; Slobin et al., 2003; Morgan et al., 2008), or have been carried out with few adult signers (Tang et al., 2007 and Engberg-Pedersen, 2003, which included 2 and 4 adult signers, respectively). It was generally assumed that the adult pattern is to use simultaneous classifier constructions. However, recent research shows that simultaneity is not obligatory in adult signing and can be sensitive to discourse organization (Özyürek et al., 2010; Perniss et al., in press). This study goes beyond previous research in directly comparing children to adults. Moreover, in the studies with signing children, it is not clear whether Figure and Ground are not mentioned at all or mentioned, but

without the use of classifier predicates. Finally, in reporting difficulties in Figure and Ground expression for sign language acquiring children, previous research has not taken into account similar patterns in Ground omissions reported for speaking children (Hickmann, 2003).

Both qualitative and quantitative analyses were conducted on the expression of Figure and Ground components in motion event descriptions, taking the claims made in previous studies into account. Since the main purpose is to examine Figure/Ground encoding, no differentiation was made between different types of Motion encoding in terms of Path and/or Manner expression. In other words, as long as signers and speakers encoded Motion (with Path and Manner information, Path only information, or Manner only information), their descriptions were included as expressions of Motion component minimally in the present study.

First of all, to be in line with previous studies and to be able to compare my findings against theirs directly, I examined Figure and/or Ground expression where signers and speakers also encoded Motion. Secondly, when signers expressed both Figure and Ground and also encoded Motion, I examined the (non)-simultaneity of Figure and Ground expression both qualitatively and quantitatively across the age groups. This two-fold analysis aims to overcome confusions in previous research where it was not possible to differentiate between whether it was the mention of Figure and Ground at all that was missing in the narrations or their simultaneous expression in classifier constructions.

Unlike in previous chapters of this dissertation, a detailed analysis of the linguistic devices used in TİD and Turkish was not conducted for the present chapter since the adult patterns needed more grammatical/linguistic analysis that could not be obtained with descriptions collected from only eight vignettes. Moreover, the analysis of how Path and Manner were expressed in the descriptions is also beyond the scope of this chapter. Thus, a fuller analysis of these aspects of motion event expressions in and across TİD and Turkish is still needed in future research.

6.3.2 Hypotheses

As in the previous chapters, three hypotheses are proposed about the effect of modality (visual-spatial versus auditory-vocal):

i) *Facilitating effect of modality*: Since the linguistic devices (i.e., simultaneous classifier constructions) that signers typically use to describe motion events carry a visual resemblance to these events, as explained in Chapter 2, such iconicity in form-meaning mappings will facilitate learning to encode motion events in a sign language.[44] In this case, TİD-acquiring children will reach adult-patterns in how frequently they encode Figure and Ground earlier than Turkish-acquiring children.

ii) *Hindering effect of modality*: The challenges of learning how to coordinate the two hands that represent Figure and Ground, together with a classifier predicate that expresses Motion or learning how to combine the multiple elements that need to be simultaneously encoded in the morphology of such constructions may play a hindering role in learning to encode motion events in TİD. In this case, TİD-acquiring children will have difficulty in expressing Figure and Ground in a motion event in an adult-like way, and lag behind age-matched Turkish-acquiring children.

iii) *Neutral effect of modality*: One might assume that the modality of language does not affect the course of development in learning to encode a motion event in TİD and Turkish beyond general principles of cognitive development and language-specific factors. If this is true, both signing and speaking children will become adult-like in expressing Figure and/or Ground at similar ages. Simultaneous expression in classifier constructions, a modality-specific aspect, might also not be acquired late.

6.3.3 Stimulus materials

The data for the current study were collected by eliciting descriptions of eight short vignettes that depict motion events where a Figure is changing its location with respect to a Ground, along a Path in a certain Manner. In these vignettes, Figures were either people (two animated, two real; a total of four vignettes) (Goldin-Meadow, Chee So, Özyürek, & Mylander, 2008) and geometric characters,

---

[44] Lexical verbs, another type of linguistic device to express motion events as also explained in Chapter 2 (2.3.2.1), generally carry less visual resemblance to the real motion event since they usually do not incorporate Figure and/or Ground information (e.g., the verb GO in example 8 from TİD in Chapter 2). The analysis of such linguistic devices is not in the scope of the present study.

which were all animated (two vignettes with tomato and two vignettes with triangle; a total of four vignettes) (Özyürek, Kita, & Allen, 2001).[45] Grounds included trees (two vignettes), hills/slopes (four vignettes), triangle (two vignettes), tomato (two vignettes), a car (one vignette), and a girl (one vignette). Note that some of the vignettes have more than one Ground. For example, in Figure 6.1 below, there are four possible Grounds, namely triangle, tree, slope/hill, and the top of the slope/hill. These Grounds can function as Goal (tree), the Surface (slope/hill), or the Source of Motion (triangle, top of the slope/hill). I did not differentiate between them, and when any of these Grounds were mentioned in the vignette description, it was analysed as having the Ground expressed.
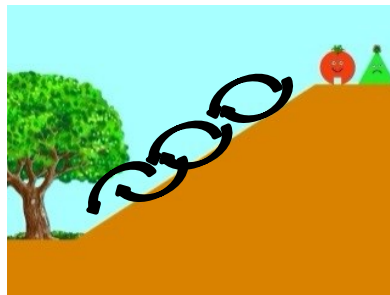
Figure 6.1: A still from a vignette that shows the tomato rolling from *top of the hill (Source)*, *away the triangle (Source)*, towards a *tree (Goal)* on a *hill/slope (Surface)*, thus having four possible Grounds.

The vignettes were between 3 and 15 seconds in duration. Four vignettes show people engaged in various motion events in which Path and Manner are combined. The other four vignettes contain geometric characters, namely a tomato and triangle.[46] The vignettes with geometric characters show three movement events: An entry event, a target motion event, and a closing event. For example, the first still in Figure 6.2 below depicts a triangle entering the scene from the left and bumping into a tomato (i.e., the entry event). In the second still, the tomato rolls up the hill (i.e., the target motion event). In the third still, the tomato falls into the water and bobs up and down (i.e., the closing event). The other four vignettes show people engaged in a certain motion event, and do not have entry and/or

---

[45] The difference between the vignettes with Figures as people and as geometric characters was not taken into consideration for the statistical analysis.

[46] Participants were free to choose their own names for the characters. I, here, refer to them as tomato and triangle.

closing events, which makes their descriptions less complex than the tomato and triangle events (Figure 6.3) (see Appendix 6.1 for stills from all vignettes used in the study).
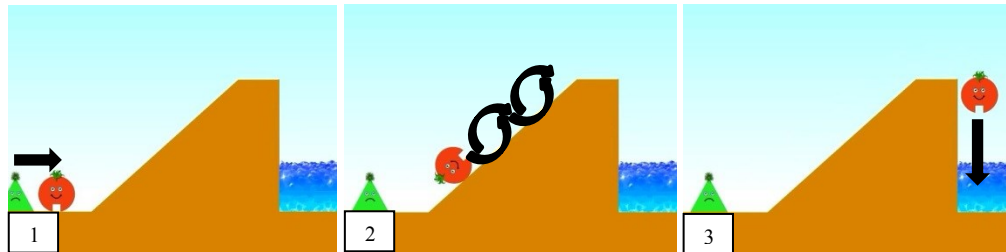
Figure 6.2: Stills from a vignette that shows three motion events.

Figure 6.3: A still from a vignette that shows real people and that does not have an entry/closing event.

6.3.4 Data coding and analysis

There were a total of 441 motion event descriptions (236 from TİD signers and 205 from Turkish speakers) for the stimulus vignettes, which showed the Motion of a Figure with respect to a Ground. This number does not include cases where participants repeated the description to exclude uncontrollable variation. For each vignette description, all signs were transcribed with Turkish and English glosses on separate tiers for the left and right hand by two hearing researchers who have good knowledge of TİD. These annotations, done with ELAN (Wittenburg et al., 2006), were checked by a deaf TİD signer. The Turkish data were coded for each picture description by a Turkish speaking research assistant.

For the vignettes with tomato and triangle, participants sometimes did not describe the target motion event, but rather described the entry and/or the closing events only (see Figure 6.2). Such

cases were not included into the current analyses. When signers and speakers encoded the target motion event (for tomato and triangle vignettes), they occasionally introduced Figure and Ground(s) while describing the entry event, and did not introduce them again for the part with the target motion event. As long as participants mentioned Figure and Ground in the entry or target motion event, their descriptions were considered to include the mention of these components. For the simple vignettes with fictive and real human figures, all of the description was analysed (Figure 6.3).

As noted earlier, some vignettes have two or more Grounds (Figure 6.1), and some of them can function as Source, Surface or Goal of Motion. The current study does not differentiate between them, and all were coded and analysed as Ground. If there was more than one Ground, all Grounds were coded, but the number of Grounds expressed was not included into the relevant analysis.

In the following section (6.4), the patterns observed in the data from both languages as a result of qualitative analyses will be reported. These patterns are later analysed quantitatively for exploring the developmental patterns for each language, as will be presented in section (6.5).

6.4 Qualitative findings

This section presents the patterns that emerged in the motion event descriptions elicited from signers and speakers. Qualitative analyses were conducted in two areas: i) Expressing Figure and/or Ground in motion event descriptions where the Motion is encoded (6.4.1), and ii) types of simultaneous expression of Figure and Ground in classifier constructions when Figure and Ground are mentioned (TİD only) (6.4.2).

6.4.1 Figure and/or Ground in motion event descriptions in TİD and Turkish

The current analysis concerns vignette descriptions in which Motion is encoded. In these descriptions, Motion encoding can include both Path and Manner information (e.g., the man *rolled down* the hill), Path only information (e.g., the man moved *down* the hill), or Manner only information (e.g., the man *rolled*). These descriptions were examined in terms of whether participants expressed Figure and/or

Ground. In these descriptions, Figure and Ground could be expressed by lexical signs or in classifier predicates or both.

The qualitative analysis revealed the following patterns: i) Figure omitted; ii) Ground omitted, iii) both Figure and Ground omitted, and iv) both Figure and Ground mentioned.

i) *Figure omitted*

In these cases, participants only mentioned the Ground, and did not express the Figure at all (i.e., either by a lexical sign or in a classifier predicate). For example, in (3a) below, a TİD signer is describing the vignette that shows a man walking up the stairs. While describing this vignette to her addressee, she refers to the stairs (1st and 2nd stills), and describes the Motion (i.e., walk) without referring to the Figure (i.e., man).[47] Similarly, in (3b), the Turkish speaker, describing the same event, refers to the Ground (i.e., stairs), but does not convey information about the Figure (i.e., man).
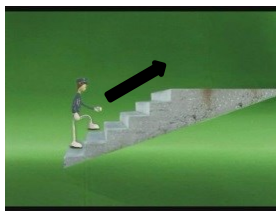
(3a)	1	2	3
LH:	STONE	STEP	WALK
RH:	STONE	STEP	WALK

"There is a stone step. [Someone] walks."

---

[47] The cases (as in 3a) have been referred to as predicates with body part classifiers by Supalla (1986) and verbs of manner of motion by Zwitserlood (2003). In the present study, these forms were considered to be lexical verbs since they lack Figure information, but more detailed analyses with a larger data set is necessary to be sure about the exact nature of these forms in TİD.

(3b) Merdiven+ler+den   çık+tı. (female, adult)

    Stair+PLU+ABL   ascend+PAST

"[Someone] went up the stairs."

    ii) Ground omitted

The motion event encodings in this group contain information about the Figure only, and do not refer to any Ground in any way (i.e. by lexical signs or in classifier predicates). An example is (4a) where a TİD signer describes the vignette in which a man is going up the stairs. He never mentions the Ground (i.e., the stairs) in his description. One might think that the slightly upward moving hand of the signer may be interpreted as "walking up stairs", thus implying Ground information incorporated in it. After checking with the deaf research assistant who is a TİD signer, such expressions were considered as Ground omission, because there is no explicit clue as to whether the Figure is moving on a Ground, away from a Ground, or towards a Ground.

    In (4b), an adult Turkish speaker describes another vignette with the tomato rolling down the hill/slope, where she does not mention any of the possible Grounds (i.e., the triangle, the hill/slope, or the tree).
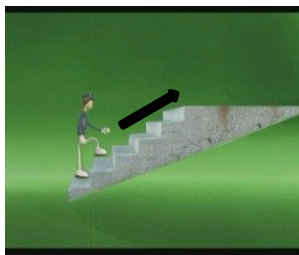
(4a)

LH:

RH: MAN   CL(man)$_{walk\_up}$

"There is a man. He is walking up."

(4b) Domates   düş+tü. (female, adult)

     Tomato   fall+PAST

  "The tomato fell down."

   iii) Omitting both Figure and Ground

Sometimes, participants omitted both Figure and Ground in their encodings of motion events. Such descriptions were not observed in the data of adult signers and speakers, but mostly in the younger age group of children acquiring TİD (5a) and Turkish (5b). Please note that in (5a), the TİD signing child uses her index finger to show only Path of Motion without incorporating information about the Figure or the Ground. If she had been using index and middle fingers wiggling that depict someone walking, then her description would have been considered to include Figure information.
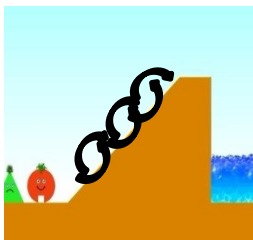
(5a)   (8;2)

LH:

RH: MOVE_UP_SLANTING

"*[Something] is slanting up.*"

(5b) Yuvarlan+dı.　　　(boy, 6;6)

　　Roll+PAST

"[Something] rolled."

　iv)　Both Figure and Ground mentioned

This category includes descriptions with Motion encodings where TİD signers and Turkish speakers expressed both Figure and Ground in classifier predicates or by lexical signs as in (6a). In this description, an adult signer of TİD starts her description by introducing the Figure (i.e., triangle) with a lexical sign (1st still). Then, she mentions and immediately localizes the Ground (i.e., slope/hill) with a lexical sign (3rd still). While she holds the lexical sign for the slope/hill in the signing space (left hand, 4th still), she introduces and localizes another Ground (i.e., tomato) with respect to the hill/slope (right hand, 4th still) with a lexical sign for "ball". Then, she encodes the Motion of the Figure (i.e., triangle) in a classifier predicate (left hand, 5th still). Recall from section (6.3.4) that some stimuli contain several entities functioning as a Ground for the Motion of the Figure. When signers and speakers mentioned any of these by lexical signs or in classifier predicates, their descriptions were considered to contain the mention of a Ground.

(6a)

	1	2	3	4	5
LH:	TRIANGLE	STONE	SLOPE	----- HOLD -----	CL(triangle)$_{jump\_up}$
RH:	TRIANGLE	STONE	SLOPE	BALL$_{loc}$	------- HOLD -------

"There is a triangle. There is a stone slope. The ball is here. The triangle is jumping up towards the ball."

In Turkish, speakers use a case marker attached to the noun for the Ground to express the relation of the Ground to the main verb that encodes Motion. As shown in (6b) below, the dative marker ("-e/a" - *to*), which is attached to a noun for the Ground, indicates the Goal of Motion. Although not exemplified here, the noun for the Ground can be affixed with an ablative marker ("-den/dan" - *from*) that conveys Source information (e.g., tepe+den [hill+ABL] - *from the hill*) or a locative case marker ("-de/da" - *at*) that conveys Surface information (e.g., tepe+de [hill+LOC] - *at the hill*) in Turkish. In (6b), the Turkish speaker mentioned only the tomato (i.e., Goal), but not the slope/hill (i.e., Surface). Since she indicated the entity towards which the Figure moves (i.e., the tomato), her narration was included in this category.

(6b) Üçgen   domates+e   doğru   yukarı   çık+tı. (male, adult)
     Triangle   tomato+DAT   towards up   ascend+PAST
      "The triangle went up to the tomato."

6.4.2 Types of simultaneity in representing Figure and Ground (TİD only)

In the current analysis, I examine the expression of both Figure and Ground in terms of simultaneous representation in TİD. Following previous studies which examined simultaneous expression of Figure and Ground in classifier constructions (e.g. Supalla 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007), I focus on the cases where the Motion of the Figure is encoded in a classifier predicate – rather than in a lexical verb as in (3a).[48] The descriptions where the Grounds were expressed by a lexical sign or in a classifier predicate were also included in the current analysis.

