Chapter 14. Learning to use gesture in narratives

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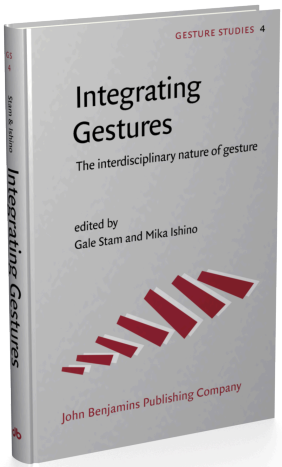

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CHAPTER 14

Learning to use gesture in narratives

Developmental trends in formal and semantic gesture competence

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This study analyses the way in which children develop their competence in the formal and semantic aspects of gesture. The analysis is focused upon the use of representational gestures in a narrative context. A group of 30 Italian children from 4 to 10 years was videotaped while telling a video cartoon to an adult. Gestures were coded according to the parameters used in Sign Languages analysis and analysed in terms of the acquisition of their properties, the accuracy of their execution and correctness in content representation.
It investigated also the development of the symbolic competence in relation both to the use of some of these parameters and to the representational strategies adopted.

Results indicate a developmental trend in all the phenomena investigated and point out some formal similarities between gesture and Sign Languages.

Keywords: co-speech gesture development, representational gestures, gesture and sl compositional parameters, italian pre-school and school age children

Introduction

In the last decades, an increasing number of scholars have shown the relevant role played by gesture in the psychological-cognitive processing of content and in the construction of discourse (Kendon 1985, 2004; McNeill 1992, 2005 to name a few).

The tight link recognized between speech and gesture in both processes has led Kendon (2004) to speak of a *speech-gesture ensemble* and McNeill (1992, 2000, 2005) to consider them as two aspects of the same underlying thought process.

Recent findings on the neurophysiology of the motor system have provided a neural basis to this claim (Gallese et al. 1996, Rizzolati et al. 1996, Umiltà et al. 2001, Kohler et al. 2002), demonstrating that hand and mouth movements overlap in a broad frontal-parietal network. This network, called 'mirror neuron system,' would be activated during both perception and production of familiar and meaningful manual gestures and mouth movements (Rizzolatti & Arbib 1998), thus creating a direct link between the sender and a receiver of a message and making the observing and doing something like manifestations of a single communicative faculty, rather than two separate abilities. On the basis of these assumptions Rizzolatti and Arbib (1998) suggest that the mirror neuron mechanism represents the basic mechanism from which language evolved. Nevertheless, if gesture and speech are intimately and remotely connected, they still constitute two different forms of content processing and expression. To the analytic, compositional, conceptual and standardized form of speech, McNeill (1992, 2000, 2005) contrasted the synthetic, holistic, imagistic and idiosyncratic one of gesture.

Yet Calbris (1990), adopting a semiotic approach, identified a variety of handshapes, movement patterns and planes of their execution, suggesting that each of these parameters presents some semantic consistency.

Pettenati et al. (2010) explored the form of representational gestures produced by children (age range 24–37 months) asked to label pictures in words and analysed them with the parameters used to describe deaf children's signs. Results of this study show that gestures representing a given picture exhibit similarities in many of the parameters across children and that these parameters are similar to those described for early signs.

Showing that gestures, like sign languages, have a compositional structure, these works give us the possibility of rethinking McNeill's thesis on their global and holistic nature. Kendon (1985, 2004), moreover, shows that even co-verbal gestures have an internal structure that differentiates them from any kind of physical activity: they are characterized by an 'excursion' (movement away from and to a rest position); a '*stroke*' (the peak of the excursion recognized by naive subjects as what the movement actually 'does' and is 'meant for'); a well 'boundedness' (gestures tend to have clear onsets and offsets).

As for the close and profound link between speech and gesture, an important contribution to their understanding has been given by studies on their developmental aspects. These studies have demonstrated that this link becomes evident from early language development: gesture and speech emerge at about the same time, refer to the same broad set of referents and serve similar communicative functions. In addition, changes in gesture use predict the onset of first words and the emergence of early syntax (Butcher & Goldin-Meadow 2000; Capirci; et al. 1996, 2002; Goldin-Meadow & Butcher, 2003).

