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The representation of action in Italian Sign Language (LIS)

Abstract: The present study investigates the types of verb and symbolic representational strategies used by 10 deaf signing adults and 13 deaf signing children who described in Italian Sign Language 45 video clips representing nine action types generally communicated by five general verbs in spoken Italian. General verbs, in which the same sign was produced to refer to several different physical action types, were rarely used by either group of participants. Both signing children and adults usually produced specific depicting predicates by incorporating, through a representational strategy, the object and/or the modality of the action into the sign. As for the different types of representational strategies, the adults used the hand-as-object strategy more frequently than the children, who, in turn, preferred to use the hand-as-hand strategy, suggesting that different degrees of cognitive complexity are involved in these two symbolic strategies. Addressing the symbolic iconic strategies underlying sign formation could provide new insight into the perceptual and cognitive processes of linguistic meaning construction. The findings reported here support two main assumptions of cognitive linguistics applied to sign languages: there is a strong continuity between gestures and language; lexical units and depicting constructions derive from the same iconic core mechanism of sign creation.

Keywords: sign language, depicting constructions, representational strategies, gesture

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1 Introduction

1.1 Overview of the objectives of the study

Action verbs are predicates referring to physical actions. This semantic category is important not only from a theoretical standpoint but also in a pragmatic view because action verbs are high-frequency words in many spoken and written languages (Moneglia 2014b; Panunzi et al. 2014). In spoken languages, the same action verb can refer to many different actions and, in turn, the same action can be identified by more than one verb resulting in numerous variations within and across languages (Panunzi et al. 2014).

From an intralinguistic point of view, every language has various strategies available to represent actions. One linguistic strategy is to use a general verb, which is a lexeme that can be used to describe several different types of actions (e. g., the Italian verb *prendere*, 'to take'). Another strategy would be to use a predicate that narrows down the action to specific occurrences, such as the Italian verb *afferrare*, 'to grasp', which refers to actions of grasping and holding using a hand, therefore representing a smaller set of events. The first aim of the present study is to investigate the use and nature of general action verbs versus predicates referring to specific actions by deaf children and adults using Italian Sign Language (LIS). This will be carried out using a recently developed cross-linguistic model for physical action verbs analysis in spoken languages (IMAGACT).

An initial pilot study on deaf adults using LIS showed a strong tendency by signers to avoid the use of action predicates referring to multiple action types, which we will refer to as "general verbs". LIS signers preferred to use "specific predicates" for single action types, depicting either a physical action incorporating one or more arguments (e. g., object and/or instrument) or the way the action was performed. For example, in describing a video clip showing a car turning a corner and a clip showing a woman turning a book page (actions which would be described by the same general verb in Italian, i. e., *girare*, 'to turn'), signing deaf participants did not use the same sign, but rather two different signs depicting the two different types of action being performed. The second aim of this study is to analyze, in greater detail, specific depicting predicates produced by signing children and adults in order to better understand processes underlying depiction. Sign languages can be considered a special window on exploring the route from perception to concept construction as the linguistic embodiment of the perceptual experiences is visible (Wilcox and Xavier 2013). From this perspective, iconicity should be considered a core

aspect of the mapping process between a sign form and a meaning construction. In depicting actions, signers can either represent the way in which the action is performed by an agent with the entire body and/or with the hands, or they can represent the form, size, or shape of the object involved in the action. Studying how actions are represented in sign languages would further contribute to a broader cognitive approach to language by drawing attention to embodied, perceptual and motor experiences of language users (Occhino and Wilcox 2017). In the present study, we will avail ourselves of categories of representational strategies that have been developed to study different visual communication systems, such as child pantomimes, co-speech gestures, and signed languages (Marentette et al. 2016; Volterra et al. 2018). Data on action verbs in LIS users can also contribute to a better understanding of the developmental continuum from action to gesture to sign (in signed languages) or to word (in spoken languages) (Capirci et al. 2005; Volterra et al. 2017).

In the following subsections, we will present the Imagact ontology, different perspectives on depicting action in sign languages, and finally, symbolic representational strategies involved in action depiction reported by gesture and sign language studies.

1.2 A common ontology of action verbs

An analysis of high-frequency lexicon in Italian has shown that 50% of 1200 higher-frequency verbal lexemes are action verbs (Panunzi and Moneglia 2004). Action verbs are also frequently used in communicative interactions between hearing children and caregivers and are acquired early in spoken Italian (Caselli et al. 2015). The IMAGACT and MODELACT research projects (http://imagact.lablita.it, http://modelact.lablita.it) collected data from large corpora of spoken English and spoken Italian. The analyses of this data have led to the development of a two-dimensional grid to describe action verbs (Moneglia 2014a; Panunzi et al. 2014). One of the aims of the resulting ontology is to describe how cognitive action types are linguistically encoded by different spoken languages. The present study represents the first attempt to apply this ontology to analyzing how different cognitive action types are encoded in sign languages.

The vertical axis of the grid represents the possible semantic values of the target verb that can vary according to different action categories or types (henceforth 'vertical variations'). The horizontal axis provides variations of single examples, which all belong to the same action type on the vertical axis (henceforth 'horizontal variations'). For example, as simplified in Table 1, the Italian

Table 1: Example of 'vertical' action types and 'horizontal' exemplars for the English general action verb 'to turn'.

The English general verb 'to turn'		
Vertical variations (action types)	**Horizontal variation (distinct instantiations)**	
Type 1: The agent moves himself/herself in space	'John turns right'	'The taxi driver turns left'
Type 2: The agent moves an object in space	'John turns a book page'	'James turns his collar up'

general verb *girare* 'to turn', can refer to different action types that are semantically different as in the sentences 'John turns right' and 'John turns a book page'. The primary difference between these two action types is that, in the first sentence, the agent moves in space, whereas in the second sentence, the agent moves an object in space. As these two sentences refer to two different types of physical actions, they represent two different vertical variations of the same general verb. A competent speaker, aided by contextual cues, would easily identify the sentences 'The taxi driver turns left' as describing a similar action type as the sentence 'John turns right', as both involve an agent moving in space. The exact meanings of the two sentences are, of course, not the same. Nonetheless, according to the IMAGACT ontology, the two sentences refer to the same action type but involve distinct instantiations or horizontal variations.

Using this methodology, the IMAGACT Ontology has identified 1010 action types (vertical variations) through analyses of transcriptions of English and Italian spoken corpora. This corpus-based analysis first identified more than 500 verbs for each language, each of which refers to one or more types of physical actions. Each physical action referred to by the verbs was then represented by means of a single video clip (i. e., video clips showing either an agent turning her body towards or a driver in a car turning left).

The possible actions described by the Italian verb only partially overlap with the actions expressed by the corresponding action verb in English. For example, while the sentence 'Mario takes a pen from the table', can be translated in Italian using the Italian verb *prendere* 'to take' (*Mario prende la penna dal tavolo*), the sentence 'Mario takes the book to the professor downstairs', cannot be translated in Italian using the verb *prendere* 'to take', because in this case the correct Italian verb would be *portare* 'to bring' (*Mario porta il libro al professore al piano di sotto*) (Moneglia 2014b).

1.3 Frozen and productive lexicon in sign languages

The present work aims to investigate the use of *lexical signs* and *productive lexicon* in representing action verbs in LIS. Sign language linguistics traditionally distinguishes frozen from productive lexicon. Lexical signs (frozen lexicon) are conventionally fixed in form and in meaning, and are usually found in SL dictionaries.

Different labels have been used for these elements, for example: core lexicon, frozen signs, lexical units, or lexemes (Brentari and Padden 2001; Cormier et al. 2012; Johnston and Schembri 1999).

On the other hand, productive lexicon refers to complex structures, which are usually not reported in sign dictionaries and have also been given different labels, such as: classifiers (Frishberg 1975), polycomponential signs (Slobin et al. 2003), productive signs, or constructed actions (Cormier et al. 2016; Schembri 2003; Schembri et al. 2005), depicting constructions (Liddell 2003), depicting signs, enactments (Ferrara and Halvorsen 2018), highly iconic structures (Cuxac and Sallandre 2007).

The difference between these two categories is that lexical signs are discrete and listable units, and therefore considered entirely linguistic and part of the core signed lexicon; on the contrary, productive signs have a holistic structure and gradient variations. This categorical division between lexical and productive signs, however, has been recently questioned and an alternative way to analyze these structures has been proposed following a usage-based approach that considers features of language use as exhibiting different degrees of analysability (Lepic 2019; Lepic and Occhino 2018; Wilcox and Occhino 2017).

In LIS, action verbs can be expressed by means of lexical units as well as by means of productive lexicon. Figure 1 and Figure 2 (see Section 2.4.1) present, respectively, an example of a complex structure in LIS (i. e., productive lexicon) that incorporates more than one argument: (i) the action of taking; (ii) a cup that is grasped; and (iii) the location of the grasped cup and an example of frozen lexicon.

The use of what has been called *depicting verbs* in signed predicates has been addressed by many researchers of different sign languages (e. g., Erlenkamp 2009; Liddell 2003; Slobin and Hoiting 1994; Zeshan 2000). Nevertheless, overall there is very little literature specifically on verbs denoting actions in signed and spoken languages, especially compared to studies on motion events. Slobin and Hoiting (1994) investigated American Sign Language (ASL) and the Sign Language of the Netherlands (SLN, now called NGT) addressing in these two sign languages the typological classification of motion events as proposed by Talmy (1985) for spoken languages. The authors pointed out that motion events can be represented by

Figure 1: Example of the depicting predicate in LIS meaning 'to take a cup from the shelf'.

simultaneous expression of figure, path and manner of movement and therefore proposed categorizing sign languages as complex verb-framed languages (Slobin and Hoiting 1994). Liddell (2003) subdivided ASL depicting verbs into three categories: (i) expressing presence of an entity in a location, (ii) describing size and shape of an entity, (iii) representing actions and movements. Depicting verbs are described by Liddell (2003) as having fixed lexical features combined with a gradient form based on visual imagery that influences their meanings. From this perspective, depicting predicates in sign languages are thus similar to sentences rather than verbs, given that they are complex productive structures which not only can incorporate several arguments, but also can result in an infinite set of possible outcomes.