     As a result of the qualitative analyses, two major patterns in representing Figure and Ground were found: i) Simultaneous-Consecutive (SimCon) and ii) non-simultaneous (NonSim). These are explained below:

i)   *Simultaneous-Consecutive (SimCon) expression of Figure and Ground*:   In this type of simultaneity, signers introduced and localized the Ground in a classifier predicate or through a

---

[48] See (8) in Chapter 2, for use of a lexical verb (i.e., GO) to describe the Motion of the Figure.

lexical sign placement, and then expressed the Motion of the Figure on the other hand in a classifier predicate. Below there is a schematized view of the SimCon type of simultaneity in motion event descriptions:[49]

(Ground NP) [Localization of Ground]   ----------------hold----------------
                                         (Figure NP) [Movement of Figure]

In (7a) below, a TİD signer is describing a girl who is walking to a car. After introducing the Ground (i.e., car) and localizing it in a classifier predicate (1st and 2nd stills, respectively), she introduces the Figure (i.e., the girl, 3rd still) and describes her walking towards the previously localized Ground classifier, which is held in the signing space (4th still).

(7a)

| | 1 | 2 | 3 | 4 |

LH: CAR   CL(flat)$_{loc}$ -------------------- HOLD --------------------
RH: CAR   GIRL   CL(girl)$_{walk}$

"*There is a car. The car is here. There is a girl. She is walking towards the car.*"

ii) *Non-Simultaneous (NonSim) expression of Figure and Ground*: In this type of expression, signers encoded the location of the Ground and the Motion of the Figure sequentially in the signing

---

[49] In the schematic representations of different types of simultaneity given below, the parts indicated with brackets show how Figure and Ground are expressed. Note that introduction of Figure and Ground may be optional since signers sometimes prefer to localize them by their lexical signs immediately. So, they are indicated in the brackets to mark their optionality.

space. This is similar to the non-simultaneous representation of Figure and Ground in static locative events. Its structure is schematized as:

(Ground NP) [Localization of Ground]

(Figure NP) [Movement of Figure]
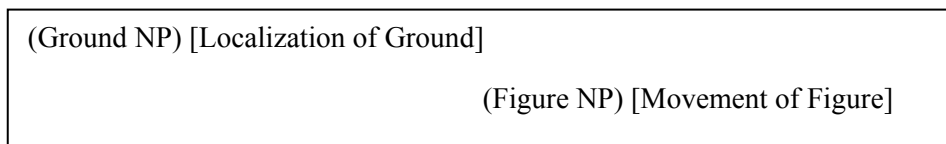
In (7b) below, a TİD signer is describing the same vignette as shown in (7a). After introducing the Ground (i.e., car) and localizing it with a classifier predicate (1st and 2nd stills, respectively), the signer introduces the Figure (i.e., the girl, 3rd still) and describes her walking towards the previously localized Ground. As opposed to the signer in (7a), this signer does not hold the Ground in the signing space while describing the movement of the Figure.

(7b)

| | 1 | 2 | 3 | 4 |

LH: CAR   CL(car)$_{loc}$

RH: CAR   GIRL   CL(girl)$_{walk}$

"*There is a car. The car is here. There is a girl. She is walking towards the car.*"

Sometimes, signers introduced the Ground by a lexical sign, but did not localize it. This is illustrated in (7c) below, where the same vignette is being described. The signer introduces both the Figure and the Ground. She does not localize the Ground at all, but just indicates the Motion of the Figure in a classifier predicate. Such cases of non-simultaneity were not observed in locative event expressions. Its schematic representation is given below:

[Ground NP] [Figure NP] [Movement of Figure]

(7c)

LH: CAR

RH: CAR   GIRL   CL(girl)$_{walk}$
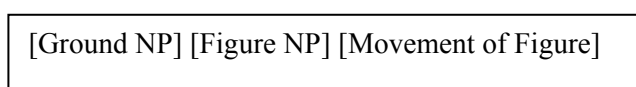
"*There is a car. There is a girl. The girl is walking [somewhere]*."

The patterns reported in this section present a general picture of the data on describing motion events in TİD and Turkish. In the following section, I will present the results of quantitative analyses where I investigated these patterns in terms of frequency of occurrence in the child and adult data in order to reveal the developmental patterns in both languages.

6.5 Quantitative findings

In the current section, I first provide the results on the frequency of encoding Figure and/or Ground in section (6.5.1). Then, the results on two types of simultaneous expression of Figure and Ground (as emerged from the qualitative analysis) in the TİD data are presented in section (6.5.2). As in previous chapters, arcsine transformation was applied to all the data before the analysis, but the mean proportions and standard errors/deviations in graphs are reported from the untransformed data. Corrections in the degrees of freedom were also made whenever the sphericity assumption was violated for repeated-measures ANOVA analyses.[50]

6.5.1 Frequency of encoding Figure and/or Ground in motion event descriptions in TİD and Turkish

Subject-based mean proportions of vignette descriptions where Motion was encoded, and participants expressed both Figure and Ground, omitted either of them, or omitted both of them were calculated

---

[50] In the present study, statistical analyses are by participants. In the future, statistical analyses by items should also be conducted.

out of all vignette descriptions where the Motion was encoded as dependent measures. The effect of language, age and omission type were analysed in a 2 (Between subjects, Language: TİD, Turkish) by 3 (Between subjects, Age: adults, older children, younger children) by 4 (Within subjects, Type of Figure-Ground expression: Both Figure and Ground expressed, Figure omitted, Ground omitted, Both Figure and Ground omitted) mixed ANOVA. The results yielded a main effect of age, $F(2,54) = 8.98$, $p < .001$, $\eta^2_p = .25$, and type of Figure-Ground expression, $F(1,72) = 242.05$, $p < .001$, $\eta^2_p = .82$, but not for language, $F(1,54) = 3.03$, $p = .09$, $\eta^2_p = .05$. There was a 2-way interaction between type of Figure-Ground expression and age, $F(3, 72) = 11.38$, $p < .001$, $\eta^2_p = .30$, but not between age and language, $F(2,54) = 1.12$, $p = .33$, $\eta^2_p = .04$, and type of Figure-Ground expression and language, $F(1, 72) = 3.10$, $p = .07$, $\eta^2_p = .05$. There was no 3-way interaction, $F(3,77) = 2.13$, $p = .11$, $\eta^2_p = .07$.

After finding an interaction between type of Figure-Ground expression and age, I conducted a one-way ANOVA which yielded main effects of age for Motion encodings with both Figure and Ground expressed, $F(2,59) = 11.25$, $p < .001$, Motion encodings with Ground omitted, $F(2,59) = 10.99$, $p < .001$, and Motion encodings with both Figure and Ground omitted, $F(2,59) = 7.15$, $p = .002$. There was no effect of age for encodings with Figure omitted, $F(2,59) = .48$, $p = .62$. Post hoc analyses (Bonferroni) showed that younger signing children expressed both Figure and Ground less frequently than adults ($p < .001$) and older children ($p = .009$). Older children and adults were similar ($p = .39$) in their encoding of both Figure and Ground. Furthermore, younger signing children omitted Ground more frequently than adults ($p < .001$) and older children ($p = .01$). There was no such difference between older children and adults ($p = .35$). Finally, younger signing children omitted both Figure and Ground more frequently than adults ($p = .004$) and older children ($p = .008$). Older children were similar to adults ($p = 1.00$). The lack of main effect of language indicates that these patterns hold true for both languages (see Figure 6.4 for TİD and 6.5 for Turkish).

Comparisons of each type of Figure-Ground expression in each age group across languages revealed that adults and children in both age groups produced Motion encodings with both Figure and Ground expressed more than all three other types (Figure omitted, Ground omitted, and both Figure and Ground omitted) ($ps < .05$). Also, adults and older children, regardless of their language, were found to omit Figure or Ground in similar amounts ($ps > .05$). This was not the case for the younger

age group of signing and speaking children, who omitted Ground more frequently than Figure ($p <$ .05) – unlike adults and older children in both languages.
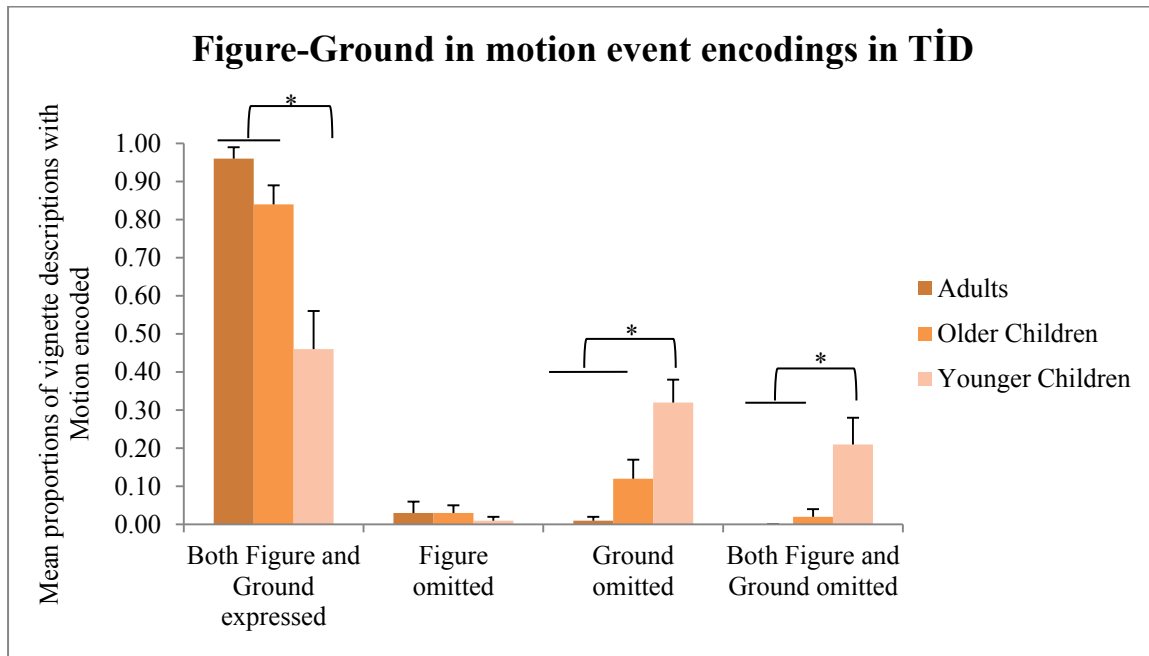

Figure 6.4: Mean proportions and error bars (representing SE) of motion event descriptions where both Figure and Ground were expressed and omitted in addition to the descriptions where either of them was omitted in TİD.
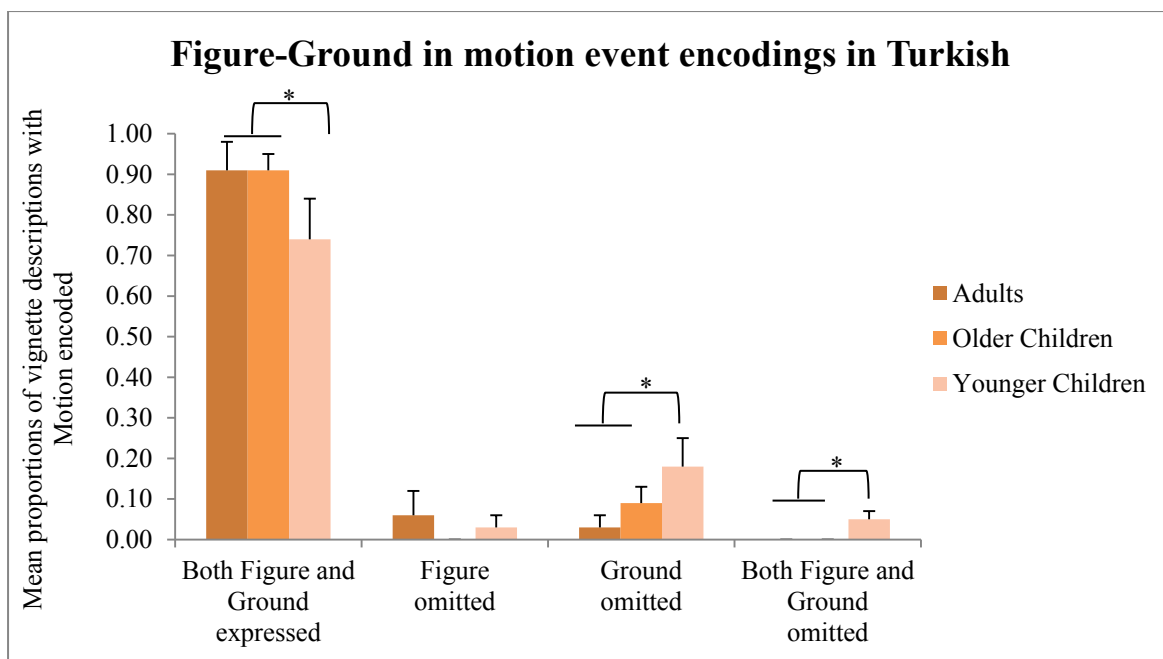
Figure 6.5: Mean proportions and error bars (representing SE) of motion event descriptions where both Figure and Ground were expressed and omitted in addition to the descriptions where either of them was omitted in Turkish.

To sum up, these results indicate that signing and speaking children become adult-like in how likely they are to encode both Figure and Ground in motion event descriptions at similar ages. Furthermore, signing children in both age groups omitted Ground (only Ground or both Figure and Ground) but not Figure in their motion event descriptions as frequently as their speaking peers.

6.5.2 Frequency of different types of simultaneity in expressing Figure and Ground (TİD only)

As mentioned in Chapter 2 (2.3.2.1), motion events can be encoded in predicates or by lexical verbs (as in 3a in the current chapter, and 8 in Chapter 2). Here I focus on the cases where both Figure and Ground are expressed, and the Motion of the Figure is encoded in a classifier predicate.

Within the motion event descriptions where both Figure and Ground were expressed in the current data, adult signers of TİD mostly used classifier predicates (58 cases out of 76, (.76)), and sometimes lexical verbs (18 cases out of 76, (.24)). Older children also preferred classifier predicates (41 out of 61, (.67), and used fewer lexical verbs (20 out of 61, (.33)), whereas younger children

seemed to prefer classifier predicates (16 out of 30, (.53)) and lexical verbs (14 out of 30, (.47)) in almost equal amounts. Therefore, this analysis includes 115 vignette descriptions out of 167 (.69) vignette descriptions where both Figure and Ground are expressed by classifier predicates but not lexical verbs. Note that it is not clear from previous research whether such a distinction was made in their analysis.

The subject-based mean proportions of Motion encodings with either simultaneous or non-simultaneous constructions were calculated out of all vignette descriptions where Motion was encoded (where both Figure and Ground were expressed). The effects of age and simultaneity type were analysed in a 3 (Between subject, Age: adult, older children, younger children) by 2 (Within subject, Type of simultaneity: simultaneous, non-simultaneous) mixed ANOVA. The results showed no main effect of type of simultaneity, $F(1,27) = .12$, $p = .73$, $\eta^2_p = .01$, or age, $F(2, 27) = .04$, $p = .96$, $\eta^2_p = .01$. There was no interaction between them, $F(2, 27) = .51$, $p = .61$, $\eta^2_p = .04$ (see Figure 6.6).
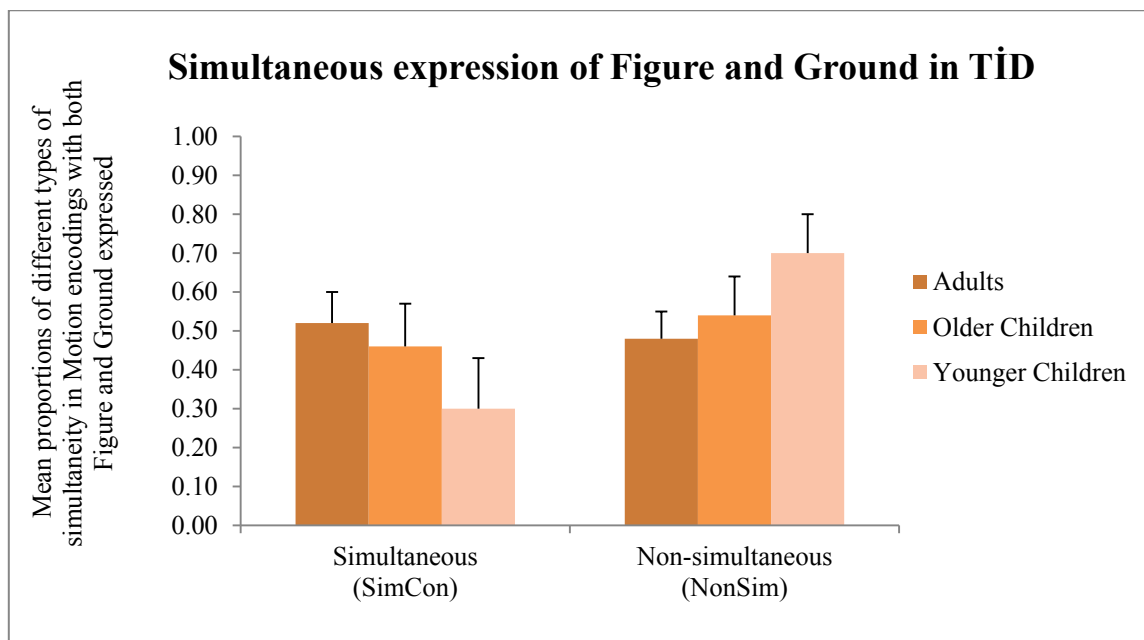

Figure 6.6: Mean proportions and error bars (representing SE) of two types of simultaneity used in motion event encodings with Figure and Ground expressed in TİD.

