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Searching for the body in language: how bodily experiences shape the way we develop and understand multimodal language

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Abstract

According to Embodied simulation theories bodily experiences are crucial in language production and comprehension. Gestures and signs are expression of the body and follow a similar process of construction and representation of meanings, on the basis of our way of interacting in and with the world: through our bodies and our hands. The purpose of this study is to give evidences regarding how the body shapes the way we develop and understand multimodal language. In order to fulfill this purpose, 41 hearing and 12 deaf children participated in the first study in which there is a comparison between gestures and signs in order to share lights on the similarities of these two ways of communication. In the second study a group of 70 LIS signs related to emotions was analyzed according to formational parameters, in order to investigate how the bodily experiences are reflected at sub-lexical level in these signs. 16 Italians and 16 foreigners participated in the third study in order to explore how conceptual metaphors in signs facilitated the comprehension of LIS signs. All together the results of the three studies support the idea of language as a multimodal system and are in line with theories of the embodiment.

Preface

This thesis contains one published manuscript (Chapters 3) and two manuscript submitted (Chapter 2 and 4).

- **Chapter 2.** Capirci, O., Proietti, M., Volterra, V. (2020). Searching for the roots of signs in children's early gestures. *Gestures.* **SUBMITTED**
- **Chapter 3.** Bonsignori, C., & Proietti, M. (2020). Emozioni in segni: il caso della LIS. *Rivista Italiana di Filosofia del Linguaggio*. https://doi.org/10.4396/SFL2019ES03
- **Chapter 4**. Proietti, M., Bonsignori, C., Farabolini, G., Capirci, O. (2020). Un-box LIS signs: conceptual metaphors comprehension through the eyes of hearing speakers. *Language and Cognition.* **SUBMITTED**

Chapter 1

Introduction

The theoretical framework of the studies collected in this thesis are theories referring to the Embodied cognition. The three papers I am going to introduce, explore the role of bodily experiences in the way we develop and understand multimodal language. To explore the contribution of the body in language, in this dissertation were investigated:

- the role of actions and bodily experience in the development of symbolic capacity in children. We investigated the production of gestures in hearing children and the production of Italian Sign Language (LIS) signs in deaf children, to highlight similarities in the two modalities of communication, since both ways originate from the way our body interacts with the environment;
- how bodily experience is expressed metaphorically at sub-lexical level in LIS signs related to emotions, to understand more regarding the way a specific bodily experience became linguistic;
- how conceptual metaphor related to bodily experiences are present in LIS signs for emotions and abstract concept, and how the presence of these metaphors helps the comprehension of LIS signs by hearing people with no knowledge of the language.

Embodiment framework

Theories related to embodied cognition lead researchers' attention to the crucial role of bodily experience in human cognitive processes (Clark, 1997; Gallagher, 2005; Smith, 2005; Varela, Thompson, Rosch 1991).

One debated theme by embodied cognition theories is semantic knowledge. According to these theories, to understand the surrounding world, people use motoric and perceptive modalities that developed in a particular ecological niche, which have a situated and enactive relation with the external environment, and collaborate in conceptual construction (Clark, 1997; Merleau-Ponty, 1945). For example, following Gibson's theory (1979) same perceptive mechanism use continuous feedback cycles with the external environment rather than having a closed structure.

On the other hand, researches showed how the motor system contributes in the understanding of other's actions scopes, highlighting the importance of the body in intersubjective comprehension (Rizzolatti et al., 1988; Rizzolatti & Sinigaglia, 2019).

Regarding language understanding, the mechanism of simulation (i.e., *Embodied simulation*, Gallese & Sinigallia 2011) was considered to be the mechanism responsible for link between our bodily experiences and language (Barsalou, 2008; Fischer e Zwaan, 2008; Gallese e Lakoff, 2005; Pülvermuller, 2005). This simulation mechanism is on at the moment we are in the process of language understanding. In the comprehension of the sentence, "John grasps the glass" there is the activation of hand-related areas of the motor cortex in our brain even if we are not doing any action with our hands (Barsalou, 2010; Cuccio & Fontana, 2017; Fischer and Zwaan, 2008; Glenberg, Witt, and Metcalfe 2013; Pulvermüller et al., 2014; Jirak et al. 2010). This simulation's mechanism is also active during language processing of linguistic description of emotion and perception. It

involves the activation of the brain's areas related to perception and emotions. According to Foroni & Semin's (2009), when someone read verbal stimuli associated to action verbs related to emotions, there is the elicitation of the same muscle activity in the face as visual stimuli do. This study confirmed the role of the bodily experience in language processing and the peculiarity of language of being far for an amodal symbolic system (e.g., Fodor 1983) and close to the position that concern it as bodily grounded.

Researchers have also been dedicated to the investigation of the comprehension of conceptual metaphors based on bodily experience generally used by speakers all over the world (Lakoff & Johnson, 1980; Johnson, 1987, Kövecses 2000). Studies on brain activities during the comprehension of conceptual metaphors revealed that the processing of a metaphorical sentence like "John grasps the idea", that includes the abstract concept of understanding, activated the hand-related area of the motor cortex (Boulenger, Hauk, and Pulvermüller, 2009, Desai et al., 2013) confirming that the understanding of metaphor is not abstract, conceptual nor disembodied. Still, this mechanism is part of the Embodied simulation.

The Body in metaphors: The Conceptual Metaphor Theory

In their famous work *Metaphors We Live By* (1980), Lakoff and Johnson proposed the Conceptual Metaphor Theory (CMT). They defined metaphors from a new perspective since according to this theory metaphor is a conceptual tool for structuring, restructuring and even generating reality: a metaphor is not merely a decorative device in language used most of all in literature. According to the CMT, metaphors arise from conceptual mappings between domains: one domain of experience, the *target domain*, to be reasoned

about in terms of another, the *source domain*. The target domain is usually an abstract concept, whereas the source domain is typically a more concrete one. If metaphor has as its basis a cross-domain mapping in the conceptual system, then words should offer just one form in which they may appear and can be express. Probably, the most famous conceptual metaphor is the UP/DOWN one, in which our bodily experience with the surroundings, like verticality, could be at the metaphorical foundation of abstract concepts like happiness and sadness ("I am feeling down/up today"). Another famous metaphor, permeating several languages is the CONTAINER metaphor, referring to the image of the body as a box in which enclose feelings (the body is a container) and thoughts (mind is a container) (Lakoff & Johnson, 1980; Koveces, 1990; Ogarkova & Soriano, 2014).

According to Gibbs (2006), when someone produces a body movement or a hand gesture, such as the one of grasping, which is congruent to the meaning of the metaphoric phrase "grasp the concept," the participant subsequently is quicker in the comprehension of the phrase, than if they had previously made some incongruent gesture (such as the pushing away gesture). Furthermore, people are quicker to understand metaphoric phrases even if they just imagine to make the gesture before processing the phrase.

Theories abovementioned highlighted the importance of the body in language, specifically in adults' comprehension and production, and in the understanding abstract and metaphorical concept. All of these researches are based on spoken languages and adults. Words are not the exclusive tool thanks to which humans can communicate, and it would be interesting to improve also the developmental perspective. In the next paragraphs, I will go further into the concept of language as multimodal and peculiarities in the production of gestures by children.

A multimodal perspective to language

If we imagine people communicating, what probably comes in our mind is an interaction between two or more people in a face-to-face situation. Speakers in these types of interactions have to understand information carried by two different channels: the acoustic-vocal, concerning words and the visuo-gestural for bodily and hands movements.

Gesticulation, referring to any willful bodily movement, is present in all the cultures and it is unnatural trying to restrain it during spontaneous communication.

There isn't only one way to gesture, in fact, gestures differ for their forms, their functions and in their degree of conventionality. According to McNeill (1992, 2005) gestures can be a "window" into cognitive processes, as they support thought and speech. Their internal structure is formed of different units: conceptual and neuromuscular. The conceptual content is what gives them meaning; the neuromuscular activity is what makes them shared. Nonetheless, our body does not shape only physical and concrete actions or events but also abstract experiences, thoughts and time and gestures can support this mapping of abstract concepts into more concrete domains. There are different types of gestures: those describing the concrete (i.e., iconic, or representational) and those for the abstract (i.e., metaphoric). The distinction between the two is not so straightforward as it seems and may differ across cultures and context of use. Concrete and abstract concepts rely both on the sensorimotor simulation and the mechanism of simulation may explain both iconic and metaphoric gestures since they are both rooted in our bodily experiences (Cuccio & Fontana, 2017). According to Kendon (2004) and McNeill (2005) gestures and speech are two aspects of the same underlying thoughts process, and we should refer to

language as a *speech-gesture ensemble*. The gesticulation is not related to adults only it is important to have also a developmental perspective.

Greater awareness of the importance of gestures in the emergence of symbolic communication and spoken language grew thanks to studies on the development of gestures in very young hearing children (Trevarthen, 1977; Bruner, 1985; Bates et al., 1979). During the first year, and together with babbling and vocalization, all infants perform motor action sequences, to manipulate and explore objects according to their common function (e.g., using a spoon to eat, throwing a ball). Thanks to the environment and the interactions with caregivers, these motor actions progressively acquire symbolic values and are then gradually performed as communicative representational (or iconic) gestures. Representational gestures can represent different objects or events outside the communicative context in which they were initially produced and in the absence of the original items, to denote a specific referent while remaining relatively stable across different contexts. An example would be a child who put an empty spoon in his/her mouth as if eating, and after reproduces the same handshape and movement used in eating with a spoon, but with an empty hand (Caselli, 1990; Capirci, Contaldo and Volterra, 2005; Capirci and Volterra, 2008; Iverson, Capirci and Caselli, 1994; Iverson et al., 2008; Sparaci and Volterra, 2017; Volterra et al., 2017, 2018).

The use of gestures from childhood (Acredolo & Goodwyn, 1988; Bates, Camaioni & Volterra, 1975; Butcher & Goldin-Meadow, 2000; Capirci, Iverson, Pizzuto & Volterra, 1996; Capirci, Volterra, 2008) thorough our entire life (Kendon, 2004; McNeill, 2005), and the existence of languages using the visuo-gestural channel only (i.e., Sign Languages), powerfully highlights the necessity to think language as a phenomenon which is intrinsically multimodal (Cienki, 2012; Perniss, 2018, Sandler, 2018).

The studies introduced above gave a brief introduction to multimodality and the presence and role of gestures in adults and children. In the next paragraph, there will be an introduction to the use of the body in communication at its fullest: Sign Languages.

The body is linguistic: sign language

Sign languages are the visual languages of Deaf communities, used all over the world. Currently, Ethnologue (https://www.ethnologue.com) lists 144 sign languages while the sign hub's atlas 244 (www.sign-hub.eu).

According to different authors, sign languages start from daily actions and interactions of the body with the surrounding world to shape linguistic meaning. The iconicity plays an important role in the linguistic systems of sign languages, and metaphorical processes are largely exploited in the construction of meaning (Cuxac, 2001; Ortega et al., 2017; Perniss et al., 2015; Pietrandrea, 2002; Russo, 2004).

In 1960, William Stokoe illustrated for the first time the possibility to analyze signs using linguistic tools, dividing signs' articulation into three main phonological features: the handshape, the movement and the place, seen as meaningless combinatorial elements. Successively, sign research identified another parameter, the palm orientation, or the rotation of the wrist and forearm (Friedman 1975). Recently, four bodily parameters were added to the manual ones: the eye-gaze, the facial expression, the mouth gestures or mouthing, the movement of the torso (Volterra et al. 2019).

The crucial point was that in signed languages these combinatorial elements are not precisely meaningless: Boyes Braem (1981) showed for the first time the systematic use of visual metaphors in the constructions of signs, meaningful elements set at the

phonological level. According to the author it was possible to analyze ASL (American Sign Language) signs focusing on handshapes' underlying metaphorical meaning. For example, the articulatory traits of the B handshape () resemble a flat surface. This resemblance is metonymically exploited in ASL signs (i.e., in "table", "paper", "book"; they are all flat objects). This type of visual iconicity is strictly tied to our perceptual experience of the world and often maps concrete features to abstract ones. This way to consider the handshapes is applicable to all the phonological features and can be extended to all sign's parameters. As pointed out by different researchers (Ortega et al., 2015; Perniss et al., 2015) sign languages mutate praxis of the use of the hand and the body into linguistics. This process is possible thanks to the mediation between signer and then those bodily aspects become part of the linguistic heritage of the community.

Conceptual metaphors are also present in sing languages. Taub (2001), suggested to see the conceptual metaphors in sign languages as based on a double mapping: the metaphorical association in the semantic pole between concrete domain and abstract domain, in common with the spoken languages, and the iconic mapping between the physical articulation of the sign and the concrete domain. For example, the ASL sign "inform", in which the hand of the signer is first closed on the forehead and then it opens moving forward (such as you held something in your mind, and then you take it out), is based on the conceptual metaphors COMMUNICATION IS SENDING from Lakoff and Johnson (1980).

After illustrated researchers that explored the peculiarities of both gestures and signs, I am going to introduce a big question that is still vivid in literature: are gestures and signs so different?

Gestures and signs: two faces of the same coin

According to the framework of the 'interface model' (Kita & Ozyürek, 2003), and the 'gesture-as simulated-action model' (Hostetter & Alibali, 2008) gestures arise from visual–spatial images that make embodiment visible, and linguistic factors can influence gesture production. The tight coupling of motor and perceptual processes that is so important for physical interactions with the world, might also be significant for the mental representation of the world. Consistent with the seminal work on the continuity between gestures and signs by Kendon (2004, 2014), many studies have applied methods and strategies used in sign language research to analyze gestures production of hearing children and adults (Pettenati, Stefanini and Volterra, 2010; Capirci, Cristilli, De Angelis and Graziano, 2011; Barsalou, 1999; Padden et al., 2013, 2015; Masson-Carro et al., 2016; Ortega, Schiefner and Özyürek, 2019). Both gestures and signs are grounded on embodied motor actions, and they are linked to real objects and events. They express this link through representational strategies analyzed in many studies, which were often ascribed with different labels. There are four iconic representations and can be summarized as follows: (a) the person's own body enacting the action of the character; (b) the hand depicting how an object is usually held or manipulated; (c) the hands becoming/ representing the item; and (d) the hands representing the size/ shape of an object (see Müller, 2013; Perniss and Vigliocco, 2014; Brentari et al., 2015; Capirci et al., 2011; Marentette et al., 2016; Volterra et al., 2017).

These strategies are also used in researches across different sign languages. However, they have been referred to using different terminologies, such as symbolic strategies, the image generating techniques or modes of representation, iconic strategies,

and iconic depictions. The strategy (a) has been labelled as own body, personification, constructed action, body classifier, and person transfer; strategy (b) as hand-as-hand, handling classifier, manipulation, and representing; strategy (c) as hand-as-object, form gesture, representing, and instrument classifier; and strategy (d) as size and shape, drawing, delimitation, tracing, size and shape specifier, and molding (Cuxac & Sallandre, 2007; Hwang et al., 2017; Nyst, 2016; Padden, Hwang, Lepic and Seegers, 2015; Padden et al., 2013).

These researchers mentioned found similarities in the way gestures and signs represent the world and highlighted how those can be very similar between each other. The strategies exploited by gestures and signs are used to express both concrete and abstract entities and actions and, in this dissertation, it will be possible to explore the different possibilities the body has to reflect the relation with the surrounding world.

Aims and research questions

The three studies in this dissertation aim to reply to one central question:

- **Are bodily experiences reflected in multimodal language?**

Figure 1 illustrates how this main question bond the three studies carried on.

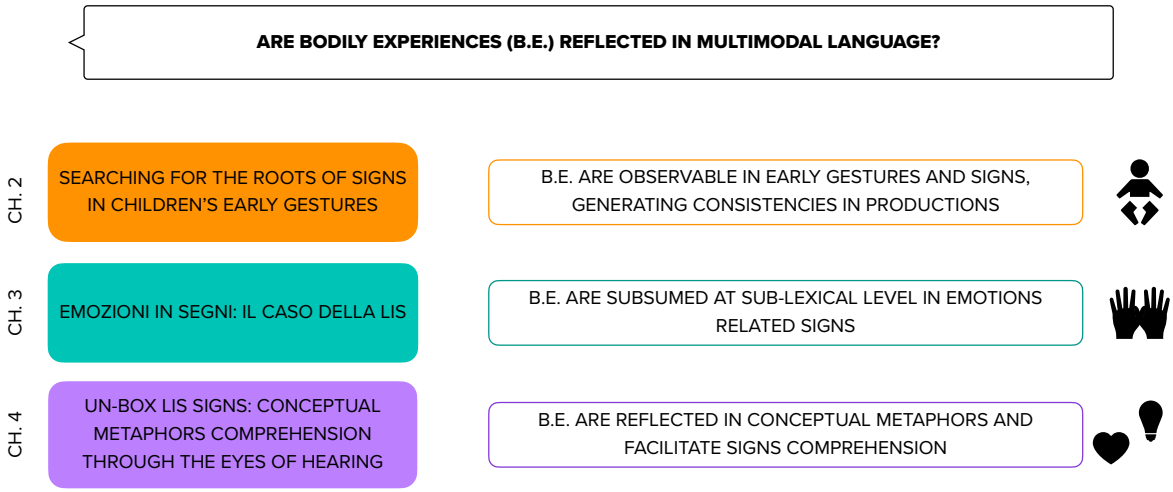

Figure 1 link between the three studies.

Considering the necessity to build a more unified picture of the relations between actions, gestures, and signs, in the first study (Chapter 2) we aim to compare co-verbal gestures produced by hearing children acquiring spoken Italian with sign production in deaf toddlers acquiring LIS from birth while they performed the same picture naming task (PinG). The execution parameters and the representational strategies observed for the gestures and signs were analyzed using the same coding system to answer to these sub-research questions:

1) Are bodily experiences at the base and ground the meaning constructions of both sign language's signs and of co-verbal gestures? It is possible to find a connection

in the form (execution parameters) and in the representational strategies which subsumed both gestures and signs? Is it therefore possible to consider gestures and signs as a continuum rather than separate by a cataclysmic break?

The second study (Chapter 3) aims to investigate sub-lexical units of LIS lexicon related to the expression of emotions and emotional states in order to answer to the second question:

2) Is the link between body and language traceable at the sub-lexical level, in the minimum elements which constitute the signs, therefore in signs execution parameters?

Considering the abovementioned literature regarding the presence of conceptual bodily related metaphors in spoken languages (in speech and in gestures) and in sign languages, and the relevance of those in language comprehension, the third study (Chapter 4) aims to offer experimental evidences concerning the role of these metaphors in comprehension in order to answer to the last questions:

3) Is it possible to find the presence of bodily experiences also in signs related to abstract concept? Is this bodily component responsible for making this type of signs more iconic and comprehensible by hearing people that do not know any sign languages? Namely, are bodily metaphors sufficiently “universal”?

Contributions to the research field

Answers to the questions of the first study (Chapter 2) will contribute to solving of the dispute between those who believe that there is a cataclysmic break between gestures and signs and those who believe that gestures produced by hearing speakers and signs produced by deaf signers represent a continuum.

The answer to the question of the second study (Chapter 3) will reveal peculiar aspects of signs' execution parameters related to emotions. It will show how bodily experiences related to emotions are impressed into phonological parameters at sub-lexical level and become visible parts of the language.

Finally, answers of the third study (Chapter 4) will give evidence to the embodiment of language and give lights to the role of the body in comprehension of language.

Chapter 2

Searching for the roots of signs in children's early gestures

Capirci, O., Proietti, M., Volterra, V. (2020). Searching for the roots of signs in children's early gestures. *Gestures.* **SUBMITTED**

Abstract

A consolidated tendency considers 'gestures' and 'signs' as distinct categories separated by a 'cataclysmic break'. According to a different approach, gestures and signs have their common origin in actions, and are considered as part of language. The aim of this study was to compare the productions of preschool speaking hearing children and signing deaf children in response to the same visual stimuli. The execution parameters and representational strategies observed in gestures and signs were analyzed using the same coding. The results showed that hearing children exposed to Italian and deaf children exposed to Italian Sign Language are consistent in their productions of gestures and signs, respectively. Furthermore, the hearing children's gestures and the deaf children's signs for some items were produced with the same parameters and according to similar representational strategies. This indicates that these two forms of communication are not separate behaviors, but should rather be considered as a continuum.

Keywords: gestures; signs; consistency; form execution; representational strategies; picture naming game (PiNG)

Introduction

Since the early studies on gestures, two contrasting perspectives have been proposed for the relation between gestures and language. One perspective considers gestures as separate and outside the realms of language, the other sees language itself as an integrated gesture–speech system. These two approaches have strong connections and consistent consequences on theories of the relationships between gestures and signs. Following the first approach, gestures and signs should be kept separate, and only signs should be considered as part of language. According to the second perspective, gestures and signs have their common origin in actions, and both need to be considered as part of language.

