

## CHAPTER TEN

# ACQUISITION OF LOCATIVE EXPRESSIONS IN CHILDREN LEARNING TURKISH SIGN LANGUAGE (TİD) AND TURKISH \*

Beyza Sümer<sup>1</sup>, Inge Zwitserlood<sup>1</sup>, Pamela Perniss<sup>2</sup>, Aslı Özyürek<sup>1,3</sup>

<sup>1</sup>Radboud University Nijmegen, The Netherlands

<sup>2</sup>Deafness Cognition and Language Research Center, University College London

<sup>3</sup>Max Planck Institute for Psycholinguistics

### Abstract

In sign languages, where space is often used to talk about space, expressions of spatial relations may rely on analogue mappings of real space onto signing space. In contrast, spoken languages express space in mostly categorical ways (e.g., adpositions). Whether and to what extent modality influences the acquisition of spatial language is controversial – mostly due to the lack of direct comparisons of deaf children to deaf adults and to age-matched hearing children in similar tasks. Furthermore, previous studies have taken mostly western languages as the model for spoken language development of spatial relations. Therefore, we compare the spatial expressions elicited from Turkish deaf children acquiring Turkish Sign Language (TİD) natively and hearing children acquiring Turkish in two different age-matched groups (preschool age and school age), as well as to those of adults. All participants described three topological spatial configurations (IN, ON, UNDER) of different objects (e.g., apple in box; pen on table). The analysis of the descriptions of these spatial relations does not suggest an effect of modality on the development of static spatial expressions in TİD and Turkish since the deaf children

---

\* This work has been supported by European Research Council Starting Grant (ERC) and NWO VIDI grant given to the fourth author as well as by the Max Planck Institute for Psycholinguistics, Nijmegen. We would like to thank Türkiye İşitme ve Konuşma Rehabilitasyon Vakfı (TİV) and Dosteller İşitme Engelliler Erken Çocukluk Eğitim Merkezi Anaokulu ve İlköğretim Okulu in İstanbul for their support in providing logistics for the study to be carried out.

and the hearing children do not differ in their development towards adult-like forms and follow similar developmental patterns in describing the spatial scenes in the study.

Keywords: Acquisition, Spatial language, Sign language, Spoken language

## 10.1. Introduction

This study investigates, for the first time, the acquisition of locative expressions (i.e., expressions of static spatial relations between two objects, e.g., a cup is on a table), by deaf children acquiring Turkish Sign Language (Türk İşaret Dili, TİD) and compares it to that of hearing children acquiring Turkish. Space is a fundamental aspect of human cognition and language. How children learn to express spatial relationships is important to our understanding of the relationship between spatial concepts and language. Sign languages offer important insights into this relationship and its acquisition due to fact that spatial expressions are produced in the visual modality, which affords analogue mappings of space to space – unlike the arbitrary form-meaning mappings primarily seen in spoken languages.

So far, the acquisition of encoding of spatial configurations has only been investigated in a few, well-studied sign languages (i.e., in American Sign Language [ASL], British Sign Language [BSL], Danish Sign Language [DSL], and Hong Kong Sign Language [HKSL]). These studies give the general impression that spatial encoding is challenging for children acquiring these languages due to the modality-specific morphological complexity of sign languages, resulting in late mastery of the adult patterns. In this chapter, we describe developmental patterns in the expression of static spatial relations by Turkish deaf children acquiring Turkish Sign Language (Türk İşaret Dili, TİD) from their deaf parents, and compare these patterns to those of children acquiring Turkish, in which spatial encoding takes a different form from what is typical in Western spoken languages (Johnston & Slobin, 1979; Aksu-Koç & Slobin, 1985) as well as from TİD. This comparison will increase our knowledge about the extent to which modality shapes the development of spatial language.

### 10.1.1. Encoding of spatial relations in spoken and sign languages

Linguistic spatial expressions can be roughly divided into two types: (i) expression of the *location* of referents relative to each other and/or to the speaker; (ii) expression of the *motion* of referents in relation to one or more other referents

and/or the speaker (Levinson, 2003). In this chapter, we focus on only the expression of location.

In expressing locative spatial relations, we distinguish between *Figure* objects, e.g., objects that are smaller compared to the other object(s) or that are in the focus of attention, and *Ground* objects, e.g., objects that are larger in comparison to the other object(s), or that are backgrounded in a spatial scene. In these expressions, the Figure object is located with respect to the Ground object. In Fig. 10-1, for example, the cat is the Figure object and the chair is the Ground object.



Fig. 10-1 Spatial configuration of a Figure object (cat) and a Ground object (chair)

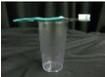
Encoding the spatial relationship between Figure and Ground objects exhibits a great deal of variation in spoken languages, ranging from the use of elements from small inventories of closed-class forms (e.g., prepositions, postpositions, case markers) to elements of large inventories of open-class forms (e.g., verbs, positionals) (Levinson & Wilkins, 2006). For example, to describe the spatial configuration in Fig. 10-1 above, English employs a (closed-class) preposition, "on":

(1) The cat is *on* the chair [English]

Turkish, on the other hand, offers two strategies to its speakers to describe the same spatial scene. One strategy is to use a general locative case marker (i.e., a postposition) that is attached to the Ground object noun. This form indicates that there is a spatial relation between Ground and Figure, without specifying the exact nature of this locative relation (e.g., support, containment, or occlusion). The other strategy allows speakers to specify the nature of the locative relation through the use of a spatial noun to which the locative case marker is affixed. For example, the general locative case marker “-de” (*at*) in (2a) merely indicates that the cat is in a spatial configuration with the chair, whereas “üst” (*on / top*) in (2b) specifies the type of spatial relation (“support” in this case) of the cat with respect to the chair:

- (2a) *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.")
- (2b) *Sandalye-nin üst-ün-de kedi var*  
 chair- GEN top-POSS-LOC cat there is  
 "There is a cat on the chair." (Lit. "There is a cat at the chair's top.")