These results show that TİD adult signers use both types of simultaneity in similar amounts while describing motion events. Furthermore, even the younger age group of signing children seem to have

reached adult patterns in how frequently they expressed Figure and Ground simultaneously in vignette descriptions where they encoded the Motion of the Figure in a classifier predicate.

6.6 Summary & Discussion

This study investigated whether TİD- and Turkish-acquiring children exhibit adult patterns at similar ages in encoding Figure and Ground in motion event descriptions, and also whether TİD-acquiring children have difficulty in expressing both Figure and Ground simultaneously while describing motion events as put forward by the previous studies (Newport & Supalla, 1980; Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008).

Three hypotheses on the possible effects of modality in the acquisition of these expressions were tested: A facilitating, a hindering, or a neutral effect of modality. The findings in general support the neutral effect of modality in encoding Figure and Ground in motion event descriptions, and simultaneous encoding of Figure and Ground does not seem to pose a difficulty for TİD-acquiring children. Findings with regard to different aspects of expressing motion events will be summarized and discussed below.

i)   Encoding Figure and Ground in motion event descriptions

The findings of the present study suggest that TİD-acquiring children are similar to Turkish-acquiring children in reaching adult patterns of encoding both Figure and Ground in motion event descriptions. Younger age children, in both languages, had a tendency to omit Ground more frequently than adults and older children. Also, younger children, in both languages, omitted Ground more frequently than Figure while describing motion events.

Similar developmental patterns found for encoding Figure and Ground in both languages supports the neutral effect of hypothesis. Moreover, both TİD signing and Turkish speaking younger children produced more motion event descriptions with Ground omitted than with Figure omitted. This finding seems to be in line with the previous studies that report the omission of Ground to be a

pervasive feature of children's motion event narrations (Supalla, 1982; Hickmann, 2003; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). This, then, shows that Ground omissions in motion event descriptions is a general aspect of language development, but is not specific to sign language learning children.

In the current study, children in both languages were found to encode both Figure and Ground as frequently as adults at around 7 years of age. This is early when compared to the findings of previous studies, which suggest a much later achievement of such expressions by children (not before 10 years of age) (Engberg-Pedersen, 2003; Hickmann, 2003; Slobin et al., 2003; Tang et al., 2007). However, note that most of these studies analysed longer discourse by these children, such as picture-story narrations – unlike the present study in which short vignette descriptions were examined. Further comparisons of longer and shorter motion event narrations might also reveal whether the length of a discourse plays a role in learning to encode both Figure and Ground in describing motion events. Also recall that the previous studies with signing children focused on presence or absence of Grounds in classifier predicates. The fact that this part of study investigated the presence or absence of Figure and Ground in the whole description may also be an explanation for this discrepancy. In this respect, the present study has a wider scope than the previous ones.

ii) *Simultaneity in encoding Figure and Ground in motion event descriptions in TİD*

Previous studies assumed that simultaneous encoding of Figure and Ground is the adult way of describing motion events (e.g., Newport & Supalla, 1980; Supalla, 1982; Slobin et al., 2003, Morgan et al., 2008). However, this study showed that adult signers of TİD used both simultaneous and non-simultaneous classifier constructions for encoding motion events almost equally.

Learning to manage the simultaneous articulation of both hands in order to represent Figure and Ground may be challenging for children acquiring a sign language, but previous studies conducted in this domain lack data on adult patterns (Newport & Supalla, 1980; Newport, 1981; Supalla, 1982; Slobin et al., 2003) or were restricted to data collected from only a small number of adults (Engberg-Pedersen, 2003; Tang et al., 2007). It is possible, then, to assume that the

simultaneous presentation of Figure and Ground may not always be the preferred strategy by adult signers – as we found here for adult TİD signers. If non-simultaneous representation of Figure and Ground is also acceptable in the data elicited from the adult signers, then the children's use of non-simultaneous constructions to represent these components does not necessarily show a late mastery in this domain of their language development.

The use of both types of simultaneous representation of Figure and Ground in motion event descriptions by adult signers of TİD might be due to the use of different types of motion events or different types of Grounds (i.e., Goal, Source, Surface). In the present study, no differentiation was made between whether the Grounds were of the Source, the Goal, or the Surface type, and different types of Grounds could have led to use of a certain type of simultaneity. A detailed analysis of the current data is necessary to be able to answer this question.
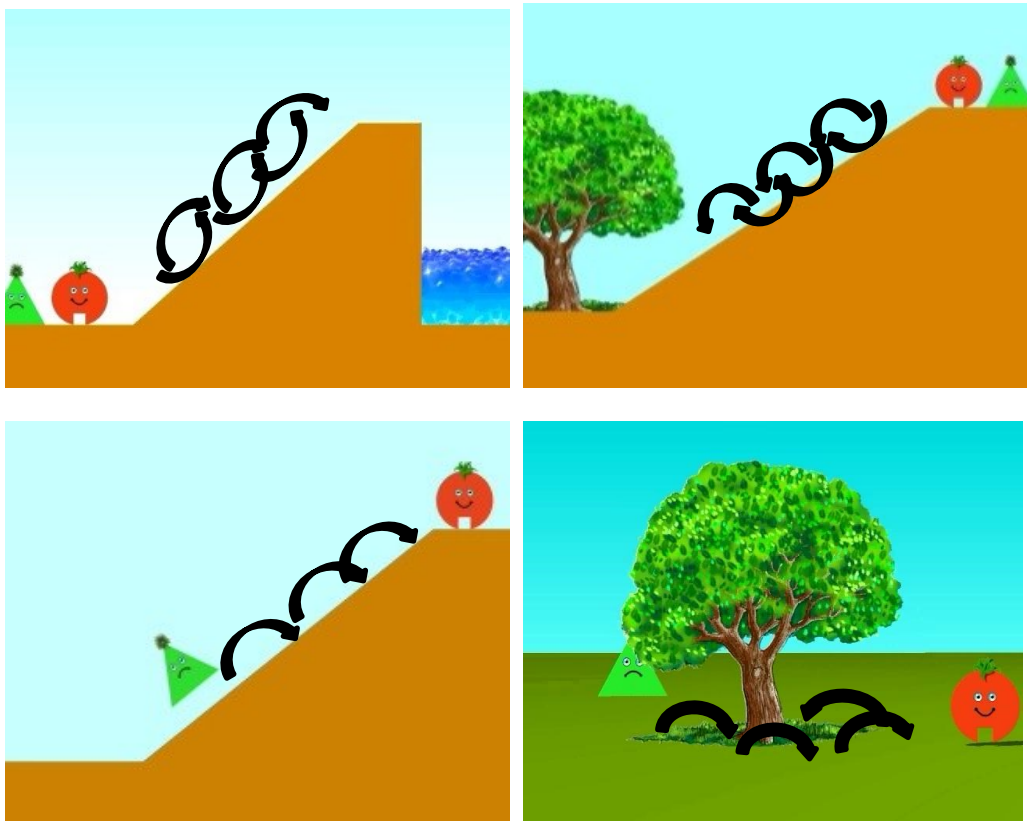
6.7 Conclusion

In this chapter, I investigated how children learn to encode Figure and Ground in motion events in a sign (i.e., TİD) and a spoken (i.e., Turkish) language. The findings show that both signing and speaking children are able to express both Figure and Ground by 7 years of age for motion events. There is however a tendency to omit Grounds in motion event descriptions across the two language groups. This finding supports the hypothesis that suggests a neutral effect of modality. That is, modality does not affect the acquisition of Figure and Ground expression in language acquisition above and beyond general guiding principles of cognitive development or early attunement into language specific patterns. Furthermore, adult signers of TİD encoded Figure and Ground in simultaneous and non-simultaneous constructions equally, and even at the younger age group TİD-acquiring children were similar to adults in this respect. In this sense, there is no evidence for the late mastery of this aspect of TİD in motion event expressions.

The stimulus set for the current study consists of eight short vignettes, each of which shows a Figure that changes its location along a Path in a salient Manner towards a Goal (as Ground) or with respect to a Surface (as Ground). This set consists of two types of vignettes: Vignettes where Figures are i) geometric characters and ii) people

i) Vignettes with geometric characters as Figures:

ii) Vignettes with people as Figures:
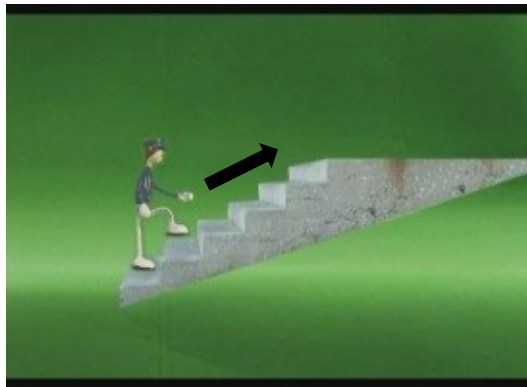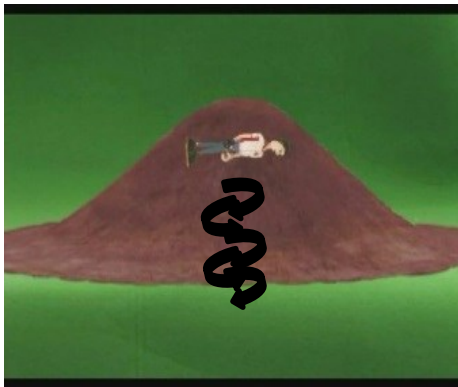
CHAPTER 7

Summary & Conclusion

7.1 Introduction

In everyday life, we constantly experience (i.e., perceive, apprehend) and communicate about many events that are visual and spatial in nature. Entities can be located or moving in relation to each other (e.g., fork to the left of a plate, a man running to his car, etc.). In spite of the seeming uniformity of how we perceive and apprehend spatial events, decades of linguistic research has shown that speakers of different spoken languages differ from each other in terms of how event components (e.g., relation of entities to each other, Manner, Path, Goal of an event) are encoded semantically and syntactically (Talmy, 1985; Slobin, 2003; Levinson and Wilkins, 2006). Sign languages, on the other hand, differ radically from spoken languages in that they use affordances of the visual-spatial modality and map spatial relations between objects in the real world onto signing space in iconic and analogue ways to varying degrees (e.g., a cup-shaped hand placed on a flat handshape to linguistically depict "a cup on a table", Emmorey, 2002; 2003; Perniss, 2007).

While learning to express spatial relations between entities in linguistically appropriate ways, children learn to segment the different components of a spatial event into semantic components, and map these onto lexical and syntactic units available in their language. Previous research in various spoken languages has shown that, in learning to do so, children are guided both by universal principles of cognitive development about space as well as by their ability to tune into the language-specific encoding possibilities in their languages (e.g., Johnston & Slobin, 1979; Choi and Bowerman, 1991; Allen et al., 2007; Hickmann, 2003). Learning spatial expression in a sign language might further be modulated by the visual-spatial nature of the modality due to the visually-motivated (i.e., iconic and analogue) correspondences between form and meaning. Previous research on signing children's spatial language abilities has suggested that the visual-spatial modality might in fact pose some difficulties in learning spatial language, and that especially constructions involving expressions

of simultaneous components of spatial events are challenging for signing children (e.g., Supalla, 1982; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007; Morgan et al., 2008). However, this previous research lacks systematic comparisons to adult patterns (except Engberg-Pedersen, 2003 and Tang et al., 2007, which had 4 and 2 adults respectively), and has not compared how spatial events can be expressed in a sign and spoken language at different times in acquisition.

This dissertation investigated the linguistic expression of space and its acquisition in a sign (i.e., TİD) and a spoken language (i.e., Turkish). Specifically, it has examined adult native signers' and speakers' encodings of static spatial relations (i.e., topological and viewpoint-dependent) and motion events in elicited picture and vignette descriptions. The spatial descriptions of native TİD-signing and Turkish-speaking children in two age groups (i.e., younger children (3;5-6;10) and older children (7;2-9;11)) were compared to those of adults in each language quantitatively. It also offered comprehensive qualitative linguistic description of the ways in which spatial relations (both in location and motion events) are encoded by TİD signing and Turkish speaking adults and children.

The current dissertation went beyond previous research on signing children's acquisition of spatial language in many ways. First, previous research on signing children's spatial language abilities has focused mainly on motion events, and has not systemically differentiated between location events and motion events. Here, I examined the acquisition of different types of spatial events (i.e., location versus motion), and further differentiated between different types of spatial relations in location events (i.e., topological versus viewpoint-dependent). The analyses were conducted for different aspects of spatial language (e.g., Figure and Ground expressions, simultaneity, types of linguistic devices, and viewpoint choice). Second, compared to previous research, I have obtained a relatively large sample of data from deaf native signing children and adults (10 in each age group) – rather than from a mixed set of participants, some of whom might be late signers or bimodal bilinguals. Furthermore, I compared child patterns to adult patterns directly, rather than to assumed adult patterns as in previous research. For the acquisition patterns in Turkish, I collected similar data from 30 native speakers of Turkish in age-matched groups. In this way, I was able to compare not only the development of a sign language to a spoken language for the first time, but also to compare the

acquisition of a less well studied sign language (i.e., TİD) to a spoken language (i.e., Turkish) that is typologically different from English in terms of how spatial relations are encoded (e.g., Özçalışkan & Slobin, 1999; 2000a, b; 2003; Allen et al., 2007). Finally, I factored the notion of iconicity into my coding by categorizing different linguistic devices with varying degrees of iconicity in representing the entities and the spatial relations between them in TİD in order to test the possible facilitating effects of modality on their acquisition. Even though iconicity has been considered not to play a role in learning a sign language in general, more recent research has shown that iconicity might be playing a role at least at the level of the lexicon (Perniss, Thompson, & Vigliocco, 2010; Thompson, Vinson, Woll, & Vigliocco, 2012; Ortega, 2013). I believe these efforts have resulted in a more nuanced understanding of whether and how the visual modality influences the acquisition of spatial language.

In this dissertation, I first examined how TİD signing and Turkish speaking adults encode two types of spatial relations. Within topological spatial relations (e.g., as expressed by "in", "on", "under" in English), I looked at different aspects of relational encoding such as expression/omission of Figure and Ground, the language-specific linguistic devices to encode spatial relations in both languages, and simultaneous representation of the entities involved in a spatial configuration (i.e., Figure and Ground) in TİD (Chapter 4). Next, I moved onto viewpoint-dependent spatial relations (e.g., "left-right" and "front-behind"), and explored adults' and children's spatial encodings in areas comparable to those in the analysis of topological spatial relations. Additionally, I examined these encodings for viewpoint choices in the TİD data (Chapter 5). Finally, I expanded my exploration to motion event descriptions – the domain that has mostly been studied for spatial language acquisition by signing children. Within the motion event descriptions elicited from adults and children in both TİD and Turkish, I focused on the mentions of Figure and Ground and on the simultaneous expression of Figure and Ground in TİD to be able to test the previous claims made in the literature on developmental patterns in these areas and compared the patterns I found in signing and speaking children's data directly (Chapter 6).