In early studies of sign languages, depicting predicates have been compared to classifier constructions in spoken languages. However, later research pointed out that the linguistic functions of this type of signed construction are not exactly equivalent to those of spoken language classifiers. For example, they fail to connect the sign to a specific semantic domain, as noun classifiers do in spoken language (e. g., the lexical numeral classifiers of Mandarin Chinese). Many sign language researchers have later considered it more appropriate to view depicting predicates as based on a cognitive mapping mechanism that blends formal properties of the signs and the representation of a certain event (for a review, see Emmorey 2003 or Liddell 2003; Erlenkamp 2009).

In our perspective, the mapping process depends on iconicity, seen as a core aspect of sign form and of the meaning construction process. Iconicity is more

than a simple mapping process between real world events/objects and formal properties of signs. As suggested by Wilcox (2004), iconicity indicates congruence of phonological and semantic structures, revealing a common conceptual space grounded in the cognitive abilities of language users and related to their perception of and interactions with the surrounding world. Addressing symbolic iconic strategies, underlying signs could thus provide new insight on the cognitive background mapping form to meaning.

1.4 The symbolic representational strategies involved in gestures and in depicting verbs

Looking at depicting properties peculiar to sign languages has prompted us to make a closer analysis of a second aspect of signed action verbs to see how specific predicates incorporate depicted actions. This question was addressed by looking at differences in representational strategies underlying specific predicate depictions produced by the participants.

Relevant to this topic is a central question posed by researchers from different academic traditions (i. e., from studies on symbol development, communicative gestures and sign languages), who face the need to analyze gestures and/ or signs: In signing and/or gesturing, do the body/hands represent real actions in the physical world (i. e., how an action is performed by the agent), or do they rather represent the object itself or its characteristics (e. g., size, shape)?

Recent studies conducted on gestures as well as on signs produced by adults and children have identified four main strategies, which are described by different terminologies depending on the academic discipline the description stems from: symbolic strategies, techniques or modes of representation, iconic strategies, and iconic depictions. Table 2 lists the different labels that have been used to describe each of the four representational strategies in symbolic developmental studies, in gestural studies on children and adults and in sign language studies. The labels used to identify these four strategies in the present paper are in bold.

Strategy (a), *own-body*, refers to the use of the entire body to depict a pattern of action performed by an agent that has many kinematic features in common with the real action that is being referred to. Strategy (b), *hand-as-hand*, refers to the use of the hand(s) to represent how an object is being held, grasped or manipulated and to show motor acts associated with object use. Strategy (c), *hand-as-object*, refers to the use of the hand(s) to represent either the object itself, or a part of it, or a class of objects. Strategy (d), *size and shape*, refers to the use of the hand(s) to represent the size and/or shape of an object, tracing the object's contours or the outcome path of a movement. In this strategy, the hand

Table 2: Terminology used for four representational strategies reported in the child development, gesture, and sign language literature, adapted from Marentette et al. (2016) and Volterra et al. (2018).

	In symbolic development studies (symbolic strategies)	In gesture studies on adults and children (techniques or modes of representation)	In sign language studies (iconic depictions)	Examples
a		**own-body** enactment mime/pantomime personification action gesture character viewpoint	constructed action body classifier person transfer	*turning*: rotating the torso/swiveling
b	imagined-object	**hand-as-hand** handling manipulation action gesture function gesture character viewpoint	constructed action handling classifier person transfer	*taking a cup*: fingers wrapped around an imaginary handle of a cup
c	body-part-as-object	**hand-as-object** modeling action gesture form gesture representing observer viewpoint	entity/ instrument classifier situation transfer form transfer	*turning over a book*: fingers stretched out to represent the book, the hand moves upside-down
d		**size-and-shape** depiction drawing delimitation observer viewpoint	size /shape specifier tracing form transfer	*tree*: tracing the form of the tree in the air

is used to describe the object but does not, as in the hand-as-object strategy, physically stand for the object itself.

These representational strategies used for depicting information about objects and events in gestures and signs highlight different types of embodied practices and may suggest a shared cognitive basis that is recruited by both communication systems.

Studies focusing specifically on symbolic development and using data from "elicited pantomimes" have reported that children older than three years of age asked to pretend to use an item (e. g., a comb), were more likely to produce hand-as-object gestures in which their hand took on the form of the object itself

(e. g., using their fingers to represent the teeth of a comb). Children older than 6 years of age also produced imagined objects in gestures but they pretended to hold and use the object and depicted its function (e. g., fingers bent as if holding an imaginary comb) (Boyatzis and Watson 1993; O'Reilly 1995). Evidence for a different kind of development was found in a recent study using a picture naming task in which young hearing Canadian and Italian children (two to three years old) were equally likely to adopt all four strategies in their gesture production, although with different frequency depending on their culture as well as on the object or event involved (Marentette et al. 2016).

In an analysis of spontaneous co-speech gestures of older children, Capirci et al. (2011) have also reported findings that contrast with those in the studies using elicited pantomimes. They suggested that these differing results could be due to different ages of the samples as well the smaller number of items (typically only 8) that had been used in the pantomime studies.

Kendon (2004) described different co-speech gestures in adult communication, showing that gesture is a medium that can be employed in many ways: to create objects, to describe their form or size, to talk about spatial relationships between objects or to represent actions. Similarly, Müller (2018), referring to these techniques as 'gestural modes of representation', points out that Kendon in his monumental opera 'Gesture' (2004) had already suggested that sign language classifiers have much in common with what has been described in gesture studies as representation techniques.

Padden et al. (2013, 2015), looking at patterned iconicity in the ASL lexicon, showed that the distribution of representational techniques can vary depending on the task. Adults seem to use different ASL signs, depending on whether they are naming an object (i. e., hand-as-object strategy) or are describing its use (i. e., hand-as-hand strategy).

A recent database of iconicity patterns in sign languages analyzes 87 concrete concepts (but not actions) in 19 different sign languages (Kimmelman et al. 2018). A preliminary analysis of these data also confirms that iconicity patterns vary across semantic fields and across languages.

Ortega et al. (2014) looked at Turkish Sign Language (TID) using a different taxonomy, dividing iconic depictions into two types: *action-based* (comparable to the first two representational strategies listed in Table 2, i. e., own-body and hand-as-hand) and *perception-based* strategies (comparable to the last two representational strategies listed in Table 2, i. e., hand-as-object and size-and-shape). The authors compared signs produced by adults and children concluding that both types of representational strategies are used, depending on the interaction context: adults interacting with adults produce more perceptual sign variants, whereas children interacting with adults produce more action-based signs.

Finally, Cormier et al. (2013) looked at the representation of actions in British Sign Language (BSL) using short cartoon clips to elicit a narrative, and focused on the differences between adults and children. The authors investigated different use of lexical items and of depicting strategies (i. e., constructed actions and depicting constructions). Their definition of constructed action is such that it may be taken to refer to similar items as the ones identified by the first two strategies reported in Table 2, while depicting construction may refer to the latter two strategies reported in Table 2. The study's main finding was that adults used simultaneous constructions (namely lexical items plus depicting strategies) more frequently than children did.

Interestingly, the classification proposed in Table 2 is comparable to David McNeill's classification for speakers' gestures, which is based on a distinction between a character viewpoint (supposedly mostly used in transitive utterances) and an observer viewpoint (associated with intransitive events). It is relevant to our study of action verbs that McNeill also pointed out that the character viewpoint is particularly used in relation to events where an agent acts on an object (McNeill 1992, 2005).

In a recent study by Ortega and Özyürek (2019), silent gestures were elicited in order to explore the implementation of four different types of iconic representation: acting, representing, drawing, and personification. The authors found systematicity in gestural forms across participants with different types of iconicity aligning with specific semantic domains.

Brentari et al. (2015) compared productions of Italian and American hearing persons who were requested to use silent gestures vs. deaf signers requested to use signs to describe the same video clips. They found that in both cultures (American and Italian), signed languages (LIS and ASL) and spoken languages (Italian and English), signers and gesturers (both adults and children) were more likely to represent agentive situations (i. e., people acting on objects) using handling strategies (i. e., hand-as-hand) rather than entity strategies (i. e., hand-as-object).

This brief overview of data of representational strategies use, considering both gestures and sign languages, suggests that studies analyzing signed productions performed by children and adults may benefit from using a uniform classification system such as the one proposed in Table 2. Furthermore, the analysis of specific depicting predicates in terms of representational strategies used by children and by adults could help us understand whether the strategy used is influenced by not only semantic but also other factors (e. g., age of participants).

Since sign language may use iconicity to exactly represent a specific action, by reproducing it in all its aspects (e. g., using the prehension used by the agent in grasping an object, or representing an object's salient feature by the hand), we hypothesized that both groups of deaf participants, children and adults,

would produce specific depicting predicates for each type of different action more frequently than general verbs.

Concerning the representational strategies, we hypothesized that the item to be described would influence the strategy used by both deaf signing children and adults, as it happens in hearing children's spontaneous gestures (Marentette et al. 2016).

2 Materials and methods

2.1 Materials

To gather data on how actions are represented in LIS by deaf children and adults, the Institute of Cognitive Sciences and Technology of the Italian National Research Council (ISTC-CNR) has designed an elicitation task for five action verbs using material video clips from the IMAGACT Ontology as stimuli.