In some earlier developmental works, gestures were primarily explored as relevant features of the 'prelinguistic' stage, as behaviors preceding and preparing the emergence of language (substantially identified with speech). In these studies, behaviors

such as playing with objects were considered gestures (Bates et al. 1979), thus linking gesture to cognitive skills separated from language but developing together with it within the same time frame and representing sort of 'cognitive precursors' of it.

More recent research supports the view that there is a remarkable continuity between prelinguistic and linguistic development and that the symbolic skills, most evident in linguistic productions, are inextricably linked to and co-evolve with more general representational abilities.

Around one year of age, words and gestures appear to encode similar meanings and go through a similar decontextualization process: both gestures and words are initially strictly related to the actions children perform with objects or with their own bodies. On the basis of these observations, it has been supposed that speech and gesture output systems draw on underlying brain mechanisms common to both language and motor functions (Iverson & Thelen 1999). In the following months, when the verbal system begins to emerge as the primary mode of linguistic communication, gesture shifts from a position of relative communicative equivalence in relation to speech to one of a support system integrated with it.

Recently, some scholars have been devoting their attention to older children, looking at the way in which they come to integrate speech and gesture in more complex tasks, like narratives. The development of narrative competence is a slow process founded on the evolution of psychological-cognitive capacities and on the acquisition of linguistic and textual devices and strategies (Stein & Glenn 1979, Peterson & McCabe 1983, Berman & Slobin 1994, Karmiloff-Smith, 1985).

In a multimodal perspective, Cassell & McNeill (1991) and McNeill (1992) observed the way in which children's gestures are functionally related to the categories of voice (C-VPT/O-VPT) and perspective (inside/outside). Studying gesture in narrative, Kita (2000) and Kita & Wood (2006) showed that children's bodies, as a representational medium, become more and more flexible and that gesture space becomes more and more symbolically distanced from the physical one.

Colletta (2004) analysed spontaneous narratives by 6- to 11-year-old French children, showing that, from 9 years on, narratives gain in linguistic complexity and children use more gestures to represent events and characters.

A recent Italian work from Capirci, Cristilli and collaborators (Capirci et al. 2008) underlines how the nature of the gestures produced during a narrative task changes with age. The study of 40 children (20 aged 5 and 20 aged 9) video-recorded while narrating a cartoon previously shown to them, examined different levels of analysis: syntactic, textual, pragmatic, narrative and gestural. The latter level showed gestures with a referential function (representational and deictic) distinguished from those with a 'pragmatic' one ('pragmatic gestures' refer to characteristics of an utterance meaning which are not part of its referential meaning or propositional content: Kendon 2004). Besides an expected improvement in syntactic, textual and narrative competences, results demonstrated a parallel development in the gestural modality: it was observed that gestures with a referential function (particularly deictic) decrease in favor of the

pragmatics and that amongst these, older children produce mostly gestures with a narrative-textual function (*discursive* and *parsing*).

In the present study we aimed at investigating the developmental trends in formal and semantic gesture competence in a narrative context. In particular, focusing on representational gestures, we devoted our attention to the way in which children learn to: (a) exploit the motor-physical potentiality of gesture to express contents; (b) use these motor-physical components as elements of a system that, like any semiotic one, requires that they be accurately performed in relation to their formal properties; (c) use each significant component of gesture to represent referents in a semantically correct way. For the analysis of gesture components we utilized the formational parameters adopted in Sign Language studies: handshapes, movements, hand orientation and place of articulation. This gave us also the possibility of comparing their use by our children with that observed in deaf children exposed to SLs (Boyes-Braem 1975; Meier et al. 2008; Clibbens 1998; Karnopp 2002; Morgan, Barrett-Jones & Stoneham 2007).

Moreover we analysed the representational strategies used by children, considering them from the point of view of the level of abstractness they reveal. The development of the symbolic capacity was investigated also in relation to the way in which children used some gesture components, like the place of their execution.