Compared to spoken languages, sign languages seem to exhibit less variability in the expression of spatial relations, and show a strong preference for the use of the physical space in front of the signer (i.e., signing space) to indicate spatial relationships between entities in a rather analogue way (also see Arık, 2009, 2013, this volume). This is predominantly done with locative predicates combined with classifiers. These predicates are positioned in the signing space to encode information about the relative locations of the referents, and the classifiers, expressed by handshapes, represent salient characteristics of the referent (Supalla, 1982; Emmorey, 2002; Zwitserlood, 2012). TİD, too, uses locative predicates for the expression of static spatial relations, often in combination with classifiers, but also with nouns and size and shape specifiers (SASSes) (Arık, 2009, 2013; Kubuş, 2008; Özyürek, Zwitserlood, & Perniss, 2010). The example from TİD in (3) shows the use of a classifier predicate to encode the spatial relation between Figure and Ground referents. First, the Ground and subsequently the Figure objects (cup and toothbrush respectively) are introduced with lexical signs, and their spatial configuration is then encoded with a classifier construction (locating the Figure, the toothbrush, with respect to the Ground, the cup).



- (3)
- |  |  |  |
|--|--|--|
|  |  |  |
| LH:  |  | CLF(round)   |
| RH:  | CUP  | TOOTHBRUSH CLF(long, thin)-BE.AT <sub>loc</sub>                                    |
- ‘There is a cup, there is a toothbrush, the toothbrush is on the cup’

The structure above exemplifies the similarities in mapping a spatial scene onto spatial expressions in different sign languages (Emmorey, 1996, 2002; Aronoff, Meir, Padden, & Sandler, 2003; Perniss, 2007):

1. Introduction of the Ground before the Figure
2. Use of classifier predicates expressing the spatial configuration of Figure and Ground after their introduction
3. Simultaneous expression of Figure and Ground by classifier constructions.

Besides classifier predicates, in some sign languages (American Sign Language (ASL): Emmorey, 2002; German Sign Language (DGS): Perniss, 2007; TİD: Arık & Wilbur, 2008) another linguistic device for the encoding of spatial relations, called “relational lexeme” or “preposition” has been observed. In contrast to the use of classifier constructions, these are fixed forms with a specific meaning that categorically indicate a type of spatial relation (e.g., support, containment, or occlusion). These elements are, however, reported to be used only infrequently, compared to the use of classifier predicates. Previous studies have shown that classifier predicates are the preferred means to express locative relations in many sign languages, including TİD (Arık & Wilbur, 2008; Özyürek et al., 2010; Arık, 2013, this volume). An example of a relational lexeme from TİD is in the third still of (4) below<sup>1</sup>.



‘There’s a cat under a table.’

### 10.1.2. Acquisition of spatial language in spoken and sign languages

The modality difference between sign and spoken languages in encoding spatial relationships leads to questions about the acquisition of these languages by children. For instance, the affordances for iconic representation of events and entities in the visual modality of sign languages in comparison to the mostly arbitrary nature of spoken languages could, in principle, facilitate the acquisition of sign languages. In addition, the motor system of the manual apparatus seems to

---

<sup>1</sup> A flat hand shape was never used as a classifier hand shape for a ‘cat’ by this or other signers in the study. That is why we concluded that it is a part of ‘UNDER’ sign. Such cases were also checked with a Turkish deaf signer.

mature slightly faster than the vocal apparatus, such that the first production of signs precedes that of words (Bonvillian, Orlansky, & Novack, 1983). Below we first outline general developmental patterns in sign and spoken languages and then focus on the development of spatial language.

### **10.1.3. General developmental patterns of acquisition of sign and spoken language**

A variety of studies of sign language acquisition (in particular ASL) show that deaf children who are born to deaf parents follow similar patterns of language development as hearing children with hearing parents. All babies (deaf or hearing) vocalize similarly during the first few months of their life. By 10 months, hearing infants pass to the canonical babbling stage where they produce well-formed syllables. Similarly, deaf children of deaf parents show manual babbling, i.e., repetition of individual sign components (handshapes and movements), growing more complex over time (Boyes-Braem, 1990; Pettito & Marentette, 1991; Marentette & Mayberry, 2000).

The first words are uttered around 12 months of age by most hearing children. The timing of two-word utterances is around 18 months. In contrast, the first recognizable signs by children acquiring ASL appear at around 8½ months (Bonvillian et al., 1983), although earlier observations are also reported (e.g., Schlesinger & Meadow, 1972; Prinz & Prinz, 1979). The timing of the two-sign/word stage, however, does not differ significantly between children acquiring a spoken vs. a sign language (Newport & Meier, 1985, Pizzuto, 2000 for Italian Sign Language, LIS). As for iconicity, Newport & Meier (1985) report that infants do not show faster acquisition of iconic signs than arbitrary signs, but it appears that the acquisition of iconic signs is facilitated after age 3 or 4, when the iconic relation between signs and their denotation becomes transparent (Brown, 1978; Tolar, Lederberg, Gokhale, & Tomasello, 2008; Pyers, 2012; Thompson, Vinson, Woll, & Vigliocco, 2012).

More developmental parallels are found when children start to combine words/signs. For instance, similar non-adult patterns of negation are observed both in children acquiring ASL and English (Newport & Meier, 1985; Lacy, 1972; Ellenberger, Moores, & Hoffmeister, 1975), as well as a U-shaped pattern in the correct use of deictic pronouns (Pettito, 1983; Hoffmeister, 1977), and rather late competence in the use of anaphoric pronouns (Hoffmeister, 1977; Newport & Meier, 1985).

#### **10.1.4. The development of spatial language in spoken and sign language**

While many aspects of language seem to develop in parallel between sign and spoken languages, this equality has been questioned for the acquisition of spatial language.

Researchers who have studied various spoken languages report that spatial language develops between the ages of 2 and 6 years for hearing children acquiring English (E. Clark, 1973), German (Grimm, 1975), Hebrew (Dromi, 1979), Afrikaans (Vorster, 1984), Italian, Serbo-Croatian, Turkish (Johnston & Slobin, 1979) and language-specific patterns can be also acquired as early as 18 months (Choi & Bowerman, 1991). So far, the development of spatial language in sign languages has been studied for ASL (Supalla, 1982; Schick, 1990), BSL (Morgan, Herman, Barriere, & Woll, 2008), DSL (Engberg-Pedersen, 2003), and HKSL (Tang, Sze, & Lam, 2007). As stated before, these languages are all reported to employ classifier predicates for expression of spatial relations. From these studies, it is reported that full mastery of expressing spatial relations is not achieved until the age of 13, which is quite late compared to what is known for spoken languages.

