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Title

Getting away from the point: The emergence of ostensive gestures and their functions

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Abstract

Within developmental psychology, pointing gestures have received a great deal of attention, while ostensive gestures have been overlooked in terms of their emergence and intentionality. In a longitudinal and micro-genetic study with six children at 9, 11, and 13 months of age, we codified gesture production of children within second-by-second data frames. We identified 480 instances of gestures and categorised whether they were of ostensive, ostensive-indexical, or indexical nature. We specified the communicative function of each gesture by analysing the object involved and their circumstances of production. Data analysis include frequencies, binomial tests, proportion comparisons, and repeated measures ANOVA. We identified a phatic function in other-directed gestures, as well as exploratory and private functions in self-directed gestures. This has important implications for children development since ostensive gestures are easier to produce and to understand than pointing. The consideration of objects would be essential for defining the communicative function of gestures.

Keywords

early ostensive gestures; self-directed gestures; communicative functions of gestures

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Getting away from the point: The emergence of ostensive gestures and their functions

Introduction

Psychological research about first intentional gestures has largely accepted the classical distinction between (1) DEICTIC GESTURES that direct attention to a present referent (e.g. showing a toy to an adult, or pointing to request an object that is out of reach), and (2) REPRESENTATIONAL GESTURES that feature an absent referent (Capirci & Volterra, 2008). According to Bates, Camaioni, & Volterra (1975), deictic gestures may comprise four different functions: ritualised request, showing, giving, and pointing. From this classification, their role in the origins of referential communication has been widely documented (Gullberg, de Bot, & Volterra, 2010; Iverson, Capirci, Volterra, & Goldin-Meadow, 2008).

Although other types of gestures have been described, pointing is by far the most explored deictic gesture. Previous studies on intentional communication and shared reference in nonhuman primates (Leavens, Hopkins, & Bard, 2008; Gómez, 2010), and with toddlers (Andrén, 2010; Liszkowski & Tomasello, 2011) highlight the predictive value of pointing for language development. Like language, pointing allows children to: (1) interact with others, and (2) communicate their intentions, feelings and requests about present but distant referents.

However, some authors today may overlook the unambiguous findings of Bates and her colleagues about the intentional and communicative nature of ostensive gestures. In recent years, the status of ostensive gestures has been questioned (Gräfenhain, Behne, Carpenter, & Tomasello, 2009; Grosse, Moll, & Tomasello, 2010), rather than supported. Indeed, with some exceptions (see holdout and giving gestures in Cameron-Faulkner, Theakston, Lieven, & Tomasello, 2015), research has largely focused on distal pointing gestures as THE gestures for communicating about shared referents.

In the scholarly literature, there is a lack of consensus regarding on what grounds a gesture can be discriminated (F. G. Rodríguez, 2012). Also, while there some agree that gestures are movements with manifest deliberate expressiveness (Kendon, 2004), this definition does not typically include object manipulations. Object manipulations are usually referred as ‘practical’ or ‘social’ actions, which are not part of a deliberate act of expression (Andrén, 2010; Goldin-Meadow et al., 2012). This fact is particularly relevant for the study of the development of ostensive gestures, as it blurs their communicative status while broadening the considerable gap between the amount of empirical evidence on pointing and ostensive gestures (Clark, 2003; Csibra, 2010; Dimitrova & Moro, 2013; Mount, 2008; Parise & Csibra, 2013).

An additional concern is the operationalisation of distal pointing as a natural product (Butterworth, 1998), which often implies morphological restrictions. According to this conceptualisation, pointing gestures are solely produced by the extension of the index finger in opposition to the rest of the hand; and in the distance, without touching the referent. On the other hand, for well-known semiologists (Eco, 1976; Peirce, 1987) indexical gestures are not limited to such distal pointing, but exist in a huge variety of communicative forms that mix traces of contiguity and vectoriality to different extent, depending on the distance between sign and referent. For instance, touch-pointing would be a means for the understanding of the communicative intention in joint actions, as it has been reported on adult-baby interactions (Rodríguez & Moro, 1999), toddlers (Kettner, 2014), and children with autism (Christie, Newson, Prevezer, & Chandler, 2009).

But distal pointing gestures are not the sole facilitators of shared reference. Both pointing and ostensive gestures are effective communicative techniques for directing the attention of others towards a present referent (Clark, 2003). We could not understand gestures and their importance for intentional communication without recognising both types of utterances. Research has shown that ostensive gestures and object uses play a key role in communicative exchanges between the adult and the child. From the beginning of

life, adults share objects with their children using rhythmic ostensive gestures that enhance infant's attention to them (Alessandroni, Moreno-Núñez, Rodríguez, & del Olmo, 2019; Moreno-Núñez, Rodríguez, & del Olmo, 2015, 2017). According to the Pragmatics of the Object (Rodríguez & Moro, 1999, 2008) objects are complex communicative referents involving social rules of use. They are not interchangeable; hence, their communicative intention may change if the object is replaced. Therefore, when adults direct an object toward their children, using it FOR THEM with a communicative intention, they are also mediating how children construct semiotic systems of increasing complexity.

On the development of children gestures, several studies have stressed that infants use similar gestures towards themselves than those that adults used during mutual communicative interactions. From a Vygotskian point of view, self-directed gestures also emerge from the interaction with adults and peers, and would imply a basic level of self-communication in young children. In the early 1960's, Werner & Kaplan (1963) reported that self-directed pointing gestures emerge before other-directed pointing. This fact has been later confirmed by further studies (Bates et al., 1975; Carpendale & Carpendale (2010); Delgado, Gómez, & Sarriá, 2011). Children could also perform self-directed ostensive gestures with a reflexive or a private function (Dupertuis & Moro, 2016; Rodríguez & Palacios, 2007).

Considering the direction of gestures (whether they are self- or other-directed) is particularly relevant when analysing their functions. Today, the IMPERATIVE and DECLARATIVE functions of deictic gestures proposed by Bates et al. (1975) are widely accepted. In gestures with an imperative function, adults are means to achieve a goal. In declarative gestures, the child usually refers to an object or an action in order to attract the attention of the adult over it. Although recent studies on functions of gestures have been mostly focused on distal pointing, there could be additional communicative functions beyond imperative and declarative. For instance, there is a distinction between

(Liszkowski, Carpenter, & Tomasello, 2007a, 2007b; Tomasello, et al., 2007). The former would be the classic function of sharing attention over a referent, and the latter imply that the child provides relevant information to someone that was not present during a certain event. In both cases children have to use their knowledge about what their partner knows, which is a commonality with INTERROGATIVE gestures, performed when children request adult regulation to fulfil a challenging task (Begus & Southgate, 2012; Moro & Rodríguez, 1991; Rodríguez, 2009; Southgate, van Maanen, & Csibra, 2007).

In the scholarly literature, there is also evidence of the diversity of functions of self-directed gestures. On the one hand, there are self-ostensive gestures with an EXPLORATORY or contemplative function, although they have been seldom explored (Dupertuis & Moro, 2016; Moro, Dupertuis, Fardel, & Piguet, 2015). These exploratory, self-directed ostensive gestures would differ from a mere exploration of the object in young infants, as they stop their action for contemplating the object. Aligned with Piaget's notion of 'perceptive acts' (1936/2007), these gestures would be an act of attention focus. On the other hand, there are studies on private contemplation of objects (Werner & Kaplan, 1963) and private pointing (Delgado et al., 2011) as a tool for self-regulation. Unlike exploratory gestures, self-directed gestures with a PRIVATE function require certain knowledge about the conventional use of the object that acts as a referent of the interaction (Rodríguez, Moreno-Núñez, Basilio, & Sosa, 2015; Rodríguez & Palacios, 2007).