In summary, I found that modality-specific effects (hindering as well as facilitating) were most visible in the domain of viewpoint-dependent spatial relations where child signers needed to

learn to map a viewpoint of the scene onto the signing space, and also to take the form and semantics of body-anchored lexemes into consideration in their spatial expressions for lateral and sagittal axes. However, for the encodings of topological spatial relations and motion event encodings, there were no visible effects of modality, at least for the aspects that I have focused on – unlike what was claimed by previous research.

In the next section (7.2), I will compare the main findings for different types of spatial events, and discuss them in terms of what they reveal in the light of the general hypotheses proposed in Chapter 3. General conclusions and avenues for future study will be presented in section (7.3).

7.2 Comparative findings

7.2.1 Figure - Ground expressions

Expression of Ground in narrations has been reported to be a late aspect of language development, and both signing and speaking children have been reported to omit Ground until 10 years of age and even beyond (e.g., Engberg-Pedersen, 2003; Slobin et al., 2003; Hickmann, 2003; Tang et al., 2007). However, in sign language acquisition research, it has not been specified whether it was the mention of Ground that is omitted, or the classifier predicate for the Ground that was not produced, when the Ground was mentioned. One of the advances of the current dissertation has been to analyse Figure and Ground mentions separately from their simultaneous expression within analogue constructions. For this reason, I will discuss the findings regarding these analyses separately below.

7.2.1.1 Figure and/or Ground omission

Figure or Ground omissions were actually rather infrequent in the descriptions of location type of spatial events, both with topological or viewpoint-dependent spatial relations, and there was no trend to omit Ground more often than Figure. Moreover, in encoding viewpoint-dependent spatial relations, younger children in both languages omitted Figure or Ground equally, and more frequently than older children and adults. I did not find such a similar pattern for encoding topological spatial relations: Younger signing children omitted Figure or Ground more frequently than older children and adults –

unlike their speaking peers who were found to be adult-like at this age. At this point, I do not have an explanation for this developmental difference across different types of spatial relations. However, this might be related to the fact that the statistical analyses were conducted on small proportions, which might have yielded significant differences. Moreover, further research on the types of objects depicted in these pictures and signing children's knowledge about the appropriate classifiers to be used for these entities needs to be conducted (i.e., if a signer does not know the appropriate classifier for a certain object, s/he may not mention Figure or Ground at all). The important point here is that there was no tendency to omit Grounds more frequently than Figures, and the cases where both were omitted were very infrequent in both languages. Please note that older children in both languages did not tend to omit Ground or Figure more than adults for any type of spatial relations.

When compared to descriptions of location events, motion event descriptions indeed elicited more Ground omissions than Figure omissions from younger children (but not from adults and older children) in both languages, thus confirming the conclusions of previous research to a certain extent. The difference in Ground omissions between location versus motion event types might be related to the fact that a motion event has more semantic components (e.g., Figure, Ground, Path, Manner) than a location event (e.g., Figure, Ground) (Göksun et al., 2009; Furman, 2012). Thus, children, regardless of their language, may find it difficult to encode different components of a motion event in an adult-like way. However, this difference already disappears for the older age group of children in both languages, which is earlier than what previous studies suggested before (beyond 10 years of age) (e.g., Engberg-Pedersen, 2003; Slobin et al., 2003; Hickmann, 2003; Tang et al., 2007).

Moreover, some of the vignettes used to elicit motion event descriptions in the present study contained actually three motion events (i.e., entry, target motion, and closing events), which required longer descriptions than the vignettes that did not have multiple parts. This might have caused the difference found for Ground omissions for different spatial event types. Further comparisons of longer and shorter motion event narrations may also reveal whether the length of a narrative plays a role in learning to encode motion events.

Some of the stimulus vignettes used in the present study included two or more Grounds, which had different semantic roles (i.e., Goal, Surface, Source), and no differentiation was made among these different types of Ground in the analyses of motion event descriptions. However, previous studies have shown that speaking children differentiate between different types of Grounds while learning to talk about motion events, and find it easier to encode Motion towards a Goal, rather than away from a Source (e.g., Freeman, Sinha, & Stedmon, 1980; Fisher, Hall, Rakowitz, & Gleitman, 1994; Lakusta & Landau, 2005). Therefore, further studies are needed to understand if similar effects also exist for signing children, and whether the omitted Grounds were of a certain type such as Source or Surface rather than Goal.

7.2.1.2 Simultaneous expression of Figure and Ground

Children acquiring a sign language were reported to have difficulty in the simultaneous expression of Figure and Ground either due to morphological complexity or articulatory difficulties (Newport & Supalla, 1980; Supalla, 1982; Newport & Meier, 1985; Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007). However, in most of these studies, the necessity of simultaneous expression in these constructions in the adult patterns has been assumed rather than verified.

Recent studies on adult users of TİD have shown that simultaneous constructions are not preferred over non-simultaneous constructions, and Figure and Ground classifiers are mostly produced non-simultaneously in locative expressions (Özyürek et al., 2010; Perniss et al., in press). Pfau & Aboh (2012) claim that simultaneous classifier constructions in NGT are also not obligatory (in location and motion event types), and Zwitserlood (in prep.) suggests that these constructions are mainly for pragmatic purposes, especially when signers want to emphasize the presence of a Ground.

In the studies presented in the current dissertation, however, TİD signing adults mostly preferred to localize Figure and Ground in the signing space simultaneously to encode both types of spatial relations. However, the target pictures used in the present studies for locative relations were shown in a set with the contrasts, some of which showed different objects than the ones in the target picture. This contrastive nature of the task might have prompted the use of simultaneous constructions

(i.e., SimSim and SimCon) more than non-simultaneous ones. Özyürek et al. (2010) and Perniss et al. (in press) also collected their data (for locative spatial relations) by using pictures, but without contrasts, and found frequent use of non-simultaneous constructions by TİD signers.

Furthermore, the type of simultaneity preferred showed variation between two types of spatial events (i.e., location versus motion) in TİD: Simultaneous expressions were more frequent in location events than in motion event descriptions (note that this is by observation, and no direct tests were conducted), and adult signers of TİD were found to prefer simultaneous and non-simultaneous constructions in similar amounts for motion event encodings. Considering the fact that a motion event has also Path and Manner components in addition to Figure and Ground, signers might have focused on expressing them, which might have resulted in a decrease in the simultaneous expression of Figure and Ground. Although not included in the current dissertation, I have shown in other work with this same data that adult signers of TİD almost always expressed both Path and Manner while describing motion events (Sümer, Zwitserlood, Perniss, & Özyürek, 2013b). Further analyses on Path and Manner encodings in TİD should be done to be able to understand if there is such an influence of Path and Manner encodings on the less simultaneous expression of Figure and Ground.

The type of simultaneity also showed variation between two types of spatial relations (i.e., topological versus viewpoint-dependent): Expressions of viewpoint-dependent relations elicited more simultaneous-consecutive (SimCon) constructions, whereas TİD signers preferred both simultaneous-simultaneous (SimSim) and simultaneous-consecutive (SimCon) constructions to similar extents for encodings of topological spatial relations. This may be related to the fact that signers need to impose a viewpoint for the viewpoint-dependent spatial relations, and using simultaneous-consecutive constructions may be a way of highlighting the angular specification necessary for encoding these relations. With a simultaneous-consecutive construction, the location of the Figure can be visibly located in a particular direction (i.e., left/right or front/behind), from a particular viewpoint (i.e., signer or addressee) with respect to the Ground. In order to emphasize the angular specification and viewpoint, in particular in the contrastive contexts presented, signers may have opted for a more

explicit "Figure with respect to Ground" encoding by localizing the Ground and holding it in the signing space, rather than localizing both Figure and Ground classifiers at the same time.

The fact that adult signers of TİD used both simultaneous and non-simultaneous constructions in expressing Figure and Ground in their motion event descriptions shows that simultaneity may not always be the preferred pattern in motion events descriptions. Therefore, the results of previous studies, most of which lack data on adult patterns (Newport & Supalla, 1980; Newport, 1981; Supalla, 1982; Slobin et al., 2003) or were restricted to data collected on a much smaller number of adults (Engberg-Pedersen, 2003; Tang et al., 2007), should be re-evaluated in terms of what is being adult-like or not in the domain of simultaneous expression of Figure and Ground for motion event encodings.

Interestingly, regardless of the variation found in the adult patterns for the type of the spatial event and relation, I found both age groups of TİD-acquiring children to produce preferred adult patterns. TİD-acquiring children, even in the younger age group, learn simultaneous constructions as a language-specific feature of their own language, and the modality of the language that they acquire does not seem to delay the acquisition of these simultaneous constructions. This might be due to the use of short video descriptions in the present study, which elicited shorter discourse compared to the picture story narrations used in most of the previous studies (Slobin et al., 2003; Engberg-Pedersen, 2003; Tang et al., 2007). It might be more difficult to use simultaneous constructions to express Figure and Ground for picture stories that typically show more than one Figure or Ground at the same time (e.g., Frog story). Eliciting data by using the same type of stimuli will provide better insights on this issue.

7.2.2 Linguistic devices in encoding spatial relations in location events

Analyses regarding children's tuning into preferred adult-like linguistic devices were not conducted for motion event descriptions, but only for the location type of event descriptions due to time constraints. Below I will discuss the findings with regard to encoding different types of spatial relations in location events (i.e., topological versus viewpoint-dependent spatial relations).

Adult signers of TİD were found to use a variety of linguistic devices (e.g., classifier predicates, relational lexemes, SASSes, lexical sign placements) to encode topological and viewpoint-dependent spatial relations. Although classifier predicates were preferred over other linguistic devices in general, the use of relational lexemes was found to be quite frequent in contrast to what has been reported in previous studies (e.g., Emmorey, 2002; Arık & Wilbur, 2008; Arık, 2013b). Furthermore, the use of relational lexemes showed variation for different types of spatial relations in the present study: TİD signing adults used these linguistic forms more frequently for viewpoint-dependent spatial relations (around .85 out of all picture descriptions for both lateral and sagittal axes) than for encoding topological spatial relations (around .25 out of all picture descriptions). Within viewpoint-dependent spatial relations, they preferred relational lexemes for sagittal axis encodings (.65) more frequently than for lateral axis encodings (.20). Moreover, TİD signing adults mostly used double linguistic devices (e.g., classifier construction and a relational lexeme) for sagittal axis encodings, but preferred a single one for the lateral axis encodings. Thus, the current dissertation contributes to the existing knowledge on the use of linguistic devices to express spatial relations, and also to the structure of locative expressions in sign languages by reporting a relatively high use of relational lexemes for both types of spatial relations, and also the use of double linguistic forms for sagittal axis encodings, which has not been reported for any other sign languages before. These findings show that relational lexemes are an integral part of locative constructions that need to be taken into account together with classifier constructions. More research on other sign languages is needed whether this relatively high use of relational lexemes is specific to TİD, or is also observed in other sign languages.

The findings of picture descriptions with topological spatial relations revealed that signing and speaking children are already adult-like in using language-specific linguistic devices at around 4 years of age. TİD-acquiring children preferred analogue constructions more than relational lexemes as signing adults did. Turkish speaking children, similar to speaking adults, also preferred the spatial nouns rather than the general locative case marker. This suggests a neutral effect of modality, and that both signing and speaking children learn to use language-specific linguistic devices to encode spatial relations as early as 4 years. Thus, both signing and speaking children seem to tune into adult patterns in this domain at quite an early age. Further studies are, however, necessary to understand if the

neutral effect of modality still exists for the acquisition of these linguistic devices in earlier age groups (i.e., before 4 years of age).

Turkish-acquiring children used a spatial noun rather than the general locative case marker while describing the location of Figure with respect to Ground. Spatial nouns are morphologically richer and more complex than the general locative case marker. Moreover, these nouns also make semantic distinctions among different types of spatial relations (i.e., containment, support, and occlusion) whereas the use of a general locative case marker indicates the existence of a spatial relation between Figure and Ground without expressing the type of this spatial relation. In the present study, even younger age Turkish-acquiring children preferred spatial nouns over the general locative case marker, thus they were specific about the type of the spatial relation that they were describing despite the fact that it required the use of a morphologically more complex linguistic device. As pointed out by Aksu-Koç (1985), the use of nominal suffixes such as the general locative case marker in nouns (e.g., masa+da - *table+LOC*) can be extended to postpositions (e.g., spatial nouns, üst+ün+de - *top+POSS+LOC*), which are formally nouns. According to her, these spatial nouns are easily analyzable and semantically transparent; that is, each one is indeed the name of a familiar location (e.g., top - *üst*). The findings of the current dissertation are consistent with this claim. However, please note that there are no previous studies that systematically investigated the acquisition of these two types of linguistic devices by Turkish speaking children.

Learning to use linguistic devices to encode viewpoint-dependent spatial relations, however, seems to be modulated by the modality of language differently for relational encodings for different axis types (i.e., lateral versus sagittal): For lateral axis encodings, TİD-acquiring children, even in younger age group, were adult-like in how likely they were to use different types of language-specific linguistic devices (i.e., analogue, categorical, other) – unlike Turkish-acquiring children, even in the older age group, who still need to tune in to adult patterns. Turkish-acquiring children did not use specific spatial nouns such as "left" and "right", but mostly used the general relational noun meaning "at the side" to encode these relations – unlike Turkish speaking adults. This late acquisition of the spatial terms "left" and "right" in Turkish is in line with previous research with speaking children who

were shown to acquire "left" and "right" late, which can be explained by a general cognitive development effect (e.g., Piaget & Inhelder, 1971; Johnston & Slobin, 1979; Johnston, 1985; 1988).

Early attunement to adult patterns for encoding spatial relations for the lateral axis by TİD signing children, on the other hand, suggests a facilitating effect of the visual-spatial modality. The reason for such an early acquisition in TİD might be related to the body-anchored nature of the relational lexemes meaning "left" and "right" in TİD. In a recent study, Li et al. (under review) also found evidence that children can learn "left-right" through the body-anchored terms for these concepts. Thus, for signing children, referring to their own body in TİD relational lexemes might have a facilitating factor in learning these spatial relations. If this is true, then for children acquiring other sign languages where relational lexemes meaning "left" and "right" are also body-anchored, similar results should be seen in learning to express these spatial relations early by signing children. If not, signing children who acquire these languages might be expected to be on a par with speaking children in the acquisition of these terms. This needs further research.

The results of the dissertation also point to a possible mismatch between comprehension (Martin & Sera, 2006; Morgan et al., 2008) and production for viewpoint-dependent spatial relations in sign languages. While modality might facilitate the production of these terms, it seems to be a hindering effect for their comprehension possibly due to the difficulty in taking another' viewpoint to be able to understand classifier constructions produced mostly from the signer viewpoint.

However, the facilitating effect of modality found for lateral axis encodings for TİD-acquiring children does not hold true for the sagittal axis encodings. Rather, there seems to be a hindering effect of modality since even the older age group of signing children used language-specific linguistic devices less frequently than adults, whereas the older age group of Turkish acquiring children were able to use linguistic devices available in their language as frequently as adults. Although TİD relational lexemes meaning "front" and "behind" are also body-anchored, this does not seem to facilitate their acquisition for signing children – unlike with the relational lexemes "left" and "right". I surmise that this asymmetry in learning to encode viewpoint-dependent spatial relations for different

axes in TİD could be related to signing adults' use of double linguistic devices (relational lexemes and analogue constructions in the same description) in their relational encodings for the sagittal axis. However, signing children almost always used a single linguistic device in their relational encodings for both axes. Thus, the difference in the frequency of using double linguistic devices by adults for different types of axes, but not by children, might have caused the non-adult-like patterns found in the child data in TİD. As will be explained further below, the use of double linguistic devices for the sagittal axis encodings by TİD signing adults indicated a specific relation between the use of space and the semantics of the relational lexemes that signing children had to learn.