Here we introduce a recent debate between these two approaches, and we review studies in favor of continuity between actions, gestures, and signs conducted with both adults and children. An experimental study is then described that compares, on the same task, co-verbal gestures produced by hearing children acquiring Italian with signs production by deaf toddlers acquiring Italian Sign Language (LIS) from birth. Finally, the findings are discussed in light of the current theoretical debate, to evaluate whether these data support a new approach to embodied language where actions, gestures, and signs are considered as a continuum.

Gestures and signs: a cataclysmic break?

There is a consolidated tendency to consider gestures and signs as two categorically distinct behaviors that are sometimes even in contrast to each other. The historical origin of this distinction appears be rooted in the need to recognize sign languages as actual languages. Starting from philosophers like Aristotle, and over many centuries, scholars from different disciplines were dominated by a vision of language as an essentially

acoustic–vocal skill. In 1960 Hockett published his list of 13 features that had to be present in any human language, among which the vocal auditory channel, arbitrariness, and discreteness had relevant roles. However, in the same year, Stokoe published his linguistic analysis that showed that American Sign Language (ASL) has structural properties that are comparable to those of vocal languages (i.e., a highly abstract, rule governed, combinatorial linguistic system), and thus must be recognized as a fully developed natural human language (Stokoe, 1960). The following efforts to demonstrate that signs are constituents of natural languages led linguists to underscore the properties that signs share with words, with the adoption of analytic tools created by studies on written forms of spoken languages. This resulted in the construction of a barrier between signs and gestures. Sign language linguists, "had to overcome considerable prejudice against the idea that gestural expression could be a language. For this reason, many maintained a sharp distinction between 'sign', as in sign language, and 'gesture', as used by speakers." (Kendon, 2013, p. 15).

Recently, in a comparison between gestures and language Goldin-Meadow and Brentari (2017) proposed a clear distinction between language as something discrete, countable, categorical, and stable, and gestures instead as a gradient that is uncountable, variable, and idiosyncratic. According to this perspective, spoken languages have co-speech gestures and sign languages have co-signed gestures. Both co-speech gestures and co-signed gestures include all of the gradient and the motivated elements that are excluded from the linguistic system.

An important statement of Goldin-Meadow and Brentari (2017) was: "If a form is part of a categorical linguistic system, that is, if it is a sign, it must adhere to standards of form. Signers who use the same sign language should all produce a particular form in the

same way if that form is a sign (i.e., there should be some invariance across signers). But we might not necessarily expect the same consistency across signers if the form is a gesture" (Goldin-Meadow and Brentari, 2017, p. 8). Extending this principle of consistency, they went further to the point of considering some formational parameters of signs as 'nonlinguistic'. The only compositional parameter for which they allowed a clear linguistic status was the handshape, while sign location and movement were considered as not consistent gestural elements, given the difficulties in treating them categorically (Goldin-Meadow and Brentari, 2017).

We are therefore faced with clear separation between gestures and signs. The former are linguistic, fully conventional, categorical and analytic, while the latter are nonlinguistic, idiosyncratic (nonconventional), gradient-based (noncategorical) and holistic. Therefore, any expression in signing that cannot be analyzed in discrete, categorical terms is defined as a gesture. Many interesting critiques to this strong separation between gestures and signs were expressed in the open peer commentary included at the end of the original target paper by Goldin-Meadow and Brentari (2017), with some responses provided by the authors (for the most interesting comments, see: Kendon 2017; Occhino and Wilcox, 2017; Barca and Pezzulo, 2017; Giezen, Costello and Carreiras, 2017; Liebal, 2017).

Most importantly, in the present study we would like to make special mention to the elegant paper offered by Müller (2018), with the emblematic title of "Gesture and sign: cataclysmic break or dynamic relations?", arising from the study by Singleton, Goldin-Meadow and McNeill (1995). Müller (2018) considered the Goldin-Meadow and Brentari (2017) position that was based on the McNeill theories (2000; 2005) that described a 'cataclysmic break' between gestures and signs, and compared this with the

Kendon (2014) approach, as outlined in the study on "Semiotic diversity in utterance production and the 'concept' of language". Indeed, the Kendon (2004) perspective laid out a multitude of ways in which common ground can be seen between gestures and signs.

Müller (2018) judged this 'conflict' between the two approaches as originating from the different types of gestures considered: McNeill (1995) and Goldin-Meadow and Brentari (2017) were only and exclusively interested in 'gesticulation' (i.e., the 'singular gesture; in the Müller, 2018, terminology), which is idiosyncratic (i.e., created on the spot by the individual speaker), global, and holistic, and for this reason they saw the cataclysmic break between gestures and signs. Instead, Kendon (2004, 2014) had in mind, above all, the 'emblems' and the 'quotable gestures' (i.e., that acquired a fixed form–meaning relation), and therefore he saw a real continuum with signs used in sign languages. For Müller (2018), therefore, this conflict can be solved by taking into consideration the whole range of gestures produced by the speakers, and considering not only one or the other extreme (i.e., singular gestures or quotable gestures), but also the 'recurrent gestures' that are the unifying elements of this continuum: "Recurrent gestures merge conventional and idiosyncratic elements and occupy a place between spontaneously created singular and emblems as fully conventionalized gestural expressions on a continuum of increasing conventionalization" (…)." (Müller, 2018, p. 2).

More importantly, Müller (2018) also added something else, namely that these two distinct positions, with McNeill (1995) and Goldin-Meadow and Brentari (2017) on the one side, and Kendon (2004, 2014) on the other, also express (more or less implicitly) two visions of what language is: "…the claim of a critical divide between gesture and sign (…) implies a static and monadic concept of language as being either present or not,

and as something that can appear 'instantaneously' within one individual. (…) They rest upon (a) a restricted concept of gesture, (b) a highly specific experimental condition, and (c) a static and narrow concept of language." (Müller, 2018, p. 11).

In our opinion, the clear separation between gestures and signs is based on an Aristotelian vision of language, which arises from the assumption that language consists of discrete elements that belong to discrete categories and that are governed by combinatorial rules. Other researchers (e.g., Occhino and Wilcox, 2017) have countered this claim by saying that we should view language (i.e., spoken or signed) as not wholly categorical, and we should view gestures as not wholly gradient based.

Another important assumption behind the McNeill (1995) position is to consider gestures as 'images', thus disregarding the practical engagements of the hands in motor actions (cf., Streeck, 2017) and the motor origin of meaning construction in gestures (Müller, 2017; Kendon, 2004). The way manual actions provide the grounding for the meaning of gestures was instead investigated by another line of research that originated from developmental psychology, which gave rise to the different perspective described in the next section.

Gesture as a form of action

Studies undertaken on the development of gestures in very young hearing children have led to greater awareness of the importance of gestures in the emergence of symbolic communication and spoken language (Trevarthen, 1977; Bruner, 1985; Bates et al., 1979). In the first year of life, and at the same time as vocalization and babbling, all infants perform motor action sequences, to explore and manipulate small objects according to their common function (e.g., using a spoon to eat, a comb to comb hair;

throwing a ball). Due to the environment and the interactions with caregivers, these motor actions gradually acquire symbolic values, and are then progressively performed as communicative representational gestures. These gestures can even represent an object or an event outside the communicative context in which they were originally produced and in the absence of the original objects, to denote a specific referent while remaining relatively stable across different contexts. An example here would be a child who places an empty spoon in his/her mouth as if eating, and subsequently reproduces the same handshape and movement used in eating with a spoon, but with an empty hand (Caselli, 1990; Capirci, Contaldo and Volterra, 2005; Capirci and Volterra, 2008; Iverson, Capirci and Caselli, 1994; Iverson et al., 2008; Sparaci and Volterra, 2017; Volterra et al., 2017, 2018).

This motor origin of meaning construction in gestures (i.e., from action to gesture) also applies to signs (i.e., from action to sign). Following the seminal work on the continuity between gestures and signs by Kendon (2004, 2014), some studies have applied methods and strategies used in sign language research to the analysis of gestures produced by hearing children and adults. Pettenati, Stefanini and Volterra (2010) analyzed the articulatory characteristics of representational gestures that were spontaneously produced by Italian hearing children from 2 years to 3 years of age. These children were requested to label the same visual stimuli and their behaviors were recorded and coded. An analysis of manual parameters was adopted here that was commonly used in sign language research to define similarities in motor constraints in the articulation of gestures and signs. They showed that the gestures of hearing children were more similar from one child to the next than might be expected. Interesting similarities and consistencies in the motor characteristics of gesture performance were also noted in

relation to hands used, location (e.g., face/head vs. neutral space), movement, and handshapes. In particular, in relation to the last of these, the same restricted set of six basic handshapes were seen to be used consistently. Closer analysis of the handshapes revealed that those that were used in gestures produced by Italian hearing children corresponded to those described by Boyes Braem (1981) as part of Stage 1 and 2 in her model of handshape acquisition in ASL. These findings were based on an indirect comparison and showed that Italian hearing children used the same handshapes in their gestures as those used by children learning ASL. This supports the view that the motor factors involved in the production of handshapes are seen in both gestures and signs.

Capirci, Cristilli, De Angelis and Graziano (2011) analyzed the way in which children develop competences in formal and semantic aspects of gesture. They focused on the use of representational gestures in the narratives produced by 30 Italian children from 4 to 10 years old while they were retelling a video cartoon to an adult. Their gestures were coded according to sign language literature parameters and analyzed in terms of the accuracy of their execution and the correctness of the content representation. To evaluate the way that the children learned to use gestures in a formally appropriate way, Capirci and colleagues (2011) formulated the concept of 'formal accuracy' and scored the behaviors observed according to three parameters: well boundedness, clearness of stroke execution, and space. Well boundedness was scored in terms of the start and the end clearness of the gestures; the clearness of the stroke was scored in terms of the gesture configuration and movement; and the space of the gesture execution was scored in terms of the visible/ nonvisible and shared/ peripheral space. The representational correctness was coded on the basis of the semantic pertinence of the gesture components (i.e., location, configuration, movement) in relation to the corresponding aspects of the referent

(i.e., its location, its shape and size, the type and direction of the action). The analysis here showed increasing mastery of the formal properties of gestures, which indicated that children gradually learned how to use expressive components of gestures to represent specific characteristics of the referents. Consideration of the accuracy of gesture execution and the appropriate referent representation also revealed a clear developmental trend. Overall, these data highlighted that like speech and sign languages, gestures constitute an analytical and compositional system of expression, and have formal and semantic properties that children gradually acquire during development of their communicative competence.

Several studies comparing gestures produced by adults from different cultures have identified similarities between their manual productions (Barsalou, 1999; Padden et al., 2013, 2015; Masson-Carro et al., 2016). Gesture similarities suggest that people's concepts emerge from the integration of multiple aspects of perceptual knowledge, such as knowledge of the shape, use, sound, and voice of some entities (Barsalou et al., 1999).

In a recent study, Ortega, Schiefner and Özyürek (2019) compared silent gestures and signs (of the sign language of The Netherlands) to determine whether there was a set of systematic gestures that could be generalized across the Dutch participants. They reported that for some concepts, the gestures showed systematic forms. Subsequently, they compared the forms of the gestures with the signs for the same concept (i.e., full, partial, no overlap) and they showed that the gestures with stronger resemblance to signs were more accurately guessed and were assigned higher iconicity ratings by nonsigners than for signs with low overlap. Gesture and sign resemblances might be justified on the

basis that a conceptual substrate that is rooted in our embodied experiences in the world can be shared by gesturers and signers.

Several models that have all been rooted in psychological or psycholinguistic tradition have been designed to describe how gestures are produced and how they relate to language and cognition. These have included: the 'sketch model' (de Ruiter, 2000), the 'lexical gesture process model' (Krauss et al., 2000), the 'growth point theory' (McNeill, 1992, 2005; McNeill & Duncan, 2000), the 'gesture in learning and development framework' (Goldin-Meadow, 2003), the 'interface model' (Kita & Ozyürek, 2003), and the 'gesture-as simulated-action model' (Hostetter and Alibali, 2008). According to the last two of these frameworks, gestures arise from visual–spatial images that make embodiment visible, and linguistic factors can influence gesture production. The tight coupling of motor and perceptual processes that is so important for physical interactions with the world might also be important for the mental representation of the world.

Gestures and signs: the same representational strategies?

Gestures and signs are both grounded on embodied motor actions, and they are linked to real objects and events through iconic representational strategies that have been analyzed in many studies, while often being ascribed different labels. Common to all of these analyses is the reference to four basic forms of iconicity that depend on how the body/ hands represent real actions in the physical world during gesture execution. These four iconic representations can be summarized as follows: (a) the person's own body enacting the action of the character; (b) the hand depicting how an object is usually held or manipulated; (c) the hands becoming/ representing the object; and (d) the hands representing the size/ shape of an object (see Müller, 1998, 2013; Perniss and Vigliocco,

2014; Brentari et al., 2015; Capirci et al., 2011; Marentette et al., 2016; Volterra et al., 2017; Bello et al., under review).

These strategies are also very familiar to researchers across different sign languages, although they have been referred to using different terminologies, such as symbolic strategies, image generating techniques or modes of representation, iconic strategies, and iconic depictions. In more detail, strategy (a) has been labelled as **own body**[1], personification, constructed action, body classifier, and person transfer; strategy (b) as **hand-as-hand,** handling classifier, manipulation, and representing; strategy (c) as **hand-as-object,** form gesture, representing, and instrument classifier; and strategy (d) as **size and shape**, drawing, delimitation, tracing, size and shape specifier, and molding (Cuxac and Sallandre, 2007; Hwang et al., 2017; Nyst, 2016; Padden, Hwang, Lepic and Seegers, 2015; Padden et al., 2013).

Different kinds of factors can determine the choice of the representational strategy used, such as the context and nature of the referent. In many sign languages, for example, the sign for 'scissors' is the V-shape  of the object itself, which is represented using a hand-as-object strategy rather than the act of using the scissors. On the other hand, the action of 'hammering' and the object 'hammer' are often expressed with the action of hammering and the hand-as-hand strategy, showing how a hammer is grasped (Volterra, Roccaforte, Di Renzo & Fontana, 2019).

[1] the terminology adopted in the present study is given in bold text

There is evidence of consistency in iconic co-speech gestures that descriptions of objects and their form appear to depend on the physical properties of the referent. According to Masson-Carro, Goudbeek and Krahmer (2016), 'highly manipulable' objects (e.g., a pen) are often depicted with gestures that mime how the object is held, while 'low manipulable' objects (e.g., a sink) are represented with gestures that show their shape. This has been observed also in studies based on elicited pantomimes. When tools are depicted in pantomime, the majority of people consistently choose to pretend to use the object, rather than choosing to use their hands to represent the object (Padden et al., 2013; Padden, Hwang, Lepic and Seegers, 2015; Van Nispen et al., 2017). These findings have also been confirmed by studies on co-speech iconic gestures (Masson-Carro et al., 2015; Ortega et al., 2019).

In two recent studies, Ortega and Özyürek (2019a, b) analyzed silent gesture production and comprehension in adults, and they showed similar characteristics in the way that these were produced. These described a systematic way of mapping semantic categories and types of iconic representations in manual productions (or the mode of representation in the Müller, 2013, terminology). They explored different types of iconic representations to express concepts (i.e., 'acting', 'representing', 'drawing', 'personification'). They first established systematicity across the participants on the basis of the gesture parameters, and they finally coded the different gesture modes of representation. They reported systematicity in gestural forms across the participants, and that different types of iconicity were associated with specific semantic domains: acting was used for actions and manipulable objects; drawing for nonmanipulable objects; and personification for animate entities. In particular, Ortega and Özyürek (2019b) compared Mexican and Dutch speakers for their silent gestures with the types of iconic

representations, and showed that both groups preferred acting for actions and manipulable objects, while they mainly used drawing for nonmanipulable objects.

Another possible factor in the selection of a specific strategy is age, although the question of whether children use different strategies at different stages of language acquisition is still an open debate (Volterra et al., 2019). To explore the use of the manual modalities in children, a study by Marentette and colleagues (2016) compared gestural and spoken productions of 2- to 3-year-old Italian and Canadian hearing children, and they showed that these two groups produced a similar range of representational techniques. In Capirci et al. (2011) the strategies used in gestures that represented the referent were analyzed using a scale from the highest to the lowest degree of concreteness. Analysis showed a developmental trend in the mastering of the symbolic competence with a gradual shift from use of the most concrete gestural forms (e.g., mime, manipulation) to the most abstract and conventional ones (e.g., hand becomes object, shape depiction/ delimitation).

Different preferences for strategies have been shown between the gestures of hearing people and the signs of signers. For example, Sutton-Spence and Boyes Braem (2013) compared data for the same task done by American hearing mimes who had no knowledge of any sign language and by British deaf signing poets. Here they showed that the gestures of the hearing mimes most frequently involved the 'hand-as-hand' strategy, and only very rarely the 'hand-as-object' strategy, whereas the deaf signing poets used an abundance of both strategies. Different sign languages also appear to differ in their use of one strategy over the other (Padden et al., 2015). Kimmelman, Klezovich and Moroz (2018) analyzed a database of iconicity patterns in sign languages to confirm that iconicity patterns differ across semantic fields and across languages.

Brentari et al. (2015) compared data across two cultures, as American and Italian, and across four languages, as Italian, LIS, English, and ASL. They reported that gesturers and signers (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). The decision of which strategy to adopt to represent a meaning appeared to depend heavily on conventions among users, which constituted established cultural traits that were accepted by specific geographic or cultural hearing or deaf communities.

Aim of the study

The studies presented so far have described interesting similarities between gestures and signs that need to be integrated to begin to build a more unified picture of the relations between actions, gestures, and signs. The aim of the present study was to compare co-verbal gestures produced by hearing children acquiring spoken Italian with sign production in deaf toddlers acquiring LIS from birth[2] while they performed the same picture naming task (PinG).

The execution parameters and the representational strategies observed for the gestures and signs were analyzed using the same coding system, which was designed to answer the following questions:

[2] From here on the term 'gesture' is used to refer to the manual and bodily actions of the hearing children, and the term 'sign' is used to refer to those produced by the deaf children. We use these two distinct terms with the sole purpose to distinguish and to compare the productions of the two groups of children, without thereby entering into a terminology discussion about the need to use the same or different labels (Volterra and Erting, 1990; Kendon, 2017; Volterra et al., 2018; Capirci et al., 2002; Volterra, 1981; Sparaci and Volterra, 2017; Volterra, Iverson and Castrataro, 2006; Volterra and Caselli, 1985).

- Are the execution parameters and the representational strategies of the gestures and signs consistent[3] across the hearing and deaf children?
- Is there consistency between the gestures and the signs? Are the execution parameters and representational strategies observed in the gestures and signs similar?
- Is the use of representational strategies influenced by the specific characteristics of the entities represented in the pictures within and between the two groups of children?

Answers to these questions will contribute to solving of the dispute between those who believe that there is a cataclysmic break between gestures and signs and those who believe that gestures produced by hearing speakers and signs produced by deaf signers represent a continuum. In particular, positive responses to these questions will support the approach of developmental studies, and as suggested by Kendon approach (2004; 2015), according to which gestures and signs are both grounded on basic embodied motor acts.

Methods

Participants

Forty-one Italian hearing children (19 females) and 12 Italian deaf children acquiring LIS (6 females) participated in this study. The mean chronological ages were 29.7 months (range 25-36 months) and 35.7 months (range 26-57 months), respectively[4].

[3] The term consistency is sometimes replaced here by the term systematicity (Ortega & Özyürek (2019a-c)
[4] For nine deaf participants, the age range was very similar to that of the hearing children - from 25 to 36 months - while three of the deaf children were a bit older: from 43 to 57 months

All of the deaf children had deaf parents using LIS in their everyday life, and had been exposed to LIS since birth. They were also exposed to spoken Italian (or mouthing) used by hearing peers, relatives and teachers, as well as to mouthed Italian used by deaf adults, including their parents.

All of the children were primary speakers of either Italian (hearing children) or LIS (deaf children), with the exclusion of children exposed to other languages, twins, and children with epilepsy, intellectual disabilities or psycho-pathological disorders. All of the parents signed their written informed consent prior to being included in the study.

The videorecordings used in the present study were previously analyzed in studies with diverse aims and for the evaluation of different skills: for the production and comprehension of spoken Italian lexicon for the hearing children (Stefanini et al., 2009; Pettenati et al., 2010), and for the signed LIS lexicon for the deaf children (Rinaldi et al., 2014 for the younger deaf children; Tomasuolo et al. 2020, for the older deaf children).