The main goal of this study is to describe the emergence of ostensive and indexical gestures and their functions. Thus, this paper examines the role of objects as an essential part of the communicative act by analysing: (1) the semiotic diversity among deictic gestures, distinguishing between ostensive, ostensive-indexical, and indexical gestures; (2) the instances of self- and other-directed gestures performed by children; and (3) the function of those gestures according to the object that was referenced.

Methods

Participants and procedures

This study was conducted within the scope of the project ‘Procesos Educativos en la Primera Infancia: Comunicación y Desarrollo Cognitivo [Educational Processes in Early Childhood: Communicative and Cognitive Development]’, whose overall goal was to examine how the educational processes between adults and children unfold during the first two years of life. The present paper draws on a subsample of six typically developing children¹ (three male, three female) who were video-recorded longitudinally at 9, 11, and 13 months of age in their own home in Madrid, Spain. All six children were the second child of their families, and three of them attended Early Childhood Education centres at the time of data collection. All families were of high-medium SES. Regarding parental education, 50% of the parents indicated that their highest academic qualification was a Diploma, while 41.7% hold a University Degree. One of the parents (8.3%) had doctoral studies.

We conducted non-structured observations during playful triadic interactions (mother-child-object), where children were sitting between their mother and a box full of toys. Infants were recorded for a minimum of 10 minutes by the same researcher and with the same eight objects (see next section on Materials for further details). All objects were provided together in the box, while parents were instructed to play with their child as they normally would. No specific instructions were provided in how to use the objects, in order to leave parent and child to engage with one another through their own strategies, so interchanges remain as spontaneous as possible.

¹ The six children are named in this paper Claudia, Gabriela, Diana, Iván, Marcos, and Matías (not their real names).

The eight objects supplied by the researcher (Table 1) were chosen for this study because they are (1) easy to grasp (given their weight and size), (2) varied regarding their potential uses, and (3) complex in terms of their conventional use, which may favor children to request for the intervention of adults when they are not yet able to use them on their own —e.g. the wind-up ladybug, with self-motion.




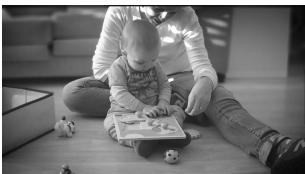










Analyses of data

Because our study aimed at analysing the features of gestural communication in children, we first analysed the videos and performed a microgenetic qualitative analysis of the video-clips to find interactive exchanges displaying gestures. To do this, we codified behaviours of the mother and the child within second-by-second data frames using ELAN² (Version 5.2, Lausberg & Sloetjes, 2009) and the procedure described by Rodríguez and Moro (1999). We defined 12 mutually-exclusive codes (Table 2) related to the nature of the functions of gestures in triadic interactions. We considered the type of gesture, the object to which the gesture refers, and the particular circumstances of production (Rodríguez, 2009; Rodríguez et al., 2015).

Frequencies, binomial tests, and proportion comparisons were calculated using IBM SPSS Statistics for Windows (v. 21). The coding system was content-validated by two of the authors, both researchers with experience in early cognitive and communicative development, who assessed the suitability of the analytical categories for the observations under consideration. Definitions were revised and further refined on several occasions prior to the analysis of inter-rater reliability. The first author and two external researchers independently analysed a 33% of randomly selected video-clips to calculate inter-rater reliability (Krippendorff's Alpha was .86).

² Max Planck Institute of Psycholinguistics, The Language Archive, Nijmegen, the Netherlands.
<http://tla.mpi.nl/tools/tla-tools/elan/>.

TABLE 1
Description of objects

Object	Object in use	Description of the object
		<p>CONSTRUCTION CUBES: Four pieces of a construction game, which can be fitted together. The four cubes are large in size (10x6 cm), so the children cannot hold two cubes in one hand at the same time.</p>
		<p>PUZZLE: Puzzle (22x22 cm) with four big pieces representing a dog (head, front body, back body) and food. It has a knob on top of each piece that facilitates that children could grasp them.</p>
		<p>WIND-UP LADYBUG: Wind-up toy. To use it is necessary to wind the right spring. Its movement and behavior is random, so it is impossible to predict where it will go. It also tumbles in the course of its behavior, and this tumbling is also unpredictable.</p>
		<p>PUPPY AND KITTY FIGURES: This item consists of two different articulated figures. The parts that can be moved are the head, the paws and the tail. They make a sound when these parts are rotated.</p>
		<p>BUBBLE MAKER: This item consists of two different pieces: a bottle filled with liquid soap and a bubble-wand and cap. In the top of the cap there is also a little plastic ball so it sounds like a rattle when shaken.</p>
		<p>SUNNY GEAR: This toy acts as a gear since the two “sunnies” cannot be detached. When one of them is grasped, the other runs downwards. They are also filled with small plastic balls, so when shaken they sound like a rattle.</p>
		<p>COW CYLINDER: Small cylinder that reproduces the “moo” of a cow when it is turned upside down.</p>

We followed a rank transformation procedure (Conover & Iman, 1981) to prepare our data for further quantitative exploration. This methodological strategy is considered a more appropriate tool for analysing non-normal data distributions, as it ensures a better preservation of their parametric properties. We used rank transformation for analysing the complexity of the semiotic status and the direction of the gesture. The procedure resulted

in six levels of complexity (see Table 2). Each observed gesture was transformed into one of these ranks and organised from lowest to highest complexity. Note that this is not a 'scale' of semiotic complexity, but a variable for comparing groups or single participants according to the complexity of their observed behaviors.

Results

We identified a total of 480 instances of gestures (Table 3), which constitute the main dataset for the quantitative analysis that we conducted. Proportion comparisons highlighted some characteristics of the gestures in our dataset. At the age of 9 months, self-directed gestures were more frequent than those directed to others, eventually reversing this trend at 13 months of age ($p < .05$).

Ostensive gestures were the most frequently produced from 9 months old as compared to other gestures of higher semiotic status. This contrast reached its peak at 11 months ($p < .05$). Among ostensive gestures, showing were significantly more frequent than giving at 9 and 11 months of age ($p < .05$), while this difference was shortened at 13 months. Indeed, showing gestures were more frequent than all other gestures at 9 months of age. Children slightly increased their production at 11 months ($p > .05$) prior to decreasing it to a lower level at 13 months of age ($p < .05$). The production of Giving gestures greatly increased at 13 months of age, presenting a statistically higher proportion ($p < .05$) as compared to 11 and 9 months separately.

Touch-pointing gestures of a mixed semiotic nature (ostensive-indexical), were also identified. They are immediate gestures because they are performed while touching the referent. At 9 and 11 months of age, touch-pointing gestures were all self-directed, while touch-pointing gestures directed to others were not observed until 13 months of age. Their frequency slightly dropped at 11 months, but re-established at 13 months.

