CHAPTER 14

A first study on the development of spatial viewpoint in sign language acquisition

The case of Turkish Sign Language

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The current study examines, for the first time, the viewpoint preferences of signing children in expressing spatial relations that require imposing a viewpoint (left-right, front-behind). We elicited spatial descriptions from deaf children (4–9 years of age) acquiring Turkish Sign Language (TİD) natively from their deaf parents and from adult native signers of TİD. Adults produced these spatial descriptions from their own viewpoint and from that of their addressee depending on whether the objects were located on the lateral or the sagittal axis. TİD-acquiring children, on the other hand, described all spatial configurations from their own viewpoint. Differences were also found between children and adults in the type of linguistic devices and how they are used to express such spatial relations.

Keywords: sign language acquisition, spatial language, viewpoint

One area of child development Ayhan has been a real pioneer is on study of the children's acquisition of evidentiality. This is certainly an area of development which shows that children learn to take different viewpoints on events and mark them linguistically. The second area is on the influence of different languages on children's linguistic and social cognitive development. These two very fundamental perspectives on language development Ayhan has shown us have certainly guided our understanding of language development in a different modality, namely in sign language acquisition. The current chapter would not have been possible without Ayhan's influence on our intellectual development- for which we are deeply grateful.

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1. Introduction

One of the unique abilities of human language and cognition is to take different viewpoints on the same events, objects and even ideas. Children, however, take some time to develop the different aspects of this skill such as to (a) understand cognitively that there can be different viewpoints/perspectives of the same event, (b) be able to describe the same event from their own versus another's (e.g., an addressee's) viewpoint and (c) learn to use language-specific skills to express these viewpoints (Piaget 1972; Moll, Meltzoff, Merzsch & Tomasello 2013). Since sign language forms are mainly expressed and perceived in the visual modality, learning to express spatial viewpoint might develop differently for signing compared to speaking children. This chapter investigates how children acquiring a sign language master expression of spatial viewpoint, especially the skills mentioned in (b) and (c) above.

1.1 Viewpoint encoding in spoken languages

Expressing viewpoint-dependent spatial relations such as left, right, in front, and behind requires speakers to choose a viewpoint, e.g., their own or that of their addressee. For example, to describe the location of the pen with respect to the paper to your addressee sitting opposite to you as in Example (1), as a speaker, you can either say "the pen is to the left of the paper", thus taking your own viewpoint, or "the pen is to the right of the paper", taking the viewpoint of your addressee. While earlier studies on the preference of viewpoint in spoken spatial descriptions have shown the primacy of adopting the (speaker's) egocentric viewpoint (e.g., Levelt 1989), the later studies found that speakers might also prefer to adopt the viewpoint of their addressee, e.g., indicating "on your left/right" in their descriptions (Schober 1993; Mainwaring, Tversky & Schiano 1996; Mainwaring, Tversky, Ohgishi & Schiano 2003).

1.2 Linguistic forms of encoding spatial relations

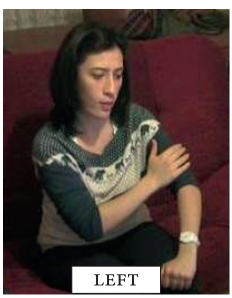
While encoding spatial relations, signers mostly use classifier predicates that afford an analogue representation of the real-world spatial configuration (e.g., Emmorey 2002). These are morphologically complex linguistic forms in which signers' hands represent the objects, for example, by depicting their size and shape. In (1) below, a native user of Turkish Sign Language (Türk İşaret Dili, TİD), for example, employs a flat handshape as the classifier for paper to refer to its flat surface (3rd still) and her index finger for pen to refer to its elongated shape after introducing them with their lexical signs (1st still for paper and 2nd still for pen). The position of the signer's hands in the classifier predicate represents the location the objects as shown in the picture.

(1)

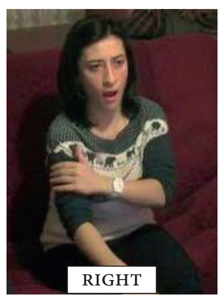
LeftHand: PEN CL(long)$_{loc}$
RightHand: PAPER CL(flat)$_{loc}$ ------- HOLD -------
"There is a paper. There is a pen. The pen is to the left of the paper."