Some of the studies conducted with deaf children show that these children have difficulty in choosing adult-like classifier handshapes (Kantor, 1980; Supalla, 1982) and sometimes use a "general classifier" instead of a specific, adult-like one. However, in another study conducted with 24 native deaf children aged between 4;5 and 9;0 years, Schick (1990) elicited classifier predicates to describe pictures showing various spatial relations and found an effect of age on using location morphemes, but not handshape morphemes (i.e., handling, class, or SASS). Therefore, she suggests that the acquisition of handshape morphemes cannot really account for the later acquisition of spatial language by deaf children.

In expressions involving a Figure and Ground, it has been reported that the expression of Ground emerges at a later stage of development (Tang et al., 2007; Morgan et al., 2008), and particularly, simultaneous expression of a Ground and a Figure object using classifier predicates has been suggested to be an area of challenge for deaf children, especially due to the articulatory difficulties of simultaneous combination of two classifiers (Supalla, 1982; Slobin et al., 2003). Furthermore, children are reported to sometimes use a more general lexical sign to express a spatial event rather than a classifier construction (Engberg-Pedersen, 2003). For example, when describing human beings falling from a higher to a lower point, children acquiring DSL preferred forms similar to the standard sign FALL (which is a two-handed sign) while none of the adults produced such a form, but rather used, for example, classifier constructions.

These studies are 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. Some studies have a mixed set of child participants, for instance, some including deaf children with deaf and with hearing parents (Engberg-Pedersen, 2003; Tang et al., 2007), or hearing children of deaf parents (Morgan et al., 2008). Also, these studies do not compare data from age-matched hearing and deaf children performing the same tasks. Thus, delays in the mastery of spatial expression by deaf children are presumed but not verified. Finally, most of these studies focused on expression of motion events (Supalla, 1982; Schick, 1990; Engberg-Pedersen, 2003; Slobin et al., 2003; Tang et al., 2007), and it is not clear to what extent the findings can be generalized over static location events.

## 10.2. The present study

In this study, the focus is on the development of expression of static spatial relations. We elicited locative descriptions from adults as well as children in two age groups and compared them, thus establishing the target and developmental patterns for such expression in TİD. In addition, we compared adult targets and developmental patterns in hearing children acquiring Turkish, looking at the same spatial configurations and using the same tasks. This direct comparison between acquisition of spatial language in a spoken language and a sign language will enhance our understanding of the impact that modality has in the language acquisition process.

These two languages were chosen for the following reasons. Turkish differs from many Indo-European languages in the way spatial relations are expressed, thus contributing to our knowledge of acquisition patterns in languages with different (spatial) structures (Johnston & Slobin, 1979; Aksu-Koç & Slobin, 1985). TİD is not in a contact relation (genetically or geographically) with the more widely studied (Western) sign languages and also differs from Turkish (Zeshan, 2003). Furthermore, Turkish and TİD are used in similar cultural settings, so that there is less chance of differences arising in the interpretation of the stimuli (see below) than with languages used in different cultures.

Focusing on these two languages, we investigated to what extent the challenges of the morphologically complex structures of spatial expressions in TİD (i.e., classifier predicates) and the articulatory difficulties of simultaneous expression of Figure and Ground might have a hindering effect for their acquisition, as assumed in the literature, in comparison to the sequential structures acquired by the hearing children. If this is the case, then we expect children learning TİD to learn adult patterns later than their hearing peers. Another possibility, however, is that the visual resemblances between spatial relations in the real world and their linguistic

representations in TİD facilitates the development of locative expressions for the deaf children. If they are, indeed, facilitating, we expect deaf children to acquire static spatial expressions (i.e., to be target-like) earlier than their hearing peers. A final possibility is that the modality may not have an effect on the development of locative expressions, and deaf and hearing children will reach the target patterns of their languages at similar ages.

### 10.2.1. Participants

To be able to follow the development of production of locative expressions, we needed to establish the target patterns as used by adults of each language. For this reason, seven native adult Turkish speakers and seven native deaf TİD users participated in our study. The development of the use of locative expressions was studied by comparing the expressions elicited from adults to the ones elicited from children in two age groups: one group of seven preschool-age children and one group of seven school-age children for each language (see Table 10-1 below)<sup>2</sup>. Three of the deaf children (two in the school-age and one in the preschool-age group) had cochlear implants (CI)<sup>3</sup>. Only one of the deaf children attended a primary school for the hearing.

Deaf school-age	Hearing school-age	Deaf preschool-age	Hearing preschool-age
7;10-9;10 (8;4)	7;8-9;5 (8;4)	4;0-7;2 <sup>4</sup> (5;8)	4;1-6;8 (5;2)

Table 10-1 Age ranges and (age means) for deaf and hearing children who participated in the study.

The hearing children were age-matched with their deaf peers. We did not include children younger than 4 years of age since our pilot studies showed that these very young children did not produce many spatial expressions in response to elicitation materials. Due to the scarcity of deaf children acquiring a sign language as a native language (i.e., from their deaf parents), the groups remain rather small. Thus, overall, 21 deaf TİD signers and 21 Turkish speakers, all residing in Istanbul, Turkey participated in this study.

<sup>2</sup> When we established age groups for this study, the starting age for primary school was 7 years of age in Turkey. However, after a recent change (September, 2012) in the educational policy, children now start school at the age of 5 years.

<sup>3</sup> Two school-aged deaf children with CIs received their implants when they were 4 years old. The preschool-aged child got her CI at the age of 3 years.

<sup>4</sup> One deaf child was 7;2 years old, but since he had not yet started primary school at the time of data collection, his data were analyzed in the "preschool-age" group.

## 10.2.2. Stimuli & Procedure

In order to be able to compare the locative expressions of children and adults, we elicited such expressions using a picture description task. All participants were asked to describe the same set of photographs in which a Figure object was situated in relation to a Ground object (e.g., pen on paper, cat in boat)<sup>5</sup>. We focused on three types of configurations that are reported to appear earliest in several (spoken) languages (Johnston & Slobin, 1979): containment, support, and occlusion<sup>6</sup>. There were ten pictures for each type of spatial configuration, with a total of 30 stimulus items.

Participants were shown the stimuli one by one on a laptop screen as presented in Fig. 10-2 for the three target relationships, and were asked to describe the photograph in the red frame to a (confederate) interlocutor, who was a native user of the same language as the participant. The interlocutor's task was to select the described photograph on a sheet containing the same set of photographs.