TABLE 2
Analytical codes and complexity values of gestures that were used for rank transformation

Semiotic Status	Specific Gestures	Directed To	Rank	Function of Gestures
Ostensive Homomateric gestures where sign and referent coincide. The gesture is produced with an object that occupies the hand.	Showing The child shows the object.	To Self	1	<p>Exploratory</p> <p>The child explores the object and holds up to himself, but any conventional use is done afterwards.</p> <hr/> <p>Private</p> <p>The child shows himself the object, and uses it conventionally immediately afterwards. The ostensive gesture is considered private because the child performs a conventional use. The private use implies, then, some “reflection” <i>with</i> and <i>about</i> the object that allows the child to perform its conventional use.</p>
		To Other	2	<p>Declarative</p> <p>The child shows the object to the adult in order to <i>obtain her attention over his action with the object</i> (e.g. the child shakes the COW CYLINDER, making it sound, and then shows it to the adult to <i>share</i> his own <i>action</i> with the object).</p> <hr/> <p>Imperative</p> <p>The child shows the object to the adult, still grasping it, requesting the other to intervene. The child is still keeping control over the object (e.g. after dipping the wand of the BUBBLE MAKER into the pot, the child places the wand in front of the adult’s mouth for her to blow “bubbles”. The interaction resumes when the adult actually blows)</p>
Giving	The child gives the object to the adult.	To Other	2	<p>Imperative</p> <p>The child gives the object to the adult, for her to intervene in some way. The child does not keep controlling the object (e.g. the child shows himself the PUPPY figure and gives it to his mother, waiting for her to do something).</p> <hr/> <p>Phatic</p> <p>The child gives the object to the adult to include her in his own plan of action, but he does not subordinate his following acts to the answer of his mother. Even if the response of the adult is positive, the child continues playing with other objects. It is called phatic in an analogy with the function of language, since it also does not imply informative content (e.g. the child gives <i>any object</i> to the adult, going back to his own action and not waiting for her to do anything).</p>

Ostensive / Indexical	Touch-pointing	To Self	3	Exploratory	The child points for himself to <i>some specific part</i> of the object, focusing his attention during its exploration. No conventional use is performed after that (e.g. after the COW CYLINDER accidentally sounds, the child points the top of the toy, like telling himself where the sound is coming from).
		To Other	4	Imperative	The child touch-points the object that the adult is holding, for his mother to act on or with it (e.g. the child touch-points the BUBBLE MAKER that the adult is holding for her to make bubbles).
				Declarative	The child touch-points an object and stares at the adult, who shares something about the object or a part of it (e.g. the child touch-points to the COW CYLINDER surface and looks to his mother after completing its canonical use. The child points to where the sound comes from).
Indexical	Pointing	To Self	5	Exploratory	The child points at something distant as if “telling himself” something (e.g. the child points the bubbles, following them as they move away across the room, but he does not look at the adult at any time).
		To Other	6	Imperative	The child points at something distant for the adult to do something with it.
				Declarative	The child points at something distant and looks to the adult to share the attention with her.

Indexical gestures observed in this study were all distal pointing. They were less frequently produced by children than other types of gestures at 9 months ($p < .05$), though their production increased at 11 months, and again at 13 months of age. Most of these productions were other-directed, while self-directed pointing gestures were barely identified at 11 and 13 months.

TABLE 3
Absolute frequencies of self- and other-directed gestures performed by children

	Semiotic Status	Ostensive Gestures				Ostensive- Indexical Gestures (mixed)		Indexical Gestures	
	Children gestures	SHOWING		GIVING		TOUCH-POINTING		POINTING	
	Directed to	Self	Other	Self	Other	Self	Other	Self	Other
Age in months	9 months old	101	13		1	11	0	0	4
	11 months old	117	34		6	5	0	1	5
	13 months old	71	43		37	10	5	4	12

Functions of ostensive, mixed and indexical gestures

After the rank transformation procedure, we used the resulting dataset as a dependent variable of a repeated measures ANOVA for the examination of the average level of complexity along the three moments of observation, both by gender (Figure 1a) and by participant (Figure 1b). This variable is represented in the Y-axis of both figures.

While this is not a study on gender effect on development, we would like to note some variations in gestures production that were observed in male and female participants. The multivariate test of Pillai's Trace shows an interaction effect of age (in months) and gender ($F(2, 477) = 430.06, p < .01$). Mauchly's test proved the sphericity of the differences among participants ($p < .01$). We also performed a within-subjects effect test that showed a statistically significant interaction between gender and age ($F(2, 956) = 195.10, p < .01$). This means that male and female participants significantly performed gestures of different complexity within the three moments of observation. Girls performed

more complex gestures than boys at 9 months of age, although the productions of all participants tended to balance from 11 months onwards. At 13 months of age, all children increased the complexity of their gestures, even though girls still over performed their male counterparts.

This analysis of the complexity of gestures was also conducted by participant to stress individual differences (Figure 1b). All participants but Claudia increased the complexity of their gestures with age. However, note that Claudia already demonstrated a higher level of gesture complexity than the rest of participants of 9 months of age. Even when she produced slightly less complex gestures at 11 months, the complexity of her production increased at 13 months, reaching one of the highest levels in our sample. The lower growth and less complex gestures were both observed in Matías, who underperformed other children especially at 11 and 13 months of age.

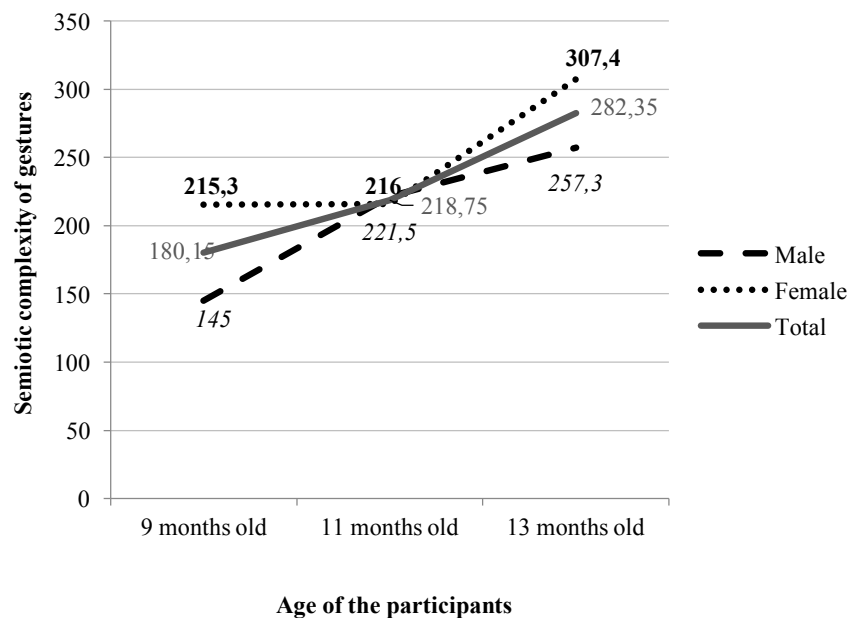


FIGURE 1a
Interaction between age, gender and the semiotic complexity of gestures