Even though much less emphasized in the sign language literature, in describing spatial relations, signers can also use lexical signs, i.e., relational lexemes (Arık 2009). These linguistic forms are more categorical than classifier predicates since in using relational lexemes signers categorize the signing space to refer to the location of the objects (e.g., left and right). In contrast to the labels used in spoken languages to express viewpoint, the visual forms of these relational lexemes in sign languages can be directly anchored to the coordinates of the signers' body, as in TİD (see 2 below).

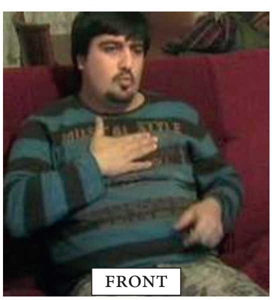
(2a)



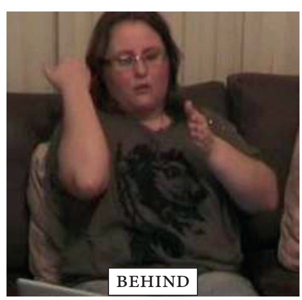
(2b)



(2c)



(2d)



Sümer, Perniss, Zwitserlood & Özyürek (2014) and Sümer (2015) have shown that TİD signers sometimes used these forms instead of classifier predicates, as shown in (3a), or together with classifier predicates within the same spatial description as in (3b).

(3a)

LeftHand: RECTANGULAR ---- HOLD ---- RIGHT
RightHand: RECTANGULAR CAKE RIGHT
"There is a rectangular-shaped object. There is a cake. The cake is at the right."

(3b)

LeftHand: BOWL -------------- HOLD --------------
RightHand: BOWL BALL CL(round)$_{loc}$ FRONT
"There is a bowl here. There is a ball. The ball is in front of the bowl."

1.3 Encoding viewpoint in sign languages

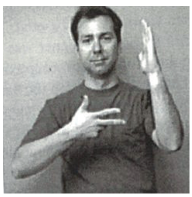
While encoding viewpoint-dependent spatial relations, signers can also prefer signer- or addressee-viewpoint. For example, as illustrated below, the female signer of American Sign Language (ASL) in (4a) adopts her own viewpoint, thus describing the picture as she sees it, while the male ASL signer in (4b) adopts the addressee's viewpoint (Emmorey 1996).

Production studies with signers have shown that spatial descriptions are primarily expressed from the signer's viewpoint (Arık 2008; 2012; Emmorey 1996;

(4a)

LeftHand: CL(vehicle)$_{loc}$
RightHand: TREE

(4b)



LeftHand: TREE
RightHand: CL(vehicle)$_{loc}$

Emmorey, Klima & Hickok 1998; Perniss 2007; Pyers, Perniss & Emmorey 2015).[1] The use of addressee viewpoint was reported by Emmorey (1996) for ASL signers who described the location of objects (using classifier predicates) from the viewpoint of their addressees, especially when objects were located on the sagittal axis (i.e., front-behind). The reasons for 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. So far there are no developmental studies with signing children in this domain.

1. However, Arık (2008; 2012) reports that adult signers of TİD also produce viewpoint-neutral spatial descriptions where their viewpoint preference is not expressed – especially when the objects involved in the spatial configuration have intrinsic fronts and backs such as people or trucks.

1.4 Acquisition of viewpoint by speaking and signing children

Research on spoken language development has shown that children first learn to express spatial relations that do not require a viewpoint (e.g., in, on under), and learn to express relations that do require a viewpoint later – possibly due to some general cognitive development principles (Johnston 1988; Johnston & Slobin 1979; Loewenstein & Gentner 2005; Piaget & Inhelder 1971; Tomasello 1987). Furthermore, children learn to express their own viewpoint earlier than another, e.g., addressee-viewpoint (Coie, Costanzo & Farnill 1973; Roberts & Aman 1993).