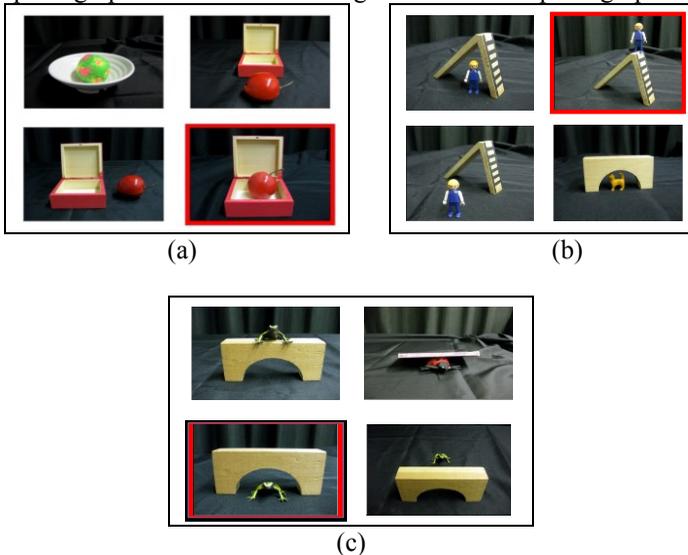


Fig. 10-2 Examples of stimulus items in which the target spatial relations (indicated with a red frame) are containment (a), support/contact (b), and occlusion (c).

<sup>5</sup> The stimuli in the study were originally developed by Jennie Pyers. We thank her for sharing these materials with us.

<sup>6</sup> We use the term “occlusion” here to refer to spatial scenes in which the Figure object is under a Ground object, even though the Figure object is not necessarily occluded from view.

Participants were recorded by two cameras from different angles, as illustrated in Fig. 10-3, so that an approximation of a 3-dimensional view was achieved, which facilitated the coding.



Fig. 10-3 Combined camera view on the signer

### 10.2.3. Coding and Analysis

A total of 1390 descriptions<sup>7</sup> (760 from deaf participants and 630 from hearing participants) for the pictures showing static spatial relations were coded using 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). For each description, all signs were transcribed with Turkish and English glosses on separate tiers for the left and right hand. For the analysis of the descriptions, we used tiers indicating: (i) presence or absence of expression of the spatial relation between the Ground and the Figure objects; (ii) the order of introduction of Ground and Figure; and (iii) the language-specific strategies used to encode the locative relation. Additionally, in the T1D descriptions, we also analyzed the presence or absence of simultaneous constructions. In some cases, signers gave a second description, or were prompted to give a clearer description by the interlocutor. Such repetitions were not counted in the analysis provided in this paper, however.

## 10.3. Results

As stated above, we compared the descriptions provided by the children to those by adults within languages in order to study the similarities and differences in these spatial descriptions. Direct comparisons of each group across the

---

<sup>7</sup> This is the total number of descriptions, including the ones in which the spatial relationship between the Figure and Ground is *not* indicated.

languages were not made as the devices available to each language are not easily comparable. For this reason, we performed separate analyses (ANOVA, MANOVA) for each language in the study rather than comparing all groups (hearing and deaf) in a single analysis.

### 10.3.1. Encoding of the spatial relations in TİD and Turkish

In this analysis we investigated to what extent descriptions encoded the spatial relations between Figure and Ground (i.e., as in (2) above for Turkish and in (3) and (4) for TİD). Descriptions were not considered to encode a spatial relation when the participant merely mentioned the objects in the target picture, without specifying the spatial relation between them (see the examples in (5) for TİD and the examples in (6) for Turkish). These examples show that children in both language groups produced similar expressions for pictures for which they did not specify the spatial relation between the entities<sup>8</sup>.

(5a)  (age 4;0) [TİD]



LH:  
RH:           PEN   CUP

‘There is a pen, there is a cup.’

<sup>8</sup> Note that participants were asked to describe each picture, rather than to provide an answer to the question “Where is X?” since that could have resulted in structures in which the Figure object was not mentioned again, whereas our aim is to understand whether and how both Figure and Ground objects are introduced and the spatial relation between them is expressed.

(5b)



(age 4;2) [TİD]

LH:

RH:

CUP  
'cup'

(6a)

(boy, age 5;4) [Turkish]

Bi(r) tane kedi var, bi(r) tane de gemi var.  
 One item cat there is, one item also ship there is.  
 'There is one cat, there is one ship'

(6b) Kedi  
 cat  
 'Cat'

(girl, age 5;4) [Turkish]

Of all descriptions by the deaf adults, 83% (out of 250 descriptions) expressed a locative relation between the Ground and the Figure. The school-age deaf children encoded the relation between Figure and Ground object in 82% of 254 descriptions. For the preschool-age deaf children, it was 46% out of 256 descriptions. One-way between-groups analysis of variance (ANOVA) and post-hoc (Tukey HSD) comparisons reveal that the preschool-age deaf children performed significantly differently from both the school-age child and adult groups in providing information about the spatial relationship between the entities ( $F(2,18) = 7.77, p < .05, r = .68$ ). Mean proportions and standard errors are indicated in Table 10-2.<sup>9</sup>

A similar pattern as found for the deaf participants was observed in the hearing groups. Hearing participants produced 210 descriptions in each age group, with a total of 630 descriptions. The results of ANOVA and post-hoc (Tukey HSD) comparisons reveal that hearing preschoolers differed significantly from hearing

<sup>9</sup> Arcsine transformations were performed on all of the data to meet the homogeneity of variance assumption; however, reported means and standard errors present actual proportions from the untransformed data.

adults and school-age children with respect to the likelihood of encoding the spatial relation ( $F(2,18) = 9.73, p < .05, r = .72$ ). Mean proportions and standard errors are indicated in Table 10-2 below.

	Deaf	Hearing
Adult	0.83 (3.50)	0.97 (1.54)
School-age	0.82 (3.45)	0.93 (2.43)
Preschool-age	0.46 (11.01)	0.83 (2.94)

Table 10-2 Mean proportions and (Standard Errors) of descriptions encoding the locative relation between Ground and Figure by all participants across age and language groups.