The five general action verbs chosen are *prendere* ('to take'), *aprire* ('to open'), *girare* ('to turn'), *rompere* ('to break'), and *attaccare* ('to attach'). These verbs occur frequently in the lexicon of Italian hearing children according to studies using the Italian version of the MacArthur-Bates Communicative Development Inventory (Caselli et al. 2015; Rinaldi et al. 2019).

Table 3 shows a list of the five target Italian predicates (with English translations). For each predicate, examples of three different action types (termed here 'vertical variations') are listed with a description of each type of variation provided in SMALL CAPS. For each action type, three examples are given ('horizontal variations'). For example, three different actions (i) *prendere un libro dal tavolo* ('to take a book from the table'); (ii) *prendere una tazza dallo scaffale* ('to take a cup from the shelf'); and (iii) *prendere un mazzo di chiavi da terra* ('to pick up a bunch of keys from the floor'), refer to the same action type, a vertical variation of the dislocation of an object that is manipulated by a semantic agent. These three examples differ in the semantic value of the position of the object with respect to the body of the agent.

It is interesting to note that in many of the cases reported in Table 3, different English verbs are used for the vertical types as well as for the horizontal variations, whereas the same general Italian verb is accepted for all types and variations. In each language, each action may also be identified through other available lexical alternatives. More details about action identification and local equivalence of action verbs can be found at http://www.imagact.it/.

As stimulus materials, 45 videos referring to the 15 action types (3 vertical variations for each of the 5 general verbs) have been used. In the videos, real

Table 3: List of the five Italian predicates (with English translation) considered in this study. For each predicate, examples of three different action types (vertical variations) are listed. A description of each action type is provided in uppercase. For each action type, three examples of horizontal variations are reported.

Types – Vertical variations	Horizontal variations		
	Prendere – 'to take'		
Type 1 (DISLOCATION OF THE THEME THAT IS TAKEN UNDER AGENT'S CONTROL – variation in the original position of the *theme* with respect to the *agent*'s body)	*Prendere un libro dal tavolo* 'To take a book from the table'	*Prendere una tazza dallo scaffale* 'To take a cup from the shelf'	*Prendere un mazzo di chiavi da terra* 'To pick up a bunch of keys from the floor'
Type 2 (DISLOCATION OF THE THEME IN A CONTAINING RELATION FRAME – variation in the *theme/container* relation)	*Prendere una scatolina dal contenitore* 'To take a packet out of a small container'	*Prendere le buste della spesa dal bagagliaio* 'To unload bags of groceries from a car trunk'	*Prendere i fazzoletti* 'To take paper handkerchiefs'
Type 3 (THEME UNDERGOES A CHANGE OF POSSESSION – variation in the *theme/source* relation)	*Prendere un libro dalle mani di un'altra persona* 'To grab a book out of another person's hands'	*Prendere il portafogli* 'To take a wallet from someone'	*Prendere i gioielli* 'To take the jewelry from a shelf'
	Attaccare – 'to attach'		
Type 1 (THEME IS HANGED OFF AN OBJECT OF REFERENCE BY AN AGENT – variation in the quality of the resulting state of the action)	*Attaccare il cappotto* 'To hang up a coat'	*Attaccare un giocattolo al soffitto* 'To attach a toy to a hanging chain'	*Attaccare un panno sullo stendipanni* 'To hang up a towel on a line'
Type 2 (THEME IS CONNECTED, WITH RESPECT TO ITS PARTS OR TO AN EXTERNAL OBJECT OF REFERENCE, BY AN AGENT – variation in the quality of the resulting state of the action)	*Attaccare le catene* 'To connect two chains together'	*Attaccare le due parti di un oggetto* 'To put two pieces of an object together'	*Attaccare il tavolo al muro* 'To move a table against a wall'
Type 3 (THEME IS STUCK ON A FRAME/ DESTINATION BY AN AGENT – variation in the instrument that allows the result)	*Attaccare il cartoncino (con la colla)* 'To glue a paper on a piece of cardboard'	*Attaccare un post-it sulla porta* 'To tape a note to a door'	*Attaccare un biglietto sulla bacheca* 'To pin a note to a bulletin board'

(*continued*)

Table 3: (*continued*)

Types – Vertical variations	Horizontal variations		
	Rompere – 'to break'		
Type 1 (THEME IS BROKEN IN TWO PARTS BY AN AGENT – variation in the shape of theme and manner of action)	*Rompere una matita* 'To break a pencil in two'	*Rompere una corda* 'To tear apart a frayed rope'	*Rompere una tavoletta* 'To split a piece of wood'
Type 2 (THEME IS MADE NOT USABLE BY AN AGENT – variation in the loss of the theme functionality)	*Rompere la ruota* 'To twist a wheel off a toy car'	*Rompere il fondo della cassetta della frutta* 'To hammer a hole in a fruit carton'	*Rompere la seduta della sedia* 'To rip the seat off a chair'
Type 3 (THEME IS SMASHED UP BY AN AGENT – variation in the manner of breaking)	*Rompere una bottiglia* 'To crash a bottle'	*Rompere una cassetta della frutta* 'To break apart a fruit carton'	*Rompere un vaso con un martello* 'To crash a flowerpot with a hammer'
	Girare – 'to turn'		
Type 1 (THE ACTOR CHANGES THE ORIENTATION OF HIS BODY – variation in the manner of orientation change)	*Girarsi solo con il busto* 'To twist around'	*Girarsi completamente* 'To turn the whole body around'	*Girarsi facendo perno con il piede* 'To twist around (to pivot on the foot)'
Type 2 (THE AGENT CHANGES THE ORIENTATION OF THE THEME – variation in the shape of the theme)	*Girare un libro* 'To turn over the book'	*Girare una cartolina* 'To turn over a postcard'	*Girare una tazza* 'To turn a cup upside down'
Type 3 (THE AGENT STIRS THE THEME – variation in the texture of the theme)	*Girare la minestra* 'To stir a soup'	*Girare le zucchine* 'To stir zucchini'	*Girare l'impasto* 'To stir a bowl of porridge'
	Aprire – To open		
Type 1 (OPENING THE THEME MAKES ITS CONTENT ACCESSIBLE – variation in the manner of the action)	*Aprire una scatola completamente* 'To takes the lid off a box (completely)'	*Aprire una scatola in parte* 'Lift the lid and set it on the rim of a box'	*Aprire una bottiglia di vino* 'To open/uncork a bottle of wine'

(*continued*)

Table 3: (*continued*)

Types – Vertical variations		Horizontal variations	
Type 2 (OPENING THE THEME RESULTS IN A BREAKING/CUTTING EVENT THAT MAKES ITS CONTENT ACCESSIBLE – variation in the manner of the action)	*Aprire una noce* 'To crack/open a nut'	*Aprire un uovo* 'To break an egg'	*Aprire un panino* 'To split/open a bread'
Type 3 (THE ACTOR OPENS A PART OF HIS OWN BODY – variation in the body part)	*Aprire gli occhi* 'To open eyes'	*Aprire la mano* 'To spread/open a hand'	*Aprire la bocca* 'To open the mouth wide'

objects are manipulated, and other visual information is restricted to essential elements to reduce distractors. The same videos were used to test both adults and children.

2.2 Participants

Two groups performed the linguistic task: 10 deaf adults (5 female; mean age 33.8 years; range 20–47 years) and 13 deaf children (8 females; mean age 9.5 years; range 8–11 years). At the time of data collection, all 13 children were attending a bimodal bilingual school where spoken/written Italian and LIS were used daily (for a more detailed description of the bimodal bilingual school, see Di Gregorio et al. 2019). Eight of the children were native signers, the remaining 5 had been exposed to LIS between 3 and 6 years of age.

All the participants in the adult group were members of the local Deaf community. Five of them had deaf parents and were native signers, while the other five had hearing parents and had acquired LIS later in life. We included these non-native adult signers as all had many years of signing experience at the time of data collection. As has been noted for other sign languages (e. g., Cormier et al. 2012 for British Sign Language), native learners are not the norm in many LIS Deaf communities, as the majority of sign language users have hearing parents and are exposed to and acquire their sign language at different ages and in different contexts (e. g., from deaf family members, at bilingual programs at school, or by daily contact with signing peers). We therefore feel that our sample reflects the heterogeneous composition of the LIS users' linguistic community.

2.3 Procedure

The children and adults all performed the same task. They were asked to watch the 45 videos one at a time and describe what was happening. One extra clip was used as a practice trial and therefore was not included in the analyses. Data were collected by two deaf colleagues, both native signers of LIS. All descriptions produced by the 23 participants have been video recorded for a total of 1035 videos (585 videos for children and 450 for adults).

2.4 Annotation and coding

All LIS productions were annotated using ELAN multimedia annotation software (2018) (http://tla.mpi.nl/tools/tla-tools/elan/). Annotation of the 1035 videos was conducted in two stages: (i) annotation of predicate type and (ii) coding of the symbolic representational strategy involved.

2.4.1 Predicate type annotation

In the first stage, productions were annotated according to the following linguistic categories:

(1)   General predicate: A sign was coded as a general predicate if it was used by participants to describe at least two different action types (vertical variations listed in Table 3 and Figure 2).

Figure 2: Screen capture of the video clip 'to take a cup from the shelf' and an example of a LIS general predicate with this meaning.

(2) Specific predicate: If a sign was used to describe only one action type, it was considered to be a specific predicate (Figure 3).
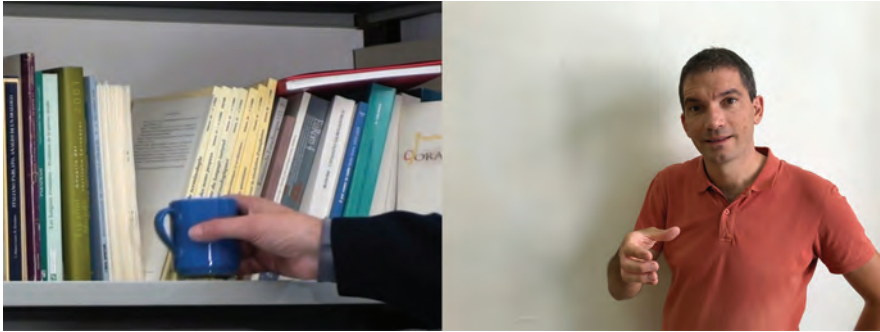
Figure 3: Screen capture of the video clip 'to take a cup from the shelf' and an example of a specific predicate with this meaning.