Although sign language acquisition has been reported to be on a par with spoken language acquisition in general (Chamberlain, Morford & Mayberry 2000; Chen-Pichler 2012; Newport & Meier 1985), differences between signing and speaking children are reported when it comes to acquisition of spatial language. For example, in acquiring viewpoint-dependent spatial relations, signing children have been found to lag behind their speaking peers in *comprehending* them (Martin & Sera 2006; Morgan, Herman, Barriere & Woll 2008). In sign languages, comprehension of these spatial relations effectively involves 180° mental rotation, as signers generally produce spatial descriptions from their own viewpoint (Pyers et al. 2015). For example, if a signer describes a scene from her own viewpoint as in (4a) above, the addressee needs to interpret what is perceived on the right as being on the left and vice versa. Mental rotation seems to be a source of difficulty for signing children in comprehending viewpoint-dependent spatial relations, and does not become adult like until 11–12 years of age (Martin & Sera 2006).

In a recent study, Sümer, Zwitserlood, Perniss and Özyürek (2014) found that TİD-signing children at around four years of age are adult-like in how frequently they use different linguistic forms (e.g., classifier predicates, relational lexemes) while encoding the location of the objects on the left-right axis. This is much earlier than their Turkish-speaking peers who are not adult-like in the same domain even at nine years of age. However, this study did not take the type of viewpoint expressed in the spatial descriptions into account and there are no previous studies that investigate which viewpoint (signer- versus addressee-viewpoint) signing children prefer to *produce* their spatial descriptions. If they are found to describe spatial scenes from their own viewpoint (i.e., signer-viewpoint) earlier than addressee-viewpoint as in the case of speaking children, then we can assume that general principles of cognitive development are at work – regardless of the language modality. Otherwise, it would be possible to think that the modality of sign languages (visual-spatial) might be modulating the acquisition of viewpoint differently for sign language acquiring children compared to speaking children.

2. Present study

In the current study, we explore two questions. First, we investigate the viewpoint preferences of adult signers of Turkish Sign Language (Türk İşaret Dili, TİD) in encoding the spatial relations between two objects located on the lateral (i.e., left-right) or sagittal axis (i.e., front-behind). Second, we ask how viewpoint preferences of TİD-acquiring children compare to those of adult signers describing the same spatial scenes.

3. Participants

Data for the current study were elicited from deaf children in two age groups: Younger children (M_{age} = 5;2, range = 3;5–6;10)[2] and older children (M_{age} = 8;3, range = 7;2–9;10) with 10 participants in each group. Their data were compared to data elicited from deaf adults (*N* = 10). All child and adult participants are native signers of TİD (i.e., all learned the language from their deaf parents), and reside in İstanbul, Turkey.

In the older age group, seven deaf children attend a primary school for the deaf and three attend mainstream schools for the hearing. In the younger age group, seven children attend a preschool education program for the deaf – three full-time (five days a week) and four part-time (two days a week) to a preschool education program for the deaf. The remaining three children in the younger age group do not attend a preschool education program and are at home during the day. It is important to note that TİD was not systematically taught at schools for the deaf in Turkey until 2015, and thus was not part of the curriculum at the time of data collection.[3]

4. Method and procedure

A picture description task was used to elicit spatial descriptions of viewpoint-dependent spatial relations from deaf children and adults in TİD. The task includes 12 picture sets. Each set contains four pictures, one of which is the target picture as highlighted with a red frame; the other three pictures are contrasts. In each picture, there are two different objects located differently with respect to each other. Target pictures are the ones who display two objects located on the lateral axis (e.g., pen

2. The tasks used in the current study were also tried with younger age groups (e.g., 3;1), but children failed to concentrate and quit the task.

3. TİD became part of the curriculum at schools for the deaf in Turkey beginning in the academic year 2015–2016, and is currently taught two hours per week to children in 1st, 2nd, and 3rd grade.

left to paper) ($N = 6$) or on the sagittal axis (e.g., ball behind a plate) ($N = 6$). To avoid the intrinsic frame of reference, the ground objects in these pictures (i.e., bigger and backgrounded objects) do not have intrinsic back and fronts – unlike in Arık (2008; 2012). None of these pictures shows people acting upon objects; and all present objects are displayed in a static situation.

The picture sets with target pictures showing objects on the sagittal axis (e.g., pen *in front of* paper) always include one contrast picture showing the opposite spatial relation to the target picture (i.e., pen *behind* paper). The sets with target pictures that display objects on the lateral axis do not include the opposite relation in the contrast items (e.g. pen *to the left of* paper occurring with pen *to the right of* paper). Thus, the types of contrast are not balanced across the sets.[4]

As seen in Figure 1, in data collection sessions, participants were asked to sit opposite a deaf addressee, who was a confederate. A laptop, on which stimulus pictures were displayed, was located on a table between them. The sessions were video-recorded using two cameras, one on the signer and the other from the top, which also later enabled the annotators to understand what the signers saw on the computer screen during their productions.