### 10.3.2. Order of introduction of Ground and Figure in TİD and Turkish

In the descriptions in which spatial relations were encoded (491 for deaf participants and 575 for hearing participants), we investigated the order in which Figure and Ground objects were introduced. In line with a previous study using a slightly different task and stimuli (Özyürek et al., 2010), we found that the deaf adults in this study almost always introduced both Ground and Figure with lexical signs, and that the Ground was usually mentioned before the Figure (see (3) above).

In the deaf group, the results of ANOVA showed a significant effect of age on the order of introduction of Ground and Figure in spatial descriptions ( $F(2,18)=14.36, p < .05, r = .78$ ). Table 10-3 below displays mean proportions and standard errors. Deaf adults and school-age deaf children preferred a "Ground before Figure" order in their spatial descriptions. There was no significant difference between these two groups. However, post-hoc comparisons (Tukey HSD) showed that preschool-age deaf children differed significantly from these two groups by preferring a "Figure before Ground" order. Thus, we saw adult-like introductions of the referents in the older children, as in (7a), where a school-age boy introduces first the Ground and then the Figure, as well as non-adult-like structures with Figure-first mentions in the younger, preschool-age children, as in (7b).



(age 9;10) [TİD]

(7a)



LH:

CLF(round)

RH:

CUP

PEN(CIL)

CLF(thin)-BE.AT<sub>loc</sub>

‘There is a cup, there is a pen(cil), the pen(cil) is in the cup.’

(age 6;10) [TİD]

(7b)



LH:

CUP

CLF(round)

RH:

PEN(CIL)

CLF(long, thin)-BE.AT<sub>loc</sub>

‘There is a pen(cil), there is a cup, the pen(cil) is in the cup.’

The order of introduction of Figure and Ground objects in Turkish is flexible. Yet, in our data, hearing adults strongly preferred to introduce the Ground before the Figure.

Similar to the deaf group, an effect of age was found for the hearing group, as well ( $F(2,18) = 10.97, p < .05, r = .74$ ). Mean proportions and standard errors are given in Table 10-3 below. Preschool-age hearing children showed a significant difference compared to hearing adults and school-age hearing children in the same way. Thus results show that adults and school-age children in both language groups prefer a "Ground before Figure" order, while deaf and hearing preschool-age children both do not have a strong order preference (see (8a) for "Ground-Figure" order and (8b) for "Figure-Ground" order).

(8a)

Bi(r)	tane	bardağ-in	iç-i-nde	kalem	var.
One	item	cup-GEN	in-POSS-LOC	pen	there is.

‘There is a pen in a cup’

(boy, age 8;2) [Turkish]

(8b)

(girl, age 5;4) [Turkish]

Kalem bardağ-in iç-i-nde.  
 Pen(cil) cup-GEN in-POSS-LOC.  
 ‘The pen is in the cup’

	Deaf	Hearing
Adult	0.98 (1.49)	0.90 (7.73)
School-age	0.93 (2.68)	0.97 (2.40)
Preschool-age	0.67 (9.04)	0.51 (12.46)

Table 10-3 Mean proportions and (Standard Errors) of "Ground before Figure" order in the descriptions with a spatial relation encoded.

### 10.3.3. Strategies for encoding the spatial relations between Ground and Figure in TİD and Turkish

Next, we examined the strategies employed to encode the spatial relations between the Figure and Ground objects in the stimuli. We analyzed the descriptions in which Figure and Ground are introduced and the spatial relation between them is indicated (491 descriptions for the deaf groups and 575 for the hearing group). The main strategy used by the deaf adults in our data was, as expected, the use of classifier constructions, as in (3). The deaf children in both the school-age and preschool-age groups also preferred this strategy. In view of expectations from previous findings (Arik & Wilbur, 2008; Özyürek et al., 2010; Arik, 2013, this volume), deaf children and adults also used relational lexemes (for an example, see (4) above) to an unexpectedly high degree (10% by deaf adults and 29% by all deaf children). Out of all descriptions of deaf adults and children combined where the target spatial relation between Figure and Ground is expressed, relational lexemes occurred mostly in expressions for occlusion type of relations (18% out of 159 descriptions), and less frequently for containment relations (11% out of 162), and support relations (8% out of 170 descriptions). Deaf adults and children in both age groups performed similarly in the use of relational lexemes.

Besides these strategies, we observed that deaf participants sometimes combined two strategies at once or used neither classifier predicate constructions nor relational lexemes. For example, they might articulate a relational lexeme with one hand and a classifier predicate with the other (3rd still in 9), use a pointing sign, not a classifier predicate, to indicate the spatial relation (3rd still in 10), or hold a lexical sign for one entity and use a classifier predicate for the other (3rd still in 11). Such strategies are grouped as "other" in Fig. 10-4 below. Such combinations were also used by adults and there is no statistically significant

difference in the use of these strategies in the overall "other" category between deaf children at both age groups and adults.



(9)



(age 9;4) [TiD]

LH: BOWL IN CLF(round)<sub>loc</sub> -----  
 RH: BOWL IN IN CUP

‘There is a bowl, there is a cup, the cup is in the bowl.’



(10)



LH: BOX APPLE IX (pointing sign)  
 RH: BOX -----

‘There is a box, there is an apple, the apple is (t)here’



(11)



LH: BED -----

RH:       BED                   PILLOW                   CLF(flat)-BE.AT<sub>loc</sub>  
 ‘There is a bed, there is a pillow, the pillow is under the bed’

A one-way between-groups multivariate analysis of variance (MANOVA) was performed to investigate the effect of age on the choice of linguistic strategy<sup>10</sup>. We determined three groups of linguistic strategies (i.e., the use of classifier predicates, the use of relational lexemes, or the use of other strategies) in describing spatial relations, thus having three dependent variables in the statistical analysis. Using Pillai's trace, there was no significant difference among age groups in deaf participants ( $V = 0.15$ ,  $F(6,34) = .47$ ,  $p > .05$ ). This suggests that deaf children at both age groups were adult-like in their choice of strategy to encode the spatial relations.