Method

Participants

Thirty developmentally typical children took part in this research. The children were divided into three groups: group I, mean age 4 (preschool age); group II, mean age 6.5 and group III, mean age 8.7 (school age). All the children were right-handed.

Procedure and task

In order to analyze the narrative abilities of the groups, all the children were video-recorded while telling an adult a short video cartoon story they had watched twice. Both the adult and the setting were familiar to them. The short video cartoon belongs

Table 1.

Groups	Age (Range)	Sex	
		Male	Female
I	4 (3.03–5.08)	4	6
II	6.5 (5.11–7.06)	2	8
III	8.7 (7.07–10.05)	4	6

to 'Pingu', a TV series. It lasts 4 minutes and contains no proper words but only some vocalizations. It shows a penguin family (parents and two different aged children) while getting ready for Christmas: the mother makes some biscuits while the children watch the preparation; the parents decorate the Christmas tree outside the igloo while inside the children wrap their presents, and in the end, they all open them under the Christmas tree.

Coding

In order to evaluate the length of children's narratives, we considered the total number of clauses produced by the three groups, whereas to assess how many and how frequently representational gestures were produced during the narratives, we considered the total number of their occurrences in the three groups and the percentage of gestures per clause.

As for the motor aspects of gestural production, we first considered whether the gestures were produced with one or two hands. In the first case, we transcribed which was involved; in the second case, we analyzed the symmetry between the two hands. Gestures were then coded according to the same parameters used to analyze Sign Languages: handshapes, place of articulation, hand orientation and movement.

To observe the way in which children learn to use gestures in a formally appropriate way, we formulated the concept of 'formal accuracy' scored in relation to three parameters. This analysis was based on a free adaptation of the 'Scale of Gestuality' proposed by Kendon, who considered it as a scale of gradient properties making some movements 'more gestural' than others[1]. The parameters we analyzed are: well boundedness, clearness of the stroke execution, shared space. Each was scored on a scale from 0 to 2.

The well boundedness was scored as follows: 0 = without a clear start and a clear end; 1 = only one of the two is clear; 2 = both are clear; NC (not classified) for consecutive gestures.

The formal clearness of the stroke was scored in relation to the gesture configuration and movement: 0 = both parameters are not clear; 1 = only one of the two is clear; 2 = both are clear.

The space of gesture execution was scored as follows: 0 = not visible by the listener; 1 = peripheral space; 2 = shared space.

We coded the representational correctness on the basis of the semantic pertinence of the gesture components (place, configuration and movement) in relation to the corresponding aspects of the referent (its location, its shape and size, the type and direction of the action). We scored it as follows: 0 = none of them is pertinent; 1 = only one is pertinent; 2 = only two are pertinent; 3 = all three are pertinent.

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1. Our classification was based on proposals presented by Kendon in a Seminar given in the Department of Psychology, University of Rome "La Sapienza" on 6 November 2006.

Finally, we analyzed the strategies used in the gestural representation of the referent conceiving a scale going from the highest to the lowest degree of concreteness and motivation. The categories, partially corresponding to those adopted by other scholars (Müller 1998, Streeck 2008) are mime, manipulation, hand becoming an object, shape depiction and/or delimitation (of objects contours), symbolic-conventional representation.

These are the types of gestures we coded according to these categories:

Mime: the gestures children produced with the whole body or only with hands and arms, miming a situation in a holistic manner and identifying themselves in the character (similar to Müller's 'the hands imitates' and Streeck's 'mimesis'); *manipulation*: the gestures by which children represented an object reproducing the shape the hand assumes while seizing it (like Streeck's 'handling'); *hand becoming an object*: the child's identification of a part of his/her hand with the object represented (similar to Müller's 'the hand portrays'); *shape depiction*: the gestures by which the children represented an object depicting its shape (like Müller's 'the hand draws' and Streeck's 'drawing'); *delimitation*: the gestures by which children represented an object delimiting its contours in the air (like Streeck's 'delimiting'); *symbolic-conventional representation*: the gestures used to express in a symbolic and conventional way some more abstract contents like spatial and temporal relationships.

Results

Initially, we analyzed the total number of clauses produced by the three groups of children. The results show that it increases considerably with age: pre-school children (group I) produce 227 clauses, while school children (groups II and III) produce respectively 394 and 395 clauses.