(3) Mixed production: A production was coded as mixed when an action was described using sequential productions including both a general and a specific predicate (Figure 4).

Figure 4: Screen capture of the video clip 'to take a cup from the shelf' and an example of a LIS mixed production (general predicate + specific predicate).

(4) Semantically related predicates: These productions were semantically adequate, but they did not depict the target physical action. For example, in the case of the videoclip for the action 'to take a wallet', the visual stimulus shows a man taking a wallet from another man's back pocket. In describing this video some participants produced the sign TO STEAL (in its conventional form), instead of something referring to the action of 'taking'. Clearly, this sign is completely acceptable to describe this scene, but it is

not interpretable as a predicate describing a physical action since its salient semantic value relates to the social interpretation of the action (Figure 5).

Figure 5: Screen capture of the video clip 'to take a wallet' and an example of a LIS semantically related predicate with the meaning 'to steal'.

(5)   Off-target: These productions did not refer to the target physical action shown in the clip. An example of an off-target response would be to describe the action of 'turning the whole body around' with the sign ELECTRICITY.

2.4.2 Symbolic representational strategy coding

In the second stage, all productions which had been classified as specific predicates (i. e., predicates referring only to one action type) were coded according to the symbolic representational strategies involved, using the taxonomy proposed in Table 2 that classifies gestures and signs according to the semantic role performed by the hands and by the body of the speaker/signer.

We coded all the specific depicting predicates as belonging to one of the following strategies:

(1)   *Own-body:* Signs that include depictions of the movements of an animate agent. For example, some participants represented the action 'to turn the whole body around' with their own body or the action 'to open the mouth wide' by opening their own mouth (Figure 6a).

(2)   *Hand-as-hand:* Signs in which the hand acts as a hand, portraying how an object is held or manipulated as well as motions associated with using the object. For example, in the case of 'to connect two chains together', a signer
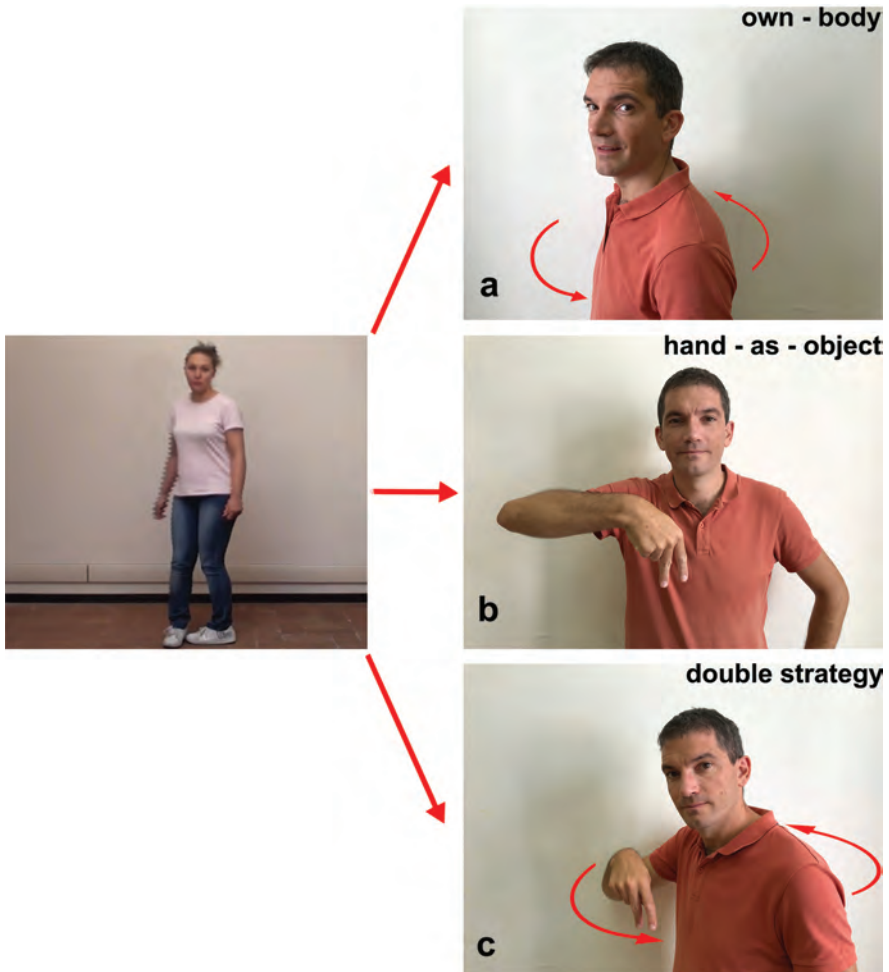
Figure 6: Screen capture of the video clip 'to turn the whole body around' and examples of (a) own-body strategy, (b) hand-as-object strategy, and (c) double strategy (own-body and hand-as-object produced simultaneously).

      can use a specific handshape and movement to reflect how the chains would be grasped and the physical manipulation of the chains (Figure 7a).

(3) *Hand-as-object:* Signs in which the hand acts as/stands for the object itself. This category included signs representing an object's salient features that is indicated by the form of the hand. For example, the same action of 'to connect two chains together' can be referred to by the curved index fingers, representing the individual chains and a movement connecting them' (Figure 7b).
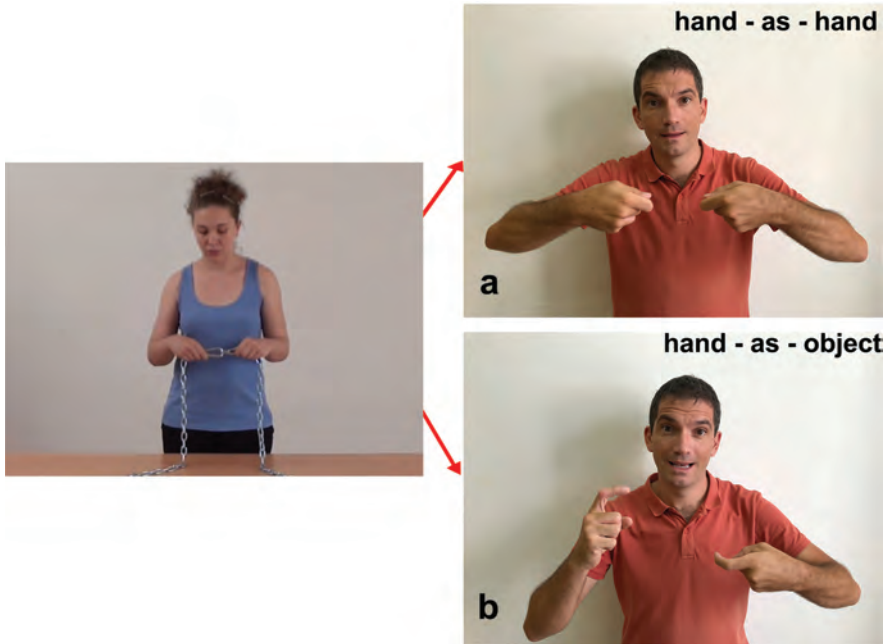
Figure 7: Screen capture of the video clip 'to connect two chains together' and examples of (a) hand-as-hand strategy, and (b) hand-as-object strategy.

(4)   *Size-and-shape:* Signs in which the hands depict a salient trait of an object's size or shape, for example by tracing the contours of the object.

Both the hand-as-hand strategy and the own-body strategy are types of enactment. The difference between them is that in the latter, it is the whole body (not only the hands) that carries the most salient semantic information of the action. Finally, given that our study considered predicates denoting actions, we did not expect that the size-and-shape representational strategy would be used by our participants.

We coded productions as *double strategy* when participants simultaneously or sequentially used two specific predicates involving two different representational strategies. As shown in Figure 6c, the signer simultaneously twists his torso (own-body strategy) and turns two fingers representing the legs of the twisting person (hand-as-object strategy). In other productions describing the action of turning over a postcard, some participants first turned one flat hand over (a hand-as-object strategy) and then repeated the same movement of the hand showed in the video-clip which involves a grasping handshape (a hand-as-hand strategy).

To calculate agreement between coders, video recordings of the productions of 4 participants (17% of total productions) were independently scored by two fluent LIS signing hearing coders, who are among the authors of this paper. We first calculated the agreement on the type of predicate (i. e., general predicate, specific predicate, mixed production, semantically related, and off target). We found that the percentage of overall agreement was 95.5% with K = 0.91 (95% confidence intervals: 0.85–0.97). Secondly, we calculated the agreement on the representational strategy used (i. e., own-body, hand-as-hand, hand-as-object, size and shape, and double strategy productions). In this case, the percentage of overall agreement was 92.6% with K = 0.83 (95% confidence intervals: 0.72–0.94). According to Landis and Koch (1977), both values of K can be interpreted as almost perfect agreement. A third coder, a deaf native signer, arbitrated in cases of any disagreement.