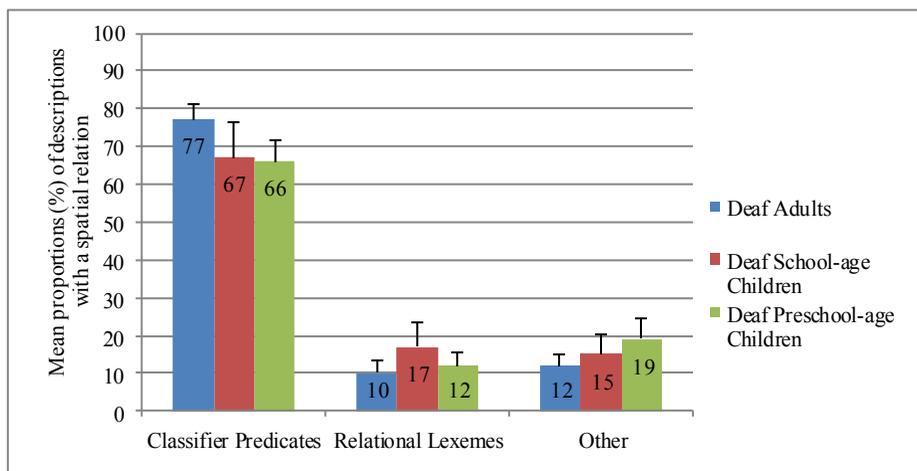


Fig. 10-4 Different strategies used to describe spatial relations by deaf participants. (Error bars are based on standard errors).

As mentioned earlier, Turkish offers two ways of expressing a static spatial relationship. Turkish speakers can either use a general locative case marker (-de), which is suffixed to the Ground object, or a more specific spatial noun (see example (2) above). Conducting a similar analysis (MANOVA)<sup>11</sup> to the one

<sup>10</sup> In addition to MANOVA analysis, we also conducted multiple independent ANOVAs to test for an effect of age on the choice of strategy to describe a spatial scene. The results of the separate univariate ANOVAs confirmed the results from MANOVA analysis.

<sup>11</sup> As we did for the TID analysis, in addition to a MANOVA analysis, we also conducted multiple ANOVAs independently to see if there is an effect of age on the choice of a

conducted for TİD and using Pillai's trace, our results revealed that Turkish adult speakers preferred the more specific strategy - that is the use of spatial nouns - and that the Turkish-acquiring children in both age groups performed similarly to the adults; they, too, used mostly specific encoding of the locative relation ( $V = .20$ ,  $F(4,36) = 1.00$ ,  $p > .05$ ).

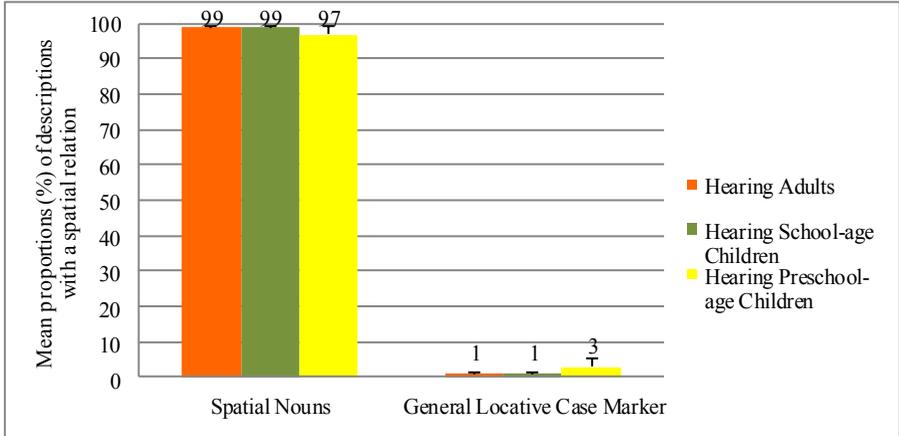


Fig. 10-5 Different strategies used to describe spatial relations by hearing participants (Error bars are based on standard errors).

### 10.3.4. Simultaneous expression of Ground and Figure in locative expressions in TİD

Simultaneous expression of Ground and Figure in a classifier construction (e.g., (3) above) has been claimed to be mastered rather late in children acquiring ASL (Slobin et al., 2003), DSL (Engberg-Pedersen, 2003), and HKSL (Tang, et al., 2007). It has been argued that this rather late mastery is a result of the morphological complexity of classifier predicates (e.g., Supalla, 1982; Newport & Supalla, 1980) and articulatory difficulties of simultaneous combination of two classifiers (Slobin et al., 2003).

It was stated in a previous study on TİD with adults (Özyürek et al., 2010; Perniss, Zwitserlood, Özyürek, 2011) that expression of Figure and Ground in

---

strategy to describe a spatial scene. The results of the separate univariate ANOVAs confirmed the results from the MANOVA analysis.

pictures showing single or multiple objects in different spatial configurations (e.g., cup(s) on a table, picture(s) on a wall) did not tend to employ simultaneous constructions frequently. However, simultaneous constructions occurred abundantly in the adult data in this study, probably due to the fact that the picture showing the target spatial relation was represented to the signer/speaker with two other pictures showing different spatial relations with the same objects and one picture with different objects (see Fig. 10-2). In addition, in Özyürek et al.'s (2010) study, there were mainly multiple Figure objects (i.e., 4 cups on a table, 2 boats in a lake) whereas the stimuli with only one Figure object elicited three times as many simultaneous constructions than those containing more than one Figure object (Perniss, Zwitserlood, & Özyürek, 2011).

In this study, we defined two types of simultaneous Figure-Ground representation. The first type (which we called "simsim") entails the simultaneous representation of Ground and Figure in a classifier construction, as in examples (3), (7a, b), and (12). In the second type ("simcon"), the classifiers for the Ground and the Figure were localized in space one after another, thus in a consecutive fashion (see example (13)). Non-simultaneity, on the other hand, refers to the expression of Figure and Ground with sequential classifier predicates, as in (14).



(age 7;10) [TİD]

(12)



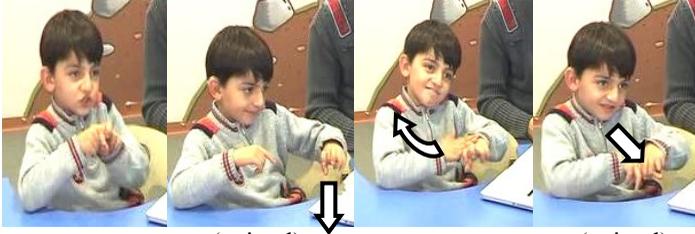
LH: CLF(long, thin)-BE.AT<sub>loc</sub>  
 RH: CUP TOOTHBRUSH CLF(round)

*There is a cup, there is a toothbrush, the toothbrush is on the cup.*



(age 6;6) [TİD]

(13)



LH: HORSE CLF(animal)BE.AT<sub>loc</sub> CAT CLF(animal)-BE.AT<sub>loc</sub>  
 RH: HORSE CAT CLF(animal)-BE.AT<sub>loc</sub>

‘There is a horse, the horse is here, there is a cat, the cat is under the horse.’