7.2.3 Viewpoint encoding in TİD

The current assumption for sign languages is that spatial descriptions are primarily expressed from the signer viewpoint for both lateral and sagittal axes encodings, (Emmorey, 1996; Emmorey et al., 1998; Perniss, 2007), and the addressee viewpoint is only, but rarely, used for sagittal axis encodings (Emmorey, 1996). The current data from TİD show that adult signers' linguistic representations of viewpoint-dependent spatial relations in analogue constructions (i.e., position of their hands in signing space) mapped onto how they saw the real spatial configuration on the lateral axis (i.e., signer viewpoint), thus being in line with the previous studies. However, these signers mostly described the location of the objects configured on the sagittal axis from the viewpoint of their addressees in analogue constructions. The reason for such a shift for their viewpoint preference in relational encodings for different axis types could be related to the use of double linguistic devices (e.g., using a classifier construction and relational lexeme in the same picture description) more frequently in the relational encodings for the sagittal axis than for the lateral axis. Further research is necessary to understand why TİD signers used double linguistic devices for sagittal axis encodings, but not for lateral axis ones.

I suggested in Chapter 5 that TİD signing adults are not actually taking a so-called "addressee viewpoint" when using analogue constructions, but their use of signing space in such constructions might get influenced by the form and semantics of body-anchored TİD relational lexemes meaning "front" and "behind" (i.e., transposing the locations of these signs from the body onto the areas in

216

signing space). Thus, they may not be merely copying the real spatial scene onto the signing space. Further studies in other sign languages where relational lexemes "front" and "behind" are or are not body-anchored are necessary to understand whether similar patterns also exist in these languages.

In encoding the locations of entities configured on the sagittal axis, TİD-acquiring children expressed the spatial relation from their own viewpoint, and failed to reach adult patterns. This might be due to the fact that signing children's use of a single linguistic form whereas adults showed a lot of use of double forms for sagittal axis encodings. Obviously, signing children still need to figure out the adult-like use of signing space in analogue constructions when, for example, classifier predicates are used together with the relational lexemes for "front" and "behind". It is possible that these children might be doing more of a visual mapping rather than semantic encoding. Therefore, modality seems to be playing a hindering role for signing children in learning adult-like viewpoint choices for sagittal axis encodings. However, this is not the case in the relational encodings for the lateral axis, where both children and adults mostly used a single linguistic device (especially analogue constructions), and described the spatial scene from their own viewpoint even at around 4 years of age. This is the first study conducted on signing children's encoding of viewpoint. More research from other sign languages is necessary to see if the findings are specific to TİD or generalizable to other sign languages and a general role of modality.

7.3 Conclusion

The main research question that I have addressed in this dissertation concerns the developmental trajectory of the linguistic expression of space in TİD and Turkish. The current work is the first in-depth exploration of the developmental patterns for different types of spatial events in TİD and Turkish. Moreover, this study is the first acquisition study with TİD-acquiring children. The results do not support one overall effect of modality in learning to express spatial relations in a sign and a spoken language. Rather, it seems that modality modulates different aspects of spatial language acquisition differently: Certain aspects of relational encodings, for example, were facilitated by the visual spatial modality (i.e., linguistic devices for relational encodings for the lateral axis) while some

other aspects were delayed (i.e., linguistic devices for relational encodings for the sagittal axis). Therefore, the iconicity that exists in the linguistic representation of spatial relations in sign languages does not always facilitate their acquisition for signing children, and other factors such as linguistic structure (i.e., the use of double linguistic forms for sagittal axis relational encodings) comes into play in their acquisition.

Further research on the comprehension of these spatial relations and events is necessary to get a fuller picture on their acquisition by signing and speaking children, especially in the domain of viewpoint encoding. The analysis of different types of linguistic devices to encode motion events (e.g., classifier predicates, lexical verbs) as used by children and adults is also necessary to have a better understanding of the acquisition of this type of spatial event. Moreover, similar analyses with the data elicited from picture story narrations (which require longer narrations than short vignette descriptions), spontaneous data as well as data from children younger than 4 years of age should be conducted to understand to what extent these findings are generalizable. Finally, the investigation of the use of co-speech gestures by children acquiring spoken languages will deepen our understanding of the effects of the visual-spatial modality on the expression of spatial relations and events.

All in all, apart from contributing to the literature on the acquisition of linguistic expression of space in TİD and Turkish, this dissertation furthers our understanding of the role of language/modality-specific factors and general principles of cognitive development on spatial language acquisition. In general, the results suggest that all three factors have roles in different aspects of learning to encode spatial relations and events.

References

Aksu-Koç, A. & Slobin, I. D. (1985). The acquisition of Turkish. In D. Slobin (Ed.), *The crosslinguistic study of language acquisition. Vol. 1: The data* (pp. 839-878). Hillside, NJ: Lawrence Erlbaum Associates.

Allen, S., Özyürek, A., Kita, S., Brown, A., Furman, R., Ishizuka, T., & Fujii, M. (2007). Language-specific and universal influences in children's syntactic packaging of Manner and Path: A comparison of English, Japanese, and Turkish. *Cognition, 102*, 16-48.

Ameka, F. K. & Levinson, S. C. (2007). Introduction: The typology and semantics of locative predicates: Posturals, positionals and other beasts. *Linguistics, 45(5)*, 847-872.

Arık, E. & Wilbur, R. (2008). Locatives, existentials, and possessives in Turkish Sign Language (TİD). Poster presented at the 82nd Annual Meeting of the Linguistic Society of America, Chicago, IL, January 3-6.

Arık, E. (2006). *Nonmanual markers and constituency in Turkish Sign Language (TİD)*. Ms. Purdue University.

Arık, E. (2008). Locative constructions in Turkish Sign Language (TİD). In R. M. de Quadros (Ed.), *Sign Languages: spinning and unraveling the past, present, and future. TISLR9, the Theoretical Issues in Sign Languages Research Conference* (pp. 15-31). Petropolis/RJ, Brazil: Editorar Arara Azul.

Arık, E. (2009). *Spatial Language: Insights from signed and spoken languages*. Unpublished doctoral dissertation, Purdue University, The USA.

Arık, E. (2010). Describing motion events in sign languages. *Poznań Studies in Contemporary Linguistics, 46(4)*, 367-390.

Arık, E. (2011). Left/right and front/back in sign, speech, and co-speech gestures across languages: What do data from Turkish Sign Language, Croatian Sign Language, American Sign Language, Turkish, Croatian, and English reveal? *Poznań Studies in Contemporary Linguistics, 47(3)*, 442-469.

Arık, E. (2013a). Türk İşaret Dili'nde sınıflandırıcılar üzerine bir çalışma [Classifiers in Turkish Sign Language]. *Bilig, 67,* 1-24.

Arık, E. (2013b). Expressions of space in Turkish Sign Language. In E. Arık (Ed.), *Current directions in Turkish Sign Language research* (pp. 219-242). Newcastle upon Tyne, UK: Cambridge Scholars Publishing.

Arık, E. (Ed.) (2013c). *Current directions in Turkish Sign Language research*. Newcastle upon Tyne, UK: Cambridge Scholars Publishing.

Aronoff, M., Meir, I., Padden, C., & Sandler, W. (2003). Classifier constructions and morphology in two sign languages. In K. Emmorey (Ed.), *Perspectives on Classifier Constructions in Sign Languages* (pp. 53-84). Mahwah NJ: Lawrence Erlbaum Associates.

Battison, R. (1978). *Lexical borrowing in American Sign Language*. Silver Spring, MD: Linstok Press.

Bedny, M., Aguirre, G. K., & Thompson-Schill, S. (2007). Item analysis in functional magnetic resonance imaging. *NeuroImage, 35*, 1093-1102.

Benedicto, E. & Brentari, D. (2004). Where did all the arguments go? Argument-changing properties of Classifiers in ASL. *Natural Language and Linguistic Theory, 22(4)*, 743-810.

Benton, A. (1959). *Right-left discrimination and finger localization*. New York: Hoeber-Harper.

Berman, R. A. & Slobin, D. (1994). *Relating events in narrative: A crosslinguistic developmental study*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Bernardino, E. L. A. (2006). *What Do Deaf Children Do When Classifiers Are Not Available? The Acquisition of Classifiers in Verbs of Motion and Verbs of Location in Brazilian Sign Language (LSB)*. Unpublished doctoral dissertation, Boston University, The USA.

Bohnemeyer, J. (2001). Spatial frames of reference in Yucatec: Referential promiscuity and task-specificity. *Language Sciences, 33*, 892-914.

Bohnemeyer, J. & Brown, P. (2007). Standing divided: Dispositional verbs and locative predications in two Mayan languages. *Linguistics, 45(5)*, 1105-1151.

Bowerman, M., de León, L., & Choi, S. (1995). Verbs, particles, and spatial semantics: Learning to talk about spatial actions in typologically different languages. In E. V. Clark (Ed.), *Proceedings of the Twenty-seventh Annual Child Language Research Forum* (pp. 101-110). Stanford, CA: Center for the Study of Language and Information.

Bowerman, M. & Choi, S. (2001). Shaping meanings for language: Universal and language-specific in the acquisition of spatial semantic categories. In M. Bowerman & S. C. Levinson (Eds.), *Language acquisition and conceptual development* (pp. 475-511). New York: Cambridge University Press.

Bowerman, M. (1989). Learning a semantic system: What role do cognitive predispositions play? In M. L. Rice, & R. L. Schiefelbusch (Eds.), *The teachability of language* (pp. 133-169). Baltimore: Paul H. Brookes.

Bowerman, M. (1996a). Learning how to structure space for language: A cross-linguistic perspective. In P. Bloom, M. Peterson, L. Nadel, & M. Garett (Eds), *Language and space* (pp. 385-436). Cambridge, MA: MIT Press.

Bowerman, M. (1996b). The origins of children's spatial semantic categories: Cognitive versus linguistic determinants. In J. J. Gumperz & S. C. Levinson (Eds.), *Rethinking linguistic relativity* (pp. 145-176). Cambridge: Cambridge University Press.

Boyes Braem, P. (1990). Acquisition of handshape in American Sign Language: a preliminary analysis. In V. Volterra & C. J. Erting (Eds.), *From gesture to language in hearing and Deaf children* (pp. 107-127). Berlin: Springer, Verlag.

Brentari, D., Coppola, M., Jung, A., & Goldin-Meadow, S. (2013). Acquiring word class distinctions in American Sign Language: Evidence from Handshape. *Language Learning and Development, 9*, 130-150.

Brown, P. (1994). The Ins and Ons of Tzeltal locative expressions: The semantics of static descriptions of location. *Linguistics, 32,* 743-90.

Brown, P. (2004). Position and motion in Tzeltal frog stories: The acquisition of narrative style. In S. Strömqvist, & L. Verhoeven (Eds.), *Relating events in narrative: Typological and contextual perspectives* (pp. 37-57). Mahwah: Erlbaum.

Chamberlain, C. & Mayberry, R. I. (2000). Theorizing about the relationship between ASL and reading. In C. Chamberlain, J. Morford, & R. I. Mayberry (Eds.), *Language Acquisition by Eye* (pp. 221-260). Mahwah, NJ: Lawrence Erlbaum and Associates.

Choi, S. & Bowerman, M. (1991). Learning to express motion events in English and Korean: The influence of language specific lexicalization patterns. *Cognition, 41*, 83-121.

Clark, E. V. (1973). Non-linguistic strategies and the acquisition of word meanings. *Cognition 2(2)*, 161-182.

Clark, E. V. (2004). How language acquisition builds on cognitive development. *Trends in Cognitive Sciences, 8(10)*, 472-478.

Clark, H. H. (1973a). Space, time, semantics, and the child. In T. E. Moore (Ed.), *Cognitive development and acquisition of language* (pp. 27-63). New York: Academic Press.

Clark, H. H. (1973b). The language-as-a-fixed-effect fallacy: Critique of language statistics in psychological research. *Journal of Verbal Learning and Verbal Behaviour, 12*, 335-359.

Coie, J. D., Costanzo, P. R., & Farnill, D. (1973). Specific transitions in the development of spatial perspective-taking ability. *Developmental Psychology, 9*, 167-177.

Corballis, M. C. & Beale, I. L. (1976). *The psychology of left-right*. Hillsdale, NJ: Erlbaum.

Coventry, K. R. & Frias-Lindqvist, A. M. (2005). The influence of movement, alignment, and orientation on the comprehension of spatial p-positions in English and Finnish. *Spatial Cognition and Computation, 5(4),* 357-375.

Cox, M. V. & Willetts, E. (1982). Childhood egocentrism: The order of acquisition of before-behind and left-right relationships. *British Journal of Educational Psychology, 52*, 366-369.

De Vos, C. (2012). *Sign-spatiality in Kata Kolok: how a village sign language of Bali inscribes its signing space*. Unpublished doctoral dissertation, Max Planck Institute for Psycholinguistics, The Netherlands.

De Beuzeville, L., Johnston, T., & Schembri, A. (2009). The use of space with indicating verbs in Australian Sign Language: A corpus-based investigation. *Sign Language & Linguistics 12(1)*, 53-82.

DeMatteo, A. (1977). Visual imagery and visual analogues in American Sign Language. In L. Friedman (Ed.), *On the other hand: New perspectives on American Sign Language* (pp. 109-136). New York: Academic Press.

Deringil S. (2002). *İktidarın sembolleri ve ideoloji. II. Abdulhamit dönemi (1876-1909) [The well Protected domains: Ideology and Legitimation of Power in the Ottoman Empire (1876-1909)]*. İstanbul: YKY Yayınları.

Dikici, A. E. (2006). *Imperfect bodies, perfect companions? Dwarfs and mutes at the Ottoman court in the sixteenth and seventeenth centuries*. Unpublished master thesis, Sabancı University, Turkey.

Dromi, E. (1979) More on the acquisition of locative prepositions: an analysis of Hebrew data. *Journal of Child Language, 6*, 547-62.

Durkin, K. (1980). The production of locative prepositions by young school children. *Educational Studies, 6(1)*, 9-30.

Durkin, K. (1981). Aspects of late language acquisition: School children's use and comprehension of prepositions. *First Language, 2(47)*, 47-59.

Ehrich, V. (1982). Discourse organization and sentence form in child language: How children describe rooms. *Papers and Reports on Child Language Development, 21*, 55-62.

Ellenberger, R. L., Moores, D. F., & Hoffmeister, R. J. (1975). Early stages in the acquisition of negation by a deaf child of deaf parents. *Research report (94), Research development and demonstration center in the education of handicapped children*. University of Minnesota.

Emmorey, K., Klima, E., & Hickok, G. (1998). Mental rotation within linguistic and nonlinguistic domains in users of American Sign Language. *Cognition, 68*, 221-246.

Emmorey, K. & Tversky, B. (2002). Spatial perspective choice in ASL. *Sign Language and Linguistics, 5(1)*, 3-25.

Emmorey, K., McColluogh, S., Mehta, S., Ponto, L. B., & Grabowski, T. J. (2013). The biology of linguistic expression impacts neural correlates for spatial language. *Journal of Cognitive Neuroscience, 25(4)*, 517-533.

Emmorey, K. & Özyürek, A. (2014). Language in our hands: Neural underpinnings of sign language and cospeech gesture. In M. S. Gazzaniga and R. Magnun (Eds.), *The Cognitive Neurosciences* (pp. 657-667). Cambridge: MIT Press.

Emmorey, K. (1996). The confluence of space and language in signed language. In P. Bloom, M.A. Peterson, L. Nadel, & M. Garrett (Eds.), *Language and Space* (pp. 171-210). Cambridge, MA: MIT Press.

Emmorey, K. (2002). *Language, cognition, and the brain: Insights from sign language research*. Mahwah, NJ: Lawrence Erlbaum Associates.

Emmorey, K. (Ed.) (2003). *Perspectives on Classifier Constructions in Sign Languages*. Mahwah, NJ: Lawrence Erlbaum Associates.

Engberg-Pedersen, E. (1993). *Space in Danish Sign Language: The semantics and the morphosyntax of the use of space in a visual language*. Hamburg: Signum Press.

Engberg-Pedersen, E. (2003). How Composite is a Fall? Adult's and Children's Descriptions of Different Types of Falls in Danish Sign Language. In K. Emmorey (Ed.), *Perspectives on Classifier Constructions in Sign Languages* (pp. 311-332). Mahwah, NJ: Lawrence Erlbaum Associates.

Evans, N. & Levinson, S. C. (2009). The myth of language universals: Language diversity and its importance for cognitive science. *Behavioral and Brain Sciences, 32(5)*, 429-492.

Fisher, C., Hall, G. D., Rakowitz, S., & Gleitman, L. (1994). When it is better to receive than to give: Syntactic and conceptual constraints on vocabulary growth. In L. Gleitman, & B. Landau (Eds.), *The acquisition of the lexicon* (pp. 333–375). Cambridge, MA: MIT Press.