3 Results

3.1 Types of production

Each participant described the 45 videos one at a time. Figure 8 shows the distribution of answers into the five categories described above (i. e., general predicate, specific predicate, mixed production, semantically related, off target) for both adults and children. In describing the 45 videos, adults used on average
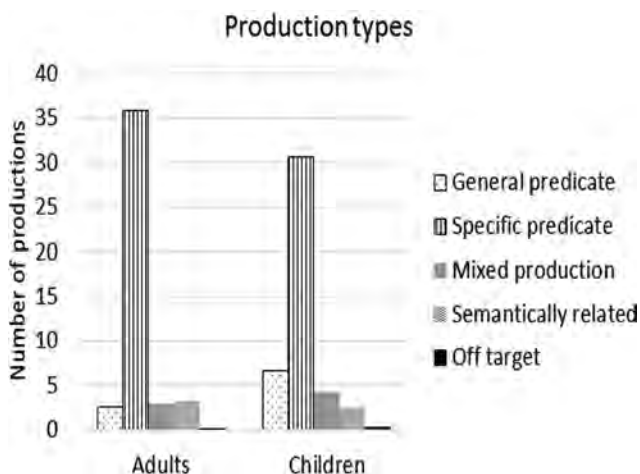
Figure 8: Distribution of types of productions by adults and children.

general predicates 2.6 times (S.D. = 1.84), specific predicates 35.9 times (S.D. = 4.09), mixed productions 2.9 times (S.D. = 1.73), semantically related predicates 3.3 times (S.D. = 1.64), and off target productions 0.2 times (S.D. = 0.42). In productions by children, general predicates were produced on average 6.69 times (S.D. = 6.07), specific predicates 30.62 times (S.D. = 5.87), mixed productions 4.31 times (S.D. = 2.87), semantically related predicates 2.46 times (S.D. = 1.51), and off target productions 0.31 times (S.D. = 0.63).

As shown in Figures 9 and 10, we also analyzed the types of production in relation to the different five target verbs. General predicates were rarely produced by adults, and when so, only to describe actions expressed in Italian by the verbs: 'to take' and 'to break'. The mixed productions, on the other hand, were mostly produced in describing the actions of 'breaking' and rarely used in describing other actions. Figure 14 shows the general predicate signs used by adults to represent the five action predicates. The signs shown in Figure 14a and Figure 14b (in the following section) representing the predicates 'to take' and 'to break' respectively, were also used in mixed productions.
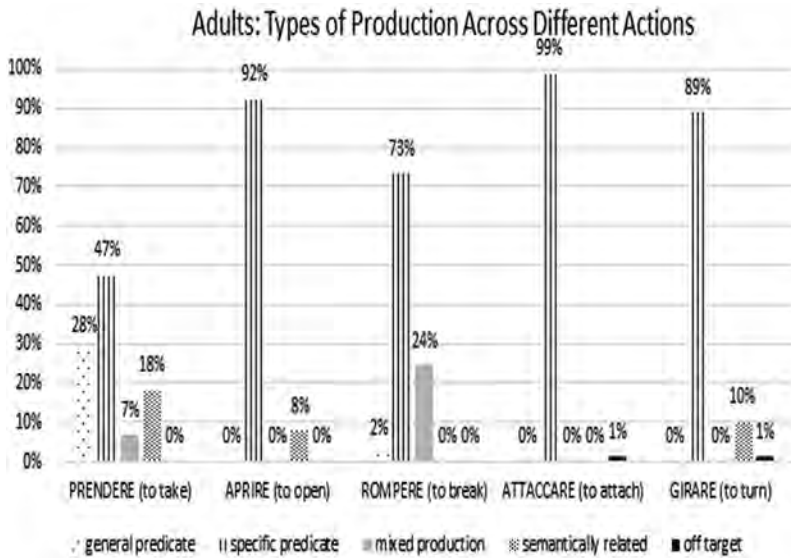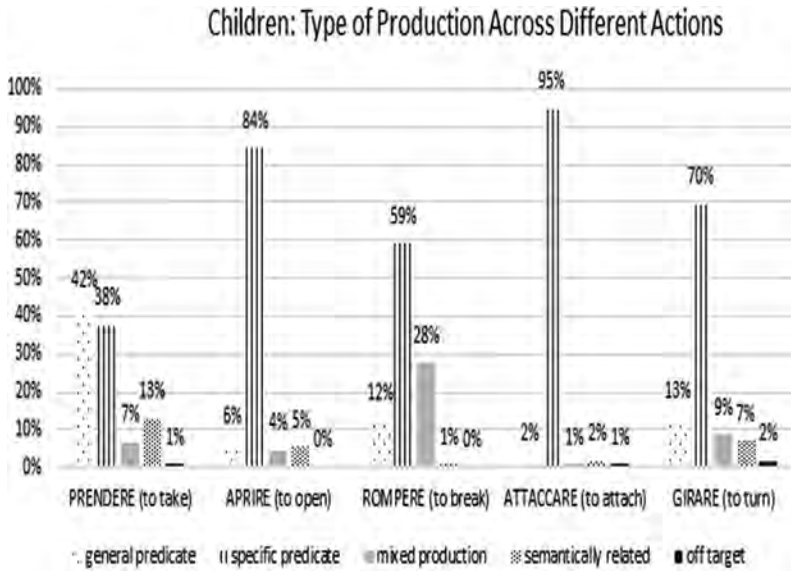

Figure 9: Types of production across different actions by adults.

Like for adults, we investigated in the children data the types of production in relation to the targeted verbs. We found different qualitative and quantitative use of general predicates compared to the adults, as shown in Figure 9. Like

**Figure 10:** Types of production across different actions by children.

adults, children used general predicates to describe action types referring to the verbs 'to take' and 'to break', but in addition, they also used general predicates in describing some videos eliciting the verbs to 'open', 'to attach' and 'to turn' (Figure 10 and Figures 14 c, d, e). However, we found no difference from the adults in their use of mixed productions, which the child also mostly used to refer to the action of 'breaking'.

A 2×5 Repeated Measures ANOVA with group (two levels: adults and children) as between subjects factor and type of answer provided as within subjects factor (five levels: general predicate, specific predicate, mixed production, semantically related predicate, off target production) was run to investigate statistical significance of the differences in the types of answers provided by adults and children. The two main effects as well as the interaction between the two factors have been tested. With respect to the two main effects, ANOVA showed no significant effect of the group, but a significant effect of the type of answer ($F(4,18) = 1004.904$, $p = 0.001$, eta squared = 0.99). Planned comparisons showed that specific predicates were produced significantly more frequently than the other four types of answers (all ps < 0.001), and that off target productions were less frequently produced than the other types of answers (all ps < 0.001). No significant differences emerged between other pairs in this comparison.

The interaction between the two factors *Type of answer x Group* approached significance (F(4,18) = 2.665, *p* = 0.06, eta squared = 0.37). Planned comparisons showed that children produced general predicates more frequently than adults, who in turn produced specific predicates more frequently than children (both *p*s > 0.05). There were no significant differences in the other levels of the factor.

3.2 Specific predicates and representational strategies

As reported above, specific predicates were the most frequent predicate type produced by children as well as adults. The specific predicates produced by participants were further analyzed to study the representational strategies involved according to the classification shown in Table 2. Percentages of 'hand-as-object', 'hand-as-hand', 'own-body', 'size and shape', and 'double strategy' were calculated as shown in Figure 11. As expected, neither adults, nor children ever used the size-and-shape strategy.
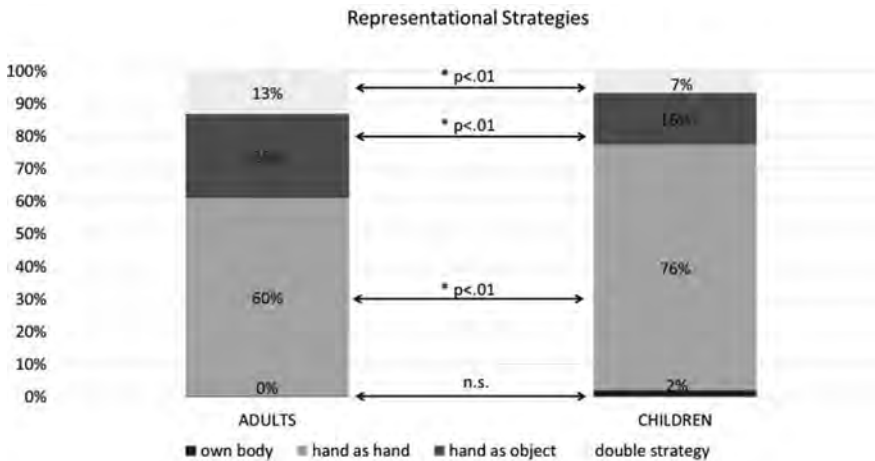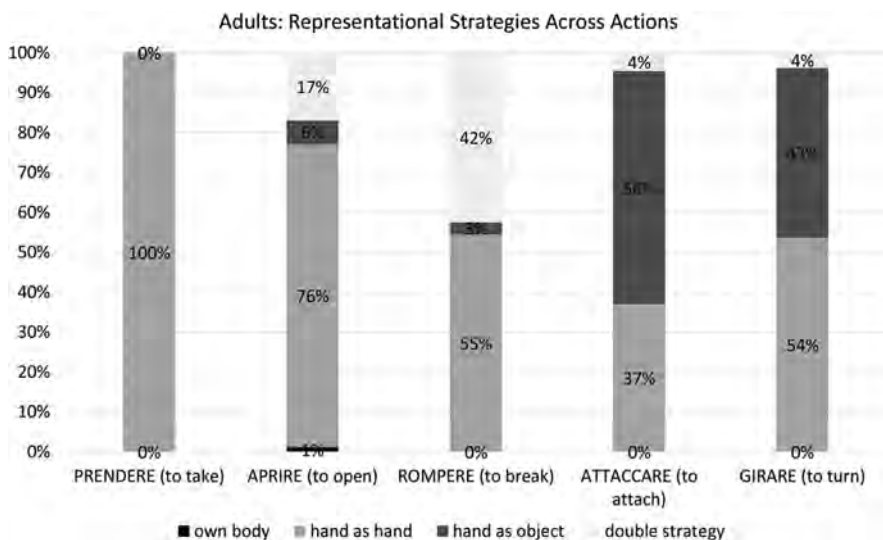

Figure 11: Distribution of representational strategies produced by adults and children.