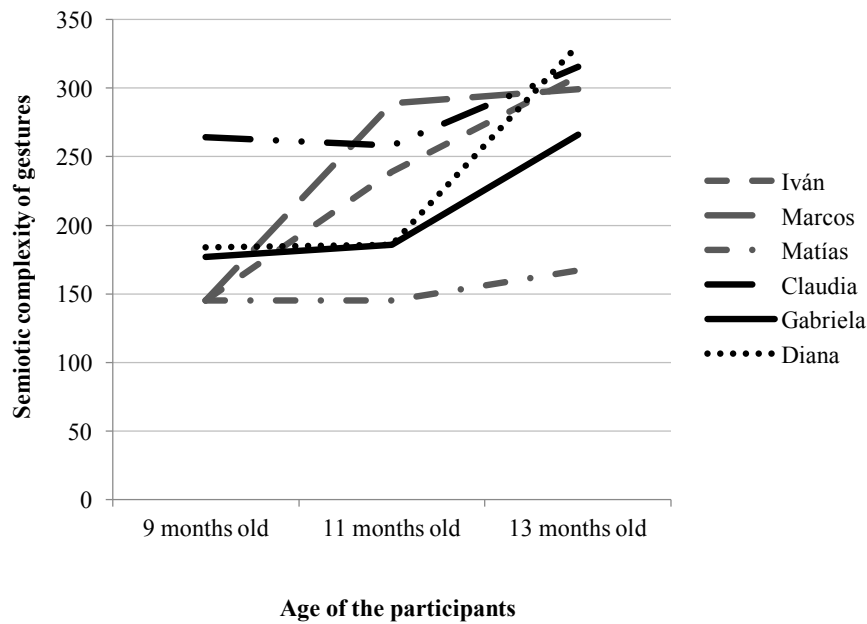


FIGURE 1b
Interaction between age and the semiotic complexity of gestures by participant

In order to explore the developmental processes of child-mother communicative interactions about and through the objects, we selected for this paper seven illustrative episodes (see Observation figures below) that justify the functions of gestures through narrative descriptions. According to our analytical codes, in the following subsections we examine whether the observed gestures were exploratory or private (for self-directed gestures); or imperative, declarative, or phatic (for other-directed gestures) (Table 4).

Ostensive Gestures

Ostensive gestures comprise showing and giving gestures. The object-referent is in the hand of the child—i.e. sign and referent coincide. Individual differences in showing gestures are stressed in Table 4. In this study, children frequently performed showing gestures with all objects and at all the ages examined. However, these gestures were increasingly shorter at 11 ($M=2.3s$, $SD=0.9$) and 13 months of age ($M=1.9s$, $SD=0.5$) than they were at 9 months ($M=3.4s$, $SD=1.3$). This could be due to children augmenting their effectiveness in catching the attention of adults, turning back to their action more quickly.

TABLE 4
Gestures performed by children and their functions

		Claudia			Gabriela			Diana			Iván			Marcos			Matías			
		9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	
SHOWING functions	self	Exploratory	23	21	4	18	19	10	21	25	6	14	8	4	3	5	6	5	15	12
	other	Declarative	7	15	15	1	3	7	5	5	9	-	8	2	-	2	-	-	-	2
		Imperative	-	-	8*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	self	Private	2	-	9	4	6	8	8	8	4	-	2	1	-	3	3	3	5	5
		Claudia			Gabriela			Diana			Iván			Marcos			Matías			
		9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	
GIVING functions	other	Imperative	-	1	8	-	-	-	-	-	-	-	9	-	1	3	-	-	-	
		Phatic	1	1	7	-	-	5	-	-	4	-	-	-	-	4	1	-	-	-
		Claudia			Gabriela			Diana			Iván			Marcos			Matías			
		9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	
TOUCH-POINTING functions	self	Exploratory	8	1	1	2	2	4	1	2	4	-	-	1	-	-	-	-	-	-
	other	Imperative	-	-	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
		Declarative	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Claudia			Gabriela			Diana			Iván			Marcos			Matías			
		9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	9m	11m	13m	
POINTING functions	self	Exploratory	-	1	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-
	other	Imperative	2	2	-	-	-	2	-	-	-	-	-	-	-	3	5	-	-	-
		Declarative	2	-	-	-	-	-	-	-	4	-	-	-	-	-	1	-	-	-

* Imperative showing gestures were subordinated to a self-regulatory function (to blow bubbles with the BUBBLE MAKER)

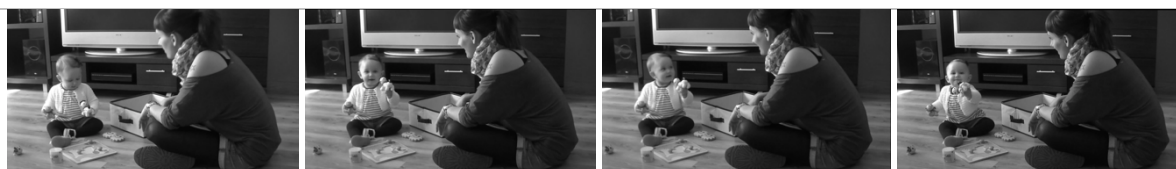
From 11 months of age, children did not merely show objects to the adult, but they showed them after performing their conventional use (e.g. obtaining sound from the cow cylinder). These showings would be more complex because they imply a greater knowledge about the object and its function.

Four different functions were found for showing gestures, namely: exploratory, imperative, declarative, and private. The exploratory function was identified for most productions of self-directed showing gestures (i.e., self-ostensive gestures), which were observed in all participants. Conversely to what was noted in the literature in relation to different types of other-directed gestures, children performed declarative showing gestures before imperative ones. All children in this study performed declarative other-directed showing gestures (see example in Figure 2), but they were less frequently observed in male participants ($p < .01$).

Observation 1. Diana 0; 11, 5 – (starts: 2.40 ends: 2.55 – duration: 15 sec)

Declarative other-directed showing gesture with the PUPPY figure (in *italics*)

Context within the session It is the start of the session and Diana has led the interaction for the first minutes, already exploring several objects which are all around the floor. She has focused on the PUPPY and KITTY figures, holding them in both hands.



1. Diana holds the KITTY figure in her right hand, and the PUPPY figure in her left hand.
2. Diana holds up the PUPPY figure while looking to the video camera.
3. Diana turns to her mother and smiles, still holding up the PUPPY figure. Her mother says ‘Wow, that is so pretty!’.
4. Diana turns again to the video camera, and *leans toward it extending her arm and holding the PUPPY figure*, while vocalising ‘Mmm!’. Her mother says ‘Do you like it?’, while Diana smiles and nods.

Relation to object use Once she received a satisfactory feedback on her gesture, Diana resumed her play with the object in interaction with her mother.

Type of gesture	Directed to	Function
Ostensive (showing gesture)	Other-directed	Declarative

FIGURE 2
Illustration of a declarative other-directed showing gesture

Imperative other-directed showing gestures were rather infrequent. Note that, when identified, they were often subordinated to a self-regulatory function of a higher level of complexity (Table 4), related to the conventional use of the object. More precisely, we observed that Claudia, at 13 months of age, was already able to take in and out the handle of the bubble maker, but she still needed her mother to actually blow the bubbles. Private self-directed showing gestures (Figure 3) were scarcely present in our data, but they tended to progressively increase with age.

Observation 2. Matías 1; 0, 24 – (starts: 4.17 ends: 4.50 – duration: 33 sec)

Private self-directed showing gesture with COW CYLINDER (in *italics*)

Context within the session It is almost the middle of the session and Matías has been playing with some of the toys. His mother has suggested to go back to the box and check what else there is available.