(14)



(age 7;11) [TID]

LH: PAPER CLF(flat)-BE.AT<sub>loc</sub> PEN CLF(long)BE.AT<sub>loc</sub>  
 RH: PAPER CLF(long)BE.AT<sub>loc</sub>

‘There is paper here, there is a pen, the pen is on the paper.’

The results of ANOVA and post hoc comparisons (Tukey HSD) show that, unlike what would be expected from previous research, the performance of the children in both age groups did not differ significantly from adults in the use of simultaneous constructions (both types; sim-sim and sim-con combined) ( $F(2,18) = 1.79, p > .05, r = .41$ ). Table 10-4 below displays mean proportions and standard errors. That is, when the children used a classifier construction, they mostly expressed Ground and Figure simultaneously, as in the final stills in (12) and (13).

	Simultaneous (both "simsim" and "simcon")
Deaf Adults	0.98 (1.29)
Deaf School-age Children	0.90 (3.58)
Deaf Preschool-age Children	0.87 (7.11)

Table 10-4 Mean proportions and (Standard Errors) of classifier constructions that include simultaneous expression of Ground and Figure.

## 10.4. Conclusion

This study provides a first account of the developmental patterns in the encoding of static spatial relations in children acquiring TİD. It is also the first study in which the acquisition of spatial language in a sign language is directly compared to adult patterns and to age-matched hearing speakers. The results show many similarities in the developmental patterns of hearing and deaf children's acquisition of locative expressions - in spite of the differences in modality and structure. We found that both deaf and hearing school-age children use adult-like strategies to describe the spatial relations between the entities. However, we also found that both deaf and hearing preschool-age children differed from adult patterns in several ways. The preschool-age children acquiring TİD and Turkish are still developing their skills in expressing a static spatial relation and the ordering of Figure and Ground. Both Turkish and TİD acquiring preschool-age children did not have a strong preference for order of Figure and Ground. In terms of choosing the preferred adult-like strategies among the ones offered in their respective languages, both TİD and Turkish learning children were adult-like in both age groups (i.e., with TİD signers preferring classifier constructions and Turkish speakers preferring the option of marking the specific spatial relation using a spatial noun). Finally, in representing Figure and Ground in a simultaneous classifier construction, the deaf children in both age groups were adult-like.

As a result of these findings, we can conclude that modality of the language being acquired does not seem to have a clearly hindering or facilitating effect on the development of spatial language in the domain of locative expressions since similar trends exist for age-matched deaf and hearing children.

## 10.5. Discussion

These findings contradict a plethora of reports from other studies, on other sign languages, that deaf children acquiring a sign language are late to achieve adult-like patterns late in the use of spatial language in comparison with hearing children acquiring a spoken language. Previous studies have found that deaf children tend to omit the expression of the Ground and avoid simultaneous expressions even until the age of 13 (Engberg-Pedersen, 2003; Slobin et al., 2003; Tang et al., 2007). The difference with regard to these previous studies might be explained in terms of task difference and task complexity. In these studies, in contrast to our study, descriptions of primarily motion events were collected, based on narrations of picture stories (i.e., Frog 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, Source, and Goal), whereas static locative relations involve only Figure and Ground objects. Göksun, Hirsh-Pasek, & Golinkoff (2009) show that Grounds were better noticed in the absence of motion (in a study with 7-12 month infants acquiring English) and suggest that the motion of a Figure object diminishes attention to other aspects of a motion event when compared to a static one. Similarly, Furman (2012) found that hearing Turkish adults and 5-year old children often omitted expression of the Ground objects when describing caused motion events. Thus, we may find different patterns in spatial descriptions of motion events.

In relation to preschool-age children's using both "Figure before Ground" and "Ground before Figure" order while describing a spatial relationship between them, one might suggest that young children find it hard to suppress Figure objects which can be more salient than Ground objects and this could lead to the non-adult-like spell-out of Figure objects before Ground objects. On the other hand, older children and adults can suppress perceptually salient Figures better and encode them later than Ground objects. However, although it is not reported in the current chapter, young deaf and hearing children have tendency to drop Figure objects rather than Ground objects in cases where they do not express both (see example 5b).

Another interesting finding of this study relates to the preference of relational lexemes to describe spatial scenes. It has been reported 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; Özyürek et al., 2010; Arık, 2013, this volume for TİD). However, in the current study, both child and adult signers used relational lexemes to provide the spatial information between Figure and Ground. The use of these devices has been found to be higher especially for occlusion (i.e., "under") type of spatial relations, compared to containment (i.e., "in") and support (i.e., on). The Özyürek et al. (2010) study looked at only support (i.e., on) and "next-to" type of spatial relations. Similarly, Arık & Wilbur (2008) and Arık (2009) included containment and support in addition to left-right and front-back type of spatial relations in their study. The higher use of relational lexemes in our study might thus be related to the inclusion of occlusion (i.e., under) type of spatial relations, which elicited relational lexemes more than other types (i.e., containment and support).

We are aware that this study has its limitations. It has focused on only a small set of spatial relations (i.e., static ones) and types (i.e., containment, support, and occlusion). Future studies should include a larger array of spatial situations, both elicited and spontaneous data, and dynamic as well as static spatial scenes. Another issue that needs further investigation is the choice of classifiers as well as the

accurateness in indicating the orientation and the relative positioning of the classifiers by TİD-acquiring children in comparison to adults.

Comparison of developmental patterns in TİD directly with those conducted with other sign languages is difficult due to the different data types used and the different spatial relations investigated. This could be remediated in the future by using similar stimuli in different sign and spoken languages. Thus, even though we have more insights into the role that modality plays in acquisition of spatial language, we surmise that for a better understanding of modality effects on sign language acquisition comparison of different spoken and sign languages is needed in the future. There is still not really enough evidence to determine the exact role of modality on the development of spatial language, because we are lacking the systematic cross-typological comparisons, as well. So, the results of our study question the generalization of the claim that spatial language poses difficulties for deaf children and call for future crosslinguistic and cross-modal studies in this domain.