Materials and procedures

The PinG (*Parole in Gioco*) test used in the present study is a picture-naming game designed as a structured task to assess lexical comprehension and production. The test has been validated for use with Italian children aged from 19 to 37 months (Bello, Caselli, Pettenati and Stefanini, 2010; Bello et al., 2012). Despite some large interindividual variability, several cross-cultural studies have confirmed that this PinG lexical naming task elicits the production of spontaneous gestures not only in Italian children growing up in a gesture-rich culture (Stefanini et al., 2009), but also in children from other cultures, (e.g., Japanese, Canadian, British, Australian; see respectively, Pettenati, Sekine, Congestrì and Volterra, 2012; Marentette et al., 2016; Cattani et al., 2019). The

PinG test has also been used to assess lexicon development of signing deaf children (Rinaldi et al., 2014).

The PinG test consists of four subtests: Nouns Comprehension (NC); Nouns Production (NP); Predicate Comprehension (PC); and Predicate Production (PP). Each of these consists of 20 lexical targets and two training items. The lexical targets were selected from the normative data of the Italian version of the MacArthur–Bates Communicative Development Inventory (Caselli, Pasqualetti and Stefanini, 2007). For this study, we analyzed only a selection of 10 pictures from the two production subtests (NP, PP) that elicited the highest production of representational gestures by hearing children according to a previous study using the PinG test (Pettenati et al., 2010). The picture set included: five pictures for nouns (i.e., glass, comb, umbrella, gloves, lion); and five pictures for predicates (i.e., opening, turning, swimming, washing, phoning).

The hearing children were individually assessed at local kindergartens, while the deaf children were individually assessed in the laboratory, at their nursery school, at local kindergartens, or in their home. The procedure was identical to that in the previous studies reported above using the PinG test for the NP and PP subtests: after a brief familiarization period, the experimenter placed a target picture in front of a child, asking "What is this?" for nouns or "What is he/she doing?" for predicates. The same procedure was used for both hearing and deaf children, with the only difference being that the hearing participants were requested to perform the task in spoken Italian by a hearing experimenter, and the deaf participants were requested to perform the task in LIS by a deaf signing experimenter, as reported in the other studies cited above.

Coding and analysis

All of the sessions were videorecorded and later coded using a time-linked video annotation system (i.e., Brugman et al., 2004), which allowing for a coding hierarchy and highly precise frame-by-frame analysis. During the task, the children produced multiple spoken/ signed utterances and multiple gestures/ signs. Various categories of gestures were produced by the hearing children (i.e., deictic, representational, conventional, beats, self-adaptors), but for comparison purposes with the signs, the analysis was restricted to representational gestures. Representational gestures were defined as pictographic representations of the meaning (or meanings) associated with the object or event represented in the picture, and the coding included not only manual gestures, but also posture, body movements, and facial expressions (Pettenati, Stefanini and Volterra, 2010).

Given the nature of the task (i.e., the children were asked to name the pictures), the criteria for coding gestures and signs were the following:

(1) the gesture/sign had to be produced after the naming request;

(2) the gesture/sign could be performed with an empty hand or while holding the photograph to be named.

Only one gesture for each item was coded (i.e., either the first gesture/sign produced or the clearest one).

To determine the 'similarity in execution', each gesture/sign was analyzed according to sign language phonological parameters, as location, handshape, palm orientation, and movement (Ortega and Özyürek, 2016, 2019a, b; Bressem, 2013; Pettenati, Stefanini and Volterra, 2010). The movement parameter was further analyzed considering: direction of

movement (i.e., toward the body, away from the body, right, left, up, down, mixed) and type of movement (i.e., single, repeated, circular, static, composite).

Furthermore, all of representational gestures and signs identified were coded for the representational strategies involved in their production (Hwang et al., 2017; Müller, 2013; Marentette et al., 2016; Volterra et al., 2018; Ortega and Özyürek 2019a, b). These representational strategies were defined as follows[5]:

1. The **own body** strategy (acting for a human entity and personification for a nonhuman entity) included all cases of enactment of actions performed by an animate agent (e.g., for the item 'swimming', the child performed the actions of a swimmer, such as paddling his/her arms in the air) or movements of a nonhuman animate agent (e.g., for the item 'lion', the child held his/her hands as claws with a menacing face and/or a roaring sound; for example, see Figure 1).

2. The **hand-as-hand** strategy (acting) included gestures/signs in which the hand/s acted as a hand/s; i.e., portraying how an object is held or manipulated. For example, for the item 'glass', the child moved a hand shaped as if holding a glass (c in sign language phonology) toward his/her mouth. As the hand-as-hand strategy is also a type of enactment, this can sometimes overlap with the own-body strategy described above. However, we distinguished between these two according to absence of presence of strong involvement of facial expression and/or labialization/ production of sounds. In the latter case, we considered the strategy as own body; e.g., the roaring example for the item 'lion' involved both vocalization and facial expression (for example, see Figure 1).

[5] In our classification, we follow the terminology used in Marentette at al. (2016), while reporting in brackets the corresponding category used in Ortega and Özyürek (2019a-c).

3. The **hand-as-object** strategy (representing) was ascribed to gestures/signs in which the hand acted as the object itself, or represented its salient features conveying information about its location and/or movement. For example, positioning an open palm hand (5 or B in sign language phonology) on the top of the head while referring to the item 'umbrella' (for example, see Figure 2).

4. The **size and shape** strategy (drawing) was used for manual productions depicting the size or shape of an object. For example, holding the hands apart to show how big something is, or moving an extended index finger with a closed fist in a circular motion to describe the movement of the marry-go-round shown in the predicate item 'turning'.

To determine 'group consistency' in the execution parameters and representational strategies of gestures/signs, we coded all of the parameters and strategies within each group of children and considered a parameter or strategy as consistent when it was observed in ≥60% of the gestures and/or signs produced within each group. To establish instead 'consistency of individual items', we compared all four parameters present in each gesture/sign (i.e., handshape, location, type of movement, direction of movement) within each group of children. Following previous studies (Ortega and Özyürek, 2019a, b), at least three out of four parameters had to be the same in ≥60% of the gestures and/or signs produced by a group for a given item.

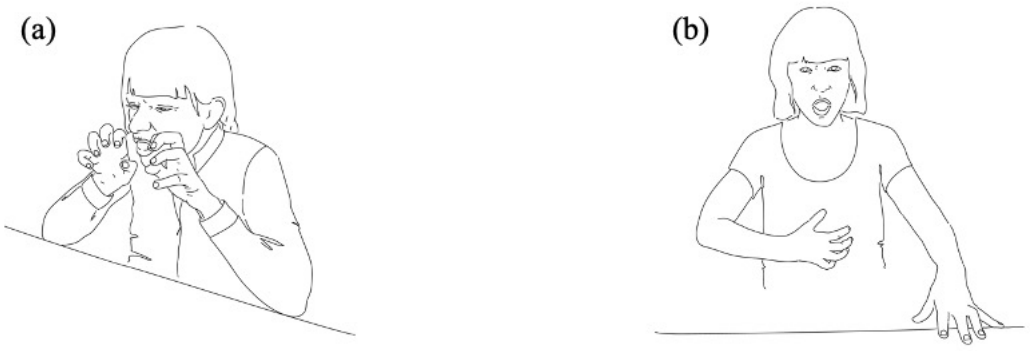

Figure 1. *Drawings representing the two productions for the item 'lion'.* ***(a)*** *Gesture performed by a hearing child.* ***(b)*** *Italian Sign Language sign (performed with the right hand).*

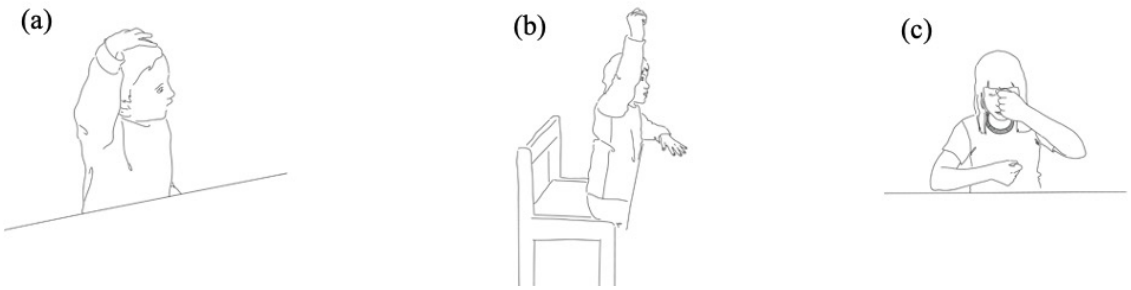

Figure 2. *Drawings representing productions of the item 'umbrella'.* ***(a)*** *The production of a hearing child performing the gesture with his hand covering his head, as an umbrella using the hand-as-object strategy.* ***(b)*** *A deaf child performing the sign with her hand, as if holding an umbrella over her head, using the hand-as-hand strategy.* ***(c)*** *A deaf child performing the Italian Sign Language sign for the item 'umbrella' with both two hands in the hand-as-hand strategy.*

Furthermore, to compare 'consistency between groups' in the execution parameters and representational strategies, all of the items for which each group reached the established consistency were selected, and comparisons were limited to those items. Parameters or strategies were considered consistent between groups when ≥60% of the children in each group produced either the same parameter or three out of four parameters, or the same strategy on an individual item.

Reliability

The data for all of the participants were independently coded by three coders (two deaf, one hearing [author MP]). Agreement between the three coders was 91% for the gesture/sign execution parameters, and 96% for the assignment of the representational strategies involved in gestures/signs production. Cases of disagreement were resolved by asking a fourth and fifth coder to choose one of the classifications proposed by the three coders.

Results

First, we analyzed the execution parameters of the gestures/signs considering the within groups consistency (i.e., within hearing, deaf) for each parameter, the consistency on individual items of the PinG test (i.e., nouns, predicates), and the between groups consistency. Secondly, we considered the representational strategies use in gestures/signs production, and analyzed the consistency within and between groups.

Execution parameters

The analysis of the group consistency in the execution parameters was based on the proportions (%) of the consistency distribution per parameter within the hearing and deaf groups of children. For each gesture/sign observed, the four parameters used in producing it were coded; e.g., for the roaring lion gesture as described above as produced for the item 'lion', we annotated: 5 bent[6] handshape, NEUTRAL SPACE location, SINGLE type of movement, AWAY FROM BODY direction of movement (see Figure 1a); on the other

[6] In the list of fonts adopted in the present paper we did not find the specific handshape with all five fingers of the hand bent, and we decided to use the following label: 5 bent

hand for the signed “lion” produced for the same item, we annotated: 5 bent handshape, CHEST location, SINGLE type of movement, RIGHT/LEFT direction of movement (see Figure 1b). Subsequently, we calculated how many times a specific parameter was present in the gestures/signs produced for a specific item within each group of hearing and deaf children; e.g., how many times the 5 bent handshape was produced in gestures/signs by hearing and deaf children in response to the item ‘lion’. The individual parameters were considered ‘consistent’ for an item when ≥60% of the participants within each group chose that specific parameter in response to the item; e.g., 75% of the children in the hearing group and 100% of the children in the deaf group used the 5 bent handshape for the item LION, and therefore the parameter was considered consistent in both groups for this item).

Figure 3 shows the proportions (%) for the degrees of consistency per parameter within the hearing and deaf groups. Overall, there was a high degree of consistency in these parameters for both the hearing and deaf children. All of the parameters reached (and in many cases exceeded) the consistency level (≥60%). In particular, location was the parameter with the highest degree of consistency in both groups (hearing children, 90%; deaf children, 100%), while handshape was the parameter with the lowest degree of consistency (hearing children, 60%; deaf children, 80%). As an example, the item ‘glass’ was performed on the MOUTH by all of the hearing and deaf children, to reach 100% consistency in both groups. On the other hand, the item ‘swimming’ led to the use of the  handshape in 82% of the gestures produced by the hearing children, while it represented 100% of the signs produced by the deaf children. Comparisons between groups also showed that the hearing children had lower consistency rates across all of the parameters compared to the deaf children.

For the between groups consistency in the execution parameters, all of the items for which each group reached the established consistency were selected (consistent items), and the comparisons were limited to these items. For the consistent items we checked whether each of the parameters used by the hearing group was the same as that used by the deaf group.

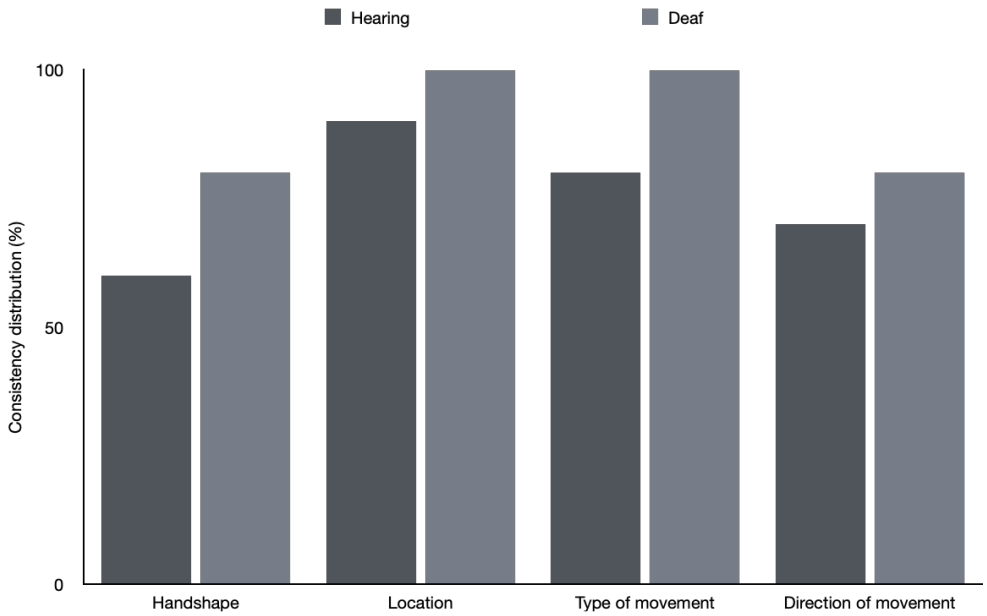

Figure 3. Consistencies for the execution parameters within the groups of hearing and deaf children.

Table 1 shows the between groups consistency in the execution parameters for each item, with the data for the hearing *versus* deaf children comparisons for the consistency for each parameter in each item. From this analysis, these two groups often produced gestures and signs in exactly the same locations (8/10 items) and with the same type of movement (7/10 items), while they generally did not use exactly the same handshape (3/10 items) and direction of movement (4/10 items).

	Execution parameter			
	Handshape	Location	Movement	
Item			**Type**	**Direction**
Glass	×	√	√	√
Comb	-	√	×	-
Umbrella	-	-	√	-
Gloves	-	√	√	-
Lion	√	×	√	×
Opening	√	√	√	-
Turning	-	√	√	√
Swimming	√	√	-	√
Washing (hands)	×	√	-	×
Phoning	×	√	√	√
Consistency in execution parameters	**3/10**	**8/10**	**7/10**	**4/10**

×, consistency not reached between groups; **√**, consistency between groups;

-, between groups comparison not possible

Table 1. Between groups consistency for the execution parameters, as the hearing and deaf children.

After the calculation of the consistency for each parameter, the consistency of the individual items was calculated. As described in the Methods, at least three of four parameters had to be the same in ≥60% of the gestures/signs produced by a group for a given item to reach item consistency. For example, for the item 'opening', most participants produced a gesture/sign with the same three parameters:  handshape; neutral space location; single type of movement.

Figure 4 shows the degrees of consistency of the individual items in the noun subtest for these two groups of children. In this analysis, the hearing participants reached 100% consistency in the production of three of the five items (i.e., 'glass', 'gloves',

'lion'), while they did not reach consistency for 'comb' and 'umbrella'. For the items 'comb' and 'umbrella', the productions of these hearing children differed in handshape and direction of movement used. For 'comb' they mainly used two types of handshapes, as  and 5 bent), and two types of direction of movement, as down and right/left (for examples, see Figure 5). For the 'umbrella' item, these hearing children used two different types of handshape, as  and  , and two directions of movement, as down and to the right (for examples, see Figure 2).

The deaf group was instead 100% consistent for four of the five items (i.e., 'glass', 'comb', 'umbrella', 'lion'). For the only exception of the item 'gloves', the productions of these deaf children differed in the direction of movement, as they either used toward the body or right/left movements, and the handshapes, as  and  (for examples, see Figure 6).

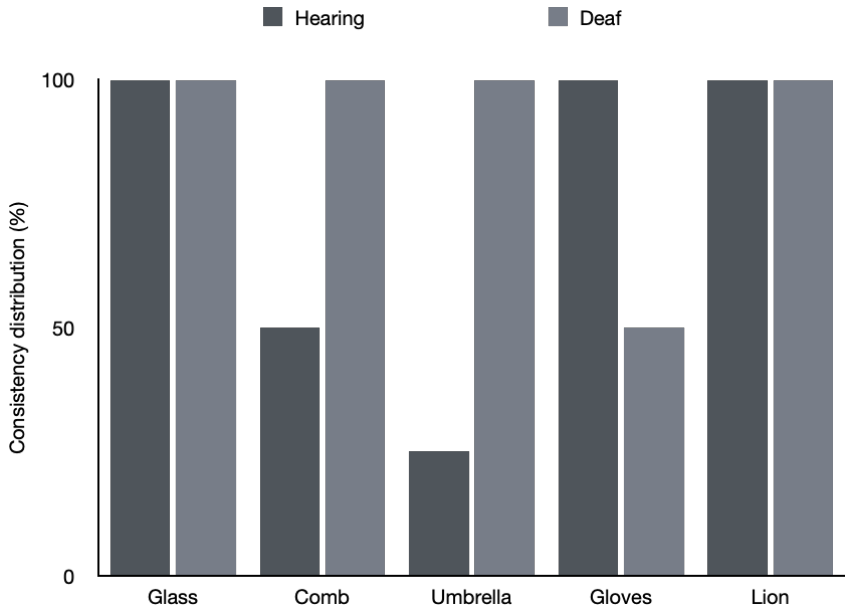

Figure 4. Consistencies for the individual items in the noun subtest within the groups of hearing and deaf children.

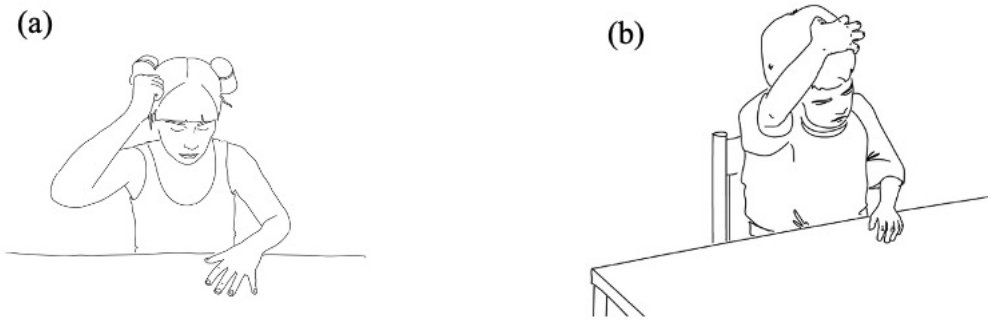

Figure 5. Drawings representing the productions of the item 'comb'. **(a)** The child is performing the item with the hand-as-hand strategy (). **(b)** The child is performing the item with the hand-as-object strategy (bent).

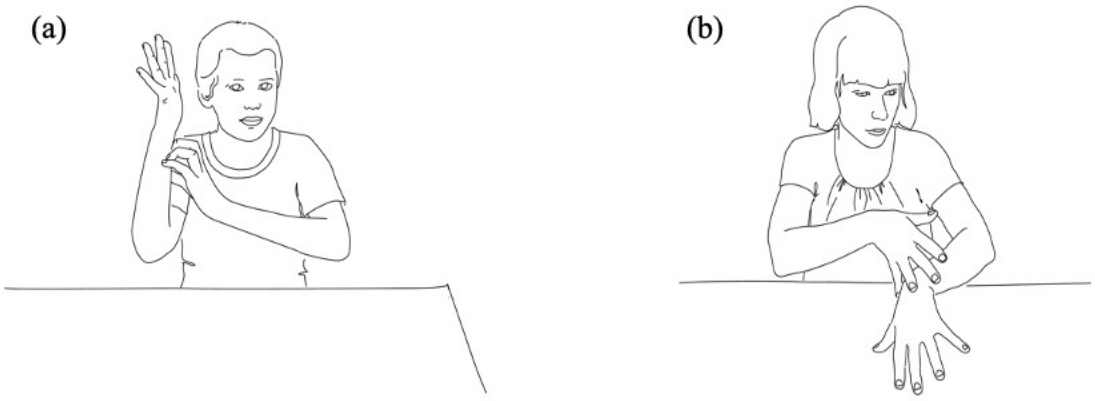

Figure 6. Drawings representing the two productions of the item 'gloves'. **(a)** The child is performing the action of taking a glove and pulling it on. **(b)** The child is passing one hand over the other for the adult Italian Sign Language sign for 'gloves'.