Freeman, N.H., Lloyd, S., & Sinha, C.G. (1980). Infant search tasks reveal early concepts of containment and canonical usage of objects. *Cognition, 8(3)*, 243-262.

Freeman, N. H., Sinha, C. G., & Stedmon, J. A. (1980). The allative bias in three-year-olds is almost proof against task naturalness. *Journal of Child Language, 8*, 283–296.

Furman, R. (2012). *Caused motion events in Turkish: Verbal and gestural representation in adults and children*. Unpublished doctoral dissertation, Radboud University, The Netherlands.

Goldin-Meadow, S., Chee So, W., Özyürek, A., & Mylander, C. (2008). The natural order of events: how speakers of different languages represent events nonverbally. *Proceedings of the National Academy of Sciences of the USA, 105(27)*, 9163-9168.

Goldin-Meadow, S. & Alibali, M.W. (2013). Gesture's role in speaking, learning, and creating language. *Annual Review of Psychology*, *123*, 448-453.

Goldin-Meadow, S. (2003). *Hearing gesture: How our hands help us think*. Cambridge, MA.: Harvard University Press.

Goldin-Meadow, S. (2004). Gestures role in the learning process. *Theory into Practice*, *43*, 314-321.

Goldin-Meadow, S. (2010). When gesture does and does not promote learning. *Language and Cognition*, *2*, 1-19.

Göksel, A. & M. Kelepir (2013). The phonological and semantic bifurcation of the functions of an articulator: HEAD in questions in Turkish Sign Language. *Sign Language and Linguistics, 16*(1), 1-30.

Göksun, T., Hirsh-Pasek, K., & Golinkoff, R. M. (2009). Processing figures and grounds in dynamic and static events. In J. Chandlee, M. Franchini, S. Lord, & G. Rheiner (Eds.), *Proceedings of the 33rd Annual Boston University Conference on Language Development* (pp. 199-210). Somerville, MA: Cascadilla Press.

Gökgöz, K. (2011). Negation in Turkish Sign Language: The syntax of nonmanual markers. *Sign Language & Linguistics, 14(1)*, 49-75.

Grimm, H. (1975) On the child's acquisition of semantic structure underlying the wordfield of prepositions. *Language and Speech, 8*, 97-119.

Grinevald, C. (2006). The expression of basic static location in a typological perspective. In M. Hickmann & S. Robert (Eds.), *Space in languages: Linguistic systems and cognitive categories* (pp. 29-58). Amsterdam/Philedelphia: John Benjamins Publishing Company.

Gullberg, M., Hendriks, H. & Hickmann, M. (2008). Learning to talk and gesture about motion in French. *First Language, 28*, 200-236.

Harris, L. & Strommen, E. (1972). The role of front-back features in children's 'front', 'back', and 'beside' placements of objects. *Merrill-Palmer Quarterly, 18*, 259-271.

Harris, L. (1972). Discrimination of left and right, and development of the logic relations. *Merrill-Palmer Quarterly, 18*, 307-320.

Hickmann, M., Taranne, P. & Bonnet, P. (2009). Motion in first language acquisition: Manner and path in French and in English. *Journal of Child Language, 36 (4)*, 705-741.

Hickmann, M. (2003). *Children's discourse: Person, space, time across languages*. Cambridge University Press: Cambridge.

Hohenstein, J. (2013). Parent–child talk about motion: Links to children's development of motion event language. *First Language, 33(4)*, 411-425.

Hoffmeister, R. (1977). The influential point. In W. Stokoe (Ed.), *Proceedings of the national symposium on sign language research and teaching* (pp. 177-191).

Howard, I. & Templeton, W. (1966). *Human spatial orientation*. London: Wiley.

İlkbasaran, D. & Taşçı, S. S. (2012). Ideology and Language in the Early Republic: A History of Deaf Education in Turkey. *Proceedings of the International Symposium on Language and Communication: Research Trends and Challenges (ISLC)* (pp. 1767-1777). Erzurum: Mega Press.

İlkbaşaran, D. (2015). *Literacies, Mobilities and Agencies of Deaf Youth in Turkey: Constraints and Opportunities in the 21st Century*. Unpublished doctoral dissertation, University of California, San Diego, The USA.

İlkbaşaran, D. (2013). Communicative practices of deaf people in Turkey and the sociolinguistics of Turkish Sign Language. In E. Arik (Ed.), *Current directions in Turkish Sign Language research* (pp.19-53). Newcastle upon Tyne, UK: Cambridge Scholars Publishing.

Jackendoff, R. (1992). *Languages of the Mind*. Bradford/MIT Press.

Jackendoff, R. (1996). The architecture of the linguistic-spatial interface. In P. Bloom, M. Peterson, L. Nadel., & M. Garrett (Eds.), *Language and Space* (pp. 1-30). Cambridge, MA: The MIT Press.

Johnston, J. R. & Slobin, D.I. (1979). The development of locative expressions in English, Italian, Serbo-Croatian and Turkish. *Journal of Child Language, 6*, 529-545.

Johnston, J. R. (1984). Acquisition of locative meanings: *Behind* and *In front of. Journal of Child Language, 11*, 407-422.

Johnston. J. R. (1985). Cognitive prerequisites: The evidence from children learning English. In D. Slobin (Ed.), *The crosslinguistic study of language acquisition. Vol.2: The data* (pp. 961-1004). Hillside, NJ: Lawrence Erlbaum Associates.

Johnston. J. R. (1988). Children's verbal representation of spatial location. In J. Stiles-Davis, M. Kritchevsky & U. Bellugi (Eds.), *Spatial Cognition: Brain bases and development* (pp. 195-205). Hillside, NJ: Lawrence Erlbaum Associates.

Johnston, T., Vermeerbergen, M., Schembri, A., & Leeson, L. (2007). "Real data are messy": Considering cross-linguistic analysis of constituent ordering in Australian Sign Language (Auslan), Vlaamse Gebarentaal (VGT), and Irish Sign Language (ISL). In P. Perniss, R. Pfau & M. Steinbach (Eds.), *Proceedings of the Workshop on Sign Languages: A Cross-linguistic Perspective* (pp. 163-205). Berlin: Mouton de Gruyter.

Kantor, R. (1980). The acquisition of classifiers in American Sign Language. *Sign Language Studies, 28*, 198-208.

Kemaloğlu, Y. K. & Kemaloğlu, P. Y. (2012). The history of sign language and deaf education in Turkey. *Kulak Burun Bogaz Ihtisas Dergisi, 22(2)*, 65-76.

Kita, S. & Özyürek, A. (2003). What does cross-linguistic variation in semantic coordination of speech and gesture reveal? Evidence for an interface representation of spatial thinking and speaking. *Journal of Memory and Language, 48*, 16-32.

Senghas, A., Kita, S., & Özyürek, A. (2004). Children creating core properties of language: Evidence from an emerging sign language in Nicaragua. *Science, 305(5691)*, 1779-1782.

Klima, E. & Bellugi, U. (1979). *The signs of language*. Cambridge, MA: Harvard University Press.

Kuczaj, S. A. & Maratsos, M. P. (1975). On the acquisition of "Front, Back", and "Side". *Child Development, 46*, 202-210.

Kubuş, O. (2008). *An analysis of Turkish Sign Language (TİD) phonology and morphology*. Unpublished master's thesis, Middle East Technical University, Turkey.

Lacy, R. (1972). The development of Pola's negation. *Working Paper, The Salk Institute*.

Lakusta, L. & Landau, B. (2005). Starting at the end: The importance of goals in spatial language. *Cognition, 96*, 1-33.

Landau, B. & Jackendoff, R. (1993). "What" and "Where" in spatial language and spatial cognition. *Behavioral and Brain Sciences, 16*, 217-265.

Levelt, W.J.M. (1983). The speaker's organization of discourse. *Proceedings of the 13th International Congress of Linguists* (pp. 278-290). Tokyo.

Levelt, W. J. M. (1989). *Speaking: From intention to articulation*. Cambridge, MA: The MIT Press.

Levinson, S. C. & Wilkins, D. (2006). Patterns in the data: Towards a semantic typology of spatial descriptor. In S. C. Levinson & D. Wilkins (Eds.), *Grammars of Space* (pp. 512-552). NY: Cambridge University Press.

Levinson, S. C. (1994). Vision, shape, and linguistic description: Tzeltal body-part terminology and object description. In J. B. Haviland and S. C. Levinson (Eds.), *Spatial conceptualization in Mayan languages. Special Issue of Linguistics, 32*, 791-855.

Levinson, S. C. (1996). Frames of reference and Molyneux's question: Cross-linguistic evidence. In P. Bloom, M. Peterson, L. Nadel, & M. Garrett (Eds.), *Language and space* (pp. 109-169). Cambridge, MA: MIT press.

Levinson, S. C. (2003). *Space in language and cognition: Explorations in cognitive diversity*. Cambridge, UK: Cambridge University Press.

Li, P., Shusterman, A., & McNaughton, A. (under review). Put your left arm in, and shake it all about: The role of the body in children's acquisition of spatial terms.

Lidell, S. (2003). Sources of meaning in ASL classifier predicates. In K. Emmorey (Ed.), *Perspectives on Classifier Constructions in Sign Languages* (pp. 311-332). Mahwah, NJ: Lawrence Erlbaum Associates.

Lloyd, P. (1991). Strategies in children's route directions. *Journal of Child Language, 18*, 171-189.

Loewenstein, J. & Gentner, D. (2005). Relational language and the development of relational mapping. *Cognitive Psychology, 50*, 315-353.

Mainwaring, S.D., Tversky, B., & Schiano, D. J. (1996). Perspective choice in spatial descriptions. *IRC Technical Report 1996-06*. Palo Alto, CA: Interval Research Corporation.

Mainwaring, S.D., Tversky, B., Ohgishi,M., & Schiano, D. J. (2003). Descriptions of simple spatial scenes in English and Japanese. *Spatial Cognition and Computation, 3*, 3-42.

Majid, A., Bowerman, M., Kita, S., Haun, D. B. M., & Levinson, S. C. (2004). Can language restructure cognition? The case for space. *Trends in Cognitive Sciences, 8(3)*, 108-114.

Marentette, P. F. & Mayberry, R. (2000). Principles for an emerging phonological system: A case study of early ASL acquisition. In C. Chamberlain, J. Morford & R. I. Mayberry, (Eds.), *Language Acquisition by Eye* (pp. 71-90). London: Lawrence Erlbaum Associates.

Marsaja, I. G. (2003). *Sociocultural, sociolinguistic, and linguistic patterns in a Deaf community: An ethnographic study of a Deaf village in North Bali*. Unpublished doctoral dissertation, La Trobe University, Australia.

Martin, A. J. & Sera, M. D. (2006). The acquisition of spatial constructions in American Sign Language and English. *Journal of Deaf Studies and Deaf Education, 11 (4)*, 391-402.

McNeill, D. (1992). *Hand and Mind: What gestures reveal about thought*. Chicago: University of Chicago Press.

McNeill, D. (2000). Analogic/analytic representations and cross-linguistic differences in thinking for speaking. *Cognitive Linguistics, 11(1-2)*. 43-60.

Miles M. (2000). Signing in the Seraglio: mutes, dwarfs and jestures at the Ottoman Court 1500-1700. *Disability & Society, 15*, 115-34.

Miller, G. A. & Johnson-Laird, P. N. (1976). *Language and Perception*. Cambridge, MA: Harvard University Press.

Morgan, G. & Woll, B. (Eds.) (2002). *Directions in sign language acquisition*. Amsterdam: John Benjamins.

Morgan, G. & Woll, B. (2003). The development of reference switching encoded through body classifiers in British Sign Language. In Emmorey, K. (Ed.), *Perspectives on Classifier Constructions in Sign Languages* (pp. 297-310). Mahwah, NJ: Lawrence Erlbaum Associates.

Morgan, G., Herman, R., Barriere, I., & Woll, B. (2008). The onset and the mastery of spatial language in children acquiring British Sign Language. *Cognitive Development, 23*, 1-19.

Morgan, G. (2000). Discourse cohesion in sign and speech. *International Journal of Bilingualism, 4(3)*, 279-300.

Morgan, G. (2002). The encoding of simultaneity in children's BSL narratives. *Journal of Sign Language and Linguistics, 5(2)*, 127-161.

Naigles, L. R., Eisenberg, A. R., Kako, E. T., Highter, M., & McGraw, N. (1998). Speaking of motion: Verb use in English and Spanish. *Language and Cognitive Processes, 13(5)*, 521- 549.

Narasimhan, B. & Brown, P. (2009). Getting the inside story: Learning to talk about containment in Tzeltal and Hindi. In V. C. Mueller-Gathercole (Ed.), *Routes to language: Studies in honor of Melissa Bowerman* (pp. 97-132). New York: Psychology Press.

Newport, E. L. & Supalla, T. (1980). The structuring of language: Clues from the acquisition of signed and spoken language. In U. Bellugi & M. Studdert-Kennedy (Eds.), *Signed and spoken language: Biological constraints on linguistic form*. Dahlem Konferenzen. Weinheim: Verlag Chemie.

Newport, E. L. & Meier, R. P. (1985). Acquisition of American Sign Language. In D. Slobin (Ed.), *The crosslinguistic study of language acquisition. Vol. 1: The data* (pp. 881-938). Hillside, NJ: Lawrence Erlbaum Associates.

Newport, E. L. (1981). Constraints on structure: Evidence from American Sign Language and language learning. In W. A. Collins. (Ed.), *Minnesota Symposia on child psychology, Vol. 14*. Hillsdale, N.J.: Lawrence Erlbaum Associates.

Nijhof, S. & Zwitserlood, I. (1999). Pluralization in Sign Language of the Netherlands (NGT). In D. Jan & T. Sanders (Eds.), *OTS Yearbook. Vol. 1998-1999*, (pp. 58-78). Utrecht: UiL OTS.

Nikanne, U. (2003). How Finnish postpositions see the axis system. In E. van der Zee & J. Slack (Eds.), *Representing direction in language and space* (pp. 191–208). Oxford, UK: Oxford University Press.

Nyst, V. (2007) Simultaneous constructions in Adamorobe Sign Language (Ghana). In M. Vermeerbergen, L. Leeson, & O. Crasborn (Eds.), *Simultaneity in Signed Languages* (pp. 127-145). Amsterdam, Philadelphia: Benjamins.

Ortega, G. (2013). *Acquisition of a signed phonological system by hearing adults: The Role of sign structure and iconicity*. Unpublished doctoral dissertation, University College London, The UK.

Özçalışkan, Ş. (2005). On learning to draw the distinction between physical and metaphorical motion: Is metaphor an early emerging cognitive and linguistic capacity? *Journal of Child Language, 32(2)*, 291-318.

Özçalışkan, Ş. & Slobin, D. I. (1999). Learning 'how to search for the frog': Expression of manner of motion in English, Spanish and Turkish. In A. Greenhill, H. Littlefield, & C. Tano (Eds.), *Proceedings of the 23rd Boston University Conference on Language Development* (pp. 541-552). Somerville, MA: Cascadilla Press.

Özçalışkan, Ş. & Slobin, D. I. (2000a). Expression of manner of movement in monolingual and bilingual adult narratives: Turkish vs. English. In A. Göksel & C. Kerslake (Eds.), *Studies on Turkish and Turkic Languages* (pp. 253-262). Wiesbaden: Harrassowitz Verlag.

Özçalışkan, Ş. & Slobin, D. (2000b). Climb up vs. ascend climbing: Lexicalization Choices in Expressing Motion Events with Manner and Path Components. In S. Catherine-Howell, S., A. Fish, & T. K. Lucas (Eds.) (2000). *Proceedings of the 24th Annual Boston University Conference on Language Development: Vol. 2* (pp. 558-570). Somerville, MA: Cascadilla Press.

Özçalışkan, Ş. & Slobin, D. (2003). Codability Effects on the Expression of Manner of Motion in Turkish and English. In A. S. Özsoy, D. Akar, M. Nakipoğlu-Demiralp, E. Erguvanlı-Taylan, & A. Aksu-Koç(Eds.), *Studies in Turkish linguistics* (pp. 259-270). Istanbul: Boğaziçi University Press.