The total number of representational gestures produced by the three groups increases between pre-school and school children: 103 produced by group I, 188 and 178 produced respectively by group II and group III. However, looking at the proportion of representational gestures in the clauses, we found that it is very similar for the three groups: 45% in group I, 48% in group II, 45% in group III.

Analyzing the use of one or two hands, we found that while the first two groups produced almost half of the gestures with one hand and half with two (group I, 47% and 53%; group II, 48% and 52%), group III produced two- handed gestures in a higher proportion (41% one hand, 59% two hands).

For the gestures produced with one hand, we observed which one was involved. The results show a strong preference for the use of the right hand in all the groups: 98% in group I, 82% in group II and 83% in group III. However, a slight increase emerges in the use of the left hand in the two older groups, going from the 2% in group I to the 18% and 17% in group II and III, respectively.

In the case of bi-manual gestures, we analyzed if the two hands were symmetrical (with same handshape and/or movement) or asymmetrical (different handshapes and/

or movements). The great majority of gestures are produced with symmetric hands by all the three groups of children: 98% of gestures in group I, 94% in group II and 87.5% in group III. Thus, the 'symmetry condition' of Sign Languages is respected [2].

Formational parameters

Gestures were coded according to the parameters used in Sign Language analysis (Stokoe 1960; Volterra 1987, 2004).

Hand-shapes

Table 2 shows the percentage of hand configurations mostly produced by the three groups of children, whereas Figure 1 shows the distribution of the different configurations in the three groups.[3]

These six handshapes account for the 84% of the total hand configurations used in the entire sample of 30 children's gestures. These handshapes constitute the basic ones in Sign Languages, and they are the most frequently used by children exposed to these languages (Boyes-Braem 1975; Meier et al. 2008; Clibbens 1998; Karnopp 2002; Morgan, Barrett-Jones & Stoneham 2007).

Looking at the distribution of the different configurations in the three groups in Figure 1, we can see that '5' is the most used by all of them; however, it is interesting to note that the use of this configuration decreases with age, while there is a gradual

Table 2.

Configurations	Percentages of the 3 Groups
5	47.12
B	14.63
A	8.02
C	5.91
L	5.62
T	2.53
Tot.	**83.83**

2. The 'symmetry condition' states that, when two hands move without touching each other, the movement and the configurational features of the sign must be the same or symmetrical for the two hands. Pettenati et al. 2010)

3. The symbols used for representing handshapes are the same adopted in SLs literature. They correspond to numbers or to alphabet letters. Different symbols can be used to represent the same handshapes by each SL: counting and finger spelling vary according to culture.

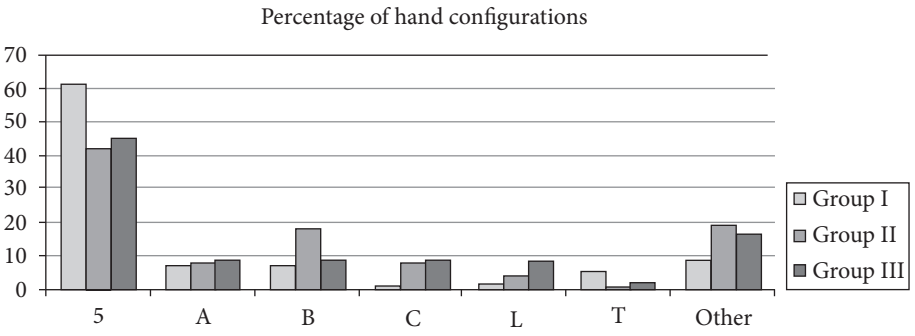

Figure 1.

increase in the use of the 'C' and 'L' ones, which were almost absent in the first group. Figure 1 also shows that the proportion of the other configurations increases with age, especially comparing the first group and the other two. In these other categories the configurations mostly used by the older children, even though not in a significant way, were the '3' and 'F.'