Figure 7 shows the degrees of consistency in the predicate subtest in the hearing and deaf children. Both groups of children were consistent in the production of all five items. Consistency was very high in both groups: the hearing group reached 75% in all of the items; the deaf group reached 100% in three items (i.e., 'turning', 'swimming', 'washing').

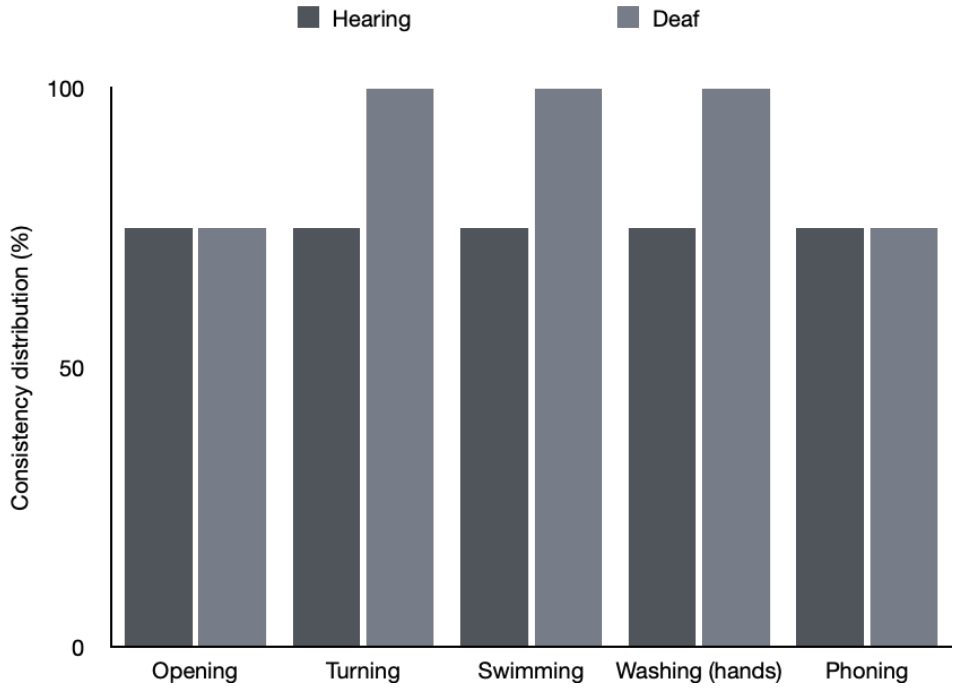

Figure 7. Consistencies for the individual items in the predicate subtest within the groups of hearing and deaf children.

To ascribe between groups consistency to the execution parameters, all of the items where each group reached the established consistency were selected, and comparisons were limited to those items only. Table 2 shows the consistencies for the hearing and deaf groups for each item according to the four execution parameters considered in the coding. Whether there is consistency between these two groups is also shown.

Item	Consistency		
	Hearing group (of 4)	Deaf group (of 4)	Comparison
Glass	4	4	√
Comb	2	4	-
Umbrella	1	4	-
Gloves	4	2	-
Lion	4	4	×
Opening	3	3	√
Turning	3	4	√
Swimming	3	4	√
Washing (hands)	3	4	×
Phoning	3	3	√

×, consistency not reached between groups; √, consistency between groups;

-, between groups comparison not possible

Table 2. Between groups consistency per execution parameters per item, as the hearing and deaf children.

This analysis shows that the hearing and deaf groups were comparable in seven items out of 10, with both being consistent in these items. Among these seven comparable items, five were produced with the same parameters (for three items, the four execution parameters were all the same, while for two items, three out of four were the same). Four of these items are part of the Predicate subtest (i.e., 'opening', 'turning', 'swimming', 'phoning'), and one is part of the Noun subtest (i.e., 'glass'). In the case of two of the items (i.e., 'lion', 'washing') where the hearing and deaf groups where both consistent, the hearing group gesture production was different from the sign production of the deaf group.

Representational strategies

Analysis of group consistency for the representational strategies was based on the proportions (%) of the consistency distributions per strategy within each group. First, we show these degrees of representational strategies for gestures/signs produced within each group, then we analyze the strategies produced by each group for a given item, and compare these within groups and between groups.

Figure 8 shows the proportions (%) of the representational strategies distribution within the hearing and deaf groups. Both the hearing and deaf children used all four representational strategies in their gesture/sign productions. In both groups the size and shape strategies were rarely used. For the other three strategies, while the hearing children did not show particular preference for any one strategy, the deaf children frequently used the hand-as-hand strategy.

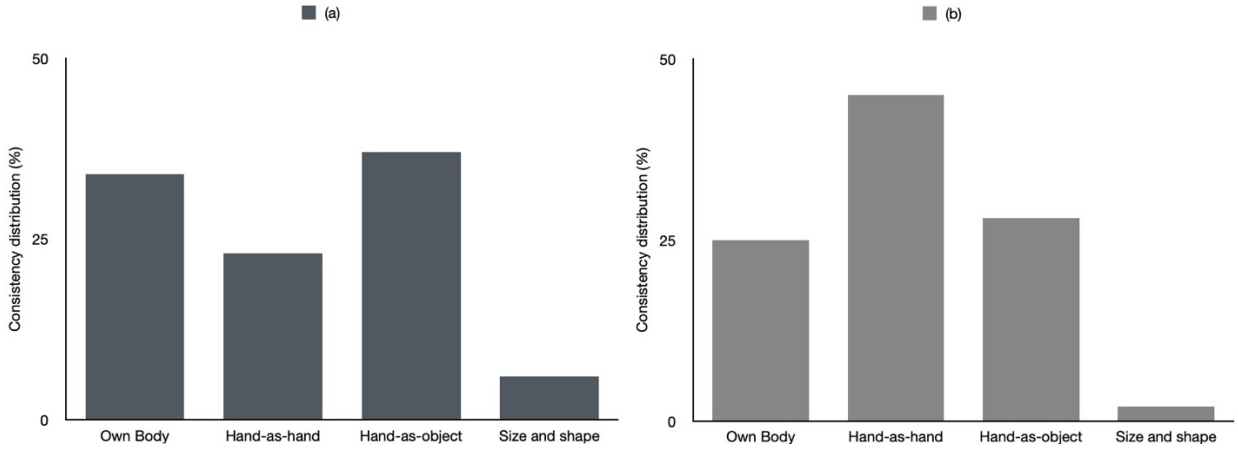

Figure 8. Representational strategy distributions within the groups of hearing **(a)** and deaf **(b)** children.

Table 3 shows the consistencies for the individual items within and between the two groups. To attribute the between groups consistency in the representational strategies, we compared whether the hearing and deaf children chose to use the same strategy for the same item. This is shown by the systematicity in Table 3, to indicate whether there was consistency between the hearing and deaf groups.

As can be seen, the hearing children were particularly consistent in the choice of their representational strategies for nouns, while they were consistent for predicates four times out of five (with the exception of the item 'phoning'). Instead, the deaf group was consistent four times out of five for their production of nouns, with the exception of the item 'gloves', and always consistent in the production of the predicates.

Both groups consistently selected a representational strategy in relation to stimulus type/item. In particular, when items represented manipulable objects (for both nouns and predicates), the preferred strategies were 'hand-as-hand' or 'hand-as-object', with the latter mainly used by the hearing children. When the items represented an animated being (e.g., 'lion') or an action performed with the body (e.g., 'swimming', 'washing hands'), the preferred strategy was 'own body' (i.e., personification).

The two groups were comparable on four items for the nouns and four for the predicates, and out of these eight items they used the same representational strategies for five. The hearing and the deaf children selected the same strategy for one item of the noun subtest (i.e., 'glass'), and for four items of the predicate subtest (i.e., 'opening', 'turning', 'swimming', 'washing hands').

Subset	Item	Consistent strategies				Consistency between groups
		Hearing group		Deaf group		
		Strategy	Consistency (%)	Strategy	Consistency (%)	
Noun	Glass	Hand-as-hand	100	Hand-as-hand	67	√
	Comb	Hand-as-object	87	Hand-as-hand	71	×
	Umbrella	Hand-as-object	71	Hand-as-hand	100	×
	Gloves	Hand-as-hand	100	Hand-as-hand	43	-
				Hand-as-object	43	-
	Lion	Own-body	75	Hand-as-object	80	×
Predicate	Opening	Hand-as-hand	100	Hand-as-hand	90	√
	Turning	Hand-as-object	67	Hand-as-object	64	√
	Swimming	Own-body	100	Own-body	90	√
	Washing (hands)	Own-body	100	Own-body	100	√
	Phoning	Hand-as-object	55	Hand-as-hand	66	-
		Hand-as-hand	45			

×, consistency not reached between groups; **√**, consistency between groups;

-, between groups comparison not possible

Table 3. Consistencies for the individual items within and between the groups.

Discussion

The objective of our study was to investigate whether and how much gestural and signed productions of hearing and deaf children are consistent both within each group and in comparisons between groups. We compared for the first time the productions of preschool hearing children (exposed to spoken Italian) and deaf children (exposed to LIS) in response to the same visual stimuli (i.e., pictures of actions, objects, animals). All of the gestures and signs productions were analyzed according to the execution parameters and the representational strategies. These data show that there was a high degree of consistency in the execution parameters and in the representational strategies within both groups of hearing and deaf children.

For the execution parameters, location was the parameter with the highest degree of consistency in both of the groups, and handshape was the parameter with the lowest degree of consistency, although this still reached the established consistency in both of the groups. With respect to items, the analysis shows that hearing children were consistent in eight items out of 10, while the deaf group production was consistent in nine items out of 10. The comparisons of the consistency between the groups show that for five items hearing and deaf children produced the same four parameters. A very similar picture emerged when we considered consistency for the representational strategies: within each group, the productions were consistent in nine items out of 10. The between group comparisons showed that the two groups used the same strategy for five items.

Current findings show that not only children exposed to sign language are consistent in their productions, as the same happened here for the hearing children in their use of gestures. The high 'consistency' in the execution parameters for both gestures and signs suggests two important points for reflection.

The first and most important one is that these findings urge us to review the definition of gestures as idiosyncratic (i.e., created on the spot), holistic, and not segmentable or analyzable. These findings are in line with data from previous studies that have indicated that many iconic gestures are highly consistent across individuals, as the body is the main articulator and it motivates the selection of consistent patterns in gesturers (Chu and Kita, 2016; Ortega and Özyürek, 2016, 2019a, b; Padden et al., 2015, 2013; van Nispen, van de Sandt-Koenderman, Mol and Krahmer, 2017).

The second consideration refers to the consistency in the productions of different execution parameters. It is clear from our data that unlike what Goldin-Meadow and Brentari claim (2017), it is not only the handshape that is 'consistently' produced, but

also the location and type of movement appear to reach high consistency, for both gestures and signs. Furthermore, the analysis of preferred strategies according to items shows that some pictures tended to elicit the use of the same strategy in all of the children across both of the groups. This finding confirms that the choice of a specific representational strategy is influenced by the type of stimulus represented – for both gestures and signs – which adds evidence to the theory that early motor experiences of children (both hearing and deaf) contribute to their building of similar modes of symbolic representation. The consistency in the use of representational strategies confirms these theories that consider actions at the origin of both gestures and signs. Finally, our findings showing that for five items the hearing and deaf children produced the same parameters and the same representational strategies in their gestures and signs appear to indicate that the two forms of communication are not separated by any 'cataclysmic break', but should instead be considered as a continuum.

Overall, these data appear to indicate that the distance between the Kendon (2004, 2014) perspective and the Goldin-Meadow and Brentari (2017) and McNeill (1995) positions might not be solved by simply saying that they are considering different types of gestures, as was speculated by Müller (2018). Indeed, our data show that even gesticulation or singular gestures have 'recurring' properties that are used in a consistent way by different gesturers. Thus, for us, even 'singular gestures' are in continuity with signs, and we do not see any clear 'cataclysmic break' between these.

On the other hand, we can agree with the Müller (2018) claim that a critical divide between gesture and sign is the result of a static and monadic concept of language. We believe that gestures and signs follow a similar process of construction and representation of meanings on the basis of our way of interacting in and with the world: through our

bodies and our hands, arising from actions and related to object affordances (Gibson, 1966; Hostetter and Alibali, 2008; Ortega and Özyürek, 2019a).

From a cognitive standpoint, we bow to the Wilcox (2009) theories on the contiguity between action, gesture, and language (as both spoken and signed). As he stated: "The phonological pole of gestures and signs consists of something that acts and its action. Hands are objects that move about and interact energetically with other objects. Hands are prototypical nouns and their actions are prototypical verbs." (Wilcox 2009: p. 402).

Conclusion

The results of the developmental study presented here strongly support the Kendon (2004, 2014) arguments that are based mainly on observations conducted on gestures performed by hearing adults. Kendon (2015, 2017) considered the term 'gesture' as categorically different from sign, and vague and ambiguous, while proposing instead to "develop a comparative semiotics of visible bodily actions as it is used in utterances used by speakers and signers" (Kendon, 2017, p. 30), which makes the relationships between action, gesture, and sign even more evident.

What is 'linguistic' communication and what is not? Even if we often convey meanings through visible bodily actions, these are rarely considered as a part of human language. However, co-verbal gestures have compositional structures and semantic significances. Studying 'speakers' and 'signers visible actions leads us to revise the dichotomy between 'linguistic' and 'enacted', and to develop a new approach to 'embodied' language.

We would like to close this study with a quotation from Kusters and Sahasrabudhe (2018) that invites us to contrast 'everyday language ideologies' of deaf people in Mumbai *versus* 'academic ideologies' on the difference between gestures and signs: "Academic ideologies on forms of gesturing and signing, organizing them on (fixed) continua or in classifications, have delocalized and decontextualized fluid language practices; simplified and essentialized their difference; or made distinctions where language users typically do not experience such distinctions […] within everyday language ideologies, the distinction between gesturing and signing is fluid, changeable, negotiable and context-dependent" (Kusters and Sahasrabudhe, 2018, p. 62).

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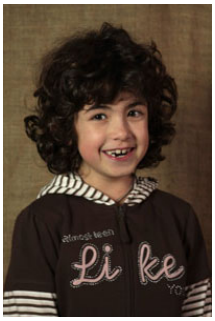
Appendix

Sample of 23 photographs and corresponding lexical items of Ping task (nouns and predicates) eliciting spontaneous representational gestures.

Washing

Kissing

Talking on a phone



Smiling

Falling

Spinning

Comb

Lion

Swimming

Pushing

Opening

Radiator

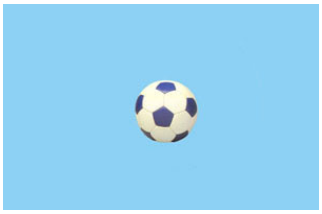
Eating

In front of

Gloves

Fork

Long



Small

Driving

Heavy

Umbrella

Flag

Nap

Chapter 3

Emozioni in segni: il caso della LIS

Bonsignori, C., & Proietti, M. (2020). Emozioni in segni: il caso della LIS. *Rivista Italiana di Filosofia del Linguaggio*.

Abstract

Theories related to embodied cognition show the important role of body experiences in human cognitive processes (Caruana, Borghi 2016, Clark 1997, Gallagher 2005, Smith 2005, Varela *et al.* 1991). Sign languages are a special window in exploring the route from perception to concept construction, as they allow to visualize linguistic embodiment of perceptual experiences (Volterra *et al.* 2018, Wilcox, Xavier, 2013). Iconicity shows a resemblance of semantic and phonological structures, revealing a common conceptual space grounded in cognitive abilities of language users and connected to their world perception and interaction. Different studies highlight the presence of visual metaphors in signs supporting the importance of embodiment and perception of the surrounding world in the construction of meanings (Boyes Braem 1981, Pietrandrea 2002, Russo 2004).

The aim of this study is to investigate linguistic representations of emotions in Italian sign language (LIS) focusing on visual metaphors subsumed at the sublexical level. For the present study, we analyzed the handshapes, movement and location of 70 signs related to emotion. Due to this analysis we identified metaphors grounded in parameters'

features (ex: the chest is the container of emotions; the down movement is mostly present in negative signs).

Identified visual metaphors reveal the importance of the body in world perception and in the process of building meaning.

Improvements in cognitive approaches to language may need to pass through an investigation of the tight metaphorical relation between form and meaning in signed emotion-related lexicon.

Keywords: Sign language, Embodiment, LIS, Metaphors, Emotions

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Introduzione

What mysteries are embedded in a sign?

The simplest words in ASL have passed through the hands of thousands of deaf people. The motions have been repeated millions of times. What happens to shape and to the meaning of common signs in ASL when they have been breathed on and embodied daily by deaf people? What metaphors have mapped onto the knuckles, fingers, skin, and bones of a sign?

(Wilcox Perrin 2000: 146)

Il farsi strada delle teorie riconducibili all'*embodied cognition* ha portato alla luce il ruolo costitutivo dell'esperienza corporea nei processi cognitivi umani (Clark 1997, Gallagher 2005, Smith 2005, Varela, Thompson, Rosch 1991). Uno dei temi affrontato dal modello *embodied* riguarda la conoscenza semantica. Secondo queste teorie, per comprendere il mondo esterno ci avvaliamo di diverse modalità percettive e motorie che si sono sviluppate in specifiche nicchie ecologiche, che hanno un rapporto enattivo e situato con l'ambiente esterno e contribuiscono alla costruzione dei concetti (Clark 1997, Merleau-Ponty 1945). Ad esempio, seguendo l'approccio di Gibson (1979) gli stessi meccanismi percettivi operano seguendo cicli continui di feedback con l'ambiente esterno più che avere una struttura modulare chiusa. D'altra parte, recenti ricerche hanno documentato come il sistema motorio contribuisca alla codifica degli scopi delle azioni altrui, evidenziando l'importanza del corpo nella comprensione intersoggettiva (Rizzolatti *et al.* 1988, Rizzolatti, Sinigaglia 2019).

Il processo cognitivo sul quale ci concentreremo in questo studio è quello del linguaggio, inteso come sistema che coinvolge il corpo e che utilizza molteplici modalità espressive.

Nella maggior parte dei casi la comunicazione tra due o più individui avviene in presenza, faccia a faccia. Durante queste interazioni gli interlocutori si trovano a interpretare informazioni veicolate da diversi canali: quello acustico-vocale per le parole e quello visivo-gestuale per i movimenti del corpo e delle mani. Il gesticolare è infatti un fenomeno presente in tutte le culture del mondo ed è innaturale reprimerlo durante la comunicazione spontanea. La presenza di questo fenomeno e l'esistenza di lingue che si esprimono in pienezza attraverso il solo canale visivo-gestuale, sono la prova della necessità di considerare il linguaggio come intrinsecamente multimodale (Cienki 2012). Diverse discipline si sono occupate di osservare da diversi punti di vista quello che è il ruolo dell'esperienza sensori-motoria nella cognizione. La linguistica cognitiva negli anni '80 ha mostrato come differenti concetti astratti si costruiscano su metafore basate sulla nostra comprensione incorporata del mondo (Lakoff, Johnson 1980, Johnson 1987). L'esperienza che i nostri corpi fanno interagendo con lo spazio circostante, come ad esempio la verticalità, costituirebbe la base su cui metaforicamente proiettare concetti astratti quali tristezza e felicità ("oggi mi sento giù"). Numerosi studi in lingue appartenenti a famiglie linguistiche molto distanti tra loro, hanno messo in luce un estensivo utilizzo di metafore legate al corpo nell'espressione di concetti astratti. L'idea centrale di questo approccio è che il linguaggio figurato che usiamo quotidianamente nel riferirci ad alcuni domini semantici rifletta il modo in cui tali domini sono concettualizzati. Ad esempio, l'utilizzo estensivo di frasi quali "le vacanze natalizie sono dietro l'angolo", "purtroppo non si può tornare indietro", "il tempo vola", suggeriscono la concettualizzazione del tempo in termini di movimento nello spazio (Lakoff, Johnson 1980, Soriano 2015).

La sistematicità delle metafore concettuali non è provata solo dalla loro presenza in lingue diverse, ma anche dal fatto che è possibile spiegare alcuni schemi polisemici e slittamenti di significato in diacronia attraverso riferimenti metaforici di questo tipo.