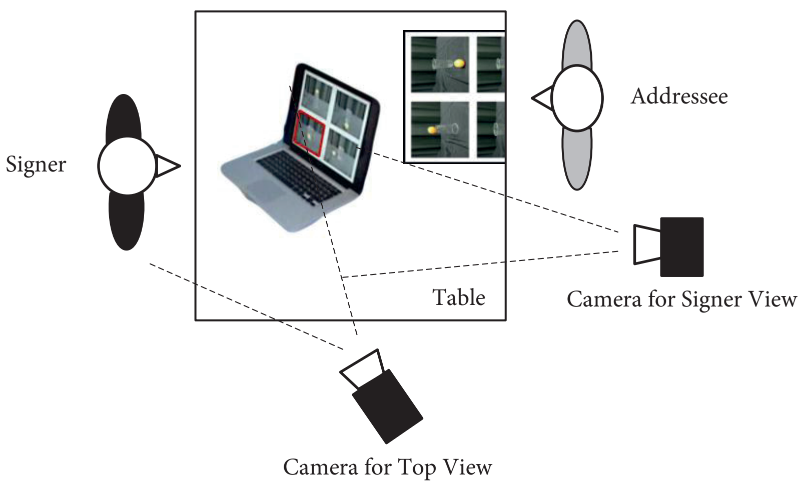


Figure 1. A schematic overview of the recording set-up

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

5. Data coding and analysis

For each picture description, all signs were transcribed and coded in ELAN (Wittenburg, Brugman, Russel, Klassmann & Sloetjes 2006) by a deaf TİD signer and two hearing researchers with good knowledge of TİD. All edited and synchronized data are stored in the language archive of Max Planck Institute for Psycholinguistics in Nijmegen.

When signers use space, as with classifier predicates, viewpoint becomes explicit since the locations of the signer's hands representing different objects in the signing space match the locations of the objects in the real spatial configuration for the signer, (i.e., with respect to the signer's picture), but are mirror images of the locations of the objects for the addressee (i.e., with respect to the addressee's picture) sitting across from the signer. The analysis in the current study, thus, investigates viewpoint preferences of signers in their use of classifier predicates. Each description was coded for viewpoint as expressed in how signers placed their hands in the signing space. Descriptions were coded as using *signer-viewpoint* when the position of the hands corresponded to the locations of entities in the picture as viewed by the signer. For example, when you take the role of the signer as a reader and describe the spatial configuration between the pen and the paper from your viewpoint, you will place the hand representing the pen to your left (on the lateral axis) for (5a) and close to your body (on the sagittal axis) for (5b). Thus, the positions of your hands in space match the locations of the corresponding entities in the picture as you see them.

In using *addressee-viewpoint*, the configuration of signers' hands in space matches the picture as seen by the addressee. As the reader, for example, your view of the signer's hands in the Examples in (6a) and (6b) are the same as how the addressee sees the spatial arrangement between pen and paper in the picture. The relative positioning of the signers' hands in space thus does not match the locations of the entities in the picture as seen by the signer.

(5a)

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

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

"There is a paper. There is a pen. The pen is to the left of the paper [signer-viewpoint, lateral axis]."

(5b)

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

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

"There is a paper. There is a pen. The pen is in front of the paper [signer-viewpoint, sagittal axis]."

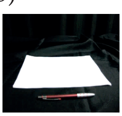
(6a)

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

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

"There is a paper. There is a pen. The pen is to the left of the paper [addressee-viewpoint, lateral axis]."

(6b)



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

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

"There is a paper. There is a pen. The pen is in front of the paper [addressee-viewpoint, sagittal axis]".

6. Results

For each picture, only the first description provided by the signer was coded in order to avoid uncontrolled variability. Signers produced a total of 353 picture descriptions, but descriptions where signers did not explicitly encode the spatial relation (N=58 descriptions) and the ones with where signers only used linguistic forms other than classifier predicates (e.g., only relational lexemes or pointing signs) ($N = 55$) were excluded from analysis, thus leaving 240 spatial descriptions to be analyzed for the current study.