Place of articulation

The place of articulation was coded as 'Not involved hand' when the gesture was produced on the not involved hand; 'Body' when it was produced on different parts of the body (head, trunk, shoulder, etc) not necessarily with direct contact, 'Neutral space' when it was produced in the space in front of the children's body.

As it is shown in Figure 2, neutral space is the most frequent location used by all the children's groups and the non-dominant hand the less frequently used. Nevertheless, group I used a very high proportion of body locations, whereas the use of 'not dominant hand' location gradually increases with age.

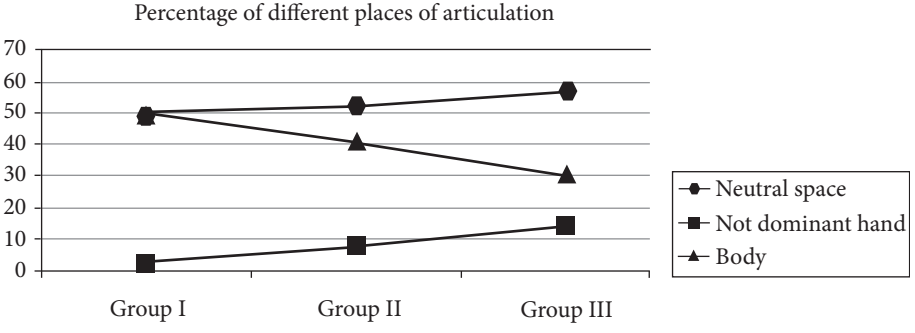

Figure 2.

Hand orientation

Figure 3 shows the different types of palm orientation used by the three groups.

In all three groups the palm is more frequently oriented 'up or down,' but we noted a developmental trend in the use of the right/left orientation from group I to groups II and III.

Movement

We analyzed the movement direction of children's gestures.

As we can see in Figure 4, with age there is a clear shift from the "up/down" to the "in front/behind" direction.

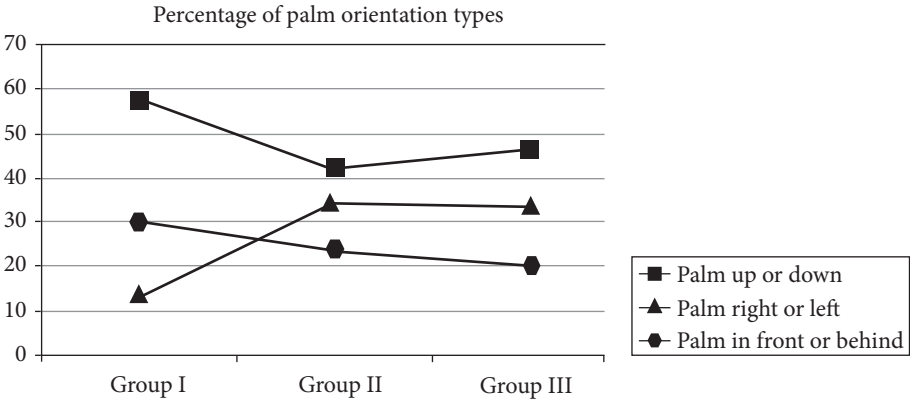

Figure 3.

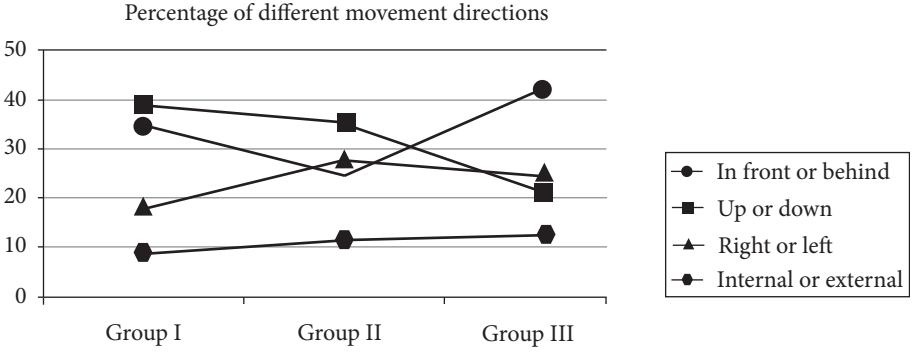

Figure 4.