Molti studi effettuati nell'ambito della linguistica cognitiva hanno avuto come interesse centrale l'espressione degli stati emotivi. L'esprimere le emozioni è un campo semantico particolarmente proficuo per questo tipo di espressioni metaforiche.

Il lessico delle emozioni, come notato da Vigliocco *et al.* (2009), Kousta *et al.* (2011) e Mazzucca *et al.* (2017) si situa in uno spazio che potremmo definire limbo semantico, a metà strada tra lessico astratto e concreto. Come sottolineato da numerosi psicolinguisti, infatti, le emozioni si riferiscono a concetti astratti di cui però l'essere umano fa esperienza, attraverso reazioni fisiologiche piuttosto concrete, come la pelle d'oca, l'aumento della temperatura corporea, l'accelerazione del battito cardiaco. Oltre ai legami di tipo metaforico, secondo Kövecses (1990, 2000) è dunque possibile rintracciare anche dei collegamenti metonimici che, all'interno dello stesso dominio, usano tratti della fisiologia delle nostre emozioni per concettualizzare l'emozione stessa. Tuttavia, nel considerare il linguaggio come fenomeno derivato da un'esperienza sensori-motoria, è necessario tener conto del ruolo della componente culturale nell'elaborazione di concetti linguistici. L'esperienza consiste nell'insieme di diversi aspetti percettivi che possono essere considerati ed enfatizzati in modi differenti da culture e lingue diverse. Ad esempio, le reazioni fisiologiche associate alla rabbia, come l'aumento della temperatura corporea, della pressione sanguigna e il velocizzarsi del respiro e del battito cardiaco, sono universali, ma lingue legate a culture diverse non danno lo stesso peso e non utilizzano gli stessi collegamenti linguistico-metaforici per riferirsi alle stesse reazioni (Ekman *et al.* 1983, Kövecses 1990, 2005). In inglese ed

ungherese, ad esempio, l'aumento della temperatura corporea e l'innalzamento della pressione sanguigna ricevono la stessa attenzione, mentre in cinese la presenza dell'aumento di pressione sembra essere molto più cruciale (Kövecses 2010). Il lavoro di Rosaldo (1980) spiega come i llongot della Nuova Guinea abbiano un termine, *liget*, che indica la rabbia, ma intesa come una sorta di intensa energia, uno stato di profonda agitazione fisica. Sembra quindi che lingue e culture differenti colleghino il loro concetto di rabbia a livelli e componenti diversi dell'*embodiment*, creando metafore in parte universali e in parte culturali. La metafora secondo la quale "la rabbia è un liquido bollente in un contenitore" (es: ribollire dalla rabbia) in lingua inglese è proprio il risultato di questo passaggio dalla selezione di una componente dell'esperienza sensori-corporea, in questo caso l'aumento della temperatura e della pressione all'interno del corpo (come contenitore delle emozioni), alla metafora linguistica (Lakoff, Kövecses 1987).

Il sistema culturale e linguistico non solo guida la scelta di quale dominio corporeo usare per costruire la metafora, ma anche la scelta di quale dominio semantico enfatizzare. La letteratura distingue nel lessico emotivo due aspetti: il valore dell'emozione in questione (positivo/negativo) e il suo livello di eccitazione, o intensità ('arousal'). Questi due aspetti sono spesso veicolati da costruzioni metaforiche diverse: ad esempio emozioni descritte come malattia rimandano alla loro valenza negativa, mentre una concettualizzazione dell'emozione come fuoco rimanda ad una forte intensità.

Evidenziando le motivazioni esperienziali della struttura linguistica, non si vuole dunque negare alla lingua e alla cultura la profonda influenza che esercitano nell'uso e nella sistematizzazione di determinati schemi metaforici. Inoltre, se consideriamo l'interazione tra parlanti e la comprensione delle metafore, il riferimento alla sola

esperienza motoria non è sufficiente, poiché, come accuratamente descritto in Fontana, Cuccio (2013), la creazione e la comprensione di rappresentazioni simboliche necessita di abilità socio-cognitive complesse.

Metafore concettuali e metonimie rappresentano un punto di vista ideale per tracciare il legame corporeo-esperienziale con la significazione; nel creare metafore infatti la nostra esperienza corporea viene usata nel processo comunicativo come base da proiettare in concetti astratti (Lakoff, Johnson 1980, Fontana, Cuccio 2013). Nelle parole e negli enunciati delle lingue vocali, tale processo è visibile solo con un'analisi semantica, nella sfera del significato. Nelle lingue dei segni, al contrario, è spesso possibile osservare l'influenza del corpo anche a livello del significante, della fonologia del segno.

Il presente lavoro si propone dunque di osservare quali metafore concettuali e quali rappresentazioni metonimiche ritroviamo cristallizzate nel lessico emotivo della Lingua dei segni italiana (LIS), partendo dalle unità costitutive del segno.

Lo scopo centrale del lavoro può essere ben raffigurato da questo esempio: in LIS uno dei segni usati per il termine 'emozione' (fig. 1) rimanda alla pelle d'oca, iconicamente raffigurata nel segno. In questo caso non siamo davanti ad una metafora cognitiva ma piuttosto ad una metonimia, che parte dal dato corporeo concreto e lo estende all'astratto; la particolare connotazione del lessico emotivo, a metà strada tra il lessico astratto e concreto, lo rende un ottimo punto di osservazione per analizzare come una lingua visiva usi il corpo nel processo di significazione.


Fig. 1 segno traducibile in italiano come ‘emozione’ (www.spreadthesign.com)

Le lingue dei segni: metafore e iconicità

Le lingue dei segni sono il sistema di comunicazione sviluppato dalle comunità di persone sorde. La natura di queste lingue è quella di esprimersi attraverso il canale visivo-gestuale e non quello fonico-acustico. L’utilizzo di una diversa modalità di espressione comporta alcune peculiarità nelle modalità di costruzione del segno linguistico, tra cui la preminenza dell’iconicità. Come è stato osservato da diversi studiosi (Cuxac 2001, Russo 2004, Pietrandrea 2002) le lingue dei segni rendono materiale di significazione prassi legate all’uso quotidiano delle mani e del corpo, che vengono mediate dalla negoziazione dei segnanti ed entrano a pieno titolo nel patrimonio linguistico della comunità. Lo stesso procedimento avviene nel caso dei gesti degli udenti (Kendon 2004), i gesti sono interpretabili come il frutto dell’azione e delle esperienze percettive concettualizzate e in quanto tali rappresentano un segno tangibile di come la rappresentazione corporea entri nella lingua.

Come dimostrato da Borghi *et al.* (2014) nel loro studio delle strategie usate dalla LIS nella rappresentazione di concetti astratti, un’attenta analisi delle diverse pratiche di significazioni riscontrabili nei segni può offrire nuovi spunti di riflessione al dibattito sulla natura incarnata del linguaggio.

Volterra *et al.* (2019), nel loro recente lavoro, propongono una nuova descrizione delle unità costitutive della LIS che evidenza l'importanza di tutte le componenti corporee, non solo quelle manuali. Un segno infatti può essere formato solo da componenti manuali, solo da componenti corporee o da una combinazione di queste due. Il segno può essere realizzato utilizzando una sola mano o anche due mani. Esso è composto da quattro parametri costitutivi: la configurazione, il luogo dove viene articolato il segno, il movimento e l'orientamento del palmo della mano. Sono poi presenti altri quattro parametri a livello corporeo: l'espressione facciale, le componenti orali[7], i movimenti del busto e la direzione dello sguardo. Gli otto parametri sopra descritti si combinano per creare unità di senso. Ciascuno degli otto parametri può avere delle caratteristiche iconiche, ad esempio la configurazione della mano può collegarsi al modo in cui si afferra un oggetto, o può rappresentare la forma di un referente.

La presenza sistematica di una dimensione del significato all'interno dei parametri del segno, spesso descritti come le unità minime del significante, è stata notata per la prima volta da Penny Boyes Braem, nel 1981. Nelle lingue dei segni la relazione tra la componente semantica e quella fonologica (realizzata dai parametri) è sì arbitraria, in quanto non esiste un rapporto di motivatezza logico-naturale necessario, tuttavia è possibile individuare un livello intermedio, definito livello di rappresentazione

[1] La presenza di componenti orali nella LIS è un fenomeno molto complesso che è stato per molti anni considerato come un fenomeno di contatto con l'italiano e quindi trascurato per non mettere in discussione l'indipendenza linguistica e il prestigio della LIS. All'interno delle componenti orali esistono i cosiddetti gesti labiali o COS – componenti orali speciali – che sono dei movimenti delle labbra non in relazione alla lingua vocale. Ci sono poi le labializzazioni dette IPP o COP – immagini di parole prestate o componenti orali del parlato, ad indicare questa volta i movimenti della bocca legati alla lingua italiana. Queste componenti possono essere paragonate ai gesti co-verbali del parlato che accompagnano il segno e, attingendo risorse dalla lingua vocale più standardizzata, permettono una maggiore intellegibilità e stabilità nella comunicazione dei parlanti (Volterra *et al.* 2019).

simbolica, dove elementi visivi introducono tratti di motivatezza naturale tra significato e significante. La studiosa descrive le configurazioni della ASL analizzando la relazione tra la forma assunta dalla mano e il significato del segno o dell'enunciato in termini di metafore, definite 'visive'. Esempio di tale prospettiva è la descrizione della configurazione B (fig. 2), caratterizzata da tratti articolatori che diventano anche semantici: il contatto delle dita disposte in piano permette in ASL il riferimento a superfici piane, la ritroviamo dunque in segni costruiti sulla rappresentazione di superfici: finestra, porta, foglio, casa, libro. Questo tipo di metafore sembrano quindi essere strettamente legate ad aspetti sensori-motori dell'esperienza.

Taub (2001), nel suo importante contributo dedicato all'iconicità nelle lingue segnate, propone una visione della costruzione di metafore concettuali in ASL fondata su una doppia associazione: l'associazione metaforica tra un dominio astratto e un dominio concreto e quella iconica che collega il dominio concreto all'articolazione del segno. Metafora e iconicità sono visti dunque come due potenti strumenti per la creazione di un linguaggio figurato estremamente vivido.

Lo studio del lessico legato all'emozioni in LIS

Obiettivo e ipotesi

Questo studio si pone l'obiettivo di osservare le unità sublessicali del lessico della LIS legate all'espressione delle emozioni e alla descrizione di stati d'animo. L'ipotesi è quella che nei parametri costitutivi dei segni siano rintracciabili delle metafore concettuali, visive, fortemente legate all'esperienza sensori-motoria. La possibilità di osservare questo fenomeno ci offre un'opportunità per orientare i nostri studi futuri e la concezione del linguaggio e della cognizione come fenomeni legati all'esperienza corporea e a considerarli come incorporati.

Metodologia

Per individuare il lessico legato all'espressione delle emozioni in LIS ci siamo inizialmente rivolti a 3 segnanti sordi esperti, collaboratori del laboratorio LaCAM dell'ISTC, ai segni presenti nel dizionario bilingue elementare della lingua dei segni italiana (Radutsky 1992) e al recente dizionario online Spreadthesign (www.spreadthesign.it). Ai segnanti è stato chiesto di indicare i segni da loro quotidianamente usati per parlare della sfera emotiva (comprendenti reazioni fisiologiche, sentimenti, stati d'animo). In questo modo è stata ottenuta una raccolta di 80 segni. La mancanza di strumenti di consultazione quali corpora e grandi dizionari, così come l'alto livello di variabilità linguistica, rende sempre necessaria una attenta valutazione dei dati linguistici raccolti.

A tal proposito, per validare la nostra raccolta di segni è stato realizzato un questionario online (Proietti *et al.* 2019) in cui i partecipanti avevano la possibilità di indicare per

ogni segno la sua valenza (positiva, negativa, ambivalente), l'uso del segno (usato spesso, poco, mai) e il livello di 'arousal' (molto calmo, neutro, molto eccitato). Nell'indicazione della valenza del segno e della sua intensità il questionario prevedeva l'utilizzo delle emoticon, seguendo una metodologia usata in studi riguardanti la valenza del lessico emotivo (Betella, Verschure 2016) siamo riusciti a limitare l'uso dell'italiano scritto, sconsigliabile nel caso di indagini linguistiche con parlanti bilingui di LIS e Italiano. Il questionario è stato compilato da 21 segnanti e ha portato all'eliminazione di 10 segni, giudicati come mai usati da più del 50% dei partecipanti.

I restanti 70 segni sono stati il punto di partenza dell'analisi descrittiva del presente studio. Attraverso l'uso del software di codifica multimodale Elan[8] sono stati codificati i seguenti parametri: la configurazione, il movimento, la maniera del movimento, il luogo e le espressioni facciali. Per la codifica di quest'ultime è stato utilizzato il sistema di trascrizione 'Sign Writing' (SW)[9] (Sutton 1981, Di Renzo *et al.* 2011) per il quale il viso risulta essere diviso in fronte, sopracciglia, occhi, sguardo, orecchie, naso, guance, respiro, bocca, lingua, denti, mento (Di Renzo *et al.* 2011). Nel presente contributo illustreremo i primi dati relativi ai parametri manuali in relazione alla valenza.

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2 https://tla.mpi.nl/tools/tla-tools/elan/, Max Planck Institute for Psycholinguistics, The Language Archive, Nijmegen, The Netherlands.

3 La coreografa Valerie Sutton utilizzò questo sistema di trascrizione per la lingua dei segni americana (ASL), adattando un sistema per descrivere i movimenti della danza originariamente ideato da lei nel 1973. La trascrizione in SW è presente accanto ad ogni immagine raffigurante i segni scelti come esempi in questo studio ed è stata curata da Alessio Di Renzo.

Risultati e analisi

Nel seguente paragrafo sono presentati i risultati inerenti all'analisi delle componenti manuali (nello specifico della configurazione, movimento e luogo) dei 70 segni: 8 segni sono stati definiti ambivalenti, 33 negativi e 29 positivi.

Cercheremo di interpretare quelle che sono le metafore visive collegate agli elementi sublessicali di questi segni partendo dalle configurazioni, per poi passare al movimento ed infine al luogo.

Nel grafico 1 si possono vedere quali sono state le configurazioni, i movimenti e i luoghi maggiormente presenti nel gruppo dei segni e come sono distribuiti questi parametri in base alle emozioni identificate come negative (in blu), positive (in verde) e ambivalenti (in grigio).

Quello che emerge soffermandoci sul parametro della configurazione è la maggiore presenza delle configurazioni 5 (fig. 2) e 5^ (fig. 2) (utilizzate sia per segni collegati ad emozioni negative che positive. Le configurazioni A (fig. 2) e G (fig. 2) sono invece collegate a connotazioni negative e raramente ambivalenti. Infine la configurazione B (fig. 12) appare essere ugualmente distribuita.

La configurazione 5 (fig. 2) è utilizzata in prevalenza per segni che si riferiscono ad emozioni positive. La mano distesa e le dita delle mani aperte possono rimandare metaforicamente all'apertura e alla distensione emotiva. Collegata a questo tipo di emozioni positive c'è anche la configurazione B (fig. 2) in cui le dita sono vicine tra loro ma comunque distese. Al contrario la configurazione 5^ (fig. 2), in cui le dita sono contratte e i muscoli della stessa mano sono tesi, è usata in molti segni riferiti alla tensione emotiva, come ad esempio 'rabbia' (fig. 3). Collegate ad emozioni negative

sono anche la configurazione A (fig. 2) in cui il pugno è completamente chiuso e la configurazione G (fig. 12) usata in segni in cui è rappresentato l'intrusione di un elemento esterno all'interno del corpo, come esemplificato dal segno 'invidia' (fig. 4).

Per quanto riguarda il parametro del movimento, osserviamo una distribuzione quasi omogenea della valenza delle emozioni nei diversi tipi di movimenti codificati.

Possiamo osservare l'eguale distribuzione del movimento circolare per emozioni negative e positive. Il movimento verso il basso invece, risulta essere collegato sia ad emozioni positive che negative, ma con una leggera predominanza verso i segni di emozioni negative (ad esempio il segno 'triste' fig. 5). Possiamo spiegare questo maggiore uso in segni connotati negativamente richiamando la metafora *up is good/ down is bad* di Lakoff e Johnson (1987). Il movimento verso l'alto è invece utilizzato sia nei segni con valenza positiva sia in quelli con valenza negativa, mentre il movimento in avanti sembra essere predominante nelle emozioni positive (ad esempio il segno 'amore', fig. 6).

L'ultimo parametro analizzato è quello del luogo: quello maggiormente usato nei segni raccolti in questo studio è il busto (fig. 3, 4, 6, 8, 10, 11, 12). Questo si rivela essere il luogo privilegiato delle emozioni, sia di connotazione negativa che positiva, mentre lo spazio neutro è utilizzato in prevalenza per emozioni negative (fig. 9).

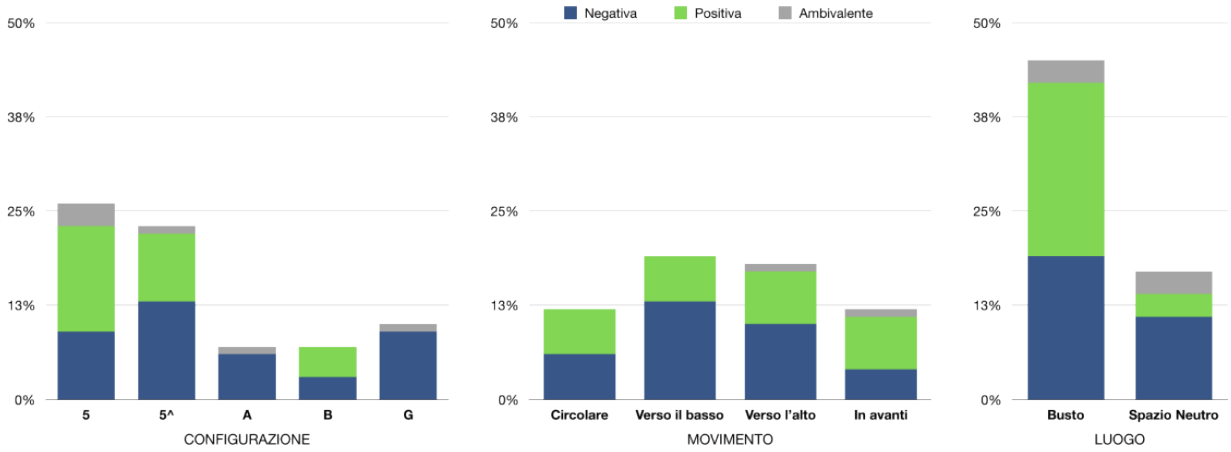

Grafico 1 - Distribuzione dei parametri: nel grafico sono raffigurati i parametri presenti in più del 10% dei segni analizzati

Fig. 2 - Le configurazioni 5, B, 5^, A, G

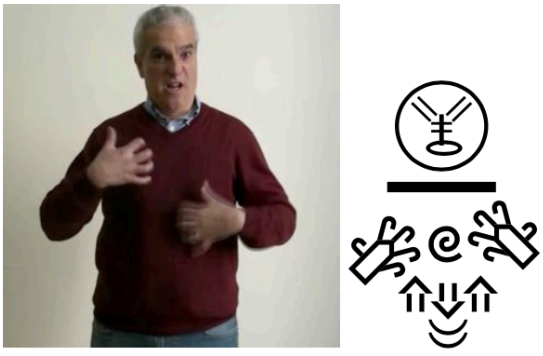

Fig. 3 - Segno traducibile in italiano con 'rabbia'

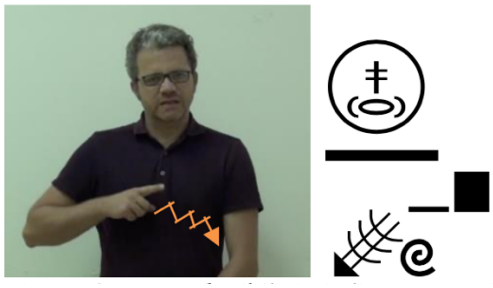

Fig. 4 - Segno traducibile in italiano come ‘invidia’

Fig. 5 - Segno traducibile in italiano come: ‘triste’

Fig. 6 - Segno traducibile in italiano come: ‘amore’

Fig. 7 - Segno traducibile in italiano come: ‘contento’

Fig. 8 - Segno traducibile in italiano come: ‘sollievo’

Fig. 9 - Segno traducibile in italiano con: ‘rassegnazione’

Fig. 10 - Segno traducibile in italiano come: ‘salire di un’emozione negativa’

Fig. 11 - Segno traducibile in italiano come: ‘sollievo, liberazione’

Fig. 12 - Segno traducibile in italiano come: ‘reprimere’

Discussione

Una prospettiva che vede il linguaggio come *embodied* apre la strada a considerare il modo in cui le lingue dei segni pertinentizzano l'interazione tra il nostro corpo e l'ambiente che ci circonda.