Subject-based mean proportions of picture descriptions with signer-viewpoint encoding were calculated out of all picture descriptions with the classifier predicates only or classifier predicates with an additional relational lexeme. On the arcsine-transformed proportions of these descriptions,[5] we carried out a two-way mixed ANOVA on the effects of age (adults, older children, younger children) and axis type (lateral, sagittal). There was a significant main effect of axis type, $F(1,27) = 11.42$, $p < .05$, $\eta^2_p = .30$. There was also a main effect of age, $F(2,27) = 18.75$, $p < .001$, $\eta^2_p = .58$, with a significant interaction with axis type, $F(2,27) = 7.23$, $p < .05$, $\eta^2_p = .35$. This indicates that the use of signer-viewpoint across different age groups varied for lateral versus sagittal axis. Due to the interaction, we analyzed first the effect of age for each axis type and found that both age groups of children were similar to adults in preferring signer-viewpoint for the locations of the objects placed on the lateral axis, $F(2, 29) = 1.41$, $p > .05$, $\eta^2 = .31$. However, this was not the case for the sagittal axis: Here the adult signers preferred signer-viewpoint less frequently than both age groups of signing children, $F(2, 29) = 24.22$, $p < .001$, $\eta^2 = .80$ (see Figure 2).

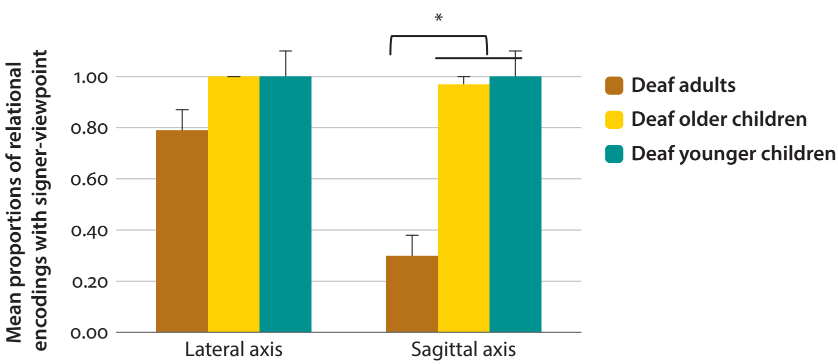


Figure 2. Mean proportions and error bars (representing SE) of descriptions with signer-viewpoint in relational encodings on the lateral and sagittal axis in TİD across age groups

5. The mean proportions and standard errors reported in the tables and graphs reflect the untransformed data.

Considering different production patterns of signer-viewpoint found for lateral versus sagittal axis encodings, we also analyzed the use of linguistic devices, that is whether signers used classifier predicates only (i.e., one linguistic device) or combined them with relational lexemes (i.e., used two linguistic devices). Specifically, we calculated the frequency of the use of two linguistic devices across different age groups. Table 1 presents proportions of descriptions with two linguistic devices out of all relational encodings on the lateral and sagittal axis for each age group. Here, we observed that signing adults used two linguistic devices more frequently than children in general. Furthermore, this difference is greater when describing the locations of objects on the sagittal axis than when describing the locations of objects on the lateral axis. Unlike adults, signing children in both age groups preferred to use a single linguistic device for relational encodings for both axis types.

Table 1. Mean proportions (SD) of relational encodings where two linguistic devices were used by TİD signers out of all relational encodings on each axis for each age group

Groups of TİD signers	Lateral axis	Sagittal axis
Deaf Adults	.21(.27)	.45(.21)
Deaf Older Children	.05(.11)	.04(.13)
Deaf Younger Children	.03(.06)	.08(.13)
TOTAL	**.11(.18)**	**.21(.24)**

The adult patterns in this study then not only display a shift from using signer-viewpoint to addressee-viewpoint, but also reveal more frequent use of both classifier predicates and relational lexemes together as compared to use of just a classifier predicate within spatial descriptions encoding relations on the sagittal axis. Specifically, out of 27 sagittal axis encodings with two linguistic devices, 24 (.89) are produced from addressee-viewpoint, and only 3 (.11) are from signer-viewpoint. In contrast, in 28 sagittal axis encodings with classifier predicates only, the proportion of use of signer-viewpoint increases considerably (11 cases, .39). These findings suggest that use of classifier predicates and relational lexemes within the same spatial description is motivated by the choice of addressee-viewpoint in adult signers.