1. The mother lean over the box and says ‘Let’s take another look, what else is in there?’. Matías reaches something from the box while his mother asks ‘What is that?’.
2. Matías takes the COW CYLINDER out of the box, which sounds because of the movement. He *holds the object up with both hands and shows it to himself* for 3 seconds.
3. Matías adjusts the grasp of the COW CYLINDER to hold it firmly with his right hand.
4. Matías shakes the COW CYLINDER with his whole right arm, making it sound (conventional use). He then smiles and turns to the video camera.
5. Matías keeps shaking the COW CYLINDER, this time towards his mother.

Relation to object use The gesture occurred right before Matías performed the conventional use of the object (to make it sound). After this sequence, he and his mother changed their focus to the PUZZLE.

Type of gesture	Directed to	Function
Ostensive (showing gesture)	Self-directed	Private

FIGURE 3
Illustration of a private self-directed showing gesture

Giving gestures, by definition, have to be directed to someone else, so we did not define any self-directed codes. Giving gestures in our study (Table 4) were observed with two functions: imperative and phatic. We found no evidence of declarative giving gestures within our sample.

Only three children used giving gestures with an imperative function: Claudia and Marcos, at 11 and 13 months of age, and Iván, at 13 months. The objects used for this purpose were the puzzle, the construction cubes, the cow cylinder, the wind-up ladybug, and the bubble maker. All of them involve certain complexity for their conventional use, requiring adults to intervene when children were unable to complete the action by themselves.

In addition, we identified a third function within giving gestures, whose relevance lied in the very act of giving, rather than in the specific object given. We have named it phatic function in analogy with the function of language, because the functional aspects of the objects seemed irrelevant in these instances: children gave anything. Objects were here vehicles of pure communicative intention, and not a sign linked to a particular conventional use. Phatic giving gestures (Figure 4) were performed by Claudia at 9 — being the sole production of giving gesture found at this age—, and 11 months, and by the three girls at 13 months of age. Among the boys, only Marcos produced phatic giving gestures at 11 and 13 months.

Observation 3. Claudia 1; 1, 4 – (starts: 1.04 ends: 1.24 – duration: 20 sec)

Phatic other-directed giving gesture with several objects (in *italics*)

Context within the session It is the very beginning of the session and Claudia has not yet attempted to use any object. She is just taking a few objects out of the box.



1. Her mother is bringing Claudia space to decide what to do and says ‘Let’s see, what do you have in there?’.
2. Claudia takes the blue CUBE from the box and *offers it to her mother without even turning to her*. She just holds it while staring at the box until her mother takes it.
3. The mother says ‘Are you giving me a piece? Very good!’, anticipating Claudia’s action while she is taking a new object from the box. Her mother adds ‘Let’s see this’.
4. Claudia takes out one of the PUZZLE’s pieces and *gives it to her mother like she did before* (without any gaze but to the box). Her mother takes it and says ‘Where does that belong? Are those the paws of the dog? Are we taking out the dog?’
5. Claudia gets back to the box, takes another piece of the PUZZLE and *gives it to her mother*. The mother replies ‘Oh, now you are giving me the head! I’ve got the head and the little paws’. Claudia turns back to the box and keeps taking out random objects for another few minutes.

Relation to object use The gesture occurred before Claudia even started to explore the objects. Prior to that, she just checked the content of the box, giving some of the objects to her mother in an apparent

attempt to hold her attention until she was ready to start playing together.

Type of gesture	Directed to	Function
Ostensive (giving gesture)	Other-directed	Phatic

FIGURE 4
Illustration of a phatic other-directed giving gesture

Ostensive – Indexical Gestures

Mixed ostensive-indexical gestures are produced with the empty hand but touching the referent. They act as a “bridge” between the ostensive and indexical worlds by comprising some aspects from both semiotic status. The ambiguity about what is the referent of the communication is thus reduced as compared to distal pointing, which facilitates the understanding of the sign. Touch-pointing gestures were not observed in all participants in this study (Table 4). Nevertheless, we identified gestures with exploratory, imperative, and declarative functions.

The three female participants performed exploratory self-directed touch-pointing gestures (Figure 5) from 9 months of age, directing their own attention towards the object. This was maintained at 11 and 13 months of age, while they were still rare in the performances of male participants. Imperative other-directed touch-pointing gestures were only observed in a very specific situation: when adults stopped blowing bubbles. Children then touch-pointed the bubble maker held by the mother as a request for her to “keep doing that action”. Observations of declarative other-directed touch-pointing gestures were infrequent.

Observation 4. Gabriela 0; 9, 3 – (starts: 6.17 ends: 6.57 – duration: 40 sec)

Exploratory self-directed touch-pointing gesture with KITTY figure (in *italics*)

Context within the session

It is the second half of the session and Gabriela has already explored some of the objects. She is starting to get tired and thus has requested for her mother to cuddle her. Her mother has taken Gabriela in her lap and is trying to promote further interchanges.



1. The mother presents the KITTY figure to Gabriela, pretending it is climbing her leg and saying 'Hello!'. Then she holds it in front of Gabriela's face and repeats 'Hello!'.
2. Gabriela holds the KITTY figure herself, staring at it and smiling.
3. For 5 seconds, Gabriela rotates the KITTY figure in her hands, exploring all sides. The object falls down from her hands and her mother catches it. The mother offers it again to Gabriela while saying 'Do you like it? Hold it!'.
4. Gabriela *touch-points* the KITTY's ears for 7 seconds, while her mother says 'Oh, you do like its ears, uh?'.

Relation to object use	The gesture occurred before Gabriela held the object up and showed it to herself in an exploratory/contemplative manner. She repeated these actions with several objects during the first session.
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Type of gesture	Directed to	Function
Ostensive-Indexical, mixed (touch-pointing gesture)	Self-directed	Exploratory

FIGURE 5
Illustration of an exploratory self-directed touch-pointing gesture

Indexical Gestures

All indexical gestures observed in this study were distal pointing (Table 4). No other indexical gestures (e.g., reaching) were found. Despite the little evidence that we obtained, we identified distal pointing gestures with three different functions: exploratory, imperative, and declarative. Exploratory self-directed distal pointing was used by children to direct their own attention towards the referent and its use. Almost all the occurrences were observed in 13 months olds. Only Claudia performed imperative other-directed distal pointing at 9 months, while some other children were able to perform them at 11 and 13 months of age (Figure 6). Declarative pointing gestures were barely observed in this study.

Observation 5. Marcos 1; 1, 0 – (starts: 2.46 ends: 3.37 – duration: 51 sec)

Imperative other-directed distal-pointing gesture with BUBBLE MAKER (in *italics*)

Context within the session

Marcos has been playing with the BUBBLE MAKER from the start of the session. He still holds its wand, while his mother has kept the pot. In an attempt to extend the interaction to other objects, his mother has taken out the COW CYLINDER and is trying to establish shared attention over it.