In the adult data, 60.06% (S.D. = 7.04) of the specific verbs involved the hand-as-hand strategy, 26.58% (S.D. = 7.73) the hand-as-object strategy, 13.09% (S.D. = 7.16) a double strategy and 0.27% (S.D. = 0.85) the own-body strategy.

In the children data, 75.53% (S.D. = 6.27) of the specific verbs involved the hand-as-hand strategy, 15.82% (S.D. = 4.81) the hand-as-object strategy, 6.83% (S.D. = 5.09) the use of a double strategy and 1.83% (S.D. = 3.24) the own-body strategy.

Figure 12 and Figure 13 show the distribution of these representational strategies among the five verbs for adults and children, respectively. In describing the action types of 'taking', all the specific predicates produced were performed using the hand-as-hand strategy. In contrast, in describing the action types of 'attaching,' adults preferred the hand-as-object strategy, while children preferred the hand-as-hand strategy.

Figure 12: Distribution of representational strategies across different actions produced by adults.

Double strategies were used by both groups in many different combinations. Both adults and children used this strategy to refer to the actions of 'opening' and 'turning'. For example, some adults and children described the videos showing a woman opening her eyes or a man opening his mouth by using the hands (hand-as-object strategy) and simultaneously by opening their own eyes or mouth (own-body strategy). Another example, from children and adults' data, was the combination of hand-as-hand and hand-as-object strategy. For example, the action of 'attaching two parts of a chain' was described by using a hand-as-hand strategy to depict the holding of the chain, while the second hand represented the object attached (hand-as-object strategy).
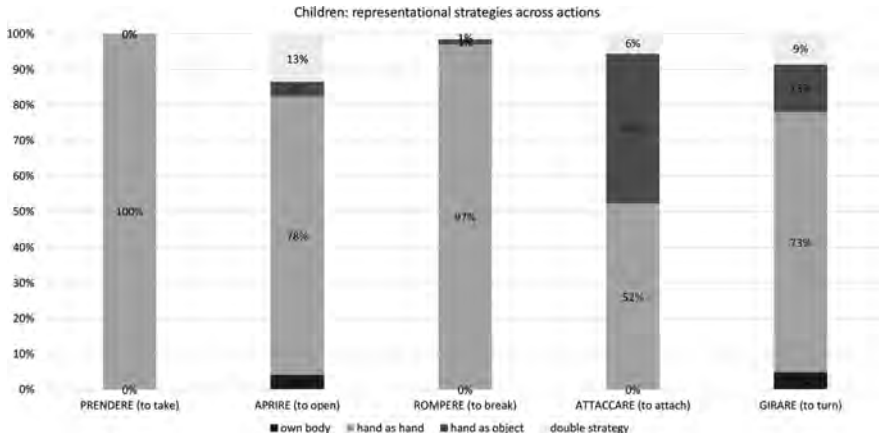
Figure 13: Distribution of representational strategies across different actions produced by children.

The differences between the two groups in the use of different strategies were investigated with non-parametric statistics (Mann-Whitney U test) as these measures represented percentages out of a given number of specific verbs produced. The two groups significantly differed in the use of three strategies. In particular, as compared to adults, children used significantly less the hand-as-object and the double strategy ($z = -3.226$; $p < 0.01$ and $z = -2.173$; $p < 0.05$, respectively), while they used significantly more frequently the hand-as-hand strategy ($z = -3.756$; $p < 0.001$). No significant difference emerged in the use of the own-body strategy, which was, anyhow, rarely used by both groups.

4 Discussion

4.1 Specific depicting predicates and general predicates

The present study contributes to better understanding of how physical actions are represented in LIS. The main finding was that both adult and children LIS signers tended more often to refer to each action type with specific rather than general predicates. In addition, our data showed that action types are most often represented using a depictive strategy that incorporates the object and/or the modality of the action into the sign. This clear pattern of preference, more evident in adults than children, supports the

hypothesis that depicting constructions play an important role in sign languages. Our study also adds to current literature by showing that this phenomenon occurs not only in complex narrative contexts, but also in single sign descriptions of short video clips portraying human actions (Cormier et al. 2013). Studies of sign languages can thus open up for us a new way to explore the route from perception to conception by showing how action types differing perceptually and motorically can lead to different conceptual representations and to different lexical forms.

The use of general predicates (i. e., the use of the same sign to represent a range of different actions) appears to occur only sporadically in our data from both children and adult signers. The few general predicates produced were conventionalized signs of the LIS lexicon, standardized in form and meaning and listed in LIS dictionaries to refer to those verbs. The signs 'to take' (Figure 14a), 'to break' (Figure 14b) and 'to open' (Figure 14c) are well attested in several LIS dictionaries (Angelini et al. 1991; Magarotto 1996; Radutzky 1992; Romeo 1991). The sign 'to attach' (Figure 14d) is found only in an online dictionary (spreadthesign.com) within a lexical compound, while the sign 'to turn' (Figure 14e) was found only in one printed dictionary (Romeo 1991) and in the online dictionary mentioned above within a lexical compound.

We found the highest percentage of use of a general predicate in the descriptions of the videos that portrayed actions for 'to take'. A possible explanation for this may be connected to the fact that the general predicate for 'to take' replicates a general grasping action. In all the nine videos shown to our participants that portray this action type, the actions were occurrences of a grasping act performed on different objects but involving a similar grasping action. In contrast, for the action 'to open', the videos portrayed a range of different actions linked to a general predicate in spoken Italian (see Table 3).

For the actions for 'to break', the LIS general predicate was rarely produced, but when it was, it occurred as part of a mixed production in combination with a sign depicting the specific action performed by the actor with the hands or with an instrument and/or with a sign depicting the broken object.

In these mixed productions, the two types of predicates, specific and general, were combined in different orders. In some productions, the specific predicate indicating the way in which the 'breaking' action is performed preceded the general verb (Figure 15), while in other productions, the opposite order was used (Figure 16). Independently of the order of the signs, the information added by the second predicate was only partially redundant, usually offering a more in-depth depiction. The signer seems to be able to place this added information before or after signing the general predicate of 'to break' either by showing how

Figure 14: The conventionalized signs meaning (a) to take, (b) to break, (c) to open, (d) to attach, and (e) to turn, as produced by participants and reported in LIS dictionaries.

the action had been performed (e. g., hitting with a hammer), or describing how the object appeared in the video after the action was performed (e. g., a shattered vase). Further studies are necessary in order to investigate whether the different order reflects different linguistic strategies, or different communicative intentions in depiction.

Figure 15: Screen capture of the video clip 'to smash a flowerpot with a hammer' and example of mixed production (specific predicate + general verb).

Figure 16: Screen capture of the video clip 'to rip the seat off a chair' and example of mixed production (general verb + specific predicate).

4.2 Representational strategies used in specific depicting predicates

We identified and analyzed the most frequently occurring representational strategies used in the production of specific depicting predicates. Results indicate that all strategies were used except for size-and-shape. Hand-as-hand was the most frequent strategy used by both children and adults. This result is consistent with the predominance of hand-as-hand strategy as documented in studies that consider the representation of agents acting on objects in hearing children's spontaneous gestures (Marentette et al. 2016), and in elicited productions of gesturers and signers (Brentari et al. 2015), of signers (Ortega et al. 2014) and of gesturers (Ortega and Özyürek 2019).

The hand-as-object strategy was significantly less used by all participants compared to the hand-as-hand strategy, although adults did use this strategy significantly more often than children.

The own-body strategy was very rarely used by itself (i. e., not in combination with other strategies) by both groups: only once by an adult (referring to the action 'to open') and in very few instances by children, again when referring to the same action. The own-body strategy was used more often in combination

with the other two strategies as a double strategy. For example, participants represented the action 'to turn the whole body around' using simultaneously their body and the hand-as-object strategy (see Figure 6b).

Which representational strategy is used seems to be influenced by the semantics of actions represented in the videos. For example, participants who described the videos showing the action 'to take' by using the hand-as-hand strategy were focusing on the acting agent represented in the videos.

Nevertheless, there are some action types that allow the use of both hand-as-hand and hand-as-object strategies. For example, in the clips referring to the action 'to attach', many of the action types have been described using one or the other strategy by adults and children. Sign languages offer the possibility to be, in signing, either 'in the action' by taking the role of the agent and acting as if being the agent (character viewpoint), or 'out of the action' by taking the role of a person observing the action (observer viewpoint). The choice of strategy here thus seemed to depend on the signers' contextual decision of whether to focus on the agent, hence using the hand-as-hand strategy, or on the object, thus using the hand-as-object strategy. In the first case, the signer adopts a character viewpoint, whereas in the second case an observer viewpoint is adopted (see Table 2).

The significant difference found in our data of adults using the hand-as-object strategy more often than children appears to support the hypothesis put forward by Taub (2001), who claimed that the use of this strategy requires a higher linguistic competence. For productions involving the hand-as-hand strategy, the signer replicates a motor action already in a repertoire that had been acquired with everyday experiences in handling objects, the difference being in signing that it is an imagined object that is being handled. The hand-as-object strategy, however, requires a further level of mental representation, as using the hand(s) to represent an object requires matching the hand(s) to a mental image of some aspect of the object.

As reported earlier (section 1.4), some previous studies on children's elicited pantomime had reached the opposite conclusion that hand-as-hand gestures that manipulate imagined objects are more complex symbolic acts compared to the representation of objects (hand-as-object) (Dick et al. 2005; O'Reilly 1995). However, Capirci et al. (2011), analyzing data of spontaneous co-speech gestures in hearing children's narratives, suggested that the hand-as-object strategy, which depicts aspects of the object, appears to be more abstract and more flexible compared to the hand-as-hand strategy which replicates manipulative acts made and observed in the physical world.