L'articolazione linguistica nelle lingue segnate è di tipo visivo e corporeo, nel senso che sono le nostre mani, le nostre espressioni e il nostro corpo a entrare nel repertorio fonologico della lingua. Questa peculiare caratteristica delle lingue segnate ci permette un'analisi delle metafore espresse all'interno del segno, nella sua costituzione.

Da una prima analisi rivolta alle configurazioni maggiormente presenti nel nostro studio possiamo vedere come le configurazioni utilizzate in almeno il 10% dei 70 segni siano la 5, 5^, A, B, G (fig. 2). Tranne la configurazione 5^ (fig. 2), le altre quattro rientrano nelle cosiddette configurazioni non-marcate. La realizzazione di questo tipo di configurazioni richiede uno sforzo motorio minimo in quanto al massimo ritroviamo l'allungamento di una o più dita. Questo tipo di configurazioni risultano essere quelle maggiormente utilizzate e acquisite per prime nelle lingue dei segni (Battison 1978, Boyes Braem 1994, Petitto, Marentette 1991, Sparaci, Volterra 2017). Considerando il suo status di configurazione marcata è ancora più interessate la cospicua presenza della 5^ (fig. 2) in segni caratterizzati dalla tensione emotiva; la relazione tra tensione e questa configurazione è stata notata anche da Pietrandrea (1995) non solo in relazione al lessico emotivo ma in uno studio effettuato su 1944 segni presenti nei dizionari LIS.

L'analisi degli altri due paramenti (movimento e luogo), ci ha portato all'individuazione di due metafore principali: quelle di orientamento nel parametro del movimento e quella del 'contenitore' nel parametro del luogo.

Come descritto nel paragrafo dei risultati, all'interno della nostra raccolta di segni è presente lo schema metaforico *up is good/down is bad*. Una prima analisi quantitativa mostra come il movimento più usato per descrivere emozioni classificate come negative è il movimento verso il basso (grafico 1). Un' analisi accurata dei segni rivela che questo movimento è presente in segni quali 'triste' (fig. 5), 'invidia' (fig. 4), 'rassegnazione' (fig. 9), 'abbattimento', 'delusione', 'demoralizzato'.

Il lessico dedicato alla sfera semantica della tristezza e della delusione si costruisce dunque all'interno di una metafora orientazionale basata su uno schema motorio. Come descritto da Lakoff e Johnson (1987) le metafore di orientamento sono fondate su schemi motorio-spaziali costruiti a partire dal movimento dei nostri corpi. Gli autori ipotizzano la formazione di tali metafore come basate sull'esperienza della nostra postura, tipicamente ricurva nell'espressione corporea dell'abbattimento.

Nonostante il tratto 'down' sia quindi presente nei nostri segni, al contrario il concetto di positività collegato all'alto sembra essere uno schema meno produttivo nei nostri dati, ma è certamente riscontrabile nel segno 'contento' (fig. 7) e nel segno 'sollievo' (fig. 8). La presenza di questo schema metaforico all'interno delle lingue segnate è stata osservata per l'ASL da Wilbur (1987), e Wilcox Perrin (2000) e da Fontana e Cuccio per le lingue dei segni primarie (LSP).

Altra metafora basata su un dato esperienziale di orientamento nello spazio è l'idea del movimento in avanti, sia delle mani che del busto, come relazione tra l'io e l'altro, in un movimento che parte dal corpo del segnante e si dirige verso l'esterno. Lo ritroviamo infatti nei segni di 'amore' (fig. 6), 'odio', 'innamorarsi', in questo caso la scelta del parametro sembra essere legata non alla valenza del concetto espresso (positivo e

negativo) ma alla salienza della relazione tra il sé e l'altro, l'emozione è un oggetto che si muove verso l'altra persona.

La metafora del 'contenitore' è invece rintracciabile nel parametro del luogo. Come mostrato nel grafico 1, il busto, comprendente il petto e lo stomaco, è il luogo più presente nella nostra raccolta di segni; tale preferenza non è estranea ad altre lingue segnate. Taub (2001) nota la presenza del petto come luogo delle emozioni nel lessico emotivo dell'ASL e, per sottolineare il valore di tale parametro, riporta l'esempio del segno ASL per 'bollire', articolato nello spazio neutro: modificando tra i parametri unicamente il luogo di esecuzione, dallo spazio neutro al petto, il segno assume il significato di 'provare un'intensa e incontrollabile rabbia'. È facile riscontrare dunque anche in ASL la presenza della metafora della rabbia come elemento fluido e ardente in un contenitore. La metafora attorno al più generale dominio del 'contenitore' è stata a lungo studiata dalla linguistica cognitiva (Lakoff, Johnson 1980, Johnson 1987) e in particolare riguardo all'espressione delle emozioni (Kövecses 2010). Secondo Lakoff e Johnson (1980) questo tipo di metafora sarebbe classificabile come ontologica (in opposizione alle metafore di orientamento) perché basata sulla nostra esperienza con gli oggetti e sostanze, e prima di tutto intende il nostro corpo come entità separata dal resto del mondo e in interazione con l'ambiente circostante in termini di dentro/fuori, contenente/contenuto. Quando si entra nella sfera delle emozioni il nostro corpo è spesso presentato in enunciati quotidiani come la sede, il contenitore appunto, delle nostre emozioni, basti pensare alle espressioni: "sono pieno di gioia" o "mi sento svuotato". Nel caso dei nostri segni, riteniamo che la LIS ci mostri un interessante esempio di cristallizzazione della metafora del contenitore. I segni raffigurati nelle immagini 10, 11 e 12 sono costruiti sulla stessa metafora del petto come contenitore di un'emozione

negativa. Nel caso del segno 10, l'emozione sale dalla pancia e arriva fino al limite del contenitore, prossimo allo scoppio, rappresentando dunque un senso di frustrazione, rabbia e tensione. Nel caso del segno raffigurato in 11, invece, il livello di tensione si abbassa, svuotando il contenitore esprimendo dunque liberazione, sollievo. Infine, il segno raffigurato in 12, attraverso una modifica della maniera del movimento e delle espressioni facciali rappresenta la repressione dell'emozione che, non svanendo da sola, viene spinta verso il basso. In questi tre segni la metafora è data non solo dalla salienza del luogo, lo stomaco, in molte lingue sede degli impulsi o dell'innamoramento ("agire di pancia", "farfalle nello stomaco"), e la parte superiore del petto, ma anche dalla configurazione della mano, B (fig. 2), spesso usata per indicare superfici piane in questo caso per indicare il livello dell'emozione contenuta. All'interno di tale metafora, osserviamo dunque come tutti parametri concorrono alla costruzione del significato e il movimento verso il basso può essere veloce e rappresentare un valore positivo, la liberazione, o, al contrario rallentare e rappresentare la repressione, con il dovuto accompagnamento delle espressioni facciali.

Conclusioni

Nel presente studio è stata avanzata l'ipotesi che le lingue dei segni siano uno strumento unico per identificare lo stretto legame che esiste tra linguaggio ed esperienza corporea. Nello specifico questo legame risulta essere maggiormente rintracciabile nelle metafore visive presenti a livello sublessicale nei segni della LIS che si riferiscono alle emozioni.

L'analisi dei segni ci ha permesso di vedere come la selezione di determinati tratti di un segno per l'espressione di un'emozione da parte dei segnanti sordi italiani, rappresenti come un certo schema percettivo-motorio sia stato riconosciuto e condiviso dalla

comunità di segnanti come esplicativo di quell'emozione e quindi vi sia stato poi attribuito un valore linguistico. Secondo tale approccio la base motoria e sensoriale della nostra esperienza è un punto di partenza dei processi di significazione, sul quale si costruiscono i simboli linguistici. Tuttavia, essa sola non è sufficiente alla creazione di una lingua: la comunicazione si fonda sulla continua negoziazione tra parlanti e su abilità cognitive complesse.

I nostri risultati si allineano dunque con una visione per cui la componente simbolica delle lingue per essere trasmessa necessita che coloro che partecipano a una conversazione abbiano conoscenza condivisa del mondo, delle sue pratiche e anche delle possibilità semiotiche del nostro corpo. Possiamo dunque immaginare l'esperienza del corpo come il punto di partenza del processo linguistico e come punto finale in cui i concetti tornano ad esprimersi anche o solo attraverso di lui.

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Chapter 4

Un-box LIS signs: conceptual metaphors comprehension through the eyes of hearing speakers

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ABSTRACT

According to Embodied simulation theories bodily experiences are crucial in language production and comprehension. Bodily experiences are often expressed in conceptual metaphors used in spoken languages, in gestures and in sign languages. The aim of this study is to investigate how conceptual metaphors (i.e., BODY AS A CONTAINER) in Italian Sign Language (LIS) signs may facilitate the comprehension of LIS signs by hearing people who do not know any sing languages. Thirty-two hearing adults, Italian and foreigners, participated in this study. Filling an online questionnaire participants had to guess the meaning of the signs. Then, they read the true meaning of the signs and rated their iconicity. Italians and foreigners attributed higher iconicity rating and show higher accuracy in responses for signs with *box metaphor*. The Italian group accuracy was also higher for signs referred to emotions. Results of this study provide experimental evidence in favor to an embodied vision of language and for the understanding of the role of conceptual metaphors in comprehension when there is no knowledge of the language.

Keywords: conceptual metaphors; signs; embodiment; bodily experiences.

INTRODUCTION

In the framework of Embodied simulation theories, there is evidence that bodily experiences play a crucial role in language production and comprehension. Bodily experiences are often expressed in conceptual metaphors used in verbal expression in spoken languages, gestures and sign languages. The present paper will address the pervasive use of conceptual metaphors in communication introducing studies on gestures and sign languages. An experimental study focused on comprehension will then be introduced, investigating the role of conceptual metaphors in understanding Italian sign language (LIS) signs by hearing people with no knowledge of LIS from Italy and from other countries. Finally, findings from our study will be discussed in light of the theoretical framework, evaluating whether our results support the approaches to embodied language considering bodily experiences crucial in the process of grounding concepts and giving new evidences regarding the role of the body in language comprehension.

The bodily experience in language: the case of conceptual metaphors

The nature of the human capacity of communication and the nature of language itself are crucial topics in literature debate. Concerning the capability of understanding language, the mechanism of simulation (i.e., *Embodied simulation*, Gallese and Sinigallia 2011) was considered as a mechanism responsible for the idea that language is bounded in our bodily experiences (Barsalou 2008; Fisher and Zwaan 2008; Gallese and Lakoff 2005; Pülvermuller 2005). This simulation mechanism is in fact active in the moment we have to understand language, for example in the comprehension of the sentence “John grasps the glass” is implicated the activation of hand-related areas of the motor cortex in our

brain even if we are not doing any action with our hands (for critical discussion and reviews: Barsalou 2010; Fisher and Zwaan 2008; Glenberg, Witt, and Metcalfe 2013; Pulvermüller et al. 2014; Jirak et al. 2010). This simulation mechanism is also activated in language processing of linguistic description of emotion and perception, involving the activation of the brain's areas related to perception and emotions. According to Foroni & Semin's (2009) study, reading verbal stimuli related to action verbs referred to emotions, elicited the same muscle activity in the face as visual stimuli do. This study confirmed the role of the bodily experience in language processing and the peculiarity of language of being far for an amodal symbolic system (e.g., Fodor 1983) and close to the position that concerns it as bodily grounded.

Researchers have also been devoted to the investigation of the comprehension of conceptual metaphors based on bodily experience frequently used by speakers all over the world (Lakoff and Johnson 1980; Johnson 1987, Kövecses 2000). Studies on brain activities during the comprehension of conceptual metaphors showed that the processing of a metaphorical sentence like "John grasps the idea", which includes the abstract concept of understanding, activated the hand-related area of the motor cortex (Boulenger, Hauk, and Pulvermüller 2009, Desai et al. 2013). These results confirmed that the understanding of metaphor is not abstract, conceptual, nor disembodied, but this mechanism is part of the Embodied simulation.

However, it has to be taken into account that the involvement of the sensorimotor system in the comprehension of non-literal language as metaphors depends on two factors: the semantic features of language stimuli (Yang and Shu 2015) and the level of deliberateness and conventionality of metaphors used in the studies (Steen 2011). The more a metaphor is conventional, the less people consider it in a "metaphorical way"; the role of bringing

the concrete to the abstract is not strong anymore, and the motor activation in the brain are weak (Bowdle and Gentner 2005; Steen 2011; Tzuyin, Lai, and Curran, 2013). In a review of the literature, Cuccio and Steen (2019) tried to explain the controversialities in the results of the studies carried on non-literal language and bodily involvement and sensorimotor activation. According to this review, only fully deliberate metaphor use recruits the full mechanism of Embodied simulation.

The topic of metaphors and how they originate, interested many cognitive linguistics researchers, especially during the 80s. In their famous work *Metaphors We Live By* (1980), Lakoff and Johnson conceived the Conceptual Metaphor Theory (CMT), defining metaphors from a new perspective: according to this theory metaphor is a conceptual tool for structuring, restructuring and even generating reality and not simply a decorative device in language used most of all in literature. According to the CMT, metaphor arises from conceptual mappings between domains: one domain of experience, the *target domain*, to be reasoned about in terms of another, the *source domain*. The target domain is usually an abstract concept, whereas the source domain is typically a more concrete one. If metaphor has as its basis a cross-domain mapping in the conceptual system, then words should offer just one form in which they may appear and can be expressed. One should be able to find metaphoric expressions in different forms of human behavior, and not only in language (Cienki and Müller 2008). There is a connection between the world of the "concrete" that we experience and the world of the abstract and thanks to conceptual metaphors there is a bridge connecting them. In this process, the body has a key role since it allows us to experience the world. Consistent with Lakoff and Johnson (1980) view, the experiential basis of metaphors is crucial in the comprehension since "our conceptual system is grounded in our experiences in the world (. . .) The kind of

conceptual system we have is a product of the kind of being we are and the way we interact with our physical and cultural environment" (Lakoff and Johnson 1980: 119). Contrary to the objectivistic view, they believe that "concepts are not defined solely in terms of inherent properties; instead, they are defined primarily in terms of interactional properties" (Lakoff and Johnson 1980: 125), and with the interaction they are referring to the experiential interactions mediated by the body.

Probably the most famous conceptual metaphor is the UP/DOWN one, in which our bodily experience with the surroundings, like verticality, could be at the metaphorical foundation of abstract concepts like happiness and sadness ("I am feeling up/down today"). Another popular metaphor, permeating several languages is the CONTAINER metaphor, referring to the image of the body as a box in which feelings (body as a container) and thoughts (mind as a container) are enclosed (Lakoff and Johnson 1980; Köveces 1990; Ogarkova and Soriano 2014).

Studies carried on languages from very different linguistic families showed a very productive use of body-related metaphors in abstract concepts like emotions and concept regarding mind's activities (see Ogarkova and Soriano 2014 for a review). However, when considering language as sensorimotor grounded, we have to take into consideration the role of the cultural component in linguistic concept elaboration. The experience consists of different perceptive aspects that could be considered and emphasized in different ways by different cultures and languages. To summarize the above-mentioned "universal vs cultural" dichotomy we can take into account the *embodied cultural prototype view* (Kövecses 2000, 2005; Maalej 2004), according to which metaphorical representation relies on both universal human experiences and more specific socio-cultural constructs. Under this view, the experiential substance for emotion

conceptualization derived from human bodily experiences, but certain qualitative variance in the realization of universal body-based metaphors is due to the cultural filter. In any case "no language will have source domains that contradict certain universal sensorimotor experiences in which targets are embedded" (Kövecses 2010: 86).

All of the researches mentioned above are based on spoken languages which express through words these bodily-based metaphors, but words are not the exclusive tool through which humans can communicate, that is why in the next paragraphs we will introduce the concept of language as multimodal.

Language as multimodal: conceptual metaphor in gestures

If we think of people communicating, what probably comes in our mind is an interaction between two or more people in a face-to-face situation. Speakers in these types of interactions have to understand information carried by two different channels: the acoustic-vocal one, concerning words, and the visuo-gestural one for bodily and hands movements.

According to Kendon: "speakers (…) can move their hands differentially, they can engage in head movements and in actions of the face, and they can do all this while they are speaking. (…) such visible actions enter into the creation of the speaker's meaning" (Kendon 2014: 3).

Thus, gesticulation, referring to any willful bodily movement, is in fact present in all the cultures and it is unnatural trying to restrain it during spontaneous communication.

The use of gestures from childhood (Acredolo and Goodwyn 1988; Bates, Camaioni and Volterra, 1975; Butcher and Goldin-Meadow 2000; Capirci, Iverson, Pizzuto and Volterra 1996; Capirci and Volterra 2008) thorough our entire life (Kendon 2004;

McNeill 2005), and the existence of languages using the visuo-gestural channel only (i.e. Sign Languages), strongly stand for the necessity of thinking language as a phenomenon which is intrinsically multimodal (Cienki 2012) or, using Kendon (2004) and McNeill (2005) words, we should consider gestures and speech as two aspects of the same underlying thoughts process, referring to language as a *speech-gesture ensemble*.

There isn't only one way to gesture, in fact gestures differ for their forms, their functions and in their degree of conventionality. We can speak of a gradient of gestures: from those which have developed fixed meanings in the culture in which they are used, called *emblems* (i.e., the ok gestures) (Efron 1941; Ekman and Friesen 1969), to gestures which are produced spontaneously and often unwittingly, and, the meaning of the latter is highly dependent on the context, like *gesticulation* (Kendon 1988). McNeill (1992) proposed a four types gesture classification: **beat** (or batons in Efron 1941 and Ekman and Friesen 1969) gestures which are flicks of the hands, up and down or forth and back movement; those gestures seem to beat the time along with the speech rhythm and have a pragmatic function. **Deictics** (or pointing gestures) are used to indicate a specific direction, location or object in the space and can be performed with any body part. **Iconic** or representative gestures depict images of actions or concrete referent; they are imagistically related to the ongoing speech, one example could be opening and closing two fingers to represent a scissor. Finally, **metaphoric gestures** depict the abstract in terms of the concrete or that engage the cognitive process of understanding something in terms of something else via cross-domain mapping (Cienki and Müller 2008). One example could be moving the hand back to refer to the "past". Defining metaphoric gestures as gestures that resemble something concrete in order to represent something abstract, directly link them to the definition of conceptual metaphor and CMT. According to McNeill (1992; 2005) gestures

can be a “window” into cognitive processes, since they support both thought and speech. Indeed, their inner structure is composed of different units: conceptual and neuromuscular. The conceptual content is what gives them meaning, the neuromuscular activity is what makes them shared.

Nonetheless, our body does not shape only physical and concrete actions or events but also abstract experiences, thoughts and time and gestures can support this mapping of abstract concepts into more concrete domains. As mentioned above, there can be gestures describing the concrete (i.e., iconic) and gestures for the abstract (i.e. metaphoric) and the distinction between the two is not so straightforward as it seems and may differ across cultures and context of use. However, both concrete and abstract concepts rely on the sensorimotor simulation, and the mechanism of simulation may explain both iconic and metaphoric gestures since they are both rooted in our bodily experiences (Cuccio and Fontana 2017).

In the volume Metaphor and Gesture, Gibbs (2008) gives an overview of psycholinguistic and psychological evidence of how metaphoric gestures are not merely the manifestation of an inner, symbolic, disembodied idea, but show the dynamic creation, and recreation, of metaphoric thought in the physical act of online communication. There is evidence that when someone produces a body movement or a hand gesture, such as the one of grasping, that is congruent to the meaning of the metaphoric phrase “grasp the concept,” the participant subsequently is quicker in comprehending the phrase than if they had previously made some incongruent gesture (like the pushing away gesture). Moreover, people are quicker in understanding metaphoric phrases even if they just imagine to make the gesture before processing the phrase (Gibbs 2006). These results suggested that engaging in body movements associated to specific metaphoric ideas (i.e., an actual

grasping motion related to the possibility that concepts can be metaphorically conceptualized as physical entities which can be grasped) enhances the simulations that people create to form a metaphoric understanding of abstract notions related to these gestures. Therefore, grasping gesture does not simply activate the literal meaning of grasping, but also its metaphorical counterpart. Moreover, the gesture is metaphorically meaningful because people think of concepts as 'things that can be grasped'. People, therefore, appear to create embodied simulations of speakers' messages that involve moment-by-moment "what must it be like" processes that make use of ongoing sensory-motor experiences such as grasping gestures.