Özçalışkan, Ş. (2007). Metaphors we 'move by': Children's developing understanding of metaphorical motion in typologically distinct languages. *Metaphor and Symbol, 22(2)*, 147-168.

Özçalışkan, Ş. 2009. Learning to talk about spatial motion in language-specific ways. In J. Guo, E. Lieven, S. Ervin-Tripp, N. Budwig, K. Nakamura, & Ş. Özçalışkan (Eds), *Cross-Linguistic Approaches to the Psychology of Language: Research in the Tradition of Dan Isaac Slobin* (pp. 263-276). New York NY: Psychology Press.

Özyürek, A., Kita, S., & Allen, S. (2001). Tomato Man movies: Stimulus kit designed to elicit manner, path and causal constructions in motion events with regard to speech and gestures. Nijmegen, The Netherlands: Max Planck Institute for Psycholinguistics, Language and Cognition group.

Özyürek, A., Zwitserlood, P., & Perniss, P. (2010). Locative expressions in signed languages: A view from Turkish Sign Language (TİD). *Linguistics, 48(5)*, 1111-1145.

Özyürek, A. & Perniss, P. M. (2011). Event representations in signed languages. In J. Bohnemeyer, & E. Pederson (Eds.), *Event representations in language and cognition* (pp. 84-107). New York: Cambridge University Press.

Papafragou, A., Massey, C., & Gleitman, L. (2002). Shake, rattle, 'n' roll: The representation of motion in language and cognition. *Cognition 84(2)*. 189-219.

Papafragou, A., Massey, C., & Gleitman, L. (2006). When English proposes what Greek presupposes: The cross-linguistic encoding of motion events. *Cognition, 98(3)*, B75-B87.

Papafragou, A., Hulbert, J., & Trueswell, J. (2008). Does language guide event perception? Evidence from eye movements. *Cognition 108(1)*. 155-184.

Pederson, E., Danziger, E., Wilkins, D. G., Levinson, S. C., Kita, S., & Senft, G. (1998). Semantic typology and spatial conceptualization. *Language, 74(3)*, 557-589.

Perniss, P., Pfau, R., & Steinbach, M. (2007). *Visible variation: Cross-linguistic studies on sign language structure*. Berlin: Mouton de Gruyter.

Perniss, P., Thompson, R.L., & Vigliocco, G. (2010). Iconicity as a General Property of Language: Evidence from Spoken and Signed Languages. *Frontiers in Psychology, 1*.

Perniss, P. M., Zwitserlood, I., & Özyürek, A. (in press). Does space structure spatial language? A comparison of spatial expression across sign languages. *Language*.

Perniss, P. (2007). *Space and iconicity in German Sign Language (DGS)*. Unpublished doctoral dissertation, Max Planck Institute for Psycholinguistics, The Netherlands.

Pettito, L. & Marentette, P. F. (1991). Babbling in the manual code: Evidence for the ontogeny of language. *Science, 251*, 1493-1496.

Petitto, L. A. (1983). *From gesture to symbol: The acquisition of personal pronouns in American Sign Language*. Unpublished qualifying paper, Harvard University, The USA.

Pfau, R. & Aboh, E. O. (2012), On the syntax of spatial adpositions in sign languages. In *Proceedings of IATL 27* (*MIT Working Papers in Linguistics*) (pp. 83-104).

Piaget, J. & Inhelder, B. (1971). *The child's conceptualization of space*. New York: Norton. (Originally published in 1948).

Piaget, J. (1972). *Judgment and reasoning in the child*. Totowa, NJ: Littlefield, Adams. (Originally published in 1928).

Pizzuto, E. (2002). The development of Italian Sign Language (LIS) in deaf preschoolers. In G. Morgan & B. Woll (Eds.), *Directions in Sign Language Acquisition* (pp. 77-114). John Benjamins: Amsterdam.

Poizner, H., Klima, E., & Bellugi, U. (1987). *What the hands reveal about the brain*. Cambridge, Mass.: MIT Press.

Pyers, J., Perniss, P., & Emmorey, K. (accepted). Viewpoint in the Visual-Spatial Modality: The Coordination of Spatial Perspective. *Spatial Cognition and Computation*.

Pyers, J., Shusterman, A., Senghas, A., Spelke, E., & Emmorey, K. (2010). Evidence from an emerging sign language reveals that language supports spatial cognition. *PNAS, 107*, 12116-12120.

Rathmann, C., Mann, W., & Morgan, G. (2007). Narrative structure and narrative development in Deaf children. *Deafness and Educational International, 9(4)*, 187-196.

Roberts, R. J. & Aman, C. J. (1993). Developmental differences in giving directions: Spatial frames of reference and mental rotation. *Child Development, 64*, 1258-1270.

Sandler, W. & Lillo-Martin (2006). *Sign Language and Linguistic Universals*. Cambridge: Cambridge University Press.

Schembri, A., Jones, C., & Burnham, D. (2005). Comparing action gestures and classifier verbs of motion: Evidence from Australian Sign Language, Taiwan Sign Language, and non-signers' gestures without speech. *Journal of Deaf Studies and Deaf Education 10(3)*, 272-290.

Schembri, A. (2003). Rethinking classifiers in signed languages. In K. Emmorey (Ed.), *Perspectives on Classifier Constructions in Sign Languages* (pp. 3-34). Mahwah, NJ: Lawrence Erlbaum Associates.

Schick, B. (1990). The effects of morphosyntactic structures on the acquisition of classifier predicates in ASL. In C. Lucas (Ed.), *Proceedings of the 33rd Annual Meeting of the Cognitive Science Society* (pp. 1595-1600). Austin, TX: Cognitive Science Society.

Schober, M. F. (1993). Spatial perspective-taking in conversation. *Cognition, 47*, 1-24.

Schuit, J., Baker, A., & Pfau, R. (2011). Inuit Sign Language: a contribution to sign language typology. *Linguistics in Amsterdam, 4(1)*, 1-31.

Shepard, R. N., &: Hurwitz, S. (1984). Upward direction, mental rotation, and discrimination of left and right turns in maps. *Cognition, 18*, 161-193.

Shusterman, A. & Li, P. (under review). Frames of reference in spatial language acquisition.

Senghas, A. (2003). Intergenerational influence and ontogenetic development in the emergence of spatial grammar in Nicaraguan Sign Language. *Cognitive Development, 18*, 511-531.

Sevinç, A. M. (2006). *Grammatical Relations and Word Order in Turkish Sign Language TİD*. Unpublished master's thesis, Middle East Technical University, Turkey.

Shepard, R. N. & Hurwitz, S. (1984). Upward direction, mental rotation, and discrimination of left and right turns in maps. *Cognition, 18*, 161-193.

Sinha, C., Thorseng, L.A., Hayashi, M., & Plunkett, K. (1994). Comparative Spatial Semantics and Language Acquisition: Evidence from Danish, English, and Japanese. *Journal of Semantics, 11(4)*, 253-287.

Sinha, C. (1982). Representational development and the structure of action. In G. Butterworth and P. Light (Eds.), *Social Cognition: Studies in the Development of Understanding* (pp. 137-162). Brighton, Harvester.

Slobin, D. I., & Hoiting, N. (1994). Reference to movement in spoken and signed languages: Typological considerations. *Proceedings of the Berkeley Linguistics Society, 20*, 487-505.

Slobin, D. I., Hoiting, N., Kuntze, M., Lindert, R., Weinberg, A., Pyers, J., Anthony, M., Biederman, Y., & Thumann, H. (2003). A Cognitive/Functional Perspective on the Acquisition of "Classifiers". In K. Emmorey (Ed.), *Perspectives on Classifier Constructions in Signed Languages* (pp. 271-296). Mahwah, NJ: Lawrence Erlbaum Associates.

Slobin, D. I. (1973). Cognitive prerequisites for the development of grammar. In C. A. Ferguson & D. I. Slobin (Eds.), *Studies of child language development* (pp. 175-208). New York: Holt, Rinehart & Winston.

Slobin, D. I. (1996). From "thought and language" to "thinking for speaking". In J. Gumperz & S. Levinson (Eds.), *Rethinking linguistic relativity* (pp. 70-96). Cambridge: Cambridge University Press.

Slobin, D. I. (2003). Language and thought online: Cognitive consequences of linguistic relativity. In D. Gentner & S. Goldin-Meadow (Eds.), *Language in mind: Advances in the study of language and thought* (pp. 157-192). Cambridge, MA: MIT Press.

Slobin, D. I. (2006). The child learns to think for speaking: Puzzles of crosslinguistic diversity in form-meaning mappings. *Studies in Language Sciences, 7*. Tokyo: Kurosio Publishers.

Supalla, T.R. (1982). *Structure and acquisition of verbs of motion and location in American Sign Language*. Unpublished doctoral dissertation, UCSD, The USA.

Sümer, B., Zwitserlood, I., Perniss, P. M., & Özyürek, A. (2012). Development of locative expressions by Turkish deaf and hearing children: Are there modality effects? In A. K. Biller, E. Y. Chung, & A. E. Kimball (Eds.), *Proceedings of the 36th Annual Boston University Conference on Language Development (BUCLD 36)* (pp. 568-580). Boston: Cascadilla Press.

Sümer, B., Zwitserlood, I., Perniss, P. M., & Özyürek, A. (2013a). Acquisition of locative expressions in children learning Turkish Sign Language (TİD) and Turkish. In E. Arik (Ed.), *Current directions in Turkish Sign Language Research* (pp. 243-272). Newcastle upon Tyne: Cambridge Scholars Publishing.

Sümer, B., Zwitserlood, I., Perniss, P. M., & Özyürek, A. (2013b). Revisiting modality effects in children's acquisition of Spatial Language. *Paper presented to the Eleventh International Conference on Theoratical Issues in Sign Language Research (TISLR 11)*. London, The UK.

Sümer, B., Perniss, P. M., Zwitserlood, I., & Özyürek, A. (2014). Learning to express "left-right" & "front-behind" in a sign versus spoken language. In P. Bello, M. Guarini, M. McShane, & B. Scassellati (Eds.), *Proceedings of the 36th Annual Meeting of the Cognitive Science Society (CogSci 2014)* (pp. 1550-1555). Austin, Tx: Cognitive Science Society.

Talmy, L. (1985). Lexicalization patterns: Semantic structure in lexical forms. In T. Shopen (Ed.). *Language typology and syntactic description (Vol: 3 Grammatical Categories and the Lexicon* (pp. 36-149). Cambridge, UK: Cambridge University Press.

Talmy, L. (1991). Path to realization via aspect and result: A typology of event conflation. *BSL, 17*, 480-519.

Talmy, L. (2003). The representation of spatial structure in spoken and signed language. In K. Emmorey (Ed.), *Perspectives on Classifier Constructions in Sign Languages* (pp. 169-195). Mahwah, NJ: Lawrence Erlbaum Associates.

Tang, G., Sze, F., & Lam, S. (2007). Acquisition of simultaneous constructions by deaf children of Hong Kong Sign Language. In M. Vermeerbergen, L. Leeson, & O. Crasborn (Eds.), *Simultaneity in Signed Languages* (pp. 283-316). Amsterdam: John Benjamins.

Taub, S. & Galvan, D. (2001). Patterns of conceptual encoding in ASL motion descriptions. *Sign Language Studies,1(2)*, 175-200.

Thompson, R.L., Vinson, D.P., Woll, B., & Vigliocco, G. (2012). The road to language learning is iconic: Evidence from British Sign Language. *Psychological Science. 23(12)*, 1443 –1448.

Tomasello, M. (1987). Learning to use prepositions: a case study. *Journal of Child Language, 14*, 79-98.

Vorster, J. (1984). The first prepositions in Afrikaans: Order and semantic distinctions. *Paper presented to the Third International Congress for the Study of Child Language*. Austin, Texas.

Weissenborn, J. (1986). Learning how to become an interlocutor: The verbal negotiation of common frames of reference and actions in dyads of 7-14 year-old children. In J. Cook-Gumperz, W. Corsaro, & J. Streek (Eds.), *Children's world and children's language* (pp. 377-404). Berlin: Mouton de Gruyter.

Wittenburg, P., Brugman, H., Russel, A., Klassmann, A., & Sloetjes, H. (2006). ELAN: A professional Framework for Multimodality Research. *Proceedings of LREC 2006. Fifth International Conference on Language Resources and Evaluation*. http://www.lrec-conf.org/proceedings/lrec2006.

Woll, B. (2003). Modality, universality, and the similarities among sign languages: An historical perspective. In A. Baker, B. van den Bogaerde, & O. Crasborn (Eds.), *Cross-linguistic perspectives in sign language research* (pp. 119-131). Hamburg: Signum Press.

Zeshan, U. (2002). Sign Language in Turkey: The story of a hidden language. *Turkic Languages, 6(2)*, 229-274.

Zeshan, U. (2003). Aspects of Türk İşaret Dili (Turkish Sign Language). *Sign Language and Linguistics, 6(1)*, 43-75.

Zeshan, U. (2006). The use of sign space in Kata Kolok. In A. Kelly, B. Narasimhan, & R. Smits (Eds.), *Annual Report 2005* (pp. 63-64). Nijmegen: Max Planck Institute for Psycholinguistics.

Zwitserlood, I., Perniss, P. M., & Özyürek, A. (2012). An empirical investigation of multiple entities in Turkish Sign Language: Considering the effects of modality? *Lingua, 122(14)*, 1636-1667.

Zwitserlood, I., Sümer, B., & Özyürek, A. (2013). Hands on the table - spatial lexemes in Turkish Sign Language (TİD). *Paper presented to the Morphology Meeting (de Morfologiedagen)*. Leeuwarden, The Netherlands.

Zwitserlood, I., Sümer, B., & Özyürek, A. (2014). Multiple routes to children's mastery of classifiers in spatial language: the case of Turkish Sign Language (TİD). *Paper presented to the 13th International Congress for the Study of Child Language*. Amsterdam, The Netherlands.

Zwitserlood, I., Sümer, B., & Özyürek, A. (in prep.). Multiple routes to children's mastery of classifiers in spatial language: the case of Turkish Sign Language (TİD).

Zwitserlood, I. (2003). *Classifying hand configurations in Nederlandse Gebarentaal (Sign Language of the Netherlands)*. Unpublished doctoral dissertation, University of Utrecht, The Netherlands.

Zwitserlood, I. (2012). Classifiers: Meaning in the hand. In: R. Pfau, M. Steinbach, & B. Woll (Eds.), *Sign language: An international handbook* (pp. 158-186). Berlin: Mouton de Gruyter.

Zwitserlood, I. (in prep.) Should the left hand know what the right hand is doing? Simultaneous classifier predicates in Sign Language of the Netherlands (NGT) as paratactic constructions.

Samenvatting

Om ruimtelijke relaties tussen entiteiten uit te drukken, gebruiken gebaarders taalkundige
uitdrukkingen vaak op een iconische manier. Hierdoor kunnen zij ruimtelijke relaties tussen
objecten in de echte wereld en *signing space* weergeven (bijvoorbeeld door visueel-
gemotiveerde vorm-betekeniskoppelingen). Door hun lichaam als spreekbuis te gebruiken,
kunnen zij dit in verschillende gradaties doen (Emmorey, 2002; Perniss, 2007). In
tegenstelling tot gebarentaal, biedt de gesproken taal, die gebruik maakt van de auditieve-
vocale modaliteit, geen ruimte voor zulke iconische koppelingen om ruimtelijke relaties uit te
drukken. Het verschil tussen de modaliteiten die gebruikt worden in gebarentaal en gesproken
taal roept interessante vragen op over hoe de modaliteit die gebruikt wordt om iets talig uit te
drukken van invloed kan zijn op het verwerven van ruimtelijke taal. Dit proefschrift
onderzoekt de effecten van deze modaliteiten (visueel-ruimtelijk versus auditief-vocaal) op
de verwerving van ruimtelijke taal door gebaarders van Turkse Gebarentaal (Türk İşaret Dili,
TİD) en sprekers van het Turks.