Formal accuracy

As Table 3 shows, we calculated the mean score of the three groups for each of the three parameters considered.

It can be observed that the formal accuracy of execution increases with age, in particular from the group I to the groups II and III. Only the parameters of the 'shared space' appear to be already mastered by Group I

Representational correctness

For this parameter, we calculated the mean score of the three groups.

We noted an increase in the gestural representational correctness from the group I to the groups II and III as shown in Table 4.

Representational strategies

Figure 5 shows the percentages of representational strategies[4] used by the three groups of children.

The data demonstrate that the 'manipulation' strategy is the most used by all three groups and decreases with age like the 'mime' strategy, (particularly from Group I to Groups II and III) whereas 'depiction of shape/delimitation' and 'hand-becomes-objects' proportionally increase. The symbolic- conventional strategy is the less used by the three groups of children.

Table 3.

	Group I	**Group II**	**Group III**
Well boundedness	1.4	1.5	1.5
Formal clearness of the stroke	1.5	1.7	1.7
Shared space	1.9	1.9	1.9
Total Formal accuracy of execution	1.6	1.7	1.7

Table 4.

	Group I	**Group II**	**Group III**
Representative	2.4	2.5	2.6

4. The label S/C refers to the *symbolic-conventional* strategy

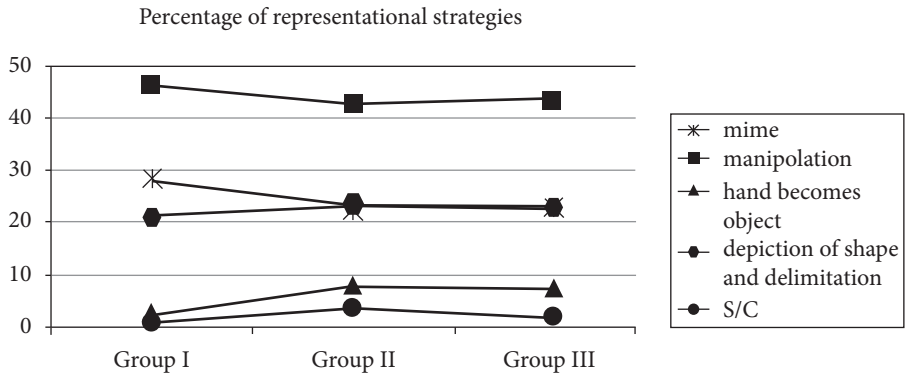

Figure 5.

Discussion and conclusion

One of our aims was to investigate whether and how it is possible to find a gradual mastering of the gestural form of expression as it happens in the mastering of the linguistic one. Our hypothesis of a parallelism between the development of the linguistic and gestural competence has been confirmed by the results which emerged in relation to all the phenomena investigated, starting with the parallelism between the increasing number of clauses and gestures in relation to age.

As for the analysis carried out on the formational parameters, it has shown a development of both the formal and the semantic aspects of gesture. The greater use that older children made of different hand orientations and locations testifies to an increasing ability to exploit the expressive resources of gesture. Also the results on the accuracy of gesture execution and the correct representation of their referents reveal a clear developmental trend. Whereas the former phenomenon testifies to an increasing mastering of the formal properties of gesture, the latter indicates that children have to learn how to use the gesture expressive components for representing in a proper way the aspects of the referents that gesture can codify.

The correlation between the acquisition of the formal and the semantic aspects of gesture compositional parameters demonstrates not only the children's increasing control of the semiotic properties of the gesture code, like for the linguistic code, but also that gesturing, like Sign Languages, constitutes an analytical and compositional system of expression.

Moreover, our research has showed that the motor constraints observed in the production of first signs by deaf children (Conlin et al. 2000) operate also in the way in which hearing toddlers use their gestures (Ann 1996). Such a result would support the notion of a continuum between gestures and signs rather than a clear boundary between non linguistic and linguistic systems (Pettenati et al. 2010).