7. Discussion

Our investigation into viewpoint preferences of adult and child TİD signers revealed two insights. Firstly, adult TİD signers prefer different viewpoints depending on the axis of objects located. Secondly, children initially prefer signer-viewpoint for both axes, and the choice of addressee-viewpoint, specifically for spatial relations on the sagittal axis, does not appear until 8–9 years of age. Below we discuss our results in more detail.

7.1 Adult patterns

Adult signers' choice of viewpoint in TİD varied depending on the axis on which objects are located. They mostly adopted signer-viewpoint in their relational encodings for objects located on the lateral axis, but preferred addressee-viewpoint marginally over signer-viewpoint for the sagittal axis. We suggest that adult signers' use of addressee-viewpoint in TİD may be motivated by the use of the two types of linguistic devices available for describing the locations of objects placed on the sagittal axis – though more research is needed to support this claim. To reiterate the findings, in these encodings, adult signers use relational lexemes before or after a classifier predicate and do so more frequently for describing objects on the sagittal axis than for objects on the lateral axis (e.g., Example (7) below). It is possible that employing body-anchored relational lexemes in TİD (i.e., forms that are produced at a fixed location on the body, e.g., touching the chest for *front* or reaching over the shoulder for *behind*) influences how signers place classifier predicates for Figure and Ground in the signing space. This seems to be the case especially for front-behind relations, as we describe in more detail below. Figure 3 presents a schematization of the proposed influence between the two types of devices. When both relational lexemes and classifier predicates are used in a relational encoding, the location of classifier predicates in the signing space parallels the spatial anchoring of the relational lexemes for front and behind on the signer's body. It seems that the signing space closer to the signer maps onto the 'behind' space, while space further from the signer maps to the 'in front of' space in placing the classifiers in the signing space.

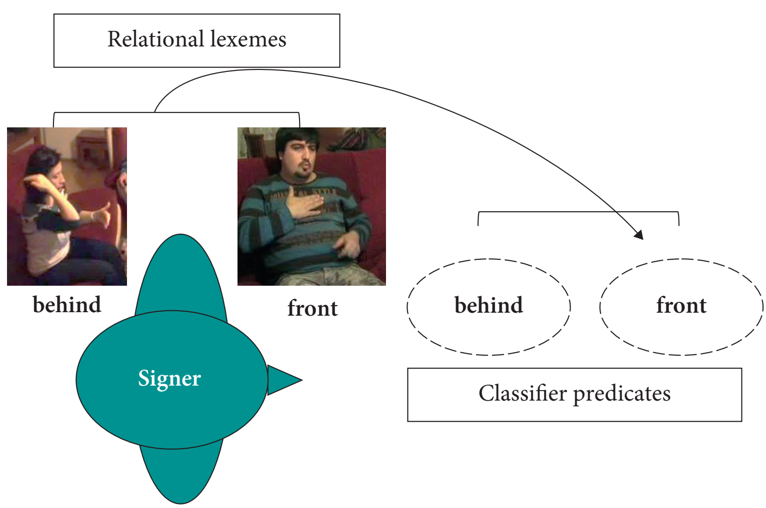
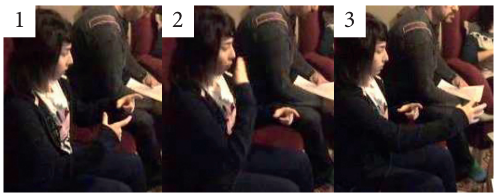


Figure 3. A schematic illustration of the spatial transposition of body-anchored relational lexemes front and behind onto signing space in the localization of classifier predicates in the TİD adult system

In the following example, an adult TİD signer is describing the picture that shows a ball (Figure) in front of a bowl (Ground). After introducing the Ground, she holds it in the signing space and uses the relational lexeme *front* to specify the relation of the Figure to the Ground. She then localizes the Figure with respect to the previously localized Ground object. In doing so, she uses the front area (far from the body) as indicated in Figure 3 above to encode the location of the Figure with respect to the Ground.