In a study by Gibbs (1999) the accuracy of hearing spoken sentences was much higher when the sentences were presented combined with gestures, suggesting that observing a speech congruent metaphoric gesture make easier to understand and remember target concepts. In neuropsychology, researches demonstrated that when someone observes another person's action there is an activation of relevant motor areas in the brain (i.e., "mirror neurons"), as if the one observing were doing exactly the same action (Decety and Grezes 1999). According to this evidence, this process can also happen in observing a metaphoric gesture: they may activate appropriate motor regions of the brain that could be linked to the embodied source domains of many metaphoric concepts (Gallese and Lakoff 2005), facilitating the embodied simulation launched to comprehend a speaker's communicative message when saying something like "I just couldn't grasp that concept."

All the researches illustrated above stress the importance of the body in language thanks to the use of gestures and, in particular, the presence and the use of metaphoric gestures in bridging the abstract and the concrete domain in exchanging meaning. In the next

paragraph, we will move one step beyond in the field of the visual-manual communication introducing sign languages and the pervasive presence of metaphors in those languages.

Metaphors in Sign Languages

Sign languages are the visual languages of Deaf communities, used all over the world. Currently, Ethnologue lists 144 sign languages (https://www.ethnologue.com/) while the sign hub's atlas 244 (www.sign-hub.eu).

As pointed out by different authors (Cuxac 2001; Ortega et al. 2017; Perniss et al. 2015; Pietrandrea 2002; Russo 2004), sign languages shaped linguistic meaning starting from the daily actions and interactions of our body with the surrounding world. Iconicity plays a significant role in the linguistic systems of sign languages, and metaphorical processes are largely exploited in the construction of meanings.

The seminal work of William Stokoe (1960) illustrated for the first time that it was possible to analyze signs using linguistic tools, breaking down signs' articulation into three main phonological features: the handshape, the movement and the place, seen as meaningless combinatorial elements. Successively, sign research identified another parameter, the palm orientation, or the rotation of the wrist and forearm (Friedman 1975). However, not all information in signed languages is on the hands, the face and body can also be used to encode lexical distinctions (Liddell 1978). Recent work on Italian Sign Language (LIS) description added to the four manual parameters four bodily parameters: the eye-gaze, the facial expression, the mouth gestures or mouthing, the movement of the torso (Volterra et al. 2019). The critical point was that in signed languages these combinatorial elements are not exactly meaningless: Boyes Braem (1981) showed for the first time the systematic use of visual metaphors in the

constructions of signs, meaningful elements set at the phonological level. The author noticed that it was possible to analyze American Sign Language (ASL) signs focusing on handshapes' underlying metaphorical meaning. For example, the articulatory traits of the B handshape () resemble a flat surface, and this similarity is metonymically exploited in ASL signs such as "table", "paper", "window", "door", "book". All of these signs are visually constructed as flat objects. This type of visual iconicity is strictly tight to our perceptual experience of the world and often maps concrete features to abstract ones. For example, the 5 handshapes () can convey the meaning of transparency in LIS signs such as clearness, glass, water etc.

This way to look at the handshapes is relevant to all the phonological features and can be extended to all sign's parameters. Pietrandrea (1994; 2002) offered a comprehensive analysis of the iconicity in the lexical signs, showing the regularities of the visual motivation of all the formational parameters. She addressed the iconic features underlying the formational parameters addressing all the signs listed in three LIS dictionaries (Angelini et al. 1991; Romeo 1991; Radutzky 1992) finding that more than 50% of the handshapes and 67% of the locations were motivated by iconic associations.

Taub (2001), proposed to see the conceptual metaphors in sign languages as based on a double mapping: the metaphorical association in the semantic pole between concrete domain and abstract domain, in common with the spoken languages, and the iconic mapping between the physical articulation of the sign and the concrete domain. For example, the ASL sign "to inform" illustrated in figure 1 is based on the conceptual metaphors COMMUNICATION IS SENDING from Lakoff and Johnson (1980). On the one hand, it is possible to observe the standard mapping between the source domain

(sending an object to someone) and the target domain (sending ideas) and, on the other hand, there is the iconic mapping to the source since the sign resembles the act of taking an object from the forehead and sending it to someone.

Figure 1. ASL sign "to inform"

Russo (2004; 2005) carefully addressed the role of visual metaphors in LIS discourse, highlighting the creative and productive features of this linguistic source, broaden its relevance beyond its presence in the frozen lexicon. He analyzed signed productions from LIS poetry, narratives and conferences, showing the dynamic and productive use of visual metaphors in the discourse constructions. For example, in a signed conference about a bimodal and bilingual education, the signer described the process of word learning as if words were objects hooked to a chain and iconically depicted this metaphor.

More recently, Borghi et al. (2014) investigated the different ways in which LIS encodes abstract concepts. The authors distinguish between signs directly showing different types of embodiment and signs that represent abstract concepts differently, for example, relying on linguistic analogy. As noted by the authors, different LIS abstract signs support for the CTM. In particular, the phonological features of the LIS predicates “to learn”, “to understand”, “to forget” and “to know” (see the Appendix) all rely on the metaphor of the MIND AS CONTAINER. In all of these signs, the head is at the same time a

phonological feature (the location of the sign) and the source of the metaphor, constructed in different ways according to the semantic of each predicate. So, for example, the concept "to understand" is visually constructed as catching (or grasping) the concept in the mind of the signer and, on the contrary, "to forget" is depicted as the act of throwing something out of the mind.

The BODY AS A CONTAINER is a productive metaphor in sign languages, described by Taub (2001) and Wilcox (2000) for the ASL. Wilcox (2000) reports an interesting example of the productivity of the MIND AS A CONTAINER in ASL; in this language the sign to indicate hearing people is performed with an index moving close to the mouth, depicting the act of speaking. Changing the location of the sign from the mouth to the forehead, the sign takes the meaning of a deaf person that has "a hearing mind", that thinks as a hearing person.

Furthermore, Taub (2001) discusses the example of the ASL sign referring to a person that is "boiling inside", which is performed on the chest, based on the conceptualization of unexpressed anger as hot fluid in a container. The author then claims that different human experiences are mapped into different parts of the body in ASL: the emotions are mapped on the chest while mental activity to the forehead.

Following this reasoning, Proietti, Di Renzo and Bonsignori (2019) and Bonsignori and Proietti (2020) showed the relevance of this type of metaphorical mapping in LIS: in a data set of 70 signs referring to emotions, the chest location was the most used compared to other locations (44%), proving that the LIS lexicon conceptualizes the chest as a container of our emotions.

This brief overview of the role of metaphors in sign languages points out that sign languages are a special viewpoint in exploring how the body and physical experiences become meaning and part of the language.

The important role played by iconicity in signed languages led a group of scholars to address the comprehension of LIS signs by hearing non signers and deaf signers with no knowledge of LIS from different European countries (Pizzuto and Volterra, 2000, Boyes Braem, Pizzuto and Volterra 2002). Pizzuto and Volterra (2000) started from an earlier study carried out by Grosso (1997) that tested the comprehensibility of 92 common LIS signs with 24 Italian hearing speakers with no knowledge of LIS. The study showed that 76% of the signs were not easily guessed, therefore were non-transparent, while 24% were easily guessed by participants. Starting from these findings, Pizzuto and Volterra (2000) selected 40 LIS signs: 20 highly transparent and 20 highly non-transparent. They showed the signs to the European deaf and hearing participants, finding that the majority of the transparent signs were easily guessed by both deaf and hearing participants, and, conversely, that the non-transparent signs were similarly hard to guess. In general, deaf participants performed better than hearing participants.

Interestingly, the authors found out that there was a subset of signs that were transparent to Italian hearing non signers, but not so easily guessed by deaf and hearing participants from other countries, because of cultural related features common to LIS signs and to Italian gestures. In fact, there are LIS signs with cultural traits that are also shared by the gestural culture of Italian speakers, as the sign for being hungry (Fig. 2) or the sign for cunning, that are both very similar to the respective conventional Italian gestures. The deaf community and the hearing one share the same nation and culture; therefore, it is

important to recognize the influence of the Italian gestural heritage on the formation of LIS signs, even on grammaticalization process (Wilcox et al. 2010, Gianfreda et al. 2014).

Figure 2. LIS sign for "hungry"

AIM

Considering the above-mentioned literature regarding the presence of conceptual bodily related metaphors in spoken languages (in speech and in gestures) and in sign languages and the relevance of those in language comprehension, this study will aim to offer experimental evidence concerning the role of these metaphors in comprehension.

Since sign languages are a special window in exploring the route from perception to concept construction, as they allow to visualize linguistic embodiment of perceptual experiences, we will use LIS as a linguistic tool to better understand the role of the body in the comprehension of language. Specifically, we aim to investigate how bodily metaphors (i.e. the BODY AS CONTAINER metaphor) in LIS signs may facilitate the comprehension of LIS signs by hearing people that do not know any sing languages.

We enrolled two groups, one composed by Italians and one by foreigners, in order to exclude that the comprehension of signs could be only due to the participants' involvement in the Italian culture. We hypothesized that both Italian and foreigner participants would understand better LIS signs which have a clear CONTAINER

metaphor. In order to understand the meaning without knowing the language, both groups will exploit bodily experiences' knowledge.

METHOD

Participants

Participants in this study comprised 32 hearing people, divided into two groups: 16 hearing Italian speakers from Italy (HISg group) and 16 hearing English speakers from other countries (HESg group).

Table 1 shows the details of the participants in this study.

	Participants	Nationality	Mean age	Female
HISg	16	Italian	33,6 years (SD=11,6)	11
HESg	4	Danish	32,9 years (SD=7,9)	9
	4	Spanish		
	2	South African		
	2	Japanese		
	1	German		
	1	Mexican		
	1	South Korean		
	1	USA		

Table 1. Participants' details: nationality, mean age (and SD) and gender.

Questionnaire

The questionnaire was generated from a previous corpus of 70 LIS signs of emotions, (author, Di Renzo, author 2019), created asking to three deaf colleagues of the LaCam Lab of the ISTC-CNR to produce all the signs related to emotions that they know. After videotaping all signs, researchers proceeded to test their frequency of use. Researchers asked to signer people in Italy, that had a higher proficiency in LIS comprehension and

production, to fill in an online questionnaire. Signers were asked to say whether they use the selected signs always, often or never. We eliminated the signs classified as "never used" from the majority of participants.

Therefore, for the present questionnaire we used 18 signs of emotions (i.e. hanger, love) from the selection mentioned above (author et al. 2019), and we further added 12 signs for abstract concepts (i.e. freedom, to doubt) from Borghi and colleagues work (2014), for a total of 30 signs.

We carefully checked that the signs we used in this study were not similar to gestures used in the Italian culture.

The 30 chosen signs were classified in two categories: the first category comprehends signs where is present the metaphor of the HEAD AS THE CONTAINER of the mind activities (See an example in Fig. 3), and signs where is present the metaphor of the BODY AS THE CONTAINER of the emotions (See an example in Fig. 4), called together: *box metaphor* signs; the second category comprehends signs where is not present a metaphor, i.e. signs that do not have this specific type of bodily metaphor, called *un-box metaphor* signs (See an example in Fig. 5). A complete list of all 30 signs as well as their classifications based on the presence or absence of the *box metaphor* is presented in the Appendix.

We also checked if these box/un-box metaphors were present in the other sign languages used in the participants' countries of origin (https://www.spreadthesign.com/it.it/search/n dictionary and https://www.realsasl.com/), finding out that these conceptual metaphor are present in all of these countries.

The questionnaire was divided into two parts. In the first one participant saw a video of a LIS sign and they were asked to write, in one word only, the meaning of the sign. In the

second part, we showed them the real meaning of the sign, and they had to rate its iconicity; namely, they had assign a score to what degree the form of the sign represented its meaning, on a Likert scale from 0 to 6 (Occhino et al. 2020; Ortega and Özyürek 2019). The questionnaire was written in Italian for the HISg and in English for the HESg (figure 6).

Figure 3. LIS sign for “to think”

Figure 4. LIS sign for “rancor”

Figure 5. LIS sign for “clear”

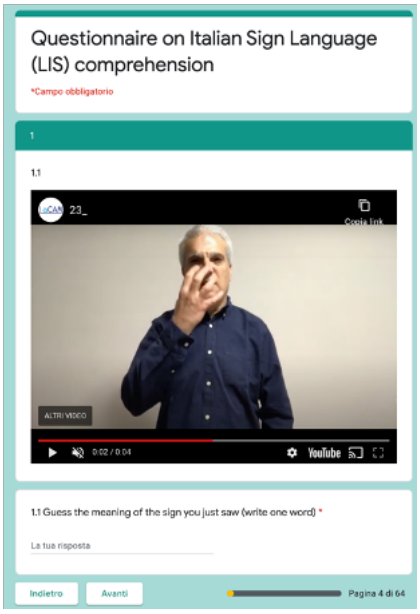

Figure 6. Questionnaire’s sample

Coding

Participants in this study rated the iconicity of signs on a scale from 0 to 6. We included all the ratings of the totality of the participants for the analysis.

We first coded the correctness of the responses, labelling as correct the words that perfectly or almost perfectly matched with the meaning of the target sign (i.e. doubt for

"to doubt", fear for "fear" and dark for "sad") and as incorrect all the words not related to the meaning of the target sign (i.e. surprise for "clear").

We further investigated the type of incorrect responses wrote by participants and classified those into five error categories: Concrete, Semantic Neighbour, Semantic Area, Physiologic Reaction and Other. We classified as Concrete the incorrect responses related to objects and action verbs (i.e. to throw for "to forget"); as Semantic Neighbour the incorrect responses whose meaning was close to target meaning (i.e. dislike for "hate"); as Semantic Area the incorrect responses related to the same semantic area of the target ones (an emotion for another emotion, i.e. concerning for "rancour"); as Physiologic Reaction the incorrect responses related to bodily reaction correlated to the meaning of the target sign (i.e. smile for "joy"); we finally coded as Other the incorrect responses completely unlikely to the target meaning (i.e. unsure for "anger").

Reliability

All data were initially coded by the second author of the study. All coded data were double-checked by the first author of the study. We discussed cases of disagreement with the last author of the paper.

The inter-rater reliability was calculated on the entire sample of data coding. Agreement between coders for the accuracy was *Cohens* κ = .989 for the HISg and *Cohens* κ = .992 for HESg. Reliability between coders for the qualitative analysis on the type of incorrect responses was *Cohens* κ = .978 for HISg and *Cohens* κ = .986 for HESg.

Statistical analysis

We conducted statistical analysis on the iconicity rating checking both *box/un-box metaphor* and sign type (i.e. sign related to emotions *vs* sign related to abstract concepts) effect, within and between the two groups of participants. Since we reported results from ranked data, (iconicity rating is scored from 0 to 6), we chose the Mann Whitney non-parametric analysis.

Then, we carried out statistical analysis on the accuracy, checking metaphor and sign type effect, within and between the two groups. Since the accuracy is a ranked data (it is coded with 0 as incorrect and 1 as correct), we chose non-parametric analysis. We use the Mann Whitney test to assess the effect of both *box/un-box metaphor* and sign type condition on accuracy, as well as to measure group difference across HISg and HESg participants.

RESULTS

We analyzed the effect of the *box* and *un-box metaphor* on the iconicity rating within-group, then we analyzed the effect of sign type on the iconicity rating within-group. Then, we conducted between groups analysis on the iconicity rating. Secondly, we conducted within-group analysis on accuracy checking the effect of *box*, *un-boxed metaphor* and then the effect of sign type. Afterwards, we conducted between groups analysis on the accuracy. Finally, we did a qualitative analysis of the type of incorrect responses of HISg and HESg group.

Iconicity rating

We looked at the effect of the *box* and *un-box metaphor* on the iconicity rating within-group: we found higher iconicity rating for signs with *box metaphor* in both groups: HISg

(U=-5.539, p<.000), and HESg (U=-5.855, p<.000). There is no effect of the sign type on the rating: HISg (U=-1.214; p=.831), and HESg (U=-.400, p=.689). The effect of the *box/un-box metaphor* on the rating is shown in figure 7.

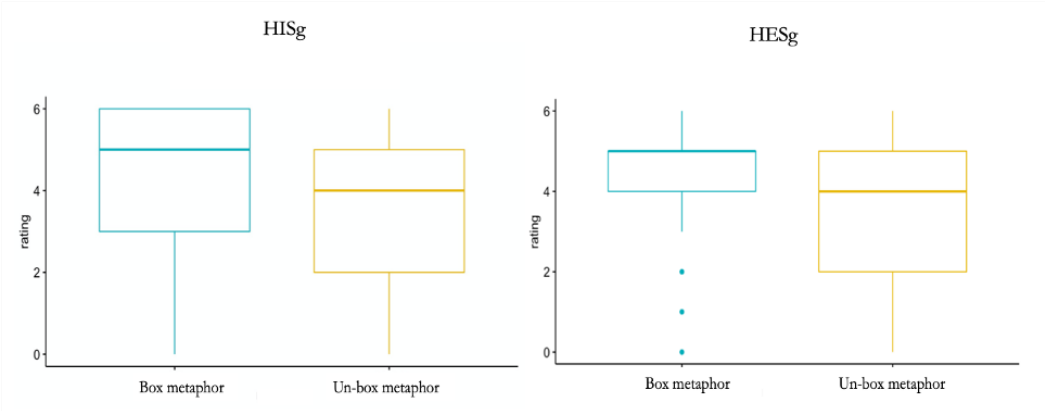

Figure 7. Box/un-box metaphor effect on iconicity rating - the boxplots represent the interquartile span of the rating for both the HISg and HESg group and the vertical line represent the median ratings.

We conducted between groups analysis on the iconicity rating: we found non-significant difference between HESg and HISg participants (U=-0.879, p=.380) in classifying stimuli.

Accuracy

Figure 8 shows HISg and HESg participants' accuracy. We conducted within-group analysis on accuracy looking for the effect of *box/un-box metaphor* and then the effect of sign type.

In the HISg group we found higher accuracy for *box metaphor* items compared to *un-box metaphor* items (U=-4,707, p<.000). Regarding the sign type, we found higher accuracy for emotion related signs (U=-2.732, p=.006) than for abstract signs.

We further explored the contribution of sign type and *box/un-box metaphor* status on correctness with a Kruskal-Wallis test (the non-parametric equivalent of a two-way ANOVA): significant contributions were found and confirmed across both *box/un-box metaphor* status (H=22.158, p<.000) and sign type (H=7.464, p=.006).

Looking at HESg participants, we found higher accuracy for *box metaphor* items compared to *un-box metaphor* items (U=-4,207, p<.000), whereas sign type did not significantly influence accuracy (U=-1.154, p=.249). We further explored the contribution of sign type and *box/un-box metaphor* status on accuracy. We conducted a Kruskal-Wallis test and we found a significant *box metaphor* effect (H=17.702; p<.000) and a non-significant effect of the sign type (H=1.331; P=.249).

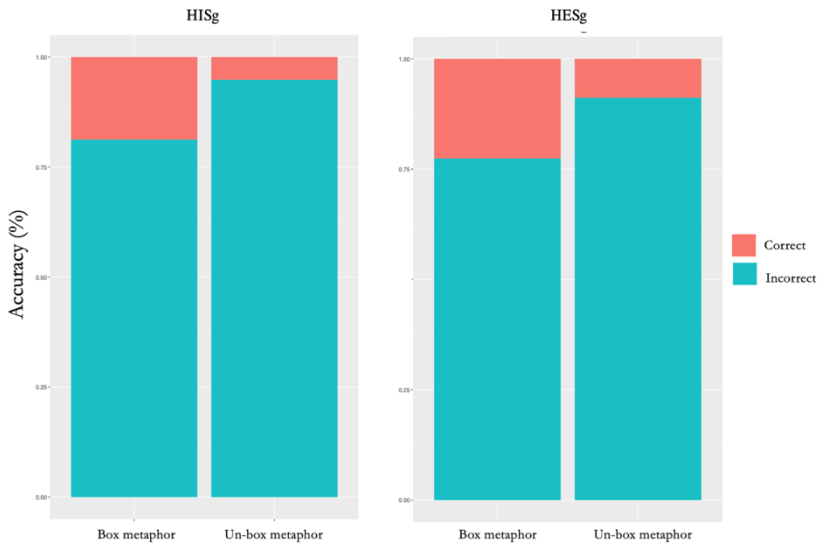

Figure 8. Accuracy distribution for box/un-box metaphor in both groups

Finally, we conducted between groups analysis on the accuracy: we found non-significant difference between HESg and HISg participants (U=-1.707, p=.088).

Qualitative analysis of the type of incorrect responses

We further conducted qualitative analysis on the type of incorrect responses of HISg and HESg group.

Figures 9 shows the distribution of incorrect responses in error categories.

We found that for *box metaphor* signs, both groups produced a higher percentage of Semantic Area and Semantic Neighbour responses. For the *un-box metaphor,* they instead produced a higher percentage of Concrete and Other responses. We found that both HISg and HESg participants responses are distributed similarly.