1. While holding the BUBBLE MAKER pot in one hand, the mother demonstrates how turning upside down the COW CYLINDER, it sounds. Then she places the COW CYLINDER in front of Marcos, who vocalises 'Uh!' and alternates gazes toward his mother and the object. His mother responds 'What is that?'.
2. The mother takes again the COW CYLINDER and offers it to Marcos, but he refuses to grasp it while vocalising 'Eeeh!' and pushing the COW CYLINDER -still in his mother's hands- apart.
3. Marcos *points at the BUBBLE MAKER pot* that his mother is holding, vocalising 'Ba ba'. He tries to introduce the wand in it. With the other hand, his mother uses again the COW CYLINDER, provoking it to sound. Marcos stops his action and stares at the COW CYLINDER for a couple of seconds.
4. Marcos *points again at the BUBBLE MAKER pot* vocalising 'Uh!' and tries to introduce the wand in it. Since he has difficulties to complete this action accurately, his mother adjusts how she is holding the pot and direct it to Marcos in order to facilitate him to introduce the wand.

Relation to object use The gesture occurred before Marcos dipped the wand into its pot, and then took it close to his mouth, pretending to blow (unsuccessfully).

Type of gesture	Directed to	Function
Indexical (distal pointing gesture)	Other-directed	Imperative

FIGURE 6
Illustration of an imperative other-directed distal-pointing gesture

Discussion

In this section, we will address three main findings. First, there was variation in production of ostensive, mixed, and indexical gestures. From 9 to 13 months of age, children performed ostensive gestures much more frequently than mixed or indexical gestures, so it seems logical to address them separately rather than from a general classification of deictic gestures. Second, we identified both self- and other-directed gestures. Considering both in our analysis might contribute to a better understanding of the emergence of intentional communication in children. Third, functions of gestures are not restricted to declarative and imperative. Infants in this study performed gestures at least with three more functions: exploratory and private function in self-directed gestures, and phatic function in other-directed giving gestures.

Children produced several ostensive gestures (showing and giving) from 9 months of age towards an intentional communicative goal. However, the low frequency of indexical (pointing) and ostensive-indexical gestures (touch-pointing) at that same age

was striking. The imbalance between these three types of gestures opens an interesting debate. We agree that distal pointing is very important for establishing a shared reference, and as such it has received great attention for decades from scholars and researchers (Crais, Douglas, & Campbell, 2004; Werner & Kaplan, 1963). However, infants become able to perform ostensive gestures before they fully develop the fine motor movements that pointing requires.

A renovated and more comprehensive research focus is needed on the emergence of early gestures, especially when objects are within a space of proximal interaction, as in this study. Considering the progression of semiotic complexity (Eco, 1976; Peirce, 1987), ostensive gestures are easier to interpret and produce because sign and referent coincide (Rodríguez et al., 2015), while indexical gestures require a greater effort of interpretation and coordination within interactions. Children performed ostensive gestures (both self- and other-directed) before pointing, which might play a role in the later development of more complex signs.

In between this developmental process, touch-pointing gestures could ease the understanding of sign-referent relationship by children. These gestures would be of medium semiotic complexity since they integrate both indexical and ostensive components. They reduce the ambiguity involved in the identification of the referent. In the scholarly literature, touch-pointing gestures have been often overlooked, or considered within a single category of pointing. However, previous studies have shown that adults frequently draw upon touch-pointing gestures for clarifying the referent in interactions with preverbal children (Rodríguez & Moro, 1999) and atypically developing children (Christie et al., 2009). There is also evidence that infants point to nearby objects before they do so to distal ones (Carpenter, Nagell, & Tomasello, 1998). These results suggest that the distance between sign and referent is progressively built –and understood- during communicative interchanges. In our study, touch-pointing gestures were observed from 9

months of age. There is a need, however, to further explore their distinction from distal pointing in terms of their development and communicative potential.

Although communicative functions of gestures have been traditionally studied in other-directed utterances, we propose that self-directed gestures may also contribute in shaping early communicative development. According to our results, self-directed gestures allow children to direct their own attention towards a novel object or event, to reflect about it (e.g. in order to complete a challenging task), or to keep themselves focused on their action. Self-directed gestures could play a crucial role as instruments of communication when infants are not yet fully competent in using varied representational and semiotic signs.

An important focus of this study is the analysis of the functions of gestures (i.e. for what purpose they were performed by children). In addition to classic functions such as protoimperative and protodeclarative (Bates et al., 1975), we distinguished other functions in both self- and other-directed gestures. In increasing degree of complexity, we observed several instances of self-directed gestures that children do with (1) a basic exploratory function, where the child paused his action in order to contemplate the object, but there was still no evidence of knowledge about its conventional use (Masataka, 2003); and (2) a private function for self-regulation (Rodríguez & Palacios, 2007), where the gesture was produced immediately before, or during the use of the object. As previous studies indicate, private gestures require more complex cognitive processes than exploratory gestures, since they imply both a certain knowledge on the task and a self-regulatory ability. Gestures with communicative functions such as emotional (Racine & Carpendale, 2007), informative (Liszkowski et al., 2007b), or interrogative (Begus & Southgate, 2012; Rodríguez, 2009) were not observed in this study. We attribute this fact to the age of our participants by the time of our observations, who were younger than those of the aforementioned studies.

It is worth mentioning that we have not found more recent references to declarative showing and giving gestures than in Bates et al. (1975), in which give and show were considered as a whole. However, it is necessary to analyse for what purpose the child gives (or shows) the object to the adult. What does the child expect from his mother? Is the adult simply an agent who holds the object while the child performs the action? Or is it someone to share the action with, or to ask for help in a shared use of the object? Listing giving and showing gestures without referring to the circumstances in which the gesture occurs seems insufficient to understand the communicative intention of the child (and, therefore, the function of his gestures).

The four different functions of showing gestures that we identified have some implications for the understanding of communicative development. First, we observed self-directed exploratory gestures, similar to the so-called self-ostensive gestures (Dupertuis & Moro, 2016; Moro et al., 2015), that seem to constitute one of the most basic levels of semiotic complexity. Second, the frequency of declarative showing gestures was particularly high, which in this case challenges the widely accepted idea that the imperative function emerges first and is less complex than the declarative function (Behne, Carpenter, & Tomasello, 2005; Cochet & Vauclair, 2010). Third, imperative showing gestures could involve some traces of a self-regulatory function when the child asks the adult for help but controlling in what, where, and when his mother should act. And fourth, private gestures, where the child shows the object to himself while facing a challenging task, evidenced that at some point children become able to think about the referent with the referent itself (Rodríguez & Palacios, 2007).

Like in showing gestures, children do not only give objects to adults for them to act upon the referent (Bates, 1976; Bates et al., 1975; Capirci, Contaldo, Caselli & Volterra, 2005), i.e. with an imperative function. In addition to this, we identified a phatic function in the giving gestures that children do. Similar to the phatic function of language

(Jakobson, 1988), the referent (i.e. the object given) becomes a pure instrument of communication. Any object would serve the same purpose (to keep the adult engaged in the interaction). There were no other indicators (e.g. sustained gaze, or a certain expectation for the reaction of the adult) that suggest an intention of the child to actively interact with the other. Moreover, the child disregarded what the mother did after receiving the object, proving that these gestures are neither of a declarative (see ‘mutual joy’ interactions in Bates et al. 1975) nor a cooperative nature (Liszkowski et al., 2006).

As we discussed before, most studies exploring indexical gestures and its communicative functions refer to distal pointing. While it is very often assumed that imperative pointing gestures emerge from actions, declarative distal pointing would be of communicative nature (Cochet & Vauclair, 2010). Curiously, this view neglects the fact that the child is born in a world where adults point every day and repeatedly to present referents (Wilkins, 2003), which may be related to the emergence of indexical gestures. This has to be considered along with the progression of both touch-pointing and distal pointing gestures in children. In this study, infants performed exploratory pointing (either touching the referent or from a distance) as part of a contemplative action when there was a novel object, or when they faced a difficulty while completing a task. These gestures were observed at a younger age than gestures with an imperative or a declarative function.