The results obtained for children's use of the space of gesture execution, also indicate an increasing symbolic competence (McNeill 2000, 2005; Kita 2006). Indeed, as we saw, older children made a lesser use of their body in favor of their non-dominant hand, thus showing an increasing ability to move from a more concrete to a more abstract way of representing the referents related to those designated by the dominant hand.

A developmental trend in the acquisition of the symbolic competence emerged also in the analysis of the gesture representational strategies, which showed a gradual shift from the use of the most concrete and motivated (mime and manipulation) to that of the most abstract and conventional one (hand becomes object and shape depiction/delimitation). Gestural movement becomes less and less like real action in the physical world and becomes representationally more flexible: hand movement can represent something else than hand movement (Kita 2006).

The results of our analysis demonstrate that gesture, like speech and Sign Languages, has formal and semantic properties children have to acquire to develop their communicative competence. While the different semiotic identity between gesture and speech has been leading developmental researchers to investigate the way in which children learn to exploit their different expressive potentialities in order to integrate them into the multimodality of communication, the semiotic affinities between gesture and Sign Language can give scholars the possibility of investigating the similarities between the principles on which their representation of reality and the internal structure of their units are based.

References

Ann, J. 1996. "On the relation between ease of articulation and frequency of occurrence of handshapes in two sign languages." *Lingua* 98: 19–41

Bates, E., Benigni, L., Bretherton, I., Camaioni, L. and Volterra, V. 1979. *The Emergence of Symbols: Cognition and Communication in Infancy*. New York: Academic Press.

Berman, R. A. and Slobin, D. I. 1994. *Relating Events in Narrative: A Crosslinguistic and Developmental Study*. Hillsdale (NJ): Erlbaum.

Boyes Braem, P. 1975. "The acquisition of handshape in ASL." Salk Institute Working Paper. The Salk Institute, La Jolla, CA.

Butcher, C. and Goldin-Meadow, S. 2000. "Gesture and the transition from one- to two-word speech: when hand and mouth come together." In *Language and Gesture*, D. McNeill (ed), 235–257. Cambridge: Cambridge University Press.

Calbris, G. 1990. *The Semiotics of French Gesture*. Bloomington: Indiana University Press.

Capirci, O., Iverson, J. M., Pizzuto, E. and Volterra, V. 1996. "Gestures and words during the transition to two-word speech." *Journal of Child Language* 23: 645–673.

Capirci, O., Caselli, M. C., Iverson, J. M., Pizzuto, E. and Volterra, V. 2002. "Gesture and the nature of language in infancy: the role of gesture as transitional device en route to two-word speech." In *The Study of Sign Languages: Essays in Honor of William C. Stokoe*, D. Armstrong, M. Karchmer and J. V. Van Cleeve (eds), 213–246. Washington, DC: Gallaudet University Press.

Capirci, O., Cristilli, C., De Angelis, V. and Ricci, S. 2008. "The relationship between speech and gesture in the development of textual and narrative competence." Paper presented at Multimod International Conference 2009. Toulouse, University of Toulouse II, 9–11 July, 2009.

Cassell, J. and McNeill, D. 1991. "Gesture and the poetic of prose." *Poetics Today* 12 (3): 375–404.

Clibbens, J. 1998. "Research on the acquisition of British Sign Language: Current issues." *Deafness and Education* 22: 10–15.

Colletta, J. M. 2004. *Le Développement de la Parole chez L'enfant Agé de 6 à 11 Ans. Corps, Langage et Cognition*. Sprimont: Mardaga.

Conlin, K. E., Mirus, G. R., Mauk, C. and Meier, R. P. 2000. "The acquisition of first signs: place, handshape and movement." In *Language Acquisition by Eye*, C. Chamberlain, J. P. Morford and R. I. Mayberry (eds), 51–69. Mahwah, NJ: Erlbaum.

Gallese, V., Fadiga, L., Fogassi, L. and Rizzolatti, G. 1996. "Action recognition in the premotor cortex." *Brain* 119: 593–609.

Goldin-Meadow, S. and Butcher, C. 2003. "Pointing toward two-word speech in children." In *Pointing: Where Language, Culture and Cognition Meet*, S. Kita (ed), 85–107. Cambridge: Cambridge University Press.