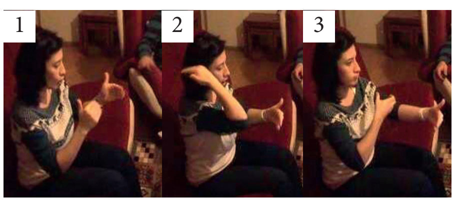
(7)



LeftHand:	BOWL$_{loc}$	----------- HOLD --------------	
RightHand:	BOWL$_{loc}$	FRONT	BALL$_{loc}$

Similarly in Example (8), the location of the Figure (cup) is expressed by two linguistic devices. After introducing and localizing the Ground (box), the signer uses the relational lexeme for *behind*, the form of which indicates the back of the body. Then, she also localizes the Figure with respect to the Ground. Note that the space that she uses to localize the Figure with respect to the Ground in this construction corresponds to the 'behind' area (close to the body) shown in the Figure 3.

(8)



LeftHand:	BOX$_{loc}$	-------------- HOLD -------------	
RightHand:	BOX$_{loc}$	BEHIND	CUP$_{loc}$

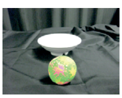
The signers' descriptions in (7) and (8) do not match the locations of the signs for the objects in signing space to the object locations as they see them in the picture. Thus, it seems as if these signers are describing the picture from the viewpoint of their addressees in terms of the use of space in their linguistic forms. We further argue that this spatial organization of the signing space with classifier predicates is motivated by the use of the relational lexemes *in front* and *behind* in TİD.

In the case of relational encodings for the lateral axis, the structure of TİD relational lexemes for left and right do not interfere with the analogue use of space, and thus we see a higher preference for signer-viewpoint in the relational encodings with the classifier predicates only. This could be due to the fact that the left side of the body used for the relational lexeme left (left arm tapped in the form of the sign for left) corresponds to the left side of the signing space and the right side of the body used for the relational lexeme right (right arm tapped in the form of the sign for right) to the right side of the signing space. This configuration matches how classifiers are placed in signing space from a signer-viewpoint – unlike what we see for addressee-viewpoint descriptions.

7.2 Child patterns

TİD-acquiring children, unlike adults, preferred to encode the spatial configuration as they saw it by preferring a single linguistic device (classifier predicates most of the time) for both axes.

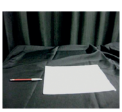
(9)



LeftHand: PLATE ----------- HOLD ----------

RightHand: PLATE BALL CL(round)$_{loc}$

(10)



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

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

It is possible that these children are initially doing more of a visual mapping of the objects they see onto the signing space. This might be an earlier developing strategy than using relational lexemes with classifier predicates, which in turn influences viewpoint choice in the use of space. This might also explain why TİD-acquiring children are faster in becoming adult-like in their viewpoint preferences for the lateral axis than for the sagittal axis encodings. However, the split in learning to express viewpoint for lateral versus sagittal axis indicates that even though signing children might be like speaking children in preferring signer-viewpoint earlier than addressee-viewpoint, this needs to be recalibrated based on the structure of other available linguistic devices. This would suggest a modality-dependent development of viewpoint expression. If this is indeed the case, it would indicate a hindering influence – rather than facilitating – of the visual modality in the domain of learning viewpoint-dependent spatial relations.

One caveat of our study is that we have not yet looked into how different viewpoints and the use of linguistic devices influence comprehension of these expressions. Before we generalize, we need more research on whether and how relational lexemes are used and on how addressee-viewpoint is comprehended by adult signers. We also need to understand better what to make of the variability of use of space for sagittal axis encodings in adults.

8. Conclusion

Taken together with the results of previous studies conducted with speaking children, our results suggest that children, regardless of the modality of the language they acquire, prefer to express viewpoint-dependent spatial relations from their own viewpoint first. Thus, it indicates that general principles of cognitive development are at work in learning to express viewpoint in such spatial relations (Piaget 1972; Moll, Meltzoff, Merzsch & Tomasello 2013). It also suggests, however, that TİD acquiring children need to go through a next step of tuning into the language-specific ways of expressing viewpoint in their own language – as also has been found for spoken languages.

Since this is the first study that has explored signing children's viewpoint preferences, these results should be further investigated in other sign languages in which relational lexemes might be more or less frequently used together with classifier predicates, or in which the phonological forms of relational lexemes might be different in relation to the body axes. This will provide further insights into modality-specific versus language-specific influences in the acquisition of viewpoint-dependent relations in sign and spoken languages.

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