Therefore, when determining the function of gestures (i.e., for what purpose children point, show, or give an object), it is crucial to consider the specific object involved and its public norms of use. Communication is rooted in shared actions, and is mediated by signs in specific realities and interactions. Uses of objects are thus influenced by culture, informal education, and communicative interchanges. For this reason, we used a naturalistic research design to capture genuine communicative situations with and about objects, while not restricting the plurality that characterises triadic interactions. We acknowledge that this approach may affect our results because of the objects chosen and

their physical proximity to the participants. However, this is also representative of typical adult-child interactions at these ages in our culture. A more comprehensive understanding of the social and cultural construction of communicative development requires further studies that consider the particularities of how interactions with others and objects unfold.

Conclusions

In conclusion, our findings show that children share referents intentionally through ostensive gestures, with others and with themselves, even when they are still unable to point. The predominance in the production of ostensive gestures highlight two issues: (1) a precise operationalisation of communicative intentionality requires the consideration of the referent —children communicate with others or themselves about and through the object—, and (2) the communicative functions of gestures should be interpreted according to the specific object involved. Additionally, including gestures of a mixed semiotic nature in our analysis helped us to understand the developmental process of intentional communication, as they may be a bridge between ostensive and indexical signs. If this is the case, more research would be necessary to explore whether or not pointing gestures develop from ostensive gestures. This would enrich the literature on the development of intentional communication before language.

Ostensive gestures are gestures in their own right because they meet the necessary requirements for being considered as instruments of intentional communication. More precisely, ostensive gestures allow (1) self- and other-directed communication about specific material referents, and (2) to gather the other and the world in a simultaneous communicative act. Given their lower semiotic complexity, ostensive gestures emerge before distal pointing both in terms of their understanding and production. The cultural specificity of objects (i.e., their social function) is fundamental in determining the communicative function of the gestures performed about them. The debate on the role of

objects as material culture and as instruments for communication is still open-ended, thus further discussion would be necessary.

References

- Alessandroni, N., Moreno-Núñez, A., Rodríguez, C., & del Olmo, M. J. (2019). Musical dynamics in early triadic interactions: A case study. *Psychological Research*. doi: 10.1007/s00426-019-01168-4
- Andrén, M. (2010). *Children's gestures from 18 to 30 months*. Lund: Lund University.
- Bates, E. (1976). *Language and context: The acquisition of pragmatics*. London: Academic Press.
- Bates, E., Camaioni, L., & Volterra, V. (1975). The acquisition of performatives prior to speech. *Merril-Palmer Quarterly*, 21(3), 205-226.
- Begus, K. & Southgate, V. (2012). Infant pointing serves an interrogative function. *Developmental Science*, 15(5), 611-617. doi: 10.1111/j.1467-7687.2012.01160.x
- Behne, T., Carpenter, M., & Tomasello, M. (2005). One-year-olds comprehend the communicative intentions behind gestures in a hiding game. *Developmental Science*, 8(6), 492-499. doi: 10.1111/j.1467-7687.2005.00440.x
- Butterworth, G. (1998). Origins of joint visual attention in infancy. *Monographs of the Society of Research in Child Development*, 63, 144-166. doi: 10.1111/j.1540-5834.1998.tb02782.x
- Cameron-Faulkner, T., Theakston, A., Lieven, E., & Tomasello, M. (2015). The relationship between infant holdout and gives, and pointing. *Infancy*, 20(5), 576-586. doi: 10.1111/infa.12085
- Carpendale, J. & Carpendale, A. B. (2010). The development of pointing: from personal directedness to interpersonal direction. *Human Development*, 53, 110–126. doi: 10.1159/000315168

- Carpenter, M., Nagell, K., & Tomasello, M. (1998). Social cognition, joint attention and communicative competence from 9 to 15 months of age. *Monographs of the Society for Research in Child Development*, 63(4), 1-174. doi: 10.2307/1166214
- Capirci, O., Contaldo, A., Caselli, M. C., & Volterra, V. (2005). From action to language through gesture: A longitudinal perspective. *Gesture*, 5(1), 155-177. doi: 10.1075/bct.10.12cap
- Capirci, O. & Volterra, V. (2008). Gesture and speech: The emergence and development of a strong and changing partnership. *Gesture*, 8(1), 22-44. doi: 10.1075/gest.8.1.04cap
- Christie, P., Newson, E., Prevezer, W., & Chandler, S. (2009). *First steps in intervention with your child with autism*. London: Jessica Kingsley.
- Clark, H. (2003). Pointing and placing. In S. Kita (Ed.). *Pointing. Where language, culture and cognition meet*, (pp. 243-268). Mahwah/London: Lawrence Erlbaum Associates.
- Cochet, H. & Vauclair, J. (2010). Pointing gestures produced by toddlers from 15 to 30 months: Different functions, hand shapes and laterality patterns. *Infant Behavior and Development*, 33, 431-441. doi: 10.1016/j.infbeh.2010.04.009
- Conover, W. J. & Iman, R. L. (1981). Rank transformations as a bridge between parametric and nonparametric statistics. *The American Statistician*, 35(3), 124-129.
- Crais, E. R., Douglas, D. D., & Campbell, C. C. (2004). The intersection of the development of gestures and intentionality. *Journal of Speech Language and Hearing Research*, 47(3), 678-694. doi: 10.1044/1092-4388(2004/052)
- Csibra, G. (2010). Recognizing communicative intentions in infancy. *Mind & Language*, 25(2), 141-168. doi: 10.1111/j.1468-0017.2009.01384.x

- Delgado, B., Gómez, J. C., & Sarriá, E. (2011). Pointing gestures as a cognitive tool in young children: Experimental evidence. *Journal of Experimental Child Psychology, 110*, 299-312. doi: 10.1016/j.jecp.2011.04.010
- Dimitrova, N. & Moro, C. (2013). Common ground on object use associates with caregivers' gestures. *Infant Behavior and Development, 36*, 618-626. doi: 10.1016/j.infbeh.2013.06.006
- Dupertuis, V. & Moro, C. (2016). Self-directed ostensions and mediations of the adult at the age of 8-, 12- and 16 months. *Integrative Psychological and Behavioral Science, 50*(4), 621-633. doi: 10.1007/s12124-016-9350-x
- Eco, U. (1976). *A theory of Semiotics*. Bloomington: Indiana University Press.
- EUDICO linguistic annotator - Elan (Version 4.1.1) [Computational software] (2011). Nijmegen: Max Planck Institute for Psycholinguistics.
- Goldin-Meadow, S., Levine, S., Zinchenko, E., Yip, T. K-Y., Hemani, N., & Factor, L. (2012). Doing gesture promotes learning a mental transformation task better than seeing gesture. *Developmental Science, 15*(6), 876-884. doi: 10.1111/j.1467-7687.2012.01185.x
- Gómez, J. C. (2010). The emergence of eye contact as an intersubjective signal in an infant gorilla: implications for models of early social cognition. *Acción Psicológica, 7*(2), 35-43. doi: 10.5944/ap.7.2.213
- Gräfenhain, M., Behne, T., Carpenter, M., & Tomasello, M. (2009). One-year-olds' understanding of nonverbal gestures directed to a third person. *Cognitive Development, 24*, 23-33. doi: 10.1016/j.cogdev.2008.10.001
- Grosse, G., Moll, H., & Tomasello, M. (2010). 21-month-olds understand the cooperative logic of requests. *Journal of Pragmatics, 42*, 3377-3383. doi: 10.1016/j.pragma.2010.05.005