    Hoofdstuk 1 en 2 introduceren het ruimtelijke domein en de taalkundige manier
waarop dit domein tot uiting komt in gebarentalen en gesproken talen. Ruimtelijke taal omvat
twee hoofdtypen om ruimtelijke gebeurtenissen weer te geven: locatie en beweging
(Levinson, 1996; 2003). De manieren om ruimtelijke relaties uit te drukken in gesproken
talen (denk daarbij bijvoorbeeld aan achterzetsels, naamvallen, werkwoorden en
positiewoorden) zijn zeer divers (Levinson & Wilkens, 2006; Evans & Levinson, 2009).
Gebaarders drukken ruimtelijke relaties vooral uit door linguistische vormen genaamd
'classifier predicates' te gebruikten, waarbij de positie en beweging van de hand(en) die
gebruikt worden om te gebaren, informatie overbrengen over de locatie en beweging van de

referent(en) (Supalla, 1982; Emmorey, 2002; Zwitserlood, 2003; Perniss, 2007). In deze predicaten worden classifiers uitgedrukt door handvormen die entiteiten *classificeren*. Dit wordt gedaan door de meest opvallende karakteristieken ervan uit te drukken, zoals kenmerken over de grootte en vorm (Supella, 1982; Emmorey, 2002; Zwitserlood, 2003; 2012).

Hoofdstuk 2 geeft ook een overzicht van eerder uitgevoerd onderzoek met gebarende en sprekende kinderen naar de verwerving van locatiebepalingen en bewegingsrelaties. Hoewel de verwerving van veel taalstructuren (zoals fonologie, of de eerste woordjes) in gesproken taal en gebarentaal op eenzelfde manier verlopen (zie Emmorey, 2002 voor commentaar), lopen gebarende kinderen toch achter op hun sprekende leeftijdsgenoten in het domein van ruimtelijke taal, ook al maken gebarentalen gebruik van iconische taalkundige uitdrukkingen, in tegenstelling tot de arbitraire vormen die worden gebruikt in gesproken talen.

In *Hoofdstuk 3* worden drie belangrijke hypothesen opgesteld over het effect van de visueel-ruimtelijke modaliteit van gebarentalen op de verwerving van ruimtelijke taal door gebarende kinderen: Indien het een faciliterend effect heeft, dan zouden gebarende kinderen eerder leren om ruimtelijke relaties uit te drukken dan hun sprekende leeftijdsgenoten. Als het echter een hinderend effect heeft, dan wordt er verwacht dat gebarende kinderen een vertraging laten zien in hun ontwikkelingspatronen van het verwerven van ruimtelijke talen ten opzichte van sprekende kinderen. Een andere mogelijkheid is om een neutraal effect van modaliteit te verwachten. Dit zou betekenen dat zowel gebarende als sprekende kinderen ruimtelijke taalstructuren zullen verwerven rond dezelfde leeftijd. Deze hypothesen zijn getest door te kijken naar beschrijvingen van statische plaatjes (voor locatiebepalingen van ruimtelijke gebeurtenissen) en korte verhalen (voor bewegingsbepalingen van ruimtelijke gebeurtenissen). Deze materialen zijn voorgelegd aan gebaarders en sprekers in drie

verschillende leeftijdsgroepen: Jonge kinderen (leeftijd tussen 3;5-6;11), oudere kinderen (leeftijd tussen 7;2-9;11) en volwassenen.

Hoofdstuk 4 verkent de verwerving van topologische ruimtelijke relaties (zoals "in", "op", "onder" in het Nederlands) in TİD en het Turks. De resultaten laten vergelijkbare ontwikkelingspatronen in gebarende en sprekende kinderen zien. Ongeacht de modaliteit van de taal die verworven wordt, laten gebarende en sprekende kinderen op vergelijkbare leeftijden dezelfde patronen als volwassenen zien in het uitdrukken van verschillende aspecten van topologische ruimtelijke relaties (zoals de manier waarop ze dit doen of het weglaten van bepaalde onderdelen). In tegenstelling tot wat uit eerdere onderzoeken naar voren kwam, duidt dit erop dat er geen effect van modaliteit in dit domein van ruimtelijke taal bestaat.

Hoofdstuk 5 onderzoekt de verwerving van het uitdrukken van ruimtelijke relaties die afhangen van het gezichtspunt van een gesprekspartner (zoals het gebruik van "links", "rechts", "voor" en "achter" in het Nederlands, afhankelijk van het gezichtspunt van de gesprekspartner). De resultaten van dit onderzoek laten zien dat de visueel-ruimtelijke modaliteit de verwerving van verschillende types gezichtspunt-afhankelijke ruimtelijke relaties op verschillende manieren beïnvloedt. Er lijkt sprake van een combinatie van faciliterende (zoals taalkundige manieren om een ruimtelijke relatie op de verticale as uit te drukken), hinderende (zoals verschillende taalkundige manieren om een ruimtelijke relatie op de zijdelingse as uit te drukken) en neutrale effecten (zoals het weglaten van *Figure* of *Ground*; het uitdrukken van een ruimtelijke relatie) van modaliteit die van invloed zijn op het leren begrijpen van gezichtspunt-afhankelijke ruimtelijke relaties.

Hoofdstuk 6 richt zich op een ander soort ruimtelijke gebeurtenis, namelijk beweging. Dit is het ruimtelijke domein dat het meest bestudeerd is bij gebarende kinderen en waarin wordt gesteld dat zij in hun verhalen over beweging de omgeving weglaten en dat zij moeite

hebben met het tegelijkertijd uitdrukken van *Figure* en *Ground* (Newport & Supalla, 1980; Supalla, 1982; Engberg-Pedersen, 2003; Slobin et al., 2003; Tang et al., 2007; Morgan et al., 2008). Daarom richt dit hoofdstuk zich op de verwervingspatronen van deze specifieke domeinen (bijvoorbeeld *Figure* en/of *Ground* uitdrukking en hun gelijktijdige representatie) in TİD het Turks. Dit onderzoek laat geen effect van modaliteit op het weglaten van de *Ground*-beschrijving zien. Daarnaast gebruikten, in tegenstelling tot wat uit eerdere onderzoeken naar voren kwam, gebarende kinderen van alle leeftijdsgroepen net zo vaak gelijktijdige expressies als volwassenen.

Hoofdstuk 7 vat alle resultaten uit de eerdere hoofdstukken samen en vergelijkt deze resultaten met elkaar. Over het algemeen laten de resultaten geen algemeen effect zien van modaliteit op het leren uitdrukken van ruimtelijke relaties in zowel gebarentaal als gesproken taal. De resultaten suggereren eerder dat modaliteit verschillende aspecten van het verwerven van ruimtelijke taal beïnvloedt. De iconiciteit die bestaat in de taalkundige representaties van ruimtelijke relaties in gebarentalen heeft daarom niet altijd een faciliterend effect op de verwerving van ruimtelijke taal voor gebarende kinderen. Andere factoren, zoals taalkundige structuren, hebben ook een effect op hun verwerving van deze relaties.

Biographical Note

Beyza Sümer was born in Edirne, Turkey, on 12 July 1981. She graduated from the Department of Foreign Language Education, Boğaziçi University in İstanbul, Turkey, with High Honours in 2004. She attended MA programme in 2005, and was promoted to the PhD program on Applied Linguistics at the same university in 2006. In 2010, she moved to Nijmegen to continue her studies at Radboud University Nijmegen, and started as a PhD student in the European Research Council Starting Grant funded project "Language in Our Hands: The role of modality in shaping development of spatial language in deaf and hearing children", awarded to Prof. Aslı Özyürek. Her PhD research is the first study on the acquisition of Turkish Sign Language (Türk İşaret Dili, TİD).

She has recently received a two-year research grant by The Scientific and Technical Research Council of Turkey (TÜBİTAK) to adapt MacArthur-Bates Communicative Development Inventory (CDI) for Turkish Sign Language, which will be the third sign language (in addition to American Sign Language and British Sign Language) for which this inventory has been developed so far. She will also continue to work as a post-doctoral researcher in the NWO/Vici funded project "Giving cognition a hand: Linking spatial cognition to linguistic expression in native and late learners of sign language and bimodal bilinguals", granted to Prof. Aslı Özyürek.

MPI Series in Psycholinguistics

1. The electrophysiology of speaking: Investigations on the time course of semantic, syntactic, and phonological processing. *Miranda van Turennout*

2. The role of the syllable in speech production: Evidence from lexical statistics, metalinguistics, masked priming, and electromagnetic midsagittal articulography. *Niels O. Schiller*

3. Lexical access in the production of ellipsis and pronouns. *Bernadette M. Schmitt*

4. The open-/closed-class distinction in spoken-word recognition. *Alette Haveman*

5. The acquisition of phonetic categories in young infants: A self-organising artificial neural network approach. *Kay Behnke*

6. Gesture and speech production. *Jan-Peter de Ruiter*

7. Comparative intonational phonology: English and German. *Esther Grabe*

8. Finiteness in adult and child German. *Ingeborg Lasser*

9. Language input for word discovery. *Joost van de Weijer*

10. Inherent complement verbs revisited: Towards an understanding of argument structure in Ewe. *James Essegbey*

11. Producing past and plural inflections. *Dirk Janssen*

12. Valence and transitivity in Saliba: An Oceanic language of Papua New Guinea. *Anna Margetts*

13. From speech to words. *Arie van der Lugt*

14. Simple and complex verbs in Jaminjung: A study of event categorisation in an Australian language. *Eva Schultze-Berndt*

15. Interpreting indefinites: An experimental study of children's language comprehension. *Irene Krämer*

16. Language-specific listening: The case of phonetic sequences. *Andrea Weber*

17. Moving eyes and naming objects. *Femke van der Meulen*

18. Analogy in morphology: The selection of linking elements in Dutch compounds. *Andrea Krott*

19. Morphology in speech comprehension. *Kerstin Mauth*

20. Morphological families in the mental lexicon. *Nivja H. de Jong*

21. Fixed expressions and the production of idioms. *Simone A. Sprenger*

22. The grammatical coding of postural semantics in Goemai (a West Chadic language of Nigeria). *Birgit Hellwig*

23. Paradigmatic structures in morphological processing: Computational and cross-linguistic experimental studies. *Fermín Moscoso del Prado Martín*

24. Contextual influences on spoken-word processing: An electrophysiological approach. *Daniëlle van den Brink*

25. Perceptual relevance of prevoicing in Dutch. *Petra M. van Alphen*

26. Syllables in speech production: Effects of syllable preparation and syllable frequency. *Joana Cholin*

27. Producing complex spoken numerals for time and space. *Marjolein Meeuwissen*

28. Morphology in auditory lexical processing: Sensitivity to fine phonetic detail and insensitivity to suffix reduction. *Rachèl J. J. K. Kemps*

29. At the same time...: The expression of simultaneity in learner varieties. *Barbara Schmiedtová*

30. A grammar of Jalonke argument structure. *Friederike Lüpke*

31. Agrammatic comprehension: An electrophysiological approach. *Marlies Wassenaar*

32. The structure and use of shape-based noun classes in Miraña (North West Amazon). *Frank Seifart*

33. Prosodically-conditioned detail in the recognition of spoken words. *Anne Pier Salverda*

34. Phonetic and lexical processing in a second language. *Mirjam Broersma*

35. Retrieving semantic and syntactic word properties. *Oliver Müller*

36. Lexically-guided perceptual learning in speech processing. *Frank Eisner*

37. Sensitivity to detailed acoustic information in word recognition. *Keren B. Shatzman*

38. The relationship between spoken word production and comprehension. *Rebecca Özdemir*

39. Disfluency: Interrupting speech and gesture. *Mandana Seyfeddinipur*

40. The acquisition of phonological structure: Distinguishing contrastive from non-contrastive variation. *Christiane Dietrich*

41. Cognitive cladistics and the relativity of spatial cognition. *Daniel B.M. Haun*

42. The acquisition of auditory categories. *Martijn Goudbeek*

43. Affix reduction in spoken Dutch. *Mark Pluymaekers*

44. Continuous-speech segmentation at the beginning of language acquisition: Electrophysiological evidence. *Valesca Kooijman*

45. Space and iconicity in German Sign Language (DGS). *Pamela Perniss*

46. On the production of morphologically complex words with special attention to effects of frequency. *Heidrun Bien*

47. Crosslinguistic influence in first and second languages: Convergence in speech and gesture. *Amanda Brown*

48. The acquisition of verb compounding in Mandarin Chinese. *Jidong Chen*

49. Phoneme inventories and patterns of speech sound perception. *Anita Wagner*

50. Lexical processing of morphologically complex words: An information-theoretical perspective. *Victor Kuperman*

51. A grammar of Savosavo, a Papuan language of the Solomon Islands. *Claudia Wegener*

52. Prosodic structure in speech production and perception. *Claudia Kuzla*

53. The acquisition of finiteness by Turkish learners of German and Turkish learners of French: Investigating knowledge of forms and functions in production and comprehension. *Sarah Schimke*

54. Studies on intonation and information structure in child and adult German. *Laura de Ruiter*

55. Processing the fine temporal structure of spoken words. *Eva Reinisch*

56. Semantics and (ir)regular inflection in morphological processing. *Wieke Tabak*

57. Processing strongly reduced forms in casual speech. *Susanne Brouwer*

58. Ambiguous pronoun resolution in L1 and L2 German and Dutch. *Miriam Ellert*

59. Lexical interactions in non-native speech comprehension: Evidence from electro-encephalography, eye-tracking, and functional magnetic resonance imaging. *Ian FitzPatrick*

60. Processing casual speech in native and non-native language. *Annelie Tuinman*

61. Split intransitivity in Rotokas, a Papuan language of Bougainville. *Stuart Robinson*

62. Evidentiality and intersubjectivity in Yurakaré: An interactional account. *Sonja Gipper*

63. The influence of information structure on language comprehension: A neurocognitive perspective. *Lin Wang*

64. The meaning and use of ideophones in Siwu. *Mark Dingemanse*

65. The role of acoustic detail and context in the comprehension of reduced pronunciation variants. *Marco van de Ven*

66. Speech reduction in spontaneous French and Spanish. *Francisco Torreira*

67. The relevance of early word recognition: Insights from the infant brain. *Caroline Junge*

68. Adjusting to different speakers: Extrinsic normalization in vowel perception. *Matthias J. Sjerps*

69. Structuring language. Contributions to the neurocognition of syntax. *Katrien R. Segaert*

70. Infants' appreciation of others' mental states in prelinguistic communication: A second person approach to mindreading. *Birgit Knudsen*

71. Gaze behavior in face-to-face interaction. *Federico Rossano*

72. Sign-spatiality in Kata Kolok: how a village sign language of Bali inscribes its signing space. *Conny de Vos*

73. Who is talking? Behavioral and neural evidence for norm-based coding in voice identity learning. *Attila Andics*

74. Lexical processing of foreign-accented speech: Rapid and flexible adaptation. *Marijt Witteman*

75. The use of deictic versus representational gestures in infancy. *Daniel Puccini*

76. Territories of knowledge in Japanese conversation. *Kaoru Hayano*

77. Family and neighbourhood relations in the mental lexicon: A cross-language perspective. *Kimberley Mulder*

78. Contributions of executive control to individual differences in word production. *Zeshu Shao*

79. Hearing speech and seeing speech: Perceptual adjustments in auditory-visual processing. *Patrick van der Zande*

80. High pitches and thick voices: The role of language in space-pitch associations. *Sarah Dolscheid*

81. Seeing what's next: Processing and anticipating language referring to objects. *Joost Rommers*

82. Mental representation and processing of reduced words in casual speech. *Iris Hanique*

83. The many ways listeners adapt to reductions in casual speech. *Katja Poellmann*

84. Contrasting opposite polarity in Germanic and Romance languages: Verum Focus and affirmative particles in native speakers and advanced L2 learners. *Giuseppina Turco*

85. Morphological processing in younger and older people: Evidence for flexible dual-route access. *Jana Reifegerste*

86. Semantic and syntactic constraints on the production of subject-verb agreement. *Alma Veenstra*

87. The acquisition of morphophonological alternations across languages. *Helen Buckler*

88. The evolutionary dynamics of motion event encoding. *Annemarie Verkerk*

89. Rediscovering a forgotten language. *Jiyoun Choi*

90. The road to native listening: Language-general perception, language-specific input. *Sho Tsuji*

91. Infants' understanding of communication as participants and observers. *Gudmundur Bjarki Thorgrímsson*

92. Information structure in Avatime. *Saskia van Putten*

93. Switch reference in Whitesands. *Jeremy Hammond*

94. Machine learning for gesture recognition from videos. *Binyam Gebrekidan Gebre*

95. Acquisition of spatial language by signing and speaking children: A comparison of Turkish Sign Language (TİD) and Turkish. *Beyza Sümer*