Our results, drawing on both children's and adults' data, are clearly more consistent with those of Taub (2001) and especially Capirci et al. (2011), who suggested a possible developmental trajectory from the hand-as-hand strategy towards the hand-as-object strategy. By reproducing the actual action, the hand-

as-hand strategy appears to be a more concrete way of representing the action, whereas the hand-as-object strategy appears to be a more abstract representation.

We further propose that the representational strategies which have been used in this research to classify the specific predicates of sign languages, which are usually iconic depictive forms of the 'productive' lexicon and are not listed in most sign language dictionaries, could also be used in the description of general predicates, the items which are described in most dictionaries. The consideration of representational strategies involved in conventional signs has also been used in a comparison of the lexicons of Swiss German Sign Language (DSGS) and German Sign Language (DGS) as reported in Ebling et al. (2015).

General predicates can be considered to be conventionalized signs of the LIS lexicon that have been standardized in form and meaning, but in which representational strategies could still be detected even if they are expressed in frozen forms. The direct mapping between the form of the sign and the meaning of the action might sometimes be no more readily recognized, as the representational strategy underlying the lexical unit has been already selected by the community of language users through a pairing process that has fixed its form and meaning in a conventionalized and stable way. This is in contrast to the use of a specific predicate when the signer can choose to use one or more of the representational strategies described above. Different factors can influence or constrain this choice: the linguistic context, the type of event to be described, the type of object involved, the topic of the discourse, as well as the individual style of the signer.

The representational strategy underlying the general signs used by our participants for the verb 'to take' (Figure 8a) and the verb 'to break' (Figure 8b) can be classified as hand-as-hand forms, while the strategies underlying the general signs used by our participants for the verb 'to open' (Figure 8c), 'to turn' (Figure 8d), and 'to attach' (Figure 8e) clearly involved hand-as-object forms.

For example, in performing the general sign meaning 'to take', the signer opens and closes the hand as if grasping something, replicating the physical action performed by the actor in the video scenes no matter what object was being grasped (i. e., a cup, a book, keys, a box, bags, handkerchiefs, a wallet, jewelry). For other general verbs, such as 'to open' and 'to attach', the actions performed in the video are very different from each other. For example, in showing 'to open', the actors performed very different actions, depending on the type of object involved (i. e., a box, a bottle, a nut, an egg, a roll of bread, eyes, a hand, a mouth). It is interesting to note that adult LIS signers in this study never used the sign 'to open' as a general predicate to describe these different opening actions, with the exception of one participant who used it to describe the action of opening a box (see Figure 8c). But looking more closely at the representational strategy underlying this general predicate, which is a conventionalized

form listed in a LIS dictionary, a hand-as-object strategy in the formation of that sign could be detected: a flat hand-as-object was used to refer to a flat surface such as the side of a box, but it was not used to open other objects like eggs or bottles, shown as exemplars of 'to open' in the video scenes. In addition, as Sutton-Spence and Braem (2013) pointed out, the hand-as-object strategy requires a high degree of linguistic community consensus on the meaning.

Furthermore, as suggested by Borghi et al. (2014), representational strategies can also be found in signs referring to abstract concepts. In the LIS sign meaning 'to forget', the closed hand moves from one side of the forehead to the other, opening at the end of the movement, and representing the action of throwing something away connected to the head/brain (hand-as-hand strategy).

The possibility of identifying in the frozen conventional signs the representational strategies used in the description of specific verbs from the productive lexicon also supports the view of a continuity between these lexical units and specific depicting predicates (Cormier et al. 2016; Ferrara and Hodge 2018; Volterra et al. 2018). From this follows the possibility of viewing both lexical units and depicting constructions as deriving from the same iconic core mechanism of sign creation. This view overturns the classical division between core lexicon and gestural components in signing as the representational strategies are entrenched in the language system. This perspective also challenges the traditional sharp distinction between these two categories, a distinction that reflects a supposed dichotomy between 'truly linguistic' features and 'gestural' features (Lepic and Occhino 2018).

It has also been observed in all sign languages studied to date that the form of the frozen signs (including both manual and non-manual parameters) can be slightly changed to modify semantic properties of the sign, and often involves depicting information. Thus, the possibility that frozen lexical signs may be adjusted in an iconic way, according to the linguistic context, suggests the existence of a linguistic continuum between describing and depicting functions (Ferrara and Halvorsen 2018). For example, in our data some occurrences of the general sign 'to take' showed a slight degree of depictive function when the location, the orientation and/or the movement of the sign was modified according to the specific action shown in the videoclip.

5 Conclusion and future directions

The representation of actions in LIS in this study is conveyed mainly by specific predicates, which rely on depicting strategies and incorporate the object and/or

the manner of the action into the linguistic expression. This preference clearly shows that depicting constructions should not be described as a peripheral phenomenon of sign languages but rather as a core mechanism. Despite the fact that our focus was on a different kind of data and differing criteria for analysis, our results support the view that a distinction between gestures and language has to be rejected (as argued by Lepic and Occhino 2018), and we propose that the strategies used in meaning construction reported on here rely on domain-general cognitive processes. Future research should be conducted to investigate similarities and differences in the modes of representation (describing vs. depicting constructions) used by deaf signers in LIS and by hearing speakers in spoken Italian performing the same linguistic task.

Finally, our finding of the more frequent use of the hand-as-object technique by adults compared to children suggests that these two strategies involve a different degree of cognitive complexity. This hypothesis should be tested in future research including young deaf preschoolers.

References

Angelini, Natalia, Rossano Borgioli, Anna Folchi & Matteo Mastromatteo. 1991. *I primi 400 segni: Piccolo dizionario della lingua Italiana dei segni per comunicare con i sordi*. Firenze: La Nuova Italia.

Borghi, Anna M., Olga Capirci, Gabriele Gianfreda & Virginia Volterra. 2014. The body and the fading away of abstract concepts and words: A sign language analysis. *Frontiers in Psychology* 5. 811.

Boyatzis, Chris J. & Malcolm W. Watson. 1993. Preschool children's symbolic representation of objects through gestures. *Child Development* 64(3). 729–735. https://doi.org/10.2307/1131214.

Brentari, Diane & Carol A. Padden. 2001. Native and foreign vocabulary in American Sign Language: a lexicon with multiple origins. In D. Brentari (ed.), *Foreign vocabulary: A cross-linguistic investigation of word formation*, 87–119. Mahwah, NJ: Psychology Press.

Brentari, Diane, Alessio Di Renzo, Jonathan Keane & Virginia Volterra. 2015. Cognitive, cultural, and linguistic sources of a handshape distinction expressing agentivity. *Topics in Cognitive Science* 7(1). 95–123. https://doi.org/10.1111/tops.12123.

Capirci, Olga, Annarita Contaldo, Maria Cristina Caselli & Virginia Volterra. 2005. From action to language through gesture: A longitudinal perspective. *Gesture* 5(1–2). 155–177. https://doi.org/10.1075/gest.5.1.12cap.

Capirci, Olga, Carla Cristilli, Valerio De Angelis & Maria Graziano. 2011. Learning to use gesture in narratives: Developmental trends in formal and semantic gesture competence. In Gale Stam & Mika Ishino (eds.), *Integrating gestures*, 89–200. Amsterdam/Philadelphia: John Benjamins Publishing.

Caselli, Maria Cristina, Arianna Bello, Pasquale Rinaldi, Silvia Stefanini & Patrizio Pasqualetti. 2015. *Il primo vocabolario del bambino: Gesti, parole e frasi. Valori di riferimento fra 8 e 36 mesi delle forme complete e delle forme brevi del questionario MacArthur-Bates CDI*. Milano: Franco Angeli.

Cormier, Kearsy, David Quinto-Pozos, Zed Sevcikova & Adam Schembri. 2012. Lexicalisation and de-lexicalisation processes in sign languages: Comparing depicting constructions and viewpoint gestures. *Language and Communication* 32(4). 329–348. https://doi.org/10.1016/j.langcom.2012.09.004.

Cormier, Kearsy, Sandra Smith & Zed Sevcikova-Sehyr. 2016. Rethinking constructed action. *Sign Language & Linguistics* 18(2). 167–204. https://doi.org/10.1075/sll.18.2.01cor.

Cormier, Kearsy, Sandra Smith & Martine Zwets. 2013. Framing constructed action in British Sign Language narratives. *Journal of Pragmatics* 55. 119–139. https://doi.org/10.1016/j.pragma.2013.06.002.

Cuxac, Christian & Marie-Anne Sallandre. 2007. Iconicity and arbitrariness in French Sign Language - highly iconic structures, degenerated iconicity and diagrammatic iconicity. *Empirical Approaches to Language Typology* 36. 13. https://doi.org/10.13140/RG.2.1.4884.8483.

Di Gregorio, Lucrezia, Vincenzina Campana, Maria Lavecchia & Pasquale Rinaldi. 2019. Include to grow: Prospects for bilingual and bicultural education for both deaf and hearing students. In M. Marschark, S. Antia & H. Knoors (eds.), *Co-enrollment in deaf education*, 165–181. Oxford: Oxford University Press.

Dick, Anthony Steven, Willis F. Overton & Stacie L. Kovacs. 2005. The development of symbolic coordination: Representation of imagined objects, executive function, and theory of mind. *Journal of Cognition and Development* 6(1). 133–161. https://doi.org/10.1207/s15327647jcd0601_8.

Ebling, Sarah, Reiner Konrad, Penny Boyes Braem & Gabriele Langer. 2015. Factors to consider when making lexical comparisons of sign languages: Notes from an ongoing comparison of German Sign Language and Swiss German Sign Language. *Sign Language Studies* 16(1). 30–56.

ELAN (Version 5.2) [Computer software]. (2018, April 04). Nijmegen: Max Planck Institute for Psycholinguistics. Retrieved from https://tla.mpi.nl/tools/tla-tools/elan/

Emmorey, Karen (ed.). 2003. *Perspectives on classifier constructions in sign languages*. Mahwah, NJ: Lawrence Erlbaum.

Erlenkamp, Sonja. 2009. Gesture verbs: Cognitive-visual mechanism of 'classifier verbs' in Norwegian Sign Language. *CogniTextes* 3. https://doi.org/10.4000/cognitextes.250.

Ferrara, Lindsay & Rolf Piene Halvorsen. 2018. Depicting and describing meanings with iconic signs in Norwegian Sign Language. *Gesture* 16(3). 371–395. https://doi.org/10.1075/gest.00001.fer.

Ferrara, Lindsay & Gabrielle Hodge. 2018. Language as description, indication, and depiction. *Frontiers in Psychology* 9. 1–15. https://doi.org/10.3389/fpsyg.2018.00716.

Frishberg, Nicolas. 1975. Arbitrariness and iconicity: Historical change in American Sign Language. *Language* 51(3). 696–719. 10.2307/412894.

Johnston, Thomas & Adam Schembri. 1999. On defining lexeme in a signed language. *Sign Language and Linguistics* 2(2). 115–185.

Kendon, Adam. 2004. *Gesture: Visible action as utterance*. Cambridge: Cambridge University Press.

Kimmelman, Vadim, Anna Klezovich & George Moroz. 2018. *Iconicity patterns in Sign Languages*. https://sl-iconicity.shinyapps.io/iconicity_patterns/.

Landis, J. Richard & Gary G. Koch. 1977. The measurement of observer agreement for categorical data. *Biometrics* 33(1). 159–174.

Lepic, Ryan. 2019. A usage-based alternative to "lexicalization" in sign language linguistics. *Glossa: A Journal of General Linguistics* 4(1). 23.

Lepic, Ryan & Corinne Occhino. 2018. A construction morphology approach to sign language analysis. In Ryan Lepic & Corinne Occhino (eds.), *The construction of words*, 141–172. Berlin: Springer.

Liddell, Scott K. 2003. *Grammar, gesture, and meaning in American Sign Language*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511615054

Magarotto, Cesare. 1996. *Vocabolario della lingua gestuale Italiana dei sordi*. Roma: Armando Editore.

Marentette, Paula, Paola Pettenati, Arianna Bello & Virginia Volterra. 2016. Gesture and symbolic representation in Italian and English-speaking Canadian 2-year-olds.". *Child Development* 87(3). 944–961. https://doi.org/10.1111/cdev.12523.

McNeill, David. 1992. *Hand and mind: What gestures reveal about thought*. Chicago: University of Chicago Press.

McNeill, David. 2005. *Gesture and thought*. Chicago: University of Chicago press.

Moneglia, Massimo. 2014a. Natural language ontology of action: A gap with huge consequences for natural language understanding and machine translation. In Zygmunt Vetulani, Joseph Mariani & Marek Kubis (eds.), *Human language technology challenges for computer science and linguistics. LTC 2011. Lecture notes in computer science*, 379–395. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-08958-4_31.

Moneglia, Massimo. 2014b. The variation of action verbs in multilingual spontaneous speech corpora: Semantic typology and corpus design. In Tommaso Raso & Heliana Mello (eds.), *Spoken corpora and linguistic studies*, 506. Amsterdam/Philadelphia: John Benjamins Publishing.

Müller, Cornelia. 2018. Gesture and sign: Cataclysmic break or dynamic relations? *Frontiers in Psychology* 9. 1651.

O'Reilly, Anne Watson. 1995. Using representations: Comprehension and production of actions with imagined objects. *Child Development* 66(4). 999. https://doi.org/10.2307/1131794.

Occhino, Corrine & Sherman Wilcox. 2017. Gesture or sign? A categorization problem. *Behavioral and Brain Sciences* 40. 36–37. https://doi.org/10.1017/S0140525X15003015.

Ortega, Gerardo & Asli Özyürek. 2019. Systematic mappings between semantic categories and types of iconic representations in the manual modality: A normed database of silent gesture. *Behavior Research Methods. Advance online publication*. https://doi.org/10.3758/s13428-019-01204-6

Ortega, Gerardo, Beyza Sumer & Asli Özyürek. 2014. Type of iconicity matters: Bias for action-based signs in sign language acquisition. *Proceedings of the Annual Meeting of the Cognitive Science Society* 36(36). 1114–1119.

Padden, Carol A., So-One Hwang, Ryan Lepic & Sharon Seegers. 2015. Tools for language: Patterned iconicity in sign language nouns and verbs. *Topics in Cognitive Science* 7(1). 81–94. https://doi.org/10.1111/tops.12121.

Padden, Carol A., Meir Irit, So-One Hwang, Ryan Lepic, Sharon Seegers & Tory Sampson. 2013. Patterned iconicity in sign language lexicons. *Gesture* 13(3). 287–308. https://doi.org/10.1075/gest.13.3.03pad.

Panunzi, Alessandro, Irene De Felice, Lorenzo Gregori, Stefano Jacoviello, Monica Monachini, Massimo Moneglia, Valeria Quochi & Irene Russo. 2014. Translating action verbs using a dictionary of images: The IMAGACT ontology. In A. Abel, C. Vettori & N. Ralli (eds.), *Proceedings of the XVI EURALEX International Conference: The User in Focus*, 1163–1170. Bolzano: EURAC research.

Panunzi, Alessandro & Massino Moneglia. 2004. La variazione semantica del verbo nel lessico dei corpora di lablita. In F. Albano Leoni, F. Cutugno, M. Pettorino & R. Savy (eds.), *Il parlato Italiano. Atti del convegno nazionale di Napoli, 13–15 Febbraio 2003*. Napoli: D'Aura Edizioni.

Radutzky, Elena. 1992. *Dizionario bilingue elementare della Lingua dei Segni Italiana LIS*. Rome: Edizioni K.

Rinaldi, Pasquale, Patrizio Pasqualetti, Silvia Stefanini, Arianna Bello & Maria Cristina Caselli. 2019. The Italian words and sentences MB-CDI: Normative data and concordance between complete and short forms. *Journal of Child Language* 46(3). 546–566.

Romeo, Orazio. 1991. *Dizionario dei segni: La lingua dei segni in 1400 immagini*. Bologna: Zanichelli.

Schembri, Adam. 2003. Rethinking 'classifiers' in signed languages. In Emmorey Karen (ed.), *Perspectives on classifier constructions in sign languages*, 13–44. United Kingdom: Psychology Press. https://doi.org/10.4324/9781410607447-7

Schembri, Adam, Caroline Jones & Denis Burnham. 2005. comparing action gestures and classifier verbs of motion: Evidence from Australian Sign Language, Taiwan Sign Language, and nonsigners' gestures without speech. *Journal of Deaf Studies and Deaf Education* 10(3). 272–290. https://doi.org/10.1093/deafed/eni029.

Slobin, Dan I. & Nini Hoiting. 1994. Reference to movement in spoken and signed languages: Typological considerations. *Annual Meeting of the Berkeley Linguistics Society* 20(1). 487. https://doi.org/10.3765/bls.v20i1.1466.

Slobin, Dan I., Nini Hoiting, Marlon Kuntze, Reyna Lindert, Amy Weinberg, Jennie Pyers, Michelle Anthony, Yael Biederman & Helen Thumann. 2003. A cognitive/functional perspective on the acquisition of "classifiers". In Emmorey Karen (ed.), *Perspectives on classifier constructions in sign languages*, 271–296. United Kingdom: Psychology Press.

Sutton-Spence, Rachel & Penny Boyes Braem. 2013. Comparing the products and the processes of creating sign language poetry and pantomimic improvisations. *Journal of Nonverbal Behavior* 37(4). 245–280. https://doi.org/10.1007/s10919-013-0160-2.

Talmy, Leonard. 1985. Lexicalization patterns: Semantic structure in lexical forms. In Timothy Shopen (ed.), *Language typology and syntactic description, Vol. 3: Grammatical categories and the lexicon*, 57–179. Cambridge: Cambridge University Press.

Taub, Sarah F. 2001. *Language from the body: Iconicity and metaphor in American Sign Language*. Cambridge: Cambridge University Press.

Volterra, Virginia, Olga Capirci, Maria Cristina Caselli, Pasquale Rinaldi & Laura Sparaci. 2017. Developmental evidence for continuity from action to gesture to sign/word. *language, Interaction and Acquisition* 8(1). 13–41. https://doi.org/10.1075/lia.8.1.02vol.

Volterra, Virginia, Olga Capirci, Pasquale Rinaldi & Laura Sparaci. 2018. From action to spoken and signed language through gesture: Some basic issues for a discussion on the evolution of the human language-ready brain. *Interaction Studies* 19(1–2). 216–238.

Wilcox, Sherman. 2004. Gesture and language: Cross-linguistic and historical data from signed languages. *Gesture* 4(1). 43–75.

Wilcox, Sherman & Corinne Occhino. 2017. Signed languages. In Barbara Dancygier (ed.), *The Cambridge handbook of cognitive linguistics* (Cambridge Handbooks in Language and Linguistics), 99–117. Cambridge: Cambridge University Press.

Wilcox, Sherman & André Nogueira Xavier. 2013. A framework for unifying spoken language, signed language, and gesture. *Todas as Letras - Revista De Lingua E Literatura* 15(1). 88–110.

Zeshan, Ulrike. 2000. *Sign language in Indo-Pakistan: A description of a signed language*. Amsterdam/Philadelphia: John Benjamins Publishing.