- Gullberg, M., de Bot, K., & Volterra, V. (2010). Gestures and some key issues in the study of language development. In M. Gullberg & K. de Bot (Eds.). *Gestures in language development* (pp. 3-33). Amsterdam: John Benjamins.
- Iverson, J. M., Capirci, O., Volterra, V., & Goldin-Meadow, S. (2008). Learning to talk in a gesture-rich world: Early communication in Italian vs. American children. *First Language, 28*, 164-181. doi: 10.1177/0142723707087736
- Jakobson, R. (1988). *Obras selectas*. Madrid: Gredos.
- Kendon, A. (2004). *Gesture: Visible action as utterance*. Cambridge: Cambridge University Press.
- Kettner, V. (2014). Early functions of pointing: The importance of routines in communicative development. Master of Arts Thesis (unedited). Simon Fraser University.
- Leavens, D., Hopkins, W., & Bard, K. (2008). The heterochronic origins of explicit reference. In Zlatev, J., Racine, T., Sinha, C. e Itkonen, E. (Eds.), *The shared mind: Perspectives on intersubjectivity*, (pp. 187-214). Amsterdam/Philadelphia: John Benjamins.
- Liszkowski, U., Carpenter, M., Striano, T., & Tomasello, M. (2006). 12-and-18-month-olds point to provide information for others. *Journal of Child Language, 7*(2), 173-187. doi: 10.1207/s15327647jcd0702_2
- Liszkowski, U., Carpenter, M., & Tomasello, M. (2007a). Reference and attitude in infant pointing. *Journal of Child Language, 34*, 1-20. doi: 10.1017/S0305000906007689
- Liszkowski, U., Carpenter, M., & Tomasello, M. (2007b). Pointing out new news, old news, and absent referents at 12 months of age. *Developmental Science, 10*(2), F1-F7. doi: 10.1111/j.1467-7687.2006.00552.x

- Liszkowski, U. & Tomasello, M. (2011). Individual differences in social, cognitive, and morphological aspects of infant pointing. *Cognitive Development*, 26, 16-29. doi: 10.1016/j.cogdev.2010.10.001
- Masataka, N. (2003). From index-finger extension to index-finger pointing: Ontogenesis of pointing in preverbal infants. In S. Kita (Ed.), *Pointing. Where language, culture, and cognition meet* (pp. 69-84). Mahwah/London: Lawrence Erlbaum Associates.
- Moreno-Núñez, A., Rodríguez, C., & del Olmo, M. J. (2015). The rhythmic, sonorous and melodic components of adult-child-object interactions between age 2 and 6 months. *Integrative Psychological and Behavioral Science*, 49(4), 737-756. doi: 10.1007/s12124-015-9298-2
- Moreno-Núñez, A., Rodríguez, C., & del Olmo, M. J. (2017). Rhythmic ostensive gestures: How adults facilitate babies' entrance into early triadic interactions. *Infant Behavior and Development*, 49, 168-181. doi: 10.1016/j.infbeh.2017.09.003
- Moro, C., Dupertuis, V., Fardel, S., & Piguet, O. (2015). Investigation of consciousness through ostensions to oneself from the onset of the use-of-object to first language. *Cognitive Development*, 36, 150–160. doi: 10.1016/j.cogdev.2015.09.002
- Moro, C. & Rodríguez, C. (1991). ¿Por qué el niño tiende el objeto hacia el adulto? La construcción social de la significación de los objetos. *Infancia y Aprendizaje*, 53, 99-118. doi: 10.1080/02103702.1991.10822286
- Mount, A. (2008). Intentions, gestures, and salience in ordinary and deferred demonstrative reference. *Mind & Language*, 23(2), 145-164. doi: 10.1111/j.1468-0017.2007.00335.x
- Parise, E. & Csibra, G. (2013). Neural responses to multimodal ostensive signals in 5-month-old infants. *Plos One*, 8(8), 1-9. doi: 10.1371/journal.pone.0072360
- Peirce, C. S. (1987). *Obra lógico-semiótica*. Madrid: Taurus.

- Piaget, J. (1936/2007). *El nacimiento de la inteligencia en el niño*. Barcelona: Ares y Mares.
- Racine, T. & Carpendale, J. (2007). The role of shared practice in joint attention. *British Journal of Developmental Psychology*, 25, 3-25. doi: 10.1348/026151006X119756
- Rodríguez, C. (2009). The 'circumstances' of gestures: Proto-interrogatives and private gestures. *New Ideas in Psychology*, 27, 288-303. doi: 10.1016/j.newideapsych.2008.04.002
- Rodríguez, C. (2015). The connection between language and the world: A paradox of the linguistic turn? *Integrative Psychological and Behavioral Science*. 49, 89-103. doi: 10.1007/s12124-014-9274-2
- Rodríguez, C., Moreno-Núñez, A., Basilio, M., & Sosa, N. (2015). Ostensive gestures come first: their role in the beginning of shared reference. *Cognitive Development*, 36, 142-149. doi: 10.1016/j.cogdev.2015.09.005
- Rodríguez, C. & Moro, C. (1999). *El mágico número tres. Cuando los niños aún no hablan*. Barcelona: Paidós.
- Rodríguez, C. & Moro, C. (2008). Coming to agreement: object use by infants and adults. In J. Zlatev, T. Racine, C. Sinha & E. Itkonen (Eds.). *The shared mind: Perspectives on intersubjectivity* (pp. 89–114). Amsterdam/Philadelphia: John Benjamins.
- Rodríguez, C. & Palacios, P. (2007). Do private gestures have a self-regulatory function? A case study. *Infant Behavior and Development*, 30(2), 180-194. doi: 10.1016/j.infbeh.2007.02.010
- Rodríguez, F. G. (2012). El hermano menor de la palabra. Panorámica de los estudios sobre el gesto. *Psiencia, Revista Latinoamericana de Ciencia Psicológica*, 4(1), 43-56. doi: 10.5872/psiencia/4.1.31

Southgate, V., Van Maanen, C., & Csibra, G. (2007). Infant pointing: Communication to cooperate or communication to learn? *Child Development*, 78(3), 735-740. doi: 10.1111/j.1467-8624.2007.01028.x

Tomasello, M. (2008). *Origins of human communication*. Cambridge: MIT Press.

Tomasello, M., Carpenter, M., & Liszkowski, U. (2007). A new look at infant pointing. *Child Development*, 78, 705-722. doi: 10.1111/j.1467-8624.2007.01025.x

Werner, H. & Kaplan, B. (1963). *Symbol formation. An organismic-developmental approach to language and the expression of thought*. New York: John Wiley & Sons.

Wilkins, D. (2003). Why pointing with the index finger is not a universal (in sociocultural and semiotic terms) In S. Kita (Ed.). *Pointing: where language, culture, and cognition meet* (pp. 171-215). Mahwah/London: Lawrence Erlbaum Associates.