Iverson, J. M. and Thelen, E. 1999. "Hand, mouth, and brain: the dynamic emergence of speech and gesture." *Journal of Consciousness Studies* 6: 19–40.

Karmiloff-Smith, A. 1985. "Language and cognitive processes from a developmental perspective." *Language and Cognitive Processes* 1: 61–85.

Karnopp, L. B. 2002. "Phonology acquisition in Brazilian Sign Languages." In *Directions in Sign Language Acquisition*, G. Morgan and B. Woll (eds), 29–53. Amsterdam: John Benjamins.

Kendon, A. 1985. "Some uses of gesture." In *Perspectives on Silence*, D. Tannen and M. Saville-Troike (eds), 215–234. Norwood, NJ: Ablex Publishing Corporation.

Kendon, A. 2004. *Gesture: Visible Action as Utterance*. Cambridge, UK: Cambridge University Press.

Kita, S. 2000. "Why do people gesture?" *Cognitive Studies* 7 (1): 9–21.

Kita, S. 2000. "How representational gestures help speaking." In *Language and Gesture*, D. McNeill (ed), 162–185. Cambridge: Cambridge University Press.

Kita, S. and Wood, C. 2006. "Semiotic characteristics of speech-accompanying gestures in children and adults' narrative." Paper presented at the Current Developments in Gesture Research. Hatfield, UK, June 30th 2006.

Kohler, E., Keysers, C. Umiltà, M. A., Fogassi, L., Gallese, V. and Rizzolatti, G. (2002). "Hearing sounds, understanding actions: action representation in mirror neurons." *Science* 297: 846–848.

McNeill, D. 1992. *Hand and Mind*. Chicago: The University of Chicago Press.

McNeill, D. 2000. *Language and Gesture*. Cambridge: Cambridge University Press.

McNeill, D. 2005. *Gesture and Thought*. Chicago: The University of Chicago Press.

Meier, R. P., Mauk, C., Cheek, A. and Moreland, C. 2008. "The form of children's early signs: Iconic or motor determinants?" *Language Learning and Development* 4: 63–98.

Morgan, G., Barrett-Jones, S. and Stoneham, H. 2007. "The first signs of language: Phonological development in British Sign Language.î *Applied Psycholinguistics* 28: 3–22.

Müller, C. 1998. "Iconicity and gesture." In *Oralité et Gestualité: Communication Multimodale, Interaction*, S. Santi, I. Guaïtella, C. Cavé, and G. Konopczynski (eds), 321–328. Paris: L'Harmattan.

Peterson, C. and McCabe, A. 1983. *Developmental Psycholinguistics: Three Ways of Looking at a Child's Narrative*. New York: Plenum Press.

Pettenati, P., Stefanini, S. and Volterra, V. 2010. "Motoric characteristics of representational gestures produced by young children in a naming task." *Journal of Child Language* 37 (4): 887–911.

Rizzolatti, G. and Arbib, M. A. 1998. "Language within our grasp." *Trends in Neuroscience* 21: 188–194.

Rizzolatti, G., Fadiga, L., Gallese, V. and Fogassi, L. 1996. "Premotor cortex and the recognition of motor actions." *Cognitive Brain Research* 3: 131–141.

Stein, N. L. and Glenn, C. G. 1979. "An analysis of story comprehension in elementary school children. "In *New Directions in Discourse Comprehension: Vol. 2: Advances in Discourse Processes*, R. O. Freedle (ed), 53–120. Norwood NJ: Ablex.

Stokoe, W. C. 1960. "Sign Language Structure: An outline of the visual communication systems of the American deaf." Studies in linguistics. Occasional Papers 8. University of Buffalo.

Streek, J. 2008. "Depicting by gesture." *Gesture* 8 (3): 285–301.

Umiltà, M. A., Kohler, E., Gallese, V., Fogassi, L., Fadiga, L., Keysers, C., and Rizzolatti, G. 2001. "I know what you are doing: a neurophysiological study." *Neuron* 31: 155–165.

Volterra, V. 1987. *La Lingua Italiana Dei Segni*. Bologna: Il Mulino (New Edition 2004)..