## 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). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Arik, 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.
- Arik, E. (2009). *Spatial Language: Insights from signed and spoken languages*. (Doctoral dissertation). Purdue University, West Lafayette, IN.
- Arik, E. (to appear/2013). Türkçe ve Türk İşaret Dili'nde İç ve Üst İlişkisi Kurulabilen Yer Belirtme Tümcelerinin Bir Karşılaştırılması. *Proceedings of the 7th International Turkish Language Conference (7. Uluslararası Türk Dili Kurultayı-Türk Dil Kurumu)*.
- Arik, E. (this volume). Expressions of spatial relations in Turkish Sign Language. In E. Arik (ed.), *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 classifiers in Sign Languages* (pp. 53-84). Mahwah NJ: Lawrence Erlbaum Associates.
- Bonvillian, J. D., Orlansky, M. D., & Novack, L. L., (1983). Early sign language acquisition and its relation to cognitive and motor development. In J. Kyle & B. Woll (Eds.), *Language in Sign: An international perspective on Sign language*. (pp. 116-125). London: Groom Helm.
- 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.

- Brown, R. (1978). Why are signed languages easier to learn than spoken languages? *Bulletin of the American Academy of Arts and Sciences*, 32(3), 25-44.
- 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.
- Dromi, E. (1979). More on the acquisition of locative prepositions: an analysis of Hebrew data. *Journal of Child Language*, 6, 547-562.
- 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, MN.
- 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: The MIT Press.
- Emmorey, K. (2002). *Language, cognition, and the brain: Insights from sign language research*. Mahwah, NJ: Lawrence Erlbaum Associates.
- 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 classifiers in Sign Languages*, (pp.311-332). Mahwah, NJ: Lawrence Erlbaum Associates.
- Furman, R. (2012). *Caused motion events in Turkish: Verbal and gestural representation in adults and children*. (Doctoral dissertation). Radboud University, Nijmegen.
- 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.
- Grimm, H. (1975). On the child's acquisition of semantic structure underlying the wordfield of prepositions. *Language and Speech*, 8, 97-119.
- Hoffmeister, R. (1977). The influential point. In W. Stokoe (Ed.), *Proceedings of the national symposium on sign language research and teaching*, 177-191.
- 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.
- Kantor, R. (1980). The acquisition of classifiers in American Sign Language. *Sign Language Studies*, 28, 198-208.
- Kuş, O. (2008). *An analysis of Turkish Sign Language (TİD) phonology and morphology*. (Master's thesis). METU, Ankara.
- Lacy, R. (1972). The development of Pola's negation. *Working Paper, The Salk Institute*.
- Levinson, S. C. (2003). *Space in language and cognition: Explorations in cognitive diversity*. Cambridge, UK: Cambridge University 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.
- 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.
- 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.
- Newport, E. L. & Supalla, T. R. (1980). Clues from the acquisition of signed and spoken language. In U. Bellugi & M. Studdert-Kennedy (Eds.), *Signed and spoken languages: Biological constraints on linguistic form* (pp. 187-212). Weinheim: Verlag Chemie GmbH.
- 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). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Özyürek, A., Zwitserlood, I., & Perniss, P. (2010). Locative expressions in signed languages: A view from Turkish Sign Language (TİD). *Linguistics*, 48(5), 1111-1145.
- Perniss, P. (2007). *Space and iconicity in German Sign Language (DGS)*. Doctoral dissertation. Nijmegen: MPI Series in Psycholinguistics.
- Perniss, P., Zwitserlood, I., & Özyürek, A. (2011). Does space structure spatial language? Linguistic encoding of space in sign languages. In L. Carlson, C. Holscher, & T. Shipley (Eds.), *Proceedings of the 33rd Annual Meeting of the Cognitive Science Society* (pp. 1595-1600). Austin, TX: Cognitive Science Society.
- Petitto, L. A. (1983). *From gesture to symbol: The acquisition of personal pronouns in American Sign Language*. (Unpublished qualifying paper), Harvard University, Cambridge, MA.
- Petitto, L. & Marentette, P. F. (1991). Babbling in the manual code: Evidence for the ontogeny of language. *Science*, 251, 1493-1496.
- Pizzuto, E. (2000). The development of Italian Sign Language (LIS) in deaf preschoolers. In G. Morgan & B. Woll (Eds.), *Directions in sign language acquisition*. Amsterdam: John Benjamins.
- Prinz, P. M., & Prinz, M. A. (1979). Simultaneous acquisition of ASL and spoken English (In a hearing child of a Deaf mother and hearing father). Phase I: Early lexical development. *Sign Language Studies*, 25, 283-296.
- Pyers, J. (2012). *The cognitive demands of acquiring a visual-spatial language: The challenges of iconicity*. Paper presented at the meeting of Multimodality and Language Learning Workshop, Nijmegen, The Netherlands.
- 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.
- Schlesinger, H. S. & Meadow, K. P. (1972). *Sound and sign: Childhood deafness and mental health*. Berkeley: University of California Press.
- Slobin, D., 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 classifiers in sign languages* (pp. 271-296). Mahwah, NJ: Lawrence Erlbaum Associates.
- Supalla, T. (1982). *Structure and acquisition of verbs of motion and location in American Sign Language*. (Doctoral dissertation). UCSD, San Diego, CA.

- 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.
- Thompson, R. L., Vinson, D. P., Woll, B., & Vigliocco, G. (2012). The Road to Language Learning is Iconic. *Psychological Science*, *23*(12), 1443-1448.
- Tolar, T. D., Lederberg, A. R., Gokhale, S., & Tomasello, M. (2008). The development of the ability to recognize the meaning of iconic signs. *Journal of Deaf Studies and Deaf Education*, *13*, 225-240.
- 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.
- 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>
- Zehsan, U. (2003). Aspects of Türk İşaret Dili (Turkish Sign Language). *Sign Language & Linguistics*, *6*(1), 43-75.
- Zwitserslood, I. (2012) Classifiers. In R. Pfau, M. Steinbach, & B. Woll (Eds.), *Sign language. An international handbook* (pp. 158-186). Berlin: Mouton de Gruyter.