The analysis of the type of errors can reveal something more on the way participants captured the meaning from signs. For example, many participants in both groups did not interpret the box metaphor correctly and instead of understanding the sign "to forget" they wrote throwing. In this case, they misunderstood an abstract for a concrete, showing that their process of comprehending the meaning stopped at the source domain. Moreover, the concrete answers reveal that participant focused on some specific parameter without considering the totality of traits expressed by the sign. For instance, they focused on the movement and the handshape in the sign for "to forget", giving nor or less importance to the location (i.e. the forehead). Furthermore, participants in both groups interpreted the sign for "surprise" as "picture", "photo", "flash", indicating that they focused on the location (i.e. the eyes of the signer), but they did not take in consideration the direction of the movement (in the sign for "surprise" the movement is an opening of the thumb and second finger while the one for the gesture and the sign for "photo" is as if you are pressing the bottom of the camera). Finally, some participant wrote tiger for "sadness" highlighting that they focused on the handshape only. The handshape resembled the claws

of the animal: in the sign for “sadness” the hand is claw shaped and the movement is downward starting from the mouth.

Overall, our qualitative analysis revealed that when participant produced an incorrect response, they often relied only on the interpretation of one or two iconic parameter/s without integrating information from the others.

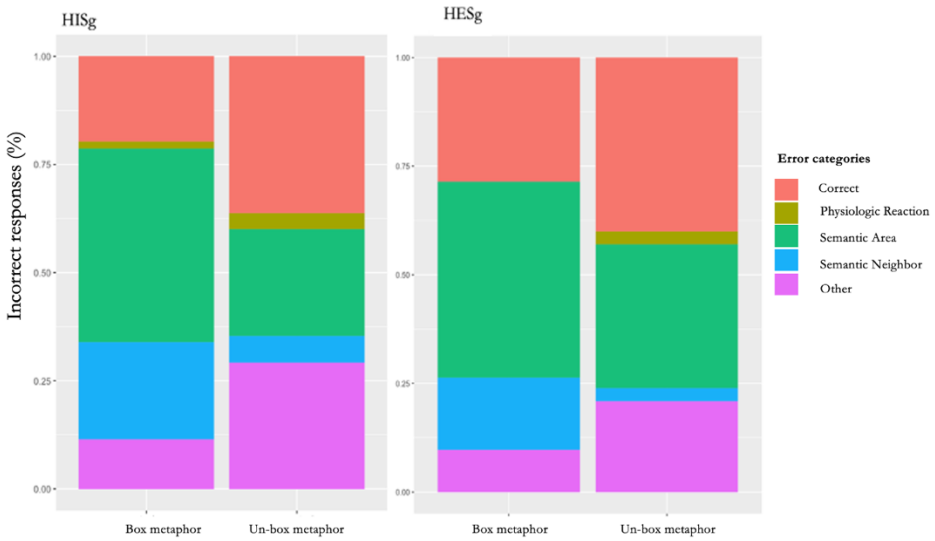

Figure 9. Distributions of incorrect responses per error categories

Discussion and conclusions

Our study aimed to investigate how bodily metaphors in LIS signs can facilitate the comprehension of LIS signs by hearing people that do not know any sign language. Our hypothesis that both Italian and foreigner participants would understand better LIS signs which have a clear CONTAINER metaphor has been confirmed. Even though the two groups produced a small number of correct responses, our results showed that both HISg and HESg accuracy was higher for the *box metaphor* signs. Both groups also rated as more iconic the signs of the *box metaphor* group while they rated in the same way emotions and abstract concepts.

Conducting quantitative analysis, we found an influence of sign type on the accuracy in the HISg group only. This result showed that Italian speaking participants gave more correct responses when the meaning of the sign was related to emotion. This difference for the HISg could be due to a cultural effect. Italian speakers could be more sensitive to some aspects of the signs related to emotions. Considering the parameters of execution of the signs used in this study, the only difference between signs in our corpus is the presence of specific facial expressions related to emotions. According to Wagner and colleagues (2014), the face is the convenient medium in expressing emotions and attitudes. Therefore, there could be something more comprehensible in the facial expressions present in emotion signs in LIS for the Italian participants who shared the same culture of Italian deaf signers. There is a debate in literature trying to disentangle whether the understanding other's emotions is a universal ability or not. Several studies demonstrated that static expressions of emotion were recognized by members of many different cultural groups (Ekman 1972; Izard 1971). However, more recent researches documented evidence for an in-group advantage, meaning that people are generally more accurate at judging emotions when those are expressed by members of their own cultural group rather than by members of a different culture (Elfenbein and Ambady 2002). In a study by Jack and colleagues (2012), researchers showed differences in the expectations of facial expression signals across diverse cultures. For example, in comparing Western Caucasian and Eastern Asian culture, they found out that the latter group expected changes of gaze to be a component of facial expressions.

The production of facial expression should be due to the activation of affective programs. These affective programs should be related to universal motoric and pancultural programs but activated by context and situations that vary from culture to culture. Therefore, the

expression of emotions should be independent of the emotion itself (Caruana and Borghi 2016).

The studies mentioned above explored the dimension of emotion comprehension. What we did in this study was to investigate the comprehension of the linguistic expression of the emotional concept. In LIS, as in other sign languages, there are certain facial expressions that are linguistically encoded in signs. For example, the signer that signed "sadness" was not sad when he was signing, but he linked the facial expression expressing the target concept to the sign since it is a non-manual feature of the sign. We could therefore hypothesize that the Italian participants were able to interpret the facial expressions of Italian signers better.

In a broader view, the results of this study are consistent with the *embodied cultural prototype view* presented in the introduction (Kövecses 2000, 2005; Maalej 2004). According to this view, the experiential basis for emotion conceptualization originated from human bodily experiences, but specific qualitative variation in the realization of universal body-based conceptual metaphors is due to the culture. Therefore, it is possible that some aspects of the LIS signs for emotions are more salient to Italians rather than participant from other countries. Further investigations are needed to implement the understanding of the role of facial expression in comprehension intra and cross-cultures.

Regarding the qualitative results, it is interesting to notice that both group's performances are quite similar. In HISg and HESg participants' incorrect responses are distributed more in the Concrete when the signs are from the *un-box metapho*r group, and in the Semantic Area when signs are from the *box metaphor* group. Therefore, even for incorrect responses, the meaning is in the same semantic area of the target sign. It could be assumed

that the clear presence of the CONTAINER metaphors helped participants in giving responses.

Our everyday interaction with the world is the starting point for the process of conceptualizing and expressing language. This study shows how metaphors related to bodily experience can help comprehension. LIS signs with the *box metaphor* were more easily recognizable since the participants relied on this productive conceptual metaphor. "Conceptual metaphor is a natural part of human thought (. . .) [and] which metaphors we have and what they mean depend on the nature of our bodies, our interactions in the physical environment, and our social and cultural practices" (Lakoff and Johnson 1980: 247).

It is common to all of us to feel emotions "running" in our body and to perceive our mind full of thoughts. That is what the participants captured by looking at signs.

This study provides experimental evidence in favor of an embodied vision of language and in particular, it sheds light in the understanding of the role of conceptual metaphor in comprehension when there is no knowledge of the language.

Appendix

Items, links to LIS signs, type of metaphor and sign type.

Italian	English	LIS	Metaphor	Sign Type
Tristezza	Sadness	https://youtu.be/PhpyhKs9h-c	Un-box	Emotion
Ricordare	To remember	https://youtu.be/TVD-t_B1oa0	Box	Abstract
Dimenticare	To forget	https://youtu.be/HR37bkeGOp4	Box	Abstract
Rassegnazione	Resignation	https://youtu.be/uR4LAact9aM	Un-box	Emotion
Felicità	Happiness	https://youtu.be/rZF2Z0Kzz7U	Un-box	Emotion
Paura	Fear	https://youtu.be/8SYnyeW9tRw	Un-box	Emotion
Chiaro	Clear	https://youtu.be/CG-NfjuiBkI	Un-box	Abstract
Conoscere	To know	https://youtu.be/UwAf4htAPGc	Box	Abstract
Odio	Hate	https://youtu.be/ac_-Gm9R034	Un-box	Emotion
Rabbia	Hanger	https://youtu.be/v5CCG1yAOJI	Box	Emotion
Sorpresa	Surprise	https://youtu.be/Yhe7YVzlhLQ	Un-box	Emotion
Desiderio	Desire	https://youtu.be/07PYEfasgAo	Un-box	Emotion
Sicuro	Sure	https://youtu.be/uUk9p4GT5tA	Un-box	Abstract
Obbligare	To obligate	https://youtu.be/9_0DUTYwIZ8	Un-box	Abstract
Vergogna	Shame	https://youtu.be/yKQLTQFzD-w	Un-box	Emotion
Liberazione	Relief	https://youtu.be/ybHGSlm3k9I	Box	Emotion
Tranquillità	Calm	https://youtu.be/UX8OM5OT1c8	Box	Emotion
Amore	Love	https://youtu.be/iI6X0WGNSD0	Box	Emotion
Impossibile	Impossible	https://youtu.be/ayGUk56hcBs	Un-box	Abstract
Soddisfazione	Satisfaction	https://youtu.be/Uo5j0dPh5iw	Box	Emotion
Pensare	To think	https://youtu.be/G2L2l8e9Who	Box	Abstract
Rancore	Rancor	https://youtu.be/AHH_Zm0VIQA	Box	Emotion
Possibile	Possible	https://youtu.be/aTPcdXM_6IU	Un-box	Abstract
Fastidio	Annoyance	https://youtu.be/3rI2IDoTChA	Un-box	Emotion

Libertà	Freedom	https://youtu.be/2tl21G2uOsc	Un-box	Abstract
Gioia	Joy	https://youtu.be/99gDEC0zvOM	Box	Emotion
Imparare	To learn	https://youtu.be/_ilgYkIGlOk	Box	Abstract
Disgusto	Disgust	https://youtu.be/biWslaF8Q3w	Box	Emotion
Preoccupazione	Concern	https://youtu.be/-_5BZlOuaxU	Un-box	Emotion
Dubitare	To doubt	https://youtu.be/gKFB7zCAMOE	Un-box	Abstract

Chapter 5

Discussion

Traditionally, research on human language has taken speech and written language as the only domains of investigation. Visual aspects of language have therefore been excluded from study for a long time. However, considering visual languages, and in particular signs and gestures jointly, in order to transcend (artificial) theoretical divides, could allow us to reach a more comprehensive account of the human language faculty.

The thought experiment proposed by Vigliocco et al. (2014) offers a window onto this approach by asking: *What if the study of language had started with the study of signed language rather than spoken language?* If the study of language had started with signed language, the multichannel/multimodal nature of language would have stood center stage from the beginning.

The contexts of face-to-face communication, in which occur the majority of human interaction, form the primary ecological niche of language, both spoken and signed, and is the primary contexts in which language is used, is learned and has evolved (Levinson & Enfield, 2006; Vigliocco et al., 2014).

In such contexts, a multitude of cues, both vocal and visual, contribute to utterance construction. Speakers in these types of interactions have to understand information carried by two different channels: the acoustic-vocal concerning words and the visa-gestural for bodily and hands movements. Gesticulation is in fact present in all the cultures and it is unnatural trying to restrain it during spontaneous communication. The presence of this phenomenon in addition to the existence of languages using the

visuo-gestural channel only, strongly stand for the necessity of thinking language as a phenomenon which is intrinsically multimodal (Cienki 2012). Additional evidence supporting a multimodal vision of language comes from recent research that suggests that what has for decades been considered to be non-linguistic could be incorporated under grammar and receptive to grammatical description. In support of this vision, Floyd in an enlightening paper in 2016, described the obligatory incorporation of celestial pointing gestures for time-of-day description for the Brazilian indigenous language Nheengatú. He discussed the innovative possibility of modality-hybrid grammars, which would incorporate gestural forms into the grammar.

In the last thirty years neuroscientific researches showed how the motor system contributes to understanding actions scopes of others, enlightening the importance of the body in intersubjective comprehension (Rizzolatti et al. 1988; Rizzolatti & Sinigaglia 2019). These innovative results opened the root to the investigation of the role of the body in language processing. According to the *Embodied simulation theory* (Gallese & Sinigallia, 2011) the mechanism of simulation was considered as a mechanism responsible for the capability of language understanding and for the idea that language is grounded in our bodily experiences (Barsalou 2008; Fisher and Zwaan 2008; Gallese and Lakoff 2005; Pülvermuller 2005).

The multimodal approach to language and the advanced results in neurolinguistics legitimately bring the role of the body in a central place in the study of language.

The present dissertation tried to understand better the multimodal nature of language and its grounded origin in the body, starting from the visuo-gestural components of language itself which are gestures and signs. Therefore, this dissertation aimed to reply to the main central question: **are bodily experiences reflected in multimodal language?**

Specifically, through the three studies presented above, this dissertation tried to add some small evidences that can contribute to answer to the main question, namely:

1) Our bodily experiences are at the base and ground the meaning constructions of both sign language's signs and of co-verbal gestures. It is possible to find this connection with the body in the form (execution parameters) and in the representational strategies which subsumed both gestures and signs. It is therefore possible to consider gestures and signs as a continuum rather than separate by a cataclysmic break.
2) The link between body and language is traceable also at the sub-lexical level, in the minimum elements which constitute the signs, in signs execution parameters.
3) It is possible to find the presence of bodily experiences also in signs related to abstract concept. This bodily component is also responsible for making this type of signs more iconic and comprehensible by hearing people that do not know any sign languages. Namely, it seems that these bodily metaphors are sufficiently "universal".

In the next three paragraphs I will present each of these topics by discussing the results of the three studies in the theoretical framework and in the reference literature.

The body is the origin: motor actions in both gestures and signs

The results of the first study highlighted that gestures and signs are both grounded on embodied motor actions. Gestures and signs showed similarities in the execution parameters that articulate them and also in the representational strategies.

The first interactions children (hearing and deaf) have with the world are characterized by an exchange between their body and the real objects that surround them. These

experiences are then reflected in gestures and signs. According to different studies motor schemas and the form of the hand used by infants in performing functional acts and in grasping, may be connected to representational gestures, performed in the absence of an object and related to specific referent, and remain quite stable in different contexts. Moreover, taking into account deictic gestures and iconic gestures allows us to trace back the origin of this early motor skills exercised by children-parents dyad (Capirci et al., 2005; Sparaci & Volterra, 2017; Volterra et al., 2018). The form of the hand children uses to grasp a glass for example, is traceable in the handshapes analyzed in the representational strategies of both signs and gestures.

Moreover, the results of the first study showed a high consistency in the performance of children, indicating that children exposed to sign language are not the only one consistent in manual production. Children exposed to spoken language were also consistent in their production of gestures. Therefore, there should be a review in the notion that define gestures as idiosyncratic, holistic and not analyzable, in line with many studies (Chu and Kita, 2016; Ortega and Özyürek 2019a, b; Padden et al., 2015, 2013; van Nispen, van de Sandt-Koenderman, Mol and Krahmer, 2017). Furthermore, due to the similarities in the productions of hearing and deaf children, for both the form and the iconic strategies, and their consistency, the results of this first study are in line with the vision of these two visible bodily actions in a continuum (Kendon, 2004-2014; Müller, 2018) and not in a cataclysmic break (Goldin-Meadow, 2017).

The body is linguistics: embodied phonology in signs

The results of the second study gave evidence to the fact that bodily experiences are reflected at sub-lexical level in signs exploiting conceptual metaphors and iconicity.

According to the pioneering work of Boyes Braem (1981), in sign languages there is a systematic use of visual metaphors in the constructions of signs, therefore, in signed languages the combinatorial elements are not exactly meaningless. The author noticed that it was possible to analyze American Sign Language (ASL) signs focusing on handshapes' underlying metaphorical meaning. This type of visual iconicity is strictly tight to our perceptual experience of the world and often maps concrete features to abstract ones. This way to look at the handshapes is relevant to all the phonological features and can be extended to all sign's parameters. According to Occhino (2017), the framework of the Embodied Cognitive Phonology provides a unifying way for understanding the perceived differences in phonological patterning and organization across the modalities. Both language-internal and language-external sources of motivation contribute to the emergence of form-meaning mappings. This form-meaning pattern is present in all sign languages and impact lexical organization.

The results of study two are in line with the researches abovementioned, and showed how execution parameters in LIS signs related to emotions are strictly linked to the semantic meaning of the signs. For example, the form of the hand can mirror the bodily experiences during the feeling of negative emotion, such as the tension. Therefore, the emotional state of the body can be reflected in the phonology of the sign. The analysis of another parameter of the LIS signs for emotions, such as the movement, revealed the presence of the body schema UP IS GOOD/DOWN IS BAD. In the results of this study, it is possible to see that the downward movement is productive for signs related to negative emotions (i.e., in signs for "sad", "delusion"). These results are consistent with the Conceptual metaphor theory of Lakoff e Johnson (1980), according to which orientational metaphors are built on motoric-spatial schemas based on the movement of our bodies (when we are

sad the posture of our body is down-oriented). Results related to the execution parameter of the location showed that the chest was the place where the majority of the emotions signs are performed. Confirming the presence in LIS signs of the productive CONTAINER metaphors also present in ASL (Taub, 2001; Wilcox, 2000) and in Primary Sign Language (Fontana & Cuccio, 2013). Overall, from the analysis of the execution parameters emerged that they can reflect the emotional state of the body.

The body is abstract: conceptual metaphors in comprehension

The results of the third study highlighted how the bodily experiences are reflected also in abstract lexicon, referred to emotions and abstract concepts, through the conceptual metaphors. According to a recent review by Borghi et al., (2017) the diffusion of embodied theories of cognition created an intense debate over the last decade, regarding the issue of how abstract concepts are represented, describing a real challenge of abstract concept. The vast framework of the embodied cognition gave evidences, each specific theory with its peculiarities, to the possibility to relate the abstract with the concrete. In the light of the Conceptual Metaphor Theory and the evidences of the Embodied Simulation theory, the results of the third study showed how in signs expressing the abstract (such as signs for emotions and abstract concepts) is possible to trace the relation with the body, is possible to find, with a gradient of strength, bodily metaphors.

The results of our study showed that the strong presence of the conceptual metaphor of the BODY IS A CONTAINER (i.e., the chest for emotions and the mind for the abstract concept) generated higher iconicity rating and also a higher percentage of correct responses in hearing people with no knowledge of any sign language. These results

suggested that identifying the bodily experiences in signs helped hearing people from different countries and cultures in understanding the meaning. Therefore, it could be possible that the kind of universality of the experience of the body with the surrounding world, is reflected in conceptual metaphors and ease the comprehensions of signs even though people do not know any sign language.

Limitations: the bodily experiences are culturally shared

The studies presented focused on the role of the body in language development, expression and comprehension. Bodily experiences are not the only factors that play crucial role in language. Our body and experiences are constantly in contact with the world and the society we live in. Each society has its proper culture, and the language development, comprehension and expression face up every time with this aspect too. There is always a kind of invisible negotiation between speakers (or signers) that share the same place of living and the same culture, in order to decide whether something is meaningful and useful in the construction and transmission of certain meanings. Bodily experiences are formed of a variety of perceptive aspects that can be emphasized and taken into consideration by different cultures and languages in different ways. This is the core of the long debate between the role of nature and nurture. In considering the nature and nurture into a continuum it has to be taken into account that, has expressed by the *embodied cultural prototype view* presented in the introduction (Kövecses 2000, 2005; Maalej 2004), the experiential basis for emotion conceptualization originated from human bodily experiences, but the culture can generate specific qualitative variation in the realization of universal body-based conceptual metaphors that can be expressed in words, gestures and signs.

In this dissertation the role of the "cultural lens" has not been sufficiently taken into account, but I am well aware that it is crucial to understand the nature (the development and the use) of human language.

Conclusion

The nature of the human capacity of communication and the nature of language itself are a crucial topic in literature debate. Theories related to the embodied cognition consider the body the crucial starting point for the process of development, understanding and processing language. This dissertation gave evidence to the concept of language as multimodal and embodied, pointing out the importance of investigating the role of the body in language studying sign languages. They are a unique window that allows us to "see" with our eyes the passage from bodily experiences to signification and to a linguistic element of language. They also allow us to "see" what is captured by speakers when conceptual metaphors are present in signs.

I would like to close this dissertation with a quotation from Lakoff & Johnson (1999): "Real people have embodied minds whose conceptual systems arise from, are shaped by, and are given meaning through living human bodies" (p. 16). This quotation clearly holds the idea of the embodiment, which remind us that is true that the language is processed in the mind, and thanks to it is potentially infinite, but is thanks to our body that we constantly mediate this possibility with the world